

KANNUR UNIVERSITY
(Abstract)

BSc. Zoology Programme - Revised Scheme & Syllabus of Core, Complementary and Open Courses under Choice Based Credit Semester System for Under Graduate Programme - implemented with effect from 2014 admission - Orders Issued.

ACADEMIC BRANCH

No. Acad/C2/909/2014

Dated, Civil Station P.O, 03-05-2014

Read: 1.U.O No. Acad/C2/2232/2014 dated 14-03-2014

2. Minutes of the meeting of the Board of Studies in Zoology held on 12-11-2013

3. Minutes of the meeting of the Faculty of Science held 25-03-2014

4. Letter dated 22-01-2014 from the Chairman, BOS in Zoology

ORDER

1. The Revised Regulations for UG Programme under Choice based Credit Semester System were implemented in this University with effect from 2014 admission as per paper read (1) above.

2. As per paper read (2) above the Board of Studies in Zoology finalized the Scheme, Syllabus & model Question Papers for Core, Complementary & open courses of BSc Zoology programme to be implemented with effect from 2014 admission..

3. As per read (3) above the faculty of Science held on 25-03-2014 approved Scheme, syllabus & model question papers for core/complementary & open courses of BSc Zoology programme to be implemented with effect from 2014 admission.

4. The Chairman, Board of Studies in Zoology (UG) vide paper read (4) above has submitted the finalized copy of Scheme, syllabus & Model question papers for core/complementary and open courses of BSc Zoology programme for implementation with effect from 2014 admission.

5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the revised scheme, syllabi & model question papers of BSc Zoology Programme with effect from 2014 admission.

6. Orders, are therefore issued implementing the revised scheme, syllabus & model question papers for core, complementary & open courses of BSc Zoology (UG) programme under CBCSS with effect from 2014 admission subject to report to Academic Council

7. Implemented revised Syllabus is appended.

Sd/-
DEPUTY REGISTRAR (ACADEMIC)
FOR REGISTRAR

Contd.....2

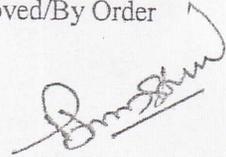
To

1. The Principals of Affiliated Colleges offering B.Sc Zoology Programme
2. The Examination Branch (through PA to CE)

Copy To:

1. The Chairman, BOS Zoology (UG)
2. PS to VC/PA to PVC/PA to Registrar
3. DR/AR I Academic
4. Central Library
5. SF/DF/FC.

Approved/By Order



Section Officer



❖ For more details log on to www.kannur.university.ac.in

Revised



BSc ZOOLOGY DEGREE PROGRAMME

REVISED SYLLABUS

**CORE COURSES
COMPLEMENTARY COURSES
&
OPEN COURSES**

With effect from 2014-15 admissions



SCHEME CORE COURSE

Sl.No.	Semester	Course Code	Name of the Course	Credit	Hours/Week	Exam Hours	Max. Marks		
							Int	Ext	Total
1	I	1B01 ZLG	Protista and Non Chordata-I	3	2	3	10	40	50
2	I	4B01ZLG-P	Practical-I	*	2	-	-	-	
3	II	2B02ZLG	Protista and Non Chordata-II	3	2	3	10	40	50
4	II	4B01ZLG-P	Practical-I	*	2	-	-	-	-
5	III	3B03ZLG	Chordata-I	3	3	3	10	40	50
6	III	4B01ZLG-P	Practical-I	*	2	-	-	-	-
7	IV	4B04ZLG	Chordata-II&Comparative anatomy	3	3	3	10	40	50
8	IV	4B01ZLG-P	Practical-I	4	2	3	10	40	50
9	V	5B05ZLG	Biochemistry & Endocrinology	3	3	3	10	40	50
10	V	5B06ZLG	Biophysics,Biostatistics &Methodology	3	3	3	10	40	50
11	V	5B07ZLG	Cell Biology &Immunology	3	3	3	10	40	50
12	V	5B08ZLG	Hereditary Science	3	3	3	10	40	50
13	V	5B09ZLG	Comparative Animal Physiology & Human Physiology.	3	3	3	10	40	50
14	V	5D0 ZLG	Open Course	2	2	2	5	20	25
15	V	6B02ZLG	Practical-II	-	8	-	-	-	
16	VI	6B10ZLG	Molecular Biology & Bio Informatics	3	3	3	10	40	50
17	VI	6B11ZLG	Environmental Science &Conservation Biology	3	3	3	10	40	50
18	VI	6B12ZLG	Developmental Biology, Teratology & Gerontology	3	3	3	10	40	50
19	VI	6B13ZLG	Ethology, Evolution & Zoogeography	3	3	3	10	40	50
20	VI	6B14ZLG	Applied Zoology	3	3	3	10	40	50
21	VI	6B02ZLG-P	Practical-II	4	-	3	10	40	50
22	VI	6B03ZLG-P	Practical-III	4	8	4	10	40	50
23	VI	6B15ZLG	Project Work	2	2	-	5	20	25

CREDIT DISTRIBUTION (B.Sc. Zoology)

Sub	Sem	Common		Core	Complementary		Open	Total
		English	Additional	Zoology	Botany	Chem		
Zoology	I	4 +3	4	3	2	2		18
	II	4 +3	4	3	2	2		18
	III	4	4	3	2	2		15
	IV	4	4	3+4	2+4	2+4		27
	V			3+3+3+3+3			2	17
	VI			3+3+3+3+3 4+4+2				25
	Total		22	16	56	12	12	2

Scheme of mark distribution (BSc. Zoology)

Courses		No. of courses	Marks per course	Total Marks
Common	English	6	50	300
	Addl. language	4	50	200
Complementary	Botany	5 (4 theory + 1 practical)	40	200
	Chemistry	5 (4 theory + 1 practical)	40	200
Core	Theory	14	50	700
	Practical	3	50	150
	Project	-	25	25
	Open course	1	25	25
Total				1800

COURSE STRUCTURE

SEMESTER-I

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I		Common Course (English)	4	5	3	10	40	50
2	I		Common Course (English)	3	4	3	10	40	50
3	I		Common Course(Additional Language)	4	4	3	10	40	50
4	I	1BOIZLG	Core Course-1	3	2	3	10	40	50
5	I	4BO1ZLG-P	Core Course- Practical.1	-	2	-	-	-	-
6	I		Complementary-1 (Course.1)	2	2	3	8	32	40
7	I		Complementary-2 (Course.1)	2	2	3	8	32	40
8	I		Complementary-1 (Course.1) Practical	-	2	-	-	-	-
9	I		Complementary-2 (Course.1) Practical	-	2	-	-	-	-

SEMESTER –II

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours /Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	II		Common Course (English)	4	5	3	10	40	50
2	II		Common Course(English)	3	4	3	10	40	50
3	II		Common Course(Additional Language)	4	4	3	10	40	50
4	II	2BO2ZLG	Core Course-II	3	2	3	10	40	50
5	II	4BOIZLG-P	Core Course- Practical.1	-	2	-	-	-	-
6	II		Complementary.1 (Course-II)	2	2	3	8	32	40
7	II		Complementary.2 (Course-II)	2	2	3	8	32	40
8	II		Complementary.1 (Course-II) Practical	-	2	-	-	-	-
9	II		Complementary.2 (Course-II) Practical	-	2	-	-	-	-

SEMESTER-III

Sl. No	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	III		Common Course (English)	4	5	3	10	40	50
2	III		Common Course (Additional Language)	4	5	3	10	40	50
3	III	3BO3ZLG	Core Course.3	3	3	3	10	40	50
4	III	4B01ZLGP	Core Course Practical-I	*	2	-	-	-	-
5	III		Complementary.1 (Course III)	2	3	3	8	32	40
6	III		Complementary.2 (Course III)	2	3	3	8	32	40
7	III		Complementary.1(Course III) Practical		2		-	-	-
8	III		Complementary.2(Course III) Practical	-	2	-	-	-	-

SEMESTER-IV

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours /Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	IV		Common Course(English)	4	5	3	10	40	50
2	IV		Common Course (Additional Language)	4	5	3	10	40	50
3	IV	4B04ZLG	Core Course.4	3	3	3	10	40	50
4	IV	4B01ZLG-P	Core Course Practical. I	4	2	3	10	40	50
5	IV		Complementary.1 (Course IV)	2	3	3	8	32	40
6	IV		Complementary.2(Course IV)	2	3	3	8	32	40
7	IV		Complementary.1(Course IV) Practical	4	2	3	8	32	40
8	IV		Complementary.2(Course IV) Practical	4	2	3	8	32	40

SEMESTER-V

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours /Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	V	5B05ZLG	Corecourse.5(Biochemistry & Endocrinology)	3	3	3	10	40	50
2	V	5B06ZLG	Core Course .6(Biophysics, Biostatistics & Methodology)	3	3	3	10	40	50
3	V	5B07 ZLG	CoreCourse.7 (Cell Biology & Immunology)	3	3	3	10	40	50
4	V	5B08ZLG	CoreCourse.8 (Hereditary Science)	3	3	3	10	40	50
5	V	5B09 ZLG	CoreCourse.9 (Comparative Animal Physiology & Human Physiology)	3	3	3	10	40	50
6	V	5DO ZLG	Open Course	2	2	2	5	20	25
7	V	6B02ZLG-P	Core Course Practical. II	-	8	-	-	-	-

SEMESTER -VI

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours /Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	VI	6B10 ZLG	Core Course.10.(Molecular Biology Bioinformatics)	3	3	3	10	40	50
2	VI	6B11ZLG	Core Course.11. (Environmental Science & Conservation Biology)	3	3	3	10	40	50
3	VI	6B12ZLG	Core Course.12.(Developmental Biology, Teratology & Gerontology)	3	3	3	10	40	50
4	VI	6B13ZLG	Core Course.13 (Ethology, Evolution & Zoogeography)	3	3	3	10	40	50
5	VI	6B14ZLG	Core Course.14 (Applied Zoology)	3	3	3	10	40	50
6	VI	6B15ZLG	Project Work	2	2	-	5	20	25
7	VI	6B02ZLGP	Core Course Practical II	4	-	3	10	40	50
8	VI	6B03ZLGP	Core Course Practical-III	4	8	4	10	40	50

SCHEME – OPEN COURSES for Vth Semester

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	V	5DO1ZLG	Nutrition and Health	2	2	2	5	20	25
2	V	5DO2ZLG	Apiculture and Sericulture	2	2	2	5	20	25
3	V	5DO3ZLG	Reproductive Health and Sex education	2	2	2	5	20	25

SCHEME COMPLEMENTARY (ZOOLOGY)

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01ZLG	Diversity of life-I	2	2	3	8	32	40
2	I	4C05ZLG-P	Practical	*	2	-	-	-	
3	II	2C02ZLG	Diversity of life-II	2	2	3	8	32	40
4	II	4C05ZLG-P	Practical	*	2	-	-	-	-
5	III	3C03ZLG	Agriculture and Forest entomology	2	3	3	8	32	40
6	III	4C05ZLGP	Practical	*	2	-	-	-	-
7	IV	4C04ZLG	Medical Zoology	2	3	3	8	32	40
8	IV	4C05ZLGP	Practical	4	2	3	8	32	40

SCHEME COMPLEMENTARY (PHYSIOLOGY)

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01PLY	Biological Chemistry	2	2	3	8	32	40
2	I	4C05PLYP	Practical	*	2	-	-	-	
3	II	2C02PLY	Cell Biology	2	2	3	8	32	40
4	II	4C05PLYP	Practical	*	2	-	-	-	
5	III	3C03PLY	Human Physiology-I	2	3	3	8	32	40
6	III	4C05PLYP	Practical	*	2	-	-	-	
7	IV	4C04PLY	Human Physiology-II	2	3	3	8	32	40
8	IV	4C05PLYP	Practical	4	2	3	8	32	40

SCHEME COMPLEMENTARY (BIOLOGICAL TECHNIQUES)

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01BGT	General Laboratory Techniques	2	2	3	8	32	40
2	I	4C05BGTP	Practical	*	2	-	-	-	
3	II	2C02BGT	Laboratory Equipments and Techniques	2	2	3	8	32	40
4	II	4C05BGTP	Practical	*	2	-	-	-	
5	III	3C03BGT	Preparation of Biological Specimens	2	3	3	8	32	40
6	III	4C05BGTP	Practical	*	2	-	-	-	
7	IV	4C04BGT	Advanced Biological Techniques	2	3	3	8	32	40
8	IV	4C05BGTP	Practical	4	2	3	8	32	40

General Regulations for B.Sc Zoology Programme

The B.Sc Zoology (Core) programme is a 120-credit programme spread over 6 semesters with a total mark of 1800. The Core subject has 14 theory courses, 3 practical courses, a group project and field study component. Besides the Core, Common and Complementary courses, the student should also obtain 2 credits from Open course, which should be from other departments and without repetition of courses.

Attendance – 75% attendance is compulsory for theory as well as practical courses, failing which a student is not eligible to appear for university examinations.

Seminars/Assignments – These are part of the curriculum and are to be critically assessed for Continuous Assessment. Marks should be awarded based on the content, presentation and the effort put in by the student. The topics for seminars and assignments given in the syllabus are not exhaustive and not meant for evaluation in the End Semester Examination.

Project – A maximum number of 10 students may take up one project. Each member of the group has to submit an individual report and is to be valued both internally and externally. External evaluation will be done along with the III practical exam. Students can take up independent projects with the approval of the supervising teacher. The project report has to be certified by the supervising teacher. The Head of the Department has to certify that the project is not a repetition of earlier work done in the department.

Field study – A field study of minimum 5 days duration has to be undertaken by each student. It may include visits to research institutes, natural history museums, wildlife sanctuaries, ecosystems and locations of biological interest. A detailed report of the study has to be prepared, which shall be valued externally in the 6th semester Practical II Examination. The report should be submitted at the time of the practical exams in the 6th semester.

Records – A record is compulsory for each practical course. The student will not be permitted to appear for practical examinations without certified practical records. The records are intended as Observation records to be done in the lab itself. Artistic sketches are not expected, except where scientific diagrams are required as per the syllabi. The valuation of records, to be done internally and externally, should be based on the effort and promptness of the student in lab work.

I SEMESTER B. Sc. DEGREE PROGRAMME (Theory)

ZOOLOGY CORE COURSE- I

PROTISTA AND NONCHORDATA - I

CODE: 1B01ZLG

[DIVERSITY, ADAPTATIONS AND FUNCTIONAL ANATOMY OF PROTOZOANS AND NONCHORDATES]

[36 hours] [2 hours per week] [3 Credits]

Aim and Objectives: The course is designed to give the student a comprehensive idea of protistan and non-chordate diversity, structure and functions. The type studies are intended to provide an understanding of the typical protista and invertebrate body structure, which has a lot in common in the various groups.

Section-A

Systematics; Natural and classical (5 hrs).

Nomenclature: Binomial and Trinomial nomenclature; International rules of Zoological nomenclature (brief account); Mention new trends in systematics like Chemotaxonomy and Serotaxonomy, Cytotaxonomy, Numerical taxonomy (Phenetics), Cladistics (Phylogenetic systematics), Molecular systematics.

II. Five kingdom classification of living organisms. Mention Cavaller-smith's eight kingdom classification also. (1 hr)

Section-B

KINGDOM PROTISTA (8 hrs)

(Give a kingdom comparative account of various functional systems of the types specified to get an idea on the evolutionary trends of diversity.)

Type: Paramecium: morphology and structural organization [as revealed by compound microscopy]; locomotion, nutrition, excretion, osmoregulation and reproduction; conjugation in detail.

Characteristic features and classification of Kingdom Protista down to phyla

[Salient features of the following phyla with note on the examples cited]

Phylum Rhizopoda. Eg: *Amoeba*

Phylum. Dinoflagellata. Eg: *Noctiluca*

Phylum. Parabasalia. Eg: *Trichonympha*

Phylum Apicomplexa [=Sporozoa] eg: *Plasmodium*

Phylum Ciliophora eg: *Vorticella*, *Ephelota*

General essay- 1. Locomotion in Protists

2. Reproduction in Protists

Section- C

KINGDOM ANIMALIA (22 hours)

Salient features of the Major Phyla of animals and their diversity [Habits, habitat, morphology, functional anatomy and life history of representative types (wherever specified) and classification of each phylum down to classes, except otherwise mentioned, and examples thereof: Study of animal diversity with typical examples from each class, with emphasis on ecological– and adaptive features, economic importance and such other points of biological interest expected. Only very brief account of each example is to be studied.]

Compare the various systems based on a specific example from each phylum

MESOZOA

A brief account of dicyemid and orthonectid mesozoans with examples:

Dicyema, *Rhopalura* (1 hr)

METAZOA

Phylum PORIFERA (4 hrs)

Classification down to classes; salient features of the classes

Class Calcispongiae Eg:: *Leucosolenia*

Class Demospongiae Eg:: *Spongilla*

Class Hyalospongiae Eg:: *Euplectella*

Give an account of canal system; mention amphiblastula, parenchymula and gemmule

Phylum CNIDARIA [=COELENTERATA] (8 hrs)

Type: Obelia Morphology and life cycle

Classification down to classes; salient features of the classes

Class Anthozoa Eg: *Adamsia*, *Zoanthus*, and *Madrepora*

Class Hydrozoa Eg: *Halitemma*, *Physalia*

Class Scyphozoa Eg: *Rhizostoma*

General essay- 1. Polymorphism in Coelenterate

2. Corals and coral reefs

Phylum CTENOPHORA [=ACNIDARIA] (1 hr)

Unique features as exemplified by Pleurobrachia; mention cidioid larva

ACOELOMATA

Phylum PLATYHELMINTHES (3 hrs)

Classification down to classes; give salient features of the following classes

Class Turbellaria Eg: *Dugesia*

Class Cestoda Eg: *Echinococcus*,

Class Trematoda Eg: *Schistosoma*, *Fasciola*

PSEUDOCOELOMATA

Super phylum ASCHELMINTHES (3 hrs)

Highlight the heterogeneous nature of animals of this group

Classification down to phyla

Phylum Nematoda characteristic features of *Ascaris* and

Examples: *Ancylostoma*, *Enterobius*, *Wuchereria* (2hrs)

Pseudocoelomate Minor Phyla:

[Salient features of the following Minor Phyla]

Phylum Gastrotricha Eg: *Chaetonotus*

Phylum Rotifera Eg: *Brachionus*

Topics for Assignment / Seminar

1. Nutrition in Protists

2. Algal Protists.

3. Parasitic Helminths

4. Parasitic Nematodes

REFERENCES

Anderson, D. T.: Invertebrate Zoology. 2e, 2001, Oxford Uty. Press (Indian Edn.2006)

Bhaskaran, K. K. & Biju Kumar, A.: Economic Zoology. Manjusha Pubs, Calicut

Dhami, P. S. & Dhami, J. K.: Invertebrate Zoology. R. Chand & Co, New Delhi

Ekambaranatha Ayyar, M. & Ananthakrishnan, T. N.: A Manual of Zoolog.y Vol. I

[Part I & II], S. Viswanathan, Madras

Encarta: 2004 Edn or new versions [CDs], Microsoft

Encyclopedia Britannica: 2004 Edn or new versions [CDs] Britannica.com India

Jordan, E. L. & Verma, P. S.: Invertebrate Zoology. S. Chand & Co, New Delhi
Kotpal, R. L.: Modern TB of Zoology: Invertebrates. Rastogi
Pechenik, J. A. 4e 2002 Biology of the Invertebrates. TMH 2002
Ruppert, E. E. et al.: Invertebrate Zoology. 7 e, 2004, Thomson Brooks Cole
<http://www.ucmp.berkeley.edu>
<http://www.mbl.edu>;
<http://phylogeny.corne>

II SEMESTER B. Sc. DEGREE PROGRAMME (Theory)
ZOOLOGY CORE COURSE- 2
PROTISTA AND NON CHORDATA –II
Code: 2BO2ZLG
[DIVERSITY, ADAPTATIONS AND FUNCTIONAL ANATOMY OF
NON-CHORDATE COELOMATES)

[36 hours] [2 hours per week] [3 Credits]

Aim and Objectives: The course is designed to give the student a comprehensive idea of non-chordate diversity, structure and functions. The type studies are intended to provide an understanding of the typical invertebrate body structure, which has a lot in common in the various groups.

COELOMATA

Phylum ANNELIDA

(7hrs)

Type: *Neanthes* or *Nereis*

Classification down to classes; salient features of the following classes

Class Polychaeta Example: *Arenicola*

Class Oligochaeta Example: *Megascolex*

Class Hirudinea Example: *Hirudinaria*

Phylum ARTHROPODA

[11 hrs]

Type: *Penaeus* [details of larval stages not expected]

Classification down to classes; salient features of the following classes

Class Trilobita [brief account only]

Class Merostomata Example: *Limulus*

Class Arachnida Example: *Palamnaeus*, spider, mention ticks and mites

Class Myriapoda Examples: *Scolopendra*, *Spirostreptus*

Class Crustacea Example: *Sacculina*, *Eupagurus*

Class Insecta Examples: *Lepisma*, Mantis, and Tabanus Southern birdwing butterfly

General essay- Larval forms of crustaceans

Phylum MOLLUSCA

[8 hrs]

Type: *Pila*

Classification down to classes; salient features of the following classes

Class Placophora example: *Chiton*

Class Bivalvia Example: *Perna*

Class Scaphopoda Example: *Dentalium*

Class Gastropoda Example: *Turbinella*

Class Cephalopoda Example: *Sepia*

General essay- Economic importance of Molluscs

Phylum ECHINODERMATA

[6 hrs]

Structural peculiarities of star fish; water vascular system in detail. Classification down to classes [of extant forms only]; salient features of the following classes and very brief account of examples

Class Crinoidea Example: *Antedon*

Class Asteroidea Example: *Astropecten*

Class Ophiuroidea Example: *Ophiothrix*

Class Holothuroidea Example: *Holothuria*

General essay- Larval forms of Echinoderms

Phylum HEMICHORDATA

[1 hr]

Salient features and Example: *Balanoglossus***Coelomate Minor Phyla:**

(3 hrs)

Salient features of the following Minor Phyla; mention examples specified [structure and life history not required)

Phylum Phoronida Example: *Phoronis*Phylum Ectoprocta [=Bryozoa] Example: *Bugula*Phylum Echiura Example: *Bonellia***Topics for Assignment / Seminar**

1] Ecological importance of earthworm and vermiculture

2] Mouth parts in Insects

3] Metamorphosis in insects; Social organization in insects

REFERENCES

Anderson, D. T.: Invertebrate Zoology. 2e, 2001, Oxford Uty. Press (Indian Edn.2006)

Bhaskaran, K. K. & Biju Kumar, A.: Economic Zoology. Manjusha Pubs, Calicut

Dhami, P. S. & Dhami, J. K.: Invertebrate Zoology. R. Chand & Co, New Delhi

Ekambaranatha Ayyar, M. & Ananthakrishnan, T. N.: A Manual of Zoology Vol. I

[Part I & II], S. Viswanathan, Madras

Encarta: 2004 Edn or new versions [CDs], Microsoft

Encyclopedia Britannica: 2004 Edn or new versions [CDs] Britannica.com India

Jordan, E. L. & Verma, P. S.: Invertebrate Zoology. S. Chand & Co, New Delhi

Kotpal, R. L.: Modern TB of Zoology: Invertebrates. Rastogi

Pechenik, J. A. 4e 2002 Biology of the Invertebrates. TMH 2002

Ruppert, E. E. et al.: Invertebrate Zoology. 7 e, 2004, Thomson Brooks Cole

<http://www.ucmp.berkeley.edu><http://www.mbl.edu><http://phylogeny.corne>

III Semester B.Sc. Degree Programme
Zoology Core Course – 3
Code: 3B03ZLG
Chordata - I
Credit: 3; Hours: 3/Week; Total hours: 54

Aim and Objectives: The course is designed to give the student a comprehensive idea of chordate diversity, structure and functions. The type studies are intended to provide an understanding of the typical vertebrate body structure, which has a lot in common in the various groups.

Chordate characters - Fundamental, General and Advanced features. Comparative outline on Chordates and Non-chordates; Diversity of chordates; classification to subphyla and their salient features. Classification followed as per J Z Young (1980). Mention 8 kingdom classification and chordate place in it. The study of representative types (wherever is specified) to be studied in detail. Diversity of chordate with brief account of examples from each group (here down to order) with emphasis on ecological and adaptive features, economic importance and other important biological features to be studied.

Protochordata: Protochordates and their present day status in animal kingdom. (1 hrs)

Subphylum: Cephalochordata: Unique features of the subphylum. Example: Branchiostoma (Amphioxus): study on Systematic position, morphology, primitive, degenerative and specialized features. (3 hrs)

Subphylum: Urochordata: Tunicates, characters and affinities; classification to classes; Neoteny or paedogenesis in tunicates.

(1 hr)

Class: Ascidiacea; features example *Ascidia* with morphology and retrogressive metamorphosis. (2 hr)

Class: Larvacea Example: *Oikopleura*

Class: Thaliacea Example: *Doliolum* (1 hr)

SubPhylum: Vertebrata: General Characters (1 hr)

Pisces :

Division 1 AGNATHA (2 hrs)

Characters and examples: *Myxine*; *Petromyzon* [mention Ammocoete larva]

Division 2 GNATHOSTOMATA

Super class **PISCES** (15 hrs)

Type: *Scoliodon sorrakowah*

Classification of Pisces down to orders; salient features of the following groups:

Class: Chondrichthyes [cartilaginous fishes]

Order Selachii: Examples: *Trygon*, *Pristis*, *Narcine*

Order Holocephali: Example: *Chimaera*

Class: Osteichthyes [bony fishes]

Order Crossopterygii [coelacanth] Example: *Latimeria*

Order Dipnoi [lung fishes] and their distribution. Examples: *Neoceratodus*, *Protopterus*, *Lepidosiren*.

Order Acanthopterygii [spiny-rayed fishes] Examples: *Mugil*, *Rastrelliger*, *Sardinella*, *Heteropneustes*, *Hippocampus*, *Etroplus*, *Channa*, *Echeneis*, *Stromaeus*. Add note on extinct groups of fishes – Placodermi and their systematic position.

General Essays: 1. Accessory respiration in fishes 2. Migration in fishes

Super Class: Tetrapoda

Class Amphibia: (18hrs)

Type: **Frog**

Classification down to order:

Order Apoda: Examples: *Ichthyophis*, *Uraeotyphlus*

Order Urodela: Examples: *Necturus*, *Ambystoma*, mention Axolotl and pedomorphosis

Order Anura: Examples: *Bufo*, *Rhacophorus*

Mention the discovery of Caecilians in Kerala eg: *Nasikabatrachus sahyadrensis* and significance of 'Bush frogs' e.g., *Philautus* sp. (Direct development without larval stage).

General Essay: Parental care in Amphibia

Class Reptilia: (8 hrs)

Salient features of the following groups with examples.

Subclass Anapsida:

Order Cotylosauria: [stem reptiles] Example: *Hylonomus*

Order Chelonia: [common turtles, tortoises etc.] Example: *Chelone*. Distinguish Turtles and tortoises.

Subclass Lepidosauria: [= Super order 1. Lepidosauria under Subclass Diapsida]

Order Rhynchocephalia: Example: *Sphenodon*

Order Squamata:

Sub order: Lacertilia Examples: *Chamaeleo*, *Calotes*,

Sub order: Ophidia Examples: *Ptyas*, *Typhlops*, *Naja*, *Daboia* (=Vipera) *Bungarus*, *Echis*, *Hydrophis*.

Subclass Archosauria [= Super order 2. Archosauria under Subclass Diapsida]

Order Crocodylia Examples: *Crocodylus*, *Gavialis*, *Alligator*

Subclass Euryapsida: brief account on the unique features

Subclass Synapsida brief account on the unique features

General topics. – 1. Biting mechanism of Snake and venom.

2. Identification key for poisonous snakes.

3. Fossil reptiles and their significance in evolutionary science.

Common topic for Discussion

1. Marine, estuarine and fresh water edible fishes..

2. Scales of fishes.

3. Tail fin of fishes.

IV Semester B.Sc. Degree Programme

Zoology Core Course – 4

Code: 4B04ZLG

Chordata – II and Comparative Anatomy

Credit: 3; Hours: 3/Week; Total hours: 54

Aim and Objectives: The course is designed to give the student a comprehensive idea of higher chordate diversity- birds and mammals, their structure and functions. The type studies are intended to provide an understanding of the typical vertebrate body structure, which has a lot in common in the various groups.

Chordate characters - Fundamental, General and Advanced features. Comparative outline on Chordates. Diversity of chordates; classification to subphyla and their salient features. Classification followed as per J Z Young (1980). Mention 8 kingdom classification and chordate place in it. The study of representative types (wherever is specified) to be studied in detail. Diversity of chordate with brief account of examples from each group (here down to order) with emphasis on ecological and adaptive features, economic importance and other important biological features to be studied. The comparative anatomy topics are intended to provide a broad understanding of the different classes, as the study of types is limited.

Class AVES

(18 hrs)

Type: Pigeon (excluding skull in skeletal system)

Classification of Aves as outlined below with the following examples.

Subclass Archaeornithes

Order Archaeopterygiformes Example: *Archaeopteryx* – brief account

Subclass Neornithes

Super order Palaeognathae [=Ratitae]

Examples: *Casuarius* (cassowary), *Apteryx* (kiwi), *Rhea*, *Struthio* (ostrich)

Super order Neognathae [=Carinatae] [pheasants, quail, turkeys, grouse] Example: *Pavo cristatus*

[screamers, water fowls] Example: *Anas*

[perching birds] Example: *Passer domesticus*

[wood peckers, barbets, honey guides] Example: *Dinopium*

[kingfishers & allies] Example: *Alcedo*

[swifts, humming birds] Example: *Micropodus*

[owls] Example: *Bubo*

[cuckoos, roadrunners, turacos] Example: *Eudynamis*

[parrots, lorries, cockatoos] Example: *Psittacula krameri*

[cranes, rails, coots, bustards] Example: *Choriotis*

[plovers, gulls, terns, auks, sand pipers] Example: *Tringa*

[pigeons, doves, sand grouse] Example: *Columba*

[diurnal birds of prey – falcons, hawks] Example: *Mylvus*

[herons, storks, ibis, spoon bills] Example: *Ardea*

[pelicans, cormorants] Example: *Pelecanus*

[Impennae] Example: *Aptenodytes* (penguin)

Mention extinct birds: passenger pigeon (*Ectopistes migratorius*), dodo (*Raphus cucullatus*).

Rediscovery of Jerdon's courser (*Cursorius bitorquatus*); Add note on Birds in Kerala

General topics –1) Flight adaptations in birds. 2) Bird migration.

Class MAMMALIA

(30 hrs)

Type: *Oryctolagus cuniculus*:

Classification of Mammalia down to the orders cited with examples specified.

Subclass Prototheria: [egg-laying mammals]**Order** Monotremata Examples: *Ornithorhynchus* (platypus), *Tachyglossus* (= Echidna)**Subclass Theria:****Infraclass: Metatheria** [Marsupials]**Order** Marsupialia Examples: *Didelphis* (opossum), *Macropus* (kangaroo)**Infraclass Eutheria: [true placental mammals]****Order** Edentata. Examples: *Bradypus* (sloth), *Dasyopus* (armadillo) *Myrmecophaga* (spiny ant eater)**Order** Pholidota. Example: *Manis* (pangolin / scaly ant eater)**Order** Lagomorpha. (rabbits and hares)**Order** Rodentia. Examples: *Funambulus*, *Ratufa***Order** Insectivora. Examples: *Paraechinus* (hedgehog), *Suncus* (=Crocidura)**Order** Dermoptera. Examples: *Cynocephalus* (=Galeopterus – flying lemur)**Order** Chiroptera. Examples: *Pteropus*, *Pipistrellus***Order** Primates Examples: *Loris*, *Macaca*, *Gorilla*, *Pongo*, *Hylobates*, *Homo***Order** Carnivora. examples: *Phoca* (seal), *Odobenus* (walrus), *Panthera* sps. *Viverricula indica* (civet)**Order** Cetacea. Examples: *Physeter* (sperm whale) *Delphinus* (dolphins), *Phocaena* (porpoise) *Balaenoptera* (baleen whale)**Order** Artiodactyla Examples: *Sus scrofa cristatus*, Gaur, Giraffa, Hemitragus (tahr), Cervus, Axis axis (spotted deer) *Antelope cervicapra* (antelope/ black buck)**Order** Perissodactyla Examples: *Equus caballus* (horse), *Rhinoceros***Order** Sirenia Examples: *Trichechus* (manatee), *Dugong***Order** Proboscidea Examples: *Elephas maximus indicus* [Indian elephant]*Loxodonta africana* [African savannah elephant] *Loxodonta cyclotis* [African forest elephant]**General essays.** – 1. Dentition in mammals.

2. Aquatic mammals.

COMPARATIVE ANATOMY - Vertebrata

(6 hrs)

Integumentary structures in vertebrates – scales, feathers and hairs; nails, claws, horns & antlers.

Heart and aortic arches in different groups of vertebrates.

Evolution of kidney in different vertebrate groups. (Pro, meso, meta and opisthonephros) Jaw suspension.

Types of vertebrae – procoelus, amphicoelus, biconvex, amphiplatian, heterocoelus.

ASSIGNMENT / SEMINAR TOPICS (Only For Internal Evaluation)

1. Amphibians in kerala
2. Snakes of Kerala
3. Fossilised reptiles.
4. Beak and feet of birds.
5. Mammals of Kerala forests.
6. Diversity of animals in Wetlands in Kerala

REFERENCES for both courses (Chordata I & II)

- Bhaskaran, K. K. & Biju Kumar, A.: Textbook of Zoology (Chordata), Manjusha
Colbert's Evolution of the Vertebrates
David Burney: Animal, Dorling-Kindersley
Dhami, P. S. & Dhami, J. K.: Chordate Zoology. R. Chand & Co
Ekambarnath Iyer – Manual of Zoology, Vol II; S V Publishers.
Encarta: (CDs), 2004 Edn or new versions, Microsoft
Encyclopedia Britannica: (CDs), 2004 Edn or new versions, Britannica, India
Harvey Pough, F. et al.: Vertebrate Life. Pearson Edn Inc, Indian Edn
Hyman: Comparative Anatomy of Vertebrates; Mc Graw Hill
Induchoodan: Keralathile Pakshigal. 1996, Kerala Sahitya Academy, Trichur
Jordan and Verma: Chordate Zoology; S. Chand & Co.
Kardong, K. V.: Vertebrates: Comparative Anatomy, Function and Evolution. 1995, WCB
Kotpal R L – Vertebrate Zoology; Rastogi Publ.
Kotpal, R. L.: Modern Textbook of Zoology: Vertebrates. Rastogi
Parker and Haswell: A Text Book of Zoology Vol 2; Mac Millan.
Prater, S. H.: The Book of Indian Animals. 1971, BNHS
Romer, A. S: The Vertebrate Body; 1992 reprint, Vakils, Feffer & Simons, Bombay
Salim Ali: Book of Indian Birds; BNHS.
Salim Ali: Birds of Kerala. 2 e, 1969, O U P
Salim Ali: The Book of Indian Birds. BNHS, Oxford.
Weichert: Anatomy of Chordates; Orient Longman.
Young JZ: Life of Vertebrates – Oxford University Press.

5 Semester B. Sc. Degree Programme (Theory)
Zoology Core Course -5
BIOCHEMISTRY AND ENDOCRINOLOGY
Code: 5BO5 ZLG
Credit: 3; Hourse: 3/week; Total Hours: 54

Aim and Objectives: The course is intended to give the student a basic understanding of the fundamental concepts in biochemistry and endocrinology, which can help in his/her understanding of other areas such as physiology. At the end of the course the student should have an idea regarding the basic physical and chemical reactions that underlies life processes.

SECTION – A: BIOCHEMISTRY (46 Hours)

Unit -I: Biochemistry and the living state – mention micro, macro & trace elements/ mineral ions – their biological significance. Water – molecular structure & dipolar nature, dissociation– concept of pH, buffers- Handerson Hassel Bach equation; Biological functions of water. **(03 hrs)**

Unit – II: Macromolecules:

Carbohydrates – basic structure, different types of glycosidic bonds and biological functions. Details of the following - mono, di and polysaccharide – aldo and keto sugars: trioses (glyceraldehydes & dihydroxy acetone), tetroses (erythrose), pentoses (ribose & ribulose), hexoses (glucose & fructose); homo polysaccharides (glycogen & chitin) and hetero polysaccharides (hyaluronic acid & chondroitin sulphate). **(03hrs)**

Proteins – basic structure, peptide bonds and biological importance of proteins and amino acids. Classification of amino acids based on functions - proteogenic and non-proteogenic aminoacids; essential, half essential and non essential aminoacods- structure of proteogenic aminoacids. Classification of proteins based on water solubility- fibrous and globular proteins. Structural levels of proteins – primary, secondary, tertiary and quaternary structure and the bonds present in them – helical, beta pleated sheet (parallel & antiparallel) examples – keratin, silk fibroin, myoglobin, haemoglobin. **(04hrs)**

Lipids – basic structure and biological importance of lipids. Classification – Simple lipids, waxes, phospholipids (lecithin, cephalin), glycolipids (cerebrosides, gangliosides), steroids (cholesterol) and prostaglandins. **(03hrs)**

Nucleic acids and biologically important Nucleotides – structure and importance of ATP, cyclic AMP, UTP, NAD, NADP, FMN, FAD; double helical structure of DNA (Watson & Crick model) , different forms DNA (A,B,C,D,Z), structure of RNAs (mention rRNA, mRNA and tRNA (clover leaf model). **(10hrs)**

Unit -III: Enzymes and Function:

Enzymes- Classification and Nomenclature (IUB) – 6 major classes. Concept of active sites, mechanism of enzyme action (lock and key & induced fit hypothesis); factors influencing the velocity of enzyme action- effect of pH, temperature, enzyme and substrate concentration;

regulation of enzyme action- activation and inhibition (competitive, non competitive, allosteric and feed back); concept of free energy, kinetic theory, Michaelio-Menten equation; isozymes. **(06hrs)**

Vitamins and biological importance-Fat soluble and Water soluble vitamins (vitaminB (Thiamine, Riboflavin, Niacin, Pantothenic acid, Cyanocobalamine, Folic acid, Pyridoxin) and C. **(02hrs)**

Unit – IV: Metabolism:

Basal metabolism- calculation BMR by Harris-Benedict formula; Energy metabolism- (a) Carbohydrate metabolism – glycolysis, glycogenolysis, glycogenesis, gluconeogenesis, Pentose Phosphate pathway), (b) Protein metabolism- deamination, transamination, decarboxylation, transmethylolation. (c) Lipid metabolism – oxidation of glycerol and fatty acids; Biosynthesis of fatty acids; Kreb’s cycle (structural details expected for all); Electron Transport System (ETS) and oxidative phosphorylation. **(15 hrs)**

SECTION B. ENDOCRINOLOGY (08hrs)

Invertebrate endocrinology - Neuroendocrine organs and hormones found in insects & crustaceans **(1hrs).**

Human endocrinology - Classification of hormones based on chemical nature (peptides and proteins, amino acid derivatives and steroid hormones); endocrine glands (Pituitary, Adrenal, Pineal, Thyroid, Parathyroid, gastrointestinal,gonads,placenta and pancreas) and their hormones (function), disorders; Concepts of neurosecretion- Hypothalamus, hypophysial interactions, releasing and inhibiting hormones. **(4hrs)**

Hormone Action- Mechanism of hormonal action at the level of cell membrane (Insulin), at the level of enzyme located in cell membrane (Adrenaline and peptide hormones), at the level of organelles (Thyroxin), at the level of genes (Steroids), positive and negative feedback regulation; hormone receptors. **(3Hrs)**

REFERENCES

- Aggarwal, S. K. Foundation course in Biology, 2nd edition-Ane’s Student edition
Arora, M. P. (2004). Biophysics, 1e, Himalay Publications
Asha Bhate (2005). Modern Tools and Techniques. Sarup & Sons.
Bajpai, P. K. (2006). Biological Instrumentation and Methodology, 1e, S. Chand & Company Ltd.
Boyer, R. (2004). Modern Experimental Biochemistry, 3e, Pearson Edn.
Bentley, P. J. Comparative vertebrate endocrinology, CUP.
Berry, A.K., A Text book of Animal Physiology, 6e, Emkay Publications, Delhi-51.
Chatterjee, C.C., Human Physiology, Medical Allied Agency.
Conn, E.E. et al. Outlines of Biochemistry, 5e, 2001, John Wiley & Sons.
Ganong, W.F., Lange Review of Medical Physiology, 20, Indian Edn., 2002, MGH.
Gorbman, A. et al. Comparative Endocrinology, JW & S.
Guyton, A.C., Hall, J.E.: Text book of Medical Physiology, IOC, Harcourt.
Plumme D., Practical Biochemistry
Hadley, M.E., Endocrinology, 5e, 200, Pearson Edn. (Singapore), ND.

Highnam & Hill: Invertebrate Endocrinology.
Hoar, W.S.: General and Comparative Animal Physiology. 1975, PHI.
Mathews, C.K. et al., Biochemistry, 3e, 2003, Pearson Edn. (Indian Edn.).
Nelson, D.L. & Cox, M.M., Lehninger Principles of Biochemistry, 4e, Palgrave MC, WHF.
Oser, B., Hawk's Physiological Chemistry, 14e, 1971, TMH.
Turner, C.D. General and Comparative Endocrinology.
Vander, A.J. et al. Human Physiology, 1998, MGH.
Voet, D. & Voet, J.G., Biochemistry, JW & S.
Williams, R.H., Text book of Endocrinology, W.B. Saunders.
David P. Plummer - Introduction to Practical Biochemistry, 3rd edn., Tata McGraw Hill Pub. Comp., New Delhi.
Nielsen – Animal Physiology – Cambridge University Press.
Wilson and Walker – Principles and Techniques of Biochemistry and Molecular Biology, 6th edition – Cambridge Low Price edition.

5 Semester B.Sc. Degree Programme (Theory)
Zoology Core Course -6
BIOPHYSICS, BIostatISTICS & METHODOLOGY
Code: 5B06 ZLG
Credit: 3; Hours: 3/ Week; Total Hours: 54

Aim and Objectives – This course is meant to introduce methodology and perspectives of science and the techniques in biophysics to help the student pursue systematically his/her interests in the chosen branch of science, i.e., zoology, in this programme. At the end of the course the student should be able to apply scientific methods independently in his areas of pursuit.

SECTION A: BIOPHYSICS (22 Hours)

Unit – 1: Tools and Techniques: (Principle, working methodology and applications).
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 (PAGE)
(e) X-ray crystallography
(f) Autoradiography
(g) pH – meter
(h) Spectrophotometer
(i) Microtome
(j) Centrifuge – different types of centrifuge – Cell fractionation, different types of centrifugation. **(17 hrs)**

Unit- II: Radiation Biology – units of radiation – ionizing and non-ionizing radiations; radioisotopes – applications (analysis, treatment); biological effects of radiation **(03 hrs)**

Unit- III: Immunological techniques – immunodiffusion – immunoelectrophoresis – ELISA – RIA (Basic principle and uses only) **(02 hrs)**

SECTION B: BIostatISTICS & RESEARCH METHODOLOGY (32 hrs)

UNIT- I. Introduction- Laws of science and basis of scientific laws.
Science as a human activity- Science and Technology, scientific attitude; methods and tools in science- scientific method, key steps of scientific method- inductive and deductive methods; posing a question; formulation of hypothesis. Significance of verification (proving), corroboration and falsification (disproving); peer reviews; Importance of models, simulations and virtual testing. **(02 hrs)**

UNIT- II. Experimentation in science - design of an experiment, observation; data collection – primary and secondary; parameter and variable - independent and dependent variables; importance of Pilot Study; Necessity of units and dimensions; repeatability, replication and randomization. Controls – negative and positive controls; Experiments to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments. **(06 hrs)**

UNIT- III. Analysis of data (biostatistics)

Biostatistics – definition, role of statistics in life sciences; Population and Sample; sampling - sample size, sampling errors and brief account of sampling methods; Presentation of data: a) Graphic representation- histogram, frequency polygon, and frequency curve; b) Diagrammatic representation - line diagram, bar diagram and pie diagram. Analysis of data (for grouped and ungrouped data): a) Measures of central tendency – mean, median and mode. b) Measures of dispersion – range, mean deviation and standard deviation.

Testing of Hypothesis – Simple, composite, null and alternative hypothesis; Types of errors - critical region, significance levels, power of test; Tests of significance – chi-square test and goodness of fit. Correlation and regression (brief account). **(10 hrs)**

UNIT- I V. Ethics in science: Sharing of knowledge; transparency and honesty; Publications and Plagiarism. (02 hrs)

Unit -V. METHODS IN ZOOLOGY

Identification- preparation of taxonomic key- simple dichotomous key, bracketed key, intended key; importance of dissections; measurement of biodiversity-diversity indices (species richness, evenness and dominance); preparation of zoological specimens- collection of aquatic organisms (plankton nets), soil organisms (Berlese Funnel), Insects (nets and traps); Preservation- wet preservation (formalin, alcohol), dry preservation (micro slides, display boxes); sketching and labeling of biological specimens - labeling – general rules and significance; Taxidermy – brief account; culturing lab organisms – paramecium culture, drosophila culture. **(12 hrs)**

REFERANCES

- Roy K N: A Text Book of Biophysics; New Central Book Agency
Ackerman E: Biophysical Science; Prentice Hall Inc.
Srivastava HS: Elements of Biochemistry; Rastogi Pub..
Abraham Mazur & Harrow: Text Book of Biochemistry; Saunders Toppan.
Pranab Kumar Banerjee: Introduction to Biophysics; S.Chand.
Bailey, N. T. J. (1994/'95). Statistical Methods in Biology, 3e, CUP/ LPE.
Collins, H. and Pinch, T. (1993). The Golem: What Every one Should Know About Science, Cambridge University Press.
Gieryn, T. F. (1999). Cultural Boundaries of Science, Univ. Chicago Press.
Green, R. H. Sampling design and Statistical Methods for Environmental Biologists. J.W. & S. Gupta, S. P. (2002). Statistical Methods. 31e, Sultan Chand & Co.
Holmes, D., Moody, P. and Dine, D. (2006). Research Methods for the Biosciences, Oxford University Press.
Pechenik, J. A. (1987). A Short Guide to Writing About Biology, Boston. Little Brown.
Prasad, S. (2004 / '05). Elements of Biostatistics, Rastogi Pubs., Meerut.
Ruxton, G. D. and Colegrave, N. (2006). Experimental Design for Life Sciences, 2e, Oxford University Press.
Rastogi, V. Fundamentals of Biostatistics 2nd edition – Ane's student edition
Snedcor, G. W. and Cochran, W. G. Statistical Methods. Allied East-West Press, ND.
Sokal, R. R. and Rohlf, F. I. Introduction to Biostatistics, W.H. Freeman.
Steel, R.G.D. and Torrie, J.H. Principles and Practice of Statistics with special reference to Biological Science.
Verma, B. L. et al. (1993). Biostatistics, OBS, ND.

Victoria, E. McMillan. (1997). Writing Papers in the Biological Sciences, Bedford Books, Boston.

Yadav, K. (1993). Teaching of Life Sciences, Anmol Pubns., New Delhi.

Useful webs

Biological methods: [www.cfkeep.org/html/stitch.php?s=98965698293378 & id = 44650773279975](http://www.cfkeep.org/html/stitch.php?s=98965698293378&id=44650773279975).

Writing Papers: www.ruf.rice.edu/~bioslabs/tools/report/reportform.html

V Semester B.Sc. Zoology Degree Programme

Zoology Core Course -7

CELL BIOLOGY AND IMMUNOLOGY

Code: 5B07 ZLG

Credit: 3; Hours: 3/week; Total Hours: 54

Aim and Objectives: To give the students an overall knowledge of cell studies, which forms one of the foundations of biological sciences. The topics cover the basic concepts in cytology and the various means and methods used in the study of cell and cell structures. Together with the practical, the student can develop basic skills in the field of microscopy and staining techniques. A few basic concepts in immunology have been added to introduce the student to this frontier area of biology.

SECTION A .CELL BIOLOGY (42 hours)

Unit I : Introduction and Definition of cell biology:History and scope of cell biology ,unit of measurement of cell;, cell theory and its modern concept .Mycoplasma, virus, viroids, virions and prions. Prokaryotes and eukaryotes. (2 hrs)

Unit II : Histological techniques

Preparation of whole mounts. Fixation and its aims, fixatives (formalin, ethanol, Bouin's fluid, Carnoy's fluid, Osmium tetroxide). Dehydration, embedding and sectioning (brief account).

Staining: common histological stains-haematoxylin, eosin, carmine. Vital stains – neutral red, Janusgreen, methylene blue, rhodamine. Stains for electron microscopy – uranylacetate, lead acetate. (3 hrs)

Unit III Cell structure and functions

1) Protoplasm – Physical properties and functions (1hr)

2) Plasma membrane – Structure (Fluid Mosaic model), mention Robertson's

Unit Membrane concept. Functions of plasma membrane – passive transport, active transport, bulk transport. Differentiation of cell surface – invaginations, microvilli, basement membrane, tight junctions (zonula occludens), gap junctions (nexus) ; cell coat (4 hrs)

3) Endoplasmic reticulum: structure and functions (1 hr)

4) Ribosomes: Prokaryotic and eukaryotic ribosomes, ultrastructure and chemical composition & functions of ribosomes. Monosomes and polysomes. Biogenesis of ribosomes. (2 hrs)

5) Golgi bodies: structure and functions (cellular secretion in detail) (2 hrs)

6) Lysosomes: structure and chemical make up polymorphism, function (cellular digestion in detail), GERL concept. (2 hrs)

7) Mitochondria: structure and chemical composition – Bioenergetics including respiratory chain and electron transport (Brief account only – details of steps not expected) Biogenesis (2 hrs)

8) Cytoskeleton – brief account of microtubules, microfilaments and intermediate filaments. (1 hr)

9) Microbodies; Peroxisomes and Glyoxysomes (1 hr)

10) Interphase nucleus: nuclear envelope, pore complex, Nucleus, Nucleoplasm, chromatin – structure and functions. (2 hrs)

11) Chromosomes: Physical and chemical structure, chromatin – heterochromatin and euchromatin. (2 hrs)

12) Giant Chromosomes – structure and functions of Polytene and Lampbrush chromosomes – mention puffs and bands, Endomitosis. (3 hrs)

Unit IV Cell Division

Cell cycle – G₁, S, G₂ and M phases, check points of cell cycle, use of Colchicines. Meiosis – details of synaptonemal complex, crossing over, chiasma, terminalisation. Spermatogenesis and Oogenesis. (5hrs)

Unit V Parthenogenesis

Types of parthenogenesis – facultative, obligatory, cyclic and complete. Arrhenotoky, thelytoky. Restitution, auto fertilisation. Significance of Parthenogenesis (2 hrs)

Unit VI Cancer. Benign and malignant tumours - metastasis. Characteristics of cancer cells. Cell lines- HeLa cells, L-cells. Hypothesis about cancer- mutation, viral and defective immunity. Proto oncogenes, oncogenes (cellular and viral), anti oncogenes. Chromosomal abnormalities associated with malignancies like chronic myelocytic leukemia and retinoblastoma. (5 hrs)

Unit VII Cells of extracellular matrix. Connective tissue cells – mesenchyme cells, fibroblasts, mast cells, fat cells; blood cells- erythrocytes, lymphocytes, monocytes, neutrophils, eosinophils, plasma cells, and macrophages. Stem cells – scope and significance. (2 hrs)

SECTION B – IMMUNOLOGY (12 hours)

Unit I. Basic concepts. Immunity, Infection, Natural and Acquired immunity, Active and Passive immunity, Immune response - Cell Mediated and Humoral. (3 hrs)

Unit II. Antigens, Haptens and Antibodies. Typical structure of antibody; Classes of antibodies and their functions. Genetic basis of antibody diversity (somatic recombination theory) Major Histocompatibility Complex, HLA typing (5hrs)
Antigen-antibody reactions – precipitation, agglutination, complement fixation, opsonisation. Primary and secondary immune responses. (2 hrs)

Unit III. Hypersensitivity reactions. Types of hypersensitivity-I, II, III & IV. Brief accounts of allergy and anaphylaxis, autoimmune reactions, immune complex disease (e.g., rheumatic fever), allograft rejection. (2 hrs)

Topics for Seminar/Assignment (Only for internal evaluation)

1. Features of prokaryotic and eukaryotic cells.
2. Differences between plant and animal cell.
3. Carcinogens.
4. Types of cancer.
5. Functions of blood.

6. Mitotic cell division.

REFERENCES

Blackwell Science Co. (Ane Books)
Darla Wise and Gordon Carter: Immunology. A comprehensive Review;
David Latchman (Editor): Basic Molecular and Cell Biology (3rd Ed); BMJ
De-Robertis: Cell and Molecular Biology-Holt Saunders
Geise: Cell Physiology – Holt Saunders
Gupta: Cell and Molecular Biology: Rastogi Publications.
Johnson et al: Molecular Biology of the Cell – Garland Science
Karp: Cell Biology – McGraw Hill.
Nandini Shetty: Immunology: Introductory Text Book; Mc Graw Hill.
Pollard and Earnshaw: Cell Biology – Saunders. Publishing Co.
Stern and Nancy: The Biology Of Cells – Wiley Eastern.
William E Paul: Fundamental Immunology; Raven

V SEMESTER BSc DEGREE PROGRAM (THEORY)

ZOOLOGY CORE COURSE 8

CODE: 5B08ZLG

HERIDITARY SCIENCE

Credit: 3; Hours: 3/week; Total Hours; 54

Aim and Objectives: The course offers a comprehensive understanding in Genetics and human genetics, an area that includes certain applied frontier concepts of biological science. The topics introduce both basic concepts as well as applied aspects. At the end of the course the student should develop a clear idea regarding the fundamentals responsible for heredity and also the various methods of manipulating these factors for human welfare, understanding of the various factors that contribute to congenital problems and to what extend their incidence can be reduced, and in case of occurrence, be managed

Unit I. Introduction: Short account of alleles (wild and mutant), homozygosity, heterozygosity, back cross and test cross. (1 hr)

Unit II. Interaction of genes. Allelic and non-allelic interactions.

Supplementary factors – 9:3:3:1, comb pattern in fowl.

Dominant epistasis – 1:3:3, plumage colour in fowl

Recessive epistasis – 9:3:4, coat colour in pigs.

Polygenic inheritance – skin colour in man.

Lethal genes – coat colour in mice. (5 hrs)

Unit III. Multiple allelism. Inheritance of coat colour in rabbits. Genetics of A B O blood groups and Rh factor in man. Mention other groups such as M, N, MN and Bombay group. Erythroblastosis foetalis. Genetic problems involving blood groups. (6 hrs)

Unit IV. Linkage and Crossing Over. Linkage groups. Complete and incompletelinkage. Disruption of linkage through crossing over and recombination. Factors affecting crossing over. Significance of crossing over. (5 hrs)

Unit V. Sex Determination. Autosomes and sex chromosomes. Male heterogamy and female heterogamy. Role of Y chromosome in humans, mention SRY gene. Sex determination in drosophila. Genic balance theory of Bridges. Barr bodies, Lyon's hypothesis; evidences for X chromosome inactivation. Gynandromorphism and sex mosaics. Hormonal and environmental influence on sex determination. (6 hrs)

Unit VI. Mutation. Mutation theory of De Vries; types of mutations; molecular basis of gene mutations. Mutagens, natural and induced mutations. Significance of mutations. Chromosomal aberrations – structural and numerical. (6 hrs)

Unit VII. Cytoplasmic inheritance. General characteristics, example: shell coiling in Limnaea and kappa particles in paramecium. (3 hrs)

Unit VIII. Human genetics Importance, Eugenics, euphenics and euthenics. Pharmacogenetics and Ecogenetics– definition, gene loci influencing drug metabolism, example: porphyria. Ecogenetics of lung diseases. (2 hrs)

Unit IX. Human Chromosomes: Identification of Human Chromosomes: - Characterisation of chromosomes using various banding techniques such as Q banding, G banding, R banding, C banding and N banding. Chromosome band nomenclature, designation of bands and sub bands. (2hrs)

Unit X. Congenital Disorders: Chromosomal and molecular level causes and clinical features of:

A) Autosomal abnormalities – 1) Trisomy 21 2) Trisomy 18 3) Trisomy 13.

B) Sex chromosomal abnormalities – 1) Turner’s Syndrome 2) Klinefelter’s Syndrome 3) XYY males.

C) Autosomal Dominant diseases and traits – Achondroplasia, Huntington’s Disease, Myotonic Muscular Dystrophy, Neurofibromatosis, polydactyli.

D) Autosomal Recessive diseases – Alkaptonuria, PKU, Albinism, Cystic Fibrosis, Sickle Cell Anaemia, Thalassaemia, Lesch Nyhan Syndrome.

E) Sex-linked Diseases – Colour blindness, Haemophilia, , Holandric traits.

F) Multi factorial Traits- Congenital heart diseases- ASD, VSD, Diabetes, Clubfoot, Alzheimer’s disease. (12 hrs)

Unit XI. Genetic Services – Pedigree Construction – symbols used in pedigree construction. Analysis of human genome – Brief account of DNA sequencing, Southern Blotting, PCR. Genetic Counselling – Directive and Non-directive. Reasons for seeking counselling. Counselling for dominant, recessive, X linked and multifactorial diseases. (6hrs)

SEMINAR / ASSIGNMENT TOPICS (Only for internal evaluation)

1. Mendel’s laws.

2. Genetic problems in monohybrid and dihybrid crosses.

3. Human Genome Project.

4. Structure of DNA.

5. Transgenic plants and animals

6. Animal cloning.

7. Sex determination in mammals and birds. (XX-XY & ZW-ZZ methods.)

REFERENCES

Bhatnagar, Kothari and Mehta: Essentials of Human Genetics; Orient Longman.

David Latchman (Editor): Basic Molecular and Cell Biology (3rd Ed); BMJ Publishing Co.

Elementary Genetics –Singleton

Gene VI by Benjamin Lewis, Oxford press

Gene VIII by Benjamin Lewis, Oxford press

General Genetics –SRb, Owen & Edger

Genetic Engineering & its applications –Joshi

Genetics & Genetic Engineering –Joshi

Genetics –Ahluwalia

Genetics –Alenberg12. Foundation of Genetics –Pai

Genetics –Gardener

Genetics –Gupta

Genetics –Sarin

Genetics -Stickberger

Genetics Vol. I and II by Pawar C. B., Himalaya publication

Genetics –Winchester

Gerald J. Stein : Human Genetics.

Gupta P K : Cytology, Genetics and Molecular Biology; Rastogi

Human Genetics : Elof Axel Carlson; TMH.

John Ringo : Fundamental Genetics; Cambridge University Press.

Mange and Mange :Basic Human Genetics; Rastogi Pub.

Miglani, Gurubachan: Basic Genetics; Narosa pub.

Principles of Genetics –Sinnot Dunn, Dobzansy

Rastogi V B : Fundamentals of Molecular Biology; Ane Books.

Sambamurthy : Genetics; Narosa Pub.

Sanjay Mandal : Fundamentals of Human Genetics ; New Age Int'l.

Strickberger : Genetics; Macmillan.

T. B. of Genetics-VeebalaRastogi

Verma & Agarwal: Genetics; S. Chand & Co.

Verma and Agarwal : Concepts of Human Genetics; S. Chand

V Semester B.Sc. Degree Programme (Theory)
Zoology Core Course -9
Comparative Animal Physiology and Human Physiology
Code: 5B O9 ZLG
Credit: 3; Hours: 3/week; Total Hours: 54

Aim and Objectives: The course is designed to give the student a detailed understanding of the major physiological processes. It is intended to convey concepts, which will kindle interest in the intricate mechanisms involved in the functioning of a living being.

Nutrition **10 hrs**

Types of nutrition – Autotrophic, Heterotrophic, Holozoic, Saprozoic and Parasitic. Symbiotic digestion (pre and post gastric). Compound stomach in ruminants.

Nutrition in man - Histology and functions of gastrointestinal tract and its associated glands. Mechanical and chemical digestion of food. Role of gastrointestinal hormones. Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins. Defaecation. Concept of balanced diet in man. Defects of modern food habits. Obesity. Importance of dietary fibers. Nutrition during pregnancy and breast feeding. Fasting and its significance.

Respiration **9 Hrs**

Respiratory organs in different groups of animal kingdom. Integument, Gills, Tracheal system, Lungs (only a brief account). Respiratory pigments in animals – Haemoglobin, Haemerythrin, Haemocyanin and Chlorocruorin.

Respiratory physiology of man - Histology of trachea and lungs. Respiratory muscles and breathing movements. Pulmonary ventilation. Respiratory volumes and capacities. Role of pulmonary surfactants. Mechanism of gas exchange. Structure & function of haemoglobin. Transport of oxygen and carbon dioxide in the blood. Oxy-haemoglobin dissociation curve, Bohr effect, reverse Bohr effect, Haldane effect. Neural (voluntary and automatic) and chemical control (mention the role of carotid and aortic bodies) of respiration. Smoking and its physiological effects. Carbon monoxide poisoning, oxygen toxicity, nitrogen narcosis. Respiratory disorders like asphyxia, hypoxia, hypercapnia.

Circulation **8 Hrs**

Comparative account of hearts in different groups of animals. Hemolymph and hemocytes. Open and closed circulatory systems. Types of hearts (Neurogenic and myogenic).

Conduction and regulation of heart beat in myogenic heart. Cardiac cycle and ECG (human). Cerebral circulation, blood brain barrier. Composition of blood. Formation and fate of blood cells. Blood clotting mechanism. Clotting factors. Intrinsic and extrinsic pathways. Anticoagulants. Blood transfusion (safety and security problems). Regulation of blood pressure. Cardiovascular problems in man- Atherosclerosis, Arteriosclerosis, Angina pectoris, Myocardial infarction, Thrombosis, Embolism.

Lymph: composition and dynamics

Excretion and osmoregulation **8 Hrs**

A brief account of excretory organs in animals. Contractile vacuoles, Protonephridia, Nephridia, Malpighian tubules, Antennary glands, Kidneys (Mention Pronephros, Mesonephros and Metanephros)

Ammonotelism, Uricotelism and Ureotelism. Urea Cycle.

Structure of human nephron and process of urine formation. Counter current mechanism. Micturition. Composition of urine. Hormonal control of kidney functions. Kidney disorders - acute renal failure, chronic renal failure, glomerular nephritis, pyelonephritis, kidney stones. Abnormal constituents of urine.

Osmoregulation. Osmoregulators and osmoconformers. Osmotic and ionic regulation in terrestrial, freshwater and marine animals. Water retention and conservation in desert animals.

Thermoregulation

2Hrs

Heat balance in animals. Poikilotherms, homeotherms and heterotherms. Adaptations to temperature extremes. Aestivation and hibernation. Counter current heat exchangers.

Muscle Physiology

6Hrs

Types of muscles – Striated, Non striated and Cardiac. Electrical, chemical and morphological changes during contraction and relaxation of striated muscle fibre. isotonic and isometric contraction. Cori cycle. Electrophysiology of muscle - threshold and spike potentials, simple muscle twitch, latent and refractory periods, summation, tetanus, tonus, staircase phenomenon. Fatigue, Oxygen debt, Rigor mortis.

Nerve and Sensory Physiology

9 Hrs

Types of neurons. Glial cells. Ionic basis of resting and action potentials. Propagation of nerve impulse in myelinated and non-myelinated nerve fibres. Giant neurons in cephalopods. Synaptic transmission (Chemical and electrical). Neurotransmitters. Neural disorders in man- Dyslexia, Parkinsons disease, Epilepsy, Alzheimers disease, Schizophrenia.

Receptors - classification and function- Mechanoreceptors, Chemoreceptors, Thermoreceptors and Photoreceptors.

Physiology of hearing and vision in Man.

Bioluminescence and Bioelectricity

2 Hrs

Biochemistry of bioluminescence. Importance of bioluminescence. Electric organs in ray fishes.

REFERENCES

Agarwal R A. : Animal Physiology and Biochemistry; S.Chand.

Berry, A.K., A Text book of Animal Physiology, 6e, Emkay Publications, Delhi-51.

Chatterjee, C.C., Human Physiology, Medical Allied Agency.

Ganong, W.F., Lange Review of Medical Physiology, 20, Indian Edn., 2002, MGH.

Guyton, A.C., Hall, J.E.: Text book of Medical Physiology, IOC, Harcourt.

Hoar W S: General and Comparative Physiology; Prentice Hall.

P S Verma, B S Tyagi, V K Agarwal: Animal Physiology

S C Rastogi: Essentials of Animal Physiology (New Age Int'l Pub.)

Schmidt Nielsen, K. (1994). Animal Physiology: Adaptation and Environment. Cambridge University Press

VI SEMESTER B. Sc. DEGREE PROGRAMME (Theory)

ZOOLOGY Core Course- 10

Code: 6B 10 ZLG

MOLECULAR BIOLOGY & BIOINFORMATICS

Credit: 3; Hours: 3/ week; Total Hours: 54

Aim and Objectives: The course familiarizes students with molecular biology which is an applied frontier areas of biological science. The section on Bioinformatics aims to understand and organize the information associated with these molecules to answer some of the larger questions in biology

Section- A: MOLECULAR BIOLOGY (27 hours)

Unit I. Introduction (4 hrs)

DNA as the genetic material. Griffith's experiments-Bacterial transformations- Experiments by Hershey and Chase. one gene – one enzyme hypothesis, one gene – one polypeptide hypothesis; central dogma of molecular biology and central dogma reverse; retroviruses.

Unit II. Genetic code (4hrs)

Gene and genetic code, cracking of genetic code; contributions of Nirenberg and associates, Khorana; Characteristics of genetic code, wobble hypothesis

Unit III. Organization of genome (5 hrs)

Classical concepts of genes. Modern concept of genes – cistron, muton, recon, compicon, transcripton; split genes, overlapping genes, pseudogenes, jumping genes, cryptic genes [brief accounts only]

Unit IV. Mitochondrial genome (1hr)

Unit V. DNA replication and repair (2hr)

Semiconservative method of DNA replication. Brief account on enzymes Repair mechanism brief account.

Unit VI. Protein synthesis: (4 hrs)

Regulation of Protein synthesis – Role of RNAs. synthesis of mRNA – promoter, enhancer and silencer sites – post transcriptional modifications – cis-trans splicing – spliceosomes – hn RNAs – activation of Amino acids – Polypeptide chain initiation, elongation and termination – release – Ribozymes – post translational modifications – coupled transcription and translation – poly cistronic mRNA – role of molecular chaperons – cell targeting proteins (brief account only).

Unit VII. Regulation of gene action: (4hrs)

In prokaryotes - operon concept, Lac operon in detail, lytic cycle and lysogeny of phages [brief account] siRNA and RNAi, House keeping genes, gene modulation.

Unit VIII. Genetic engineering (3hrs)

Gene cloning and DNA sequencing: Introduction, cloning vectors (plasmids, phages, cosmids, virus, YAC), Enzymes of rDNA technology (Exonuclease, Endonuclease, Restriction enzyme, DNA ligase, DNA polymerase, Reverse transcriptase)

Section- B: INFORMATICS AND BIO INFORMATICS (27 hours)

Unit I. An overview of Information technology and Bioinformatics. Mention the scope and applications. Internet as a knowledge repository. Academic search techniques. Course management with MOODLE. Digital libraries. National services such as INFLIBNET. (6 hr)

Unit II. Major databases in Bioinformatics (5 hrs)

a)Primary databases: Nucleotide sequence databases – Mention EMBL, DDBJ, Genbank
Protein sequence databases – Mention Swiss Prot, PIR, MIPS

Metabolite databases – Mention KEGG, EcoCyc	
b)Secondary databases: Mention PROSITE, PRINTS, Blocks	
Unit III. Database Search Engines	(4hrs)
Mention Entrez at NCBI of USA, SRS at EBI of England, STAG at DDBJ of Japan	
Unit IV. Sequence Similarity Search	(3hrs)
Pairwise sequence alignment: Mention BLAST, FASTA, Multiple sequence alignment: Mention CLUSTAL W, CLUSTAL X	
Unit V. Micro arrays	(2 hrs)
Data analysis tools and methods	
Unit VI. Genomics	(2 hrs)
DNA sequencing- Application (Brief account)	
Unit VII. Proteomics	(2 hrs)
Tools and applications -2D PAGE, Mass spectrometry, gel electrophoresis (Brief account)	
Unit VIII. Metabolomics	(1hrs)
Tools and applications (Brief account)	
Unit IX. Applications of Bioinformatics	(2 hrs)

References:-Molecular biology:

Alberts, B. et al. Molecular Biology of the Cell.
 Bhaskaran, K.K. & Biju Kumar, A.: Cell Biology, Genetics & Molecular Biology.
 Brooks, R. J.: Genetics: Analysis and Principles. 1999, Addison Wesley
 Burns, G. W. & Bottino, P. J.: The Science of Genetics. 6/7e, Maxwell McMillan
 Darnell, J. et al.: Molecular Cell Biology. Scientific American Book
 De Robertis, E. D. P. et al.: Cell and Molecular Biology TMH
 Dobzhansky, Th.: The Genetics and Origin of Species. Columbia Uty. Press
 Freifelder: Molecular Biology. Narosa Pubg. House, N. D.
 Gangane, S. D.: Human Genetics. 2e, 2000, B. I. Churchill Livingstone, N D.
 Garland Pubg. Inc., New York.
 Gerlad Karp: Cell and Molecular Biology.
 Good Enough, U.: Genetics. Halt, Reinharts & Winston
 Gupta, P. K.: Cell and Molecular Biology, 2e, 2002, Rastogi Pubs., Meerut.
 Kleinsmith, L. J. & Kish, V. M.: Principles of Cell and Molecular Biology. 2e,
 Lewin, B. Genes IX edition. OUP
 Manjusha.
 Sharma, A. K. & Sharma, A.: Chromosome Techniques. 1990, Butterworth
 Watson, Baker, Bell, Gann and Levin, Molecular Biology of Genes.
 Winnacker EL From Genes to Clones. Panima Publishing Corporation.

References:- Bioinformatics

- Alan Evans, Kendal Martin et al – Technology in Action; Pearson Prentice Hall.
- Anilkumar et al. General informatics and bioinformatics. Ane Books Pvt Ltd.
- Jin Xiong – Essential Bioinformatics; Cambridge University Press.
- Neelam Yadav – A Handbook of Bioinformatics; Anmol Publications.
- Rajaraman V – Introduction to Information Technology; Prentice Hall.
- K K Bhaskaran- Manjusha Publications
- Vijayakumaran- Academica

Web Resources:_ www.computerhistory.org, www.learnthenet.com, science data bases.

VI SEMESTER B. Sc. DEGREE PROGRAMME (Theory)
ZOOLOGY Core Course- 11
ENVIRONMENTAL SCIENCE AND CONSERVATION BIOLOGY
Code: 6B 11ZLG
Credit: 3; Hours: 3/week; Total Hours: 54

Aim and Objectives: To create solid base in the basic concepts of environmental studies and to give appreciation on diversity of life on earth. To provide an understanding of different levels of biological diversity. To realize the current status of biodiversity and to create interest for conservation of biodiversity

SECTION A- ENVIRONMENTAL SCIENCE- (34 hours)

Unit I. Environment and the concept of ecosystem.

Abiotic factors – Electromagnetic spectrum, visible light, temperature, soil, water, air. Biotic factors- Producers, consumers, decomposers. Ecosystem interaction and interrelationship between biotic and abiotic factors. The ecosystem as a cybernetic system. Homeostasis of the ecosystem. (4 hrs)

Unit II. Ecosystem Energetics – Fundamental concepts relating to energy

Energy flow in the ecosystem. Laws of thermo dynamics. concept of productivity; food chain; food web, trophic levels and trophic structure. Ecological pyramids. (4 hrs)

Unit III. Biochemical cycles. Basic types – Gaseous cycle- Carbon & Nitrogen

cycles. Sedimentary cycle – Phosphorous cycle. Hydrologic cycle. Recycling pathways and recycling index. (5 hrs)

Unit IV. Limiting factors – concept of limiting factors Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors. (2 hrs)

Unit V. Population Ecology: Properties of Population – Density, natality, mortality, age distribution, biotic potential, environmental resistance, energy carrying capacity. Population growth forms (J and S curves). Emigration, immigration, migration and population fluctuation. (4 hrs)

Unit VI. Community Ecology – Definition and characters. Species diversity, stratification and dominance. Ecotone and Edge effect. Ecological indicators. Community periodicity. Ecological succession- Basic types of succession. Process in succession. (3 hrs)

Unit VII. Population interactions – Interspecific association – positive and negative interactions – mutualism, commensalisms, parasitism, predation, competition, proto co-operation. (4 hrs)

Unit VIII. Habitat ecology – Biosphere and its divisions – Lithosphere, Hydrosphere and Atmosphere. Physical features, fauna and their adaptations in A) Aquatic ecosystem – i) Freshwater (lentic & lotic) ii) Marine – Pelagic and benthic realms. iii) Estuaries iv) mangroves.

B) Terrestrial ecology – Forest, Grassland, desert, tundra and cave biomes. (8 hrs)

SECTION B : CONSERVATION BIOLOGY (20hrs)

Unit I Biodiversity and its conservation. Definition, scope, hotspots of biodiversity, value of biodiversity, causes of biodiversity depletion. Conservation of biodiversity. Threatened and endemic species. Sustainable development. (4 hrs)

Unit II. Levels of biodiversity: Species diversity – brief account on economic values-food, medicine, clothing, shelter, tools and recreation; scientific and educational values; spiritual and ecological values). Ecosystem diversity – definition; values of ecosystems

Genetic diversity - importance of genetic diversity, mention basic methods for molecular analysis of genetic diversity - electrophoresis, RFLP, RAPD, (3 hrs)

Unit III - Threats to Biodiversity:

Extinction Process: Causes of extinction; species more vulnerable to extinction; rare species; brief account on human induced threat and sensitivity to extinction. Degradation and loss of Ecosystem: Contamination (brief account on air pollution, water pollution and soil pollution - mention pesticides); role of dams, roads and other structures; soil erosion; deforestation; desertification; fragmentation. Overexploitation: Commercial; subsistence exploitation; recreational exploitation; incidental exploitation; indirect exploitation; consequences of exploitation. (4 hrs)

Unit IV Environmental management (2 hrs)

Role of human in sustainable development. Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS). Environmental ethics. Mention the role of IT in Environment and human health (Remote sensing, GIS, GPS)

Unit V. Legal measures (4 hrs)

Environmental laws – objectives and features (in brief) of the following laws:-

- i) Wildlife Protection Act (1972)
- ii) The water (Prevention and control of pollution) Act
- iii) The Forest (Conservation) Act – 1980.
- iv) Environment (Protection) Act – 1986.
- v) Patents Act 1970 and its amendments

Unit XI. Global environmental Issues. (3hrs)

Causes, effects and remedial measures of Air, water, Noise, Radioactive, solid waste and pesticide pollution. Ozone depletion, Green house effect, Global warming, Acid rain, oil spills, Impact of sand mining, wetland reclamation, rain water harvesting.

REFERENCES

- Andrew S. Pullin 2002. Conservation Biology. Cambridge University Press, Cambridge, UK.
- Anji Reddy M Text book of Environmental science and Technology. BS publications
- Anne E. Magurran 2004. Measuring Biological Diversity. Blackwell Publishing, MA, USA.
- Aravind Kumar : Text Book of Environmental Science; APH Pub Corporation (New Delhi).
- Chapman & Reiss : Ecology- Principles and Applications; Cambridge.
- Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.
- Chatterjee B: Environmental Laws- Implementation and Problems.
- Daily, G.C. (Ed.), 1997. Nature Services : Societal Dependence on Natural Ecosystems. Island Press, Washington D C.
- Darlington PJ Jr. : Zoogeography- The Geographical Distribution of Animals
- Forman, R.T and M. Gordaon. 1986. Landscape Ecology. John Wiley & Sons, NY, USA.
- Henry J G and Heinke W G. Environmental Science and Engineering. Pearson Education
- Joseph K and Nagendran R. Essentials of Environmental studies. Pearson Education
- Kapoor, V.C. 1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub. Co, New Delhi.
- Karunakaran, C.K. 2003. Politics of vanishing forests in Kerala. Kerala Sastra Sahitya Parishat, Thiruvananthapuram.

Land resource based perspective plan for 2020 AD. Kerala State Land Use Board, Thiruvananthapuram

Myers, Norman.1984. The Primary Source: Tropical Forests and Our Future. W.W. Norton & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. Nature, 403:853-858.

Nair, K.N.S and Parameswaran,P.1976. Keralathinte Sampath (Wealth of Kerala). Kerala Sastra Sahithya Parishad, Trivandrum, Kerala.

Nair, M.P., Pushpangathan, P., Rajasekharan, S.,Narayanan Nair.K. and Dan Mathew. Jaivavaividhyam (Biodiversity). State Institute of Languages, Thiruvananthapuram

Odum E P and Barret : Fundamentals of Ecology; Thomson.

Selected Further Readings

Sharma P D : Environmental Biology; Rastogi Pub.

Smith RL : Ecology and Field Biology; Harper Collins.

State of the Environment Report, Kerala. (Annual Publication), Kerala State Council for Science, Technology and Environment, Thiruvananthapuram

Supriyo Chakraborty.2004 Biodiversity. Pointer Publishers, Jaipur, India.

Townsend CR : Essentials of Ecology; Blackwell Science.

Trivedi R K: Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards; Enviromedia.

Varma PS & Agarwal VK : Environmental Biology; S. Chand.

Wilson E.O., 1988 (Editor).Biodiversity. National Academy press, Washington DC, USA.

Web Resources

<http://www.ncbi.nlm.gov>.

<http://tolweb.org>

<http://www.biosis.org>

<http://ucmp.berkeley.edu>

<http://species.enviroweb.;org>

<http://iczn.org>

<http://www.unep.org>

<http://www.iucn.org>

<http://www.cbd.org>

VI SEMESTER BSc DEGREE PROGRAM (THEORY)
ZOOLOGY CORE COURSE 12
CODE:6B12ZLG
DEVELOPMENTAL BIOLOGY ,TERATOLOGY AND GERONTOLOGY
(54 Hours) (3 hours per week) (3 credits)

Aims and Objectives. The course is designed to give the student a detailed understanding of the major steps in embryological development. It is intended to convey concepts, which will kindle interest in the intricate mechanisms involved in the development of animals.

Unit I. Introduction (1hr)

Theories of preformation, epigenesis and germplasm, germ layers and derivatives

Unit II. Types of eggs (2 hrs)

Classification of egg based on: the amount of yolk (micro, meso & macrolecithal), the distribution (iso, centro & telolecithal), presence or absence of shell (cleidoic & non cleidoic), the development (determinate & indeterminate) with examples; egg membranes (primary, secondary and tertiary)

Unit III. Cleavage and cell lineage (3 hrs)

Types of cleavage with examples based on planes (meridional, vertical, Equatorial and Latitudinal); based on amount of yolk (Holoblastic & Meroblastic); based on devt. (Determinate & Indeterminate); based on Pattern (Radial & Spiral). Cell lineage studies in planocera, Different types of blastula.

Unit IV. Development of Frog (7 hrs)

Fertilization, Cleavage, Blastulation & fate map, Morphogenetic movement and formation of germ layers, neurulation & notochord formation, mesoderm and coelom formation, organogeny of brain, eye and heart, hormonal control of amphibian metamorphosis.

Unit V. Development of chick (7 hrs)

Structure of egg, fertilization, cleavage, blastulation, gastrulation and formation of germ layers. Salient features of chick embryo at primitive streak stage, 24 & 33, 48 hour stage. (Torsion and flexion). Development and functions of extra embryonic membranes.

Unit VI. Development of Man (6 hrs)

Structure of Graffian follicle, ovulation, corpus haemorrhagicum, corpus luteum and corpus albicans, cleavage, blastulation, implantation, gastrulation upto the formation of germ layers; Gestation, Placentation (diff. types of placenta) and functions, parturition and lactation. Prenatal Diagnosis-Buccal smear test, Ultrasonography, Amniocentesis, Chorionic Villi Sampling, Foetoscopy

Unit VII. Reproductive technologies (6 hr)

Brief account of semen collection, preservation, storage, artificial insemination, infertility management. Cryopreservation and embryo transfer-Collection and care of eggs, in vitro fertilization and embryo transfer, test tube babies Assisted Reproductive Techniques (ART) IUF, ET, AI, GIFT, ZIFT, ICSI embryo or oocyte donation, surrogate mother.

Unit VIII. Cell Differentiation and Gene action during development (4 hrs)

Cell differentiation, totipotency, pluripotency, dedifferentiation and dedifferentiation controlled gene expression during development, Homeotic genes, Mention Hox genes, Stem cells, their significance and applications

Unit IX. Regeneration

(2 hrs)

Definition & types (Morphallaxis and epimorphosis), Histological and Cytological events in regeneration in general, mention factors affecting regeneration

Unit X. Stem cells

(3hrs)

Embryonic stem cells and stem cell research. Cloning experiments in animals – ethical issues in human cloning

Unit XI. Experimental Embryology

(6 hrs)

Construction of fate map — Vital staining, Marking With carbon particles & radio active tracing, Spemann's constriction experiments on amphibian embryos (Potency of nuclei and grey crescent), Gradient experiments in sea urchin, organizers in amphibian development (primary, secondary & tertiary).

Unit XIII. Teratology and Gerontology

(6 Hrs)

Environmental disruption of animal development (alcohol, drugs, Nicotine and chemicals (Refer Developmental Biology, Scott F. Gilbert)

(2hrs)

Changes due to aging. Apoptosis. Theories of aging. Nutrition and Aging, life span and life expectancy, old age care.

Seminar Topics / Assignment

(Only for Internal assessment)

1. Structure of different types of egg (amphioxus, frog, insect)
2. Corpus haemorrhagicum, Corpus luteum & Corpus albicans
3. Types of regeneration
4. Factors affecting regeneration
5. Role of hormones in parturition and lactation.
6. History of embryology

References

- Agarwal, P., Chordate Embryology and Histology, 1e, 2001, Krishna Prakashan
- Balinsky, B.I. Embryology, Saunders & Topan
- Bejley, D.J. et al., Human Reproduction & Developmental Biology, 1980, McMillan
- Berril, N.J. & Karp, G. Development TMH.
- Gilbert, S.C., Developmental Biology, 5e, Sinauer Associates.
- Jayaprakash, M. A Manual of Developmental Biology, 2e, Academia, Trivandrum.
- Patten, B.M.: Early Embryology of the Chick, 1973, TMH.
- Patten, B.M.: Foundations of Embryology, 1958, McGraw Hill.
- Rugh, R.: Frog Reproduction and Development.
- Sastry & Shukul: Developmental Biology, 2003, 1e, Rastogi Pub.
- Scott, F., Gilbert: Developmental Biology – Sinaur Associates.
- Verma, P.S. & Agarwal V.K.: Chordate Embryology.
- Vijayakumar Nair, K. & George P.V. A Manual of Developmental Biology, 3e, 2002.
- Wolpert, L.: Principles of Development, 1994, OUP.
- Muller, Developmental Biology, Springer Publishers.

VI Semester B. Sc. Degree Programme (Theory)
Zoology Core Course -13
ETHOLOGY, EVOLUTION AND ZOOGEOGRAPHY
Code: 6B 13 ZLG

Credit: 3; Hours: 3/ week; Total Hours: 54

Aim and objectives: To introduce the students to a comprehensive account of the important concepts in evolution and ethology. Topics are included to present both the classic as well as the modern views concerning the process of evolution. The student is expected get a broad idea about the mechanisms involved in the process of natural selection and evolution of animal species.

Topics in ethology are selected to help the students understand the basics of the subject.

The topics in zoogeography aims to give a basic idea about the factors that affect animal distribution and to give an overview of the faunal features of our region.

ETHOLOGY (20 Hrs)

History, Scope and Branches of ethology (1 hr)

Innate behaviour (2hrs)

Orientation, taxes and kineses, simple reflexes and instincts, Motivation, Models of motivation – Lorenz's Psycho hydraulic model and Deutsch's model

Learned behaviour (2 hrs)

Habituation, conditioned reflex, trial and error learning, latent learning, imprinting, insight learning

Neural mechanisms in behavior (2Hrs)

Role of Hypothalamus in behavior, Role of other brain centres in motivation and behavior, Limbic system and behavior

Hormones and behaviors (2 Hr.)

Role of hormones in –reproductive behavior, sexual behavior, maternal behavior, aggressive behavior and scent marking

Biological clocks/rhythm (2 hrs)

Photoperiod, circadian rhythm, migration, navigation and homing instinct, diapause, hibernation, aestivation.

Communication in animals (2hr)

Different types of communication. Visual, Auditory, Tactile and Chemical. Pheromones – classification. Insect pheromones. Mammalian pheromones. Human pheromones.

Sociobiology (7hrs)

Social groups- Merits and demerits. Properties of organized societies.

Insect societies. Characteristics of insect societies. Social organization in honey bees and termites

Social groups in mammals - dominance hierarchy, territorial behavior, mating groups and mating strategies. social life in elephants, social life in primates

EVOLUTION (24 Hrs)

1) History of Evolutionary thought (2Hrs)

Pre Darwinian theories – A brief mention of Essentialism, The Great chain of being, James Ussher, Carolus Linnaeus, Comte De Buffon, Erasmus Darwin, Lamarck, George Cuvier and Charles Lyell

2) Origin of life on earth (2 Hrs)

Theories, Modern approaches- Oparin concept, Urey-Miller experiment.

- 3) Evidences of Organic Evolution (4hrs)
Morphological, anatomical, physiological, biochemical, Biogeographical embryological and palaeontological evidences Geological time scale, Fossils, Fossilization, fossil dating, significance of fossils
- 4) Theories of organic evolution (3 hrs)
Lamarck's theory and its criticism, Weisman's germplasm theory, Neolamarckism, Darwin's theory and its criticism, Contribution of Alfred Russel Wallace. Neo Darwinism, Hugo De Vries' mutation theory
- 5) Modern concepts of evolutionary forces (2hrs)
Genetic basis of evolution, genetic drift, Hardy-Weinberg equilibrium, punctuated equilibrium
- 6) Nature of evolution (4hrs)
Adaptive radiation and Divergent evolution (Darwin's finches), Convergent evolution, Preadaptation, species concept and intraspecific categories. Isolation and isolating mechanisms. Speciation. Co evolution. kin selection .
- 7) Mimicry and colouration (2Hrs)
Batesian mimicry, Mullerian mimicry, Mimicry and evolution, Colouration and evolution
- 8) Course of evolution (2 hr)
Origin of life - modern ideas - naked gene hypothesis RNA world theory evolution of eukaryotes. Micro evolution and macro evolution
- 9) Molecular evolution (2Hrs)
Neutral theory of kimura, concept of molecular clock, mitochondrial eve hypothesis, selfish genes, C value paradox
- 10) Human evolution (1 hr)
Current understanding of Human evolution (Brief mention only)

ZOOGEOGRAPHY (10 hrs)

1. Animal Distribution (2 hrs)
(a) Geographic distribution of animals - cosmopolitan distribution, discontinuous distribution, bipolar distribution and isolated distribution
(b) Factors affecting animal distribution; Barriers to animal distribution - Physical barriers (topographical and climatic); biological barriers.
- 2. Zoogeographical realms (7 hrs)**
Only brief account of each realm is expected. Mention the areas included, brief account of the physical features and fauna: Palaearctic region, Oriental region, Australian region (Mention Weber's line and Wallace line), Ethiopian region, Nearctic region and Neotropical region. Biogeographical classification of India: Western Ghats, Eastern Ghats and the Himalayas.
3. Insular fauna (1 Hr.)
Continental islands, Oceanic islands, Ancient islands

REFERENCES

Andrews. M.I and Joy, K.P. 2003. Environmental biology, evolution, Ethology and Zoogeography. St.Mary's press and book dept. Changanassery.
Aubrey Manning & Dawkins: An Introduction to Animal Behaviour; Cambridge.
Boulenger, E.G. Animal behaviour, 1994, Atlantic Pub.& Distributors

Darwin, C.: The Origin of Species, 6e. OUP.
Dobzhansky Th. (1964): Genetics and the Origin of Species. Columbia University Press
ReenaMathur: Animal Behaviour, Rastogi & Co., Meerut.
Rostogi, V.B. Organic Evolution, Kedernath, Ramnath publishers, Meerut.
Strickberger M W : Evolution; Jones & Barlett.
Susantha Goonathilake: Merged Evolution – Gordon and Breach Publishers.
Tiwari, S. K.: Zoogeography of India and South East Asia. CBS Pubs., New Delhi.
Verma P.S. & Agarwal, V.L. concepts of evolution S.Chand & Company.
Vijayakumaran Nair K. et al.: Environmental Biology, Ethology, Evolution. Academica, TVM

VI SEMESTER B.Sc. DEGREE PROGRAMME (Theory)

Zoology Core Course - 14

APPLIED ZOOLOGY

Code: 6B14ZLG

Credit: 3; Hours: 3/week; Total Hour: 54

Section- A. ENTOMOLOGY

1. Introduction: (1hr)

Mention Agricultural entomology, Forest entomology, Veterinary entomology Medical entomology , Forensic entomology, Industrial entomology, Nutritional entomology, Cultural entomology.

2. Agricultural Pests (7 hrs)

Definition of pest, Kinds of insect pests , Nature of damage caused and control measures of the following pests:

(a). Pests of paddy

1. *Spodoptera mauritia* (Rice swarming caterpillar)

2. *Leptocorisa acuta* (Rice bug)

(b). Pests of coconut

1. *Oryctes rhinoceros* (Rhinoceros beetle)

2. *Rhynchophorus ferrugineus* (Red palm weevil)

3. Coconut mite- brief account of damage and control.

(c). Pests of stored products

1. *Sitophilus oryzae* (Rice weevil)

2. *Callosobruchus chinensis* (Pulse beetle)

3. Productive Insects (8 hrs)

(a). Apiculture

1. Culture methods, modern equipments in Apiculture

2. Brief description of common species of *Apis*

3 Honey bee products: bee wax and its uses, chemical composition of honey and uses

(b). Sericulture

1. Brief description of *Bombyx mori* (Mulberry silk moth), *Antheraea paphia* (tassar silkworm)

2. Sericulture and extraction of silk

3. Types of silk: Tasar, Muga and Eri Silk

(c). Lac culture

1. Brief account on lac insect (*Laccifer lacca*)

2. Uses of lac.

3. Culture Technique.

4. Beneficial insects (1 hr)

Role of parasites, predators, scavengers, weed killers, pollinators.

5. Insect Pest Management (5 hrs)

1. Cultural control

2 Mechanical control

3. Biological control

4. Chemical control

5. Integrated pest management (IPM)

Section- B. AQUACULTURE

(6hrs)

1. Introduction, Aquaculture and scope in Kerala and India
2. Brief account on Pisciculture, Prawn culture, Mussel culture and Pearl Culture (with examples). Brief account on culture of Aquarium fishes.

Section- C POULTRY SCIENCE

(6hrs)

1. Introduction, Importance of egg production, Nutritive value of eggs.
2. Breeds of fowl:
 - a) Exotic breeds: *Rhode Island Red, Plymouth Rock, New Hampshire.*
 - b) Indigenous breeds: *Chittagong, Gangus*
3. Poultry breeding: Economic tracts - relation with breeding, meat products

Section -D ANIMAL HUSBANDRY

(8 hrs)

1. Introduction, Live stock husbandry - origin, domestication of cattle.
2. Breeds of cattle
3. Artificial insemination
4. Storage of semen
5. Embryo transfer technology
6. Common diseases :(a) Anthrax (b) Foot and mouth diseases (c) Rinderpest

Section -E DAIRY SCIENCE

(4hrs)

1. Importance of dairy farming
2. Common dairy Processes: a) Pasteurization b) Freezing c) Soft curd milk d) Skimmed milk e) Toned milk . f) Nutritional value of milk. Dairy products: cream, butter, cheese, ice cream, AG mark

Section –F PARASITOLOGY

(8hrs)

1. Introduction
2. Human Parasites:

Mention the habits, habitat, life cycle, mode of infection, control measures of the following parasites: *Entamoeba histolytica, Plasmodium vivax, Taenia solium, Ascaris lumbricoides, Wuchereria bancrofti, Enterobius vermicularis.*
3. Insect Vectors of human diseases :

Anopheles, Culex, Aedes, Xenopsylla, Cimex, Pediculus, Phthirus (Mention habits, structure, disease caused and control).

References

- Agency Jhingran. V.C.: Fish and Fisheries of India. Hindustan Pub. Corpn.
Alikunhi, K.M. : Fish Culture in India
Allahabad Winton. A. L.: Fish and Fish Products, 2000. Agro.
Banerjee, G.C.: ATB of Animal Husbandry. 8e. 1998. Oxford & IBH.
Banerjee, G.C.: Poultry, Oxford & IBH.
Bee Keeping 2003. Agro Bios.
Bombay.
Boraiah, G., Lecturers on Sericulture 2e. 1994, SBS Pub. Bangalore.
Campbell, J.R. & Lasley, J.R: The Science of Animals that serve Mankind. TMH.
Cherian & Ramachandran Bee keeping in South Indian Govt. Press, Madras.
Cutting, C.L. Fish Processing and preservation. 2002, Agro.
Day, F.: The Fishes of India. Vols. 1 & 11, 1971. Today and Tomorrow Book

Dileep de Sarkar: The Silkworm Biology Genetics and breeding.
Eckles, C.R. Combs, W.B. & Macy, H.: Milk & Milk Products. Tata MGH.
FAO. manual of silkworm rearing. a manual of mulberry cultivation. A manual
Gupta, K.C. Romance of Scientific Bee keeping - Khadi Pratisthan. Calicut.
Hindustan Pub. Corporation of India.
ICARD: Handbook of Animal Husbandry, 1990/97, ICAR, Pusa, N.d.
Jull, M.A.: Poultry Husbandry, 3e, TMH.
Kurian, C.V. & Sebastian. C.V.: Prawn and Prawn Fisheries of India
Lasley, J.F.: Genetics of Livestock Improvement. 1987, Prentice Hall Eaglewood.
Linter & Sunk: Poultry Science, Lippincot & Co. N.Y.
Mahadevappa, D. et al. Mulberry Silk reeling Technology.
Mishra, R.C. Perspectives in Indian. Apiculture 2002. Agro Bios. Phillips, E.F.,
Nayar, M.R.G.K. A Monograph on Crop pests of Kerala and their control.
of silk feeling.
Pillai, T.P.: Aquaculture Principles and Practices of Fishing, New Books.
Rajendra Kumar Nath, R.: Freshwater Aquaculture, Scientific Pubs., Jodhpur.
Samuel, C.T.: Marine Fisheries in India, Cochin University.
Sarda Singh: Bee Keeping in India, ICAR.
Sastry N.S.R.: Farm Animal Management & Poultry Production. Vikas.
Sastry, N.S.R. Farm Animal Management & Poultry Prodcution.
Sastry, N.S.R. Thomas, C.K. & Singh R.A.: Poultry Production.
Shammi, O. Applied Fisheries, 2002, Agro Bios.
Singh H & Mossa: Livestock & Poultry Production, PHI.
Sinu, V.R.P. & Ramachandran, V. Reshwater Fish Culture. ICAR.
Sobti Medical Zoology Shoban Lal & Co.
Sreerama Reddy G. Silkworm Breeding
Srivastava, C.B.L. Fishery Science and Indian Fisheries, 2e. 2002, Kitab Mahal.
Sulochana Chetty & Ganga: Sericulture.
Tamaki. Y.: Sericology: Central Silk Board, 95-B, Marine Drive, Bombay-2.
Thomas, C.K. & Sastry, N.S.R.: Dairy Bovine Production, 1991, Kalyani.
Ullal, S.R. & Narasimhanna. M.N.: HB of Practical Sericulture, Central Silk Board,

B.Sc. ZOOLOGY DEGREE PROGRAMME (PRACTICALS)

PRACTICAL- I

(PROTISTA, NON CHORDATA AND CHORDATA)

Code: 4B 04 ZLG (P)

Lecture hours: 2 hours/week in the first four Semesters and Examination in the 4 th Semester)

No. of credits: 4

In taxonomy specimens should be identified by their generic name. Students should examine the specimens in the lab and draw labelled sketches. Notes should contain classification, morphological and functional peculiarities and other significant features. The record should be in the form of an observation book. Artistic diagrams are not needed. There should be no tracing of figures from textbooks. Only the relevant region need be drawn in some case. (e.g., head & tail region of snakes). Wherever possible, specimens not included in the theory syllabus should be given for lab study, so that students are introduced to more organisms. In SECTIONS and OSTEOLGY, neatly labelled scientific diagrams should be drawn. Dissections of DMC and IAEC are to be strictly followed. Cultured animals alone should be used for conducting dissections \mounting .

TAXONOMY: Protista (3) Porifera (2) Cnidaria (5) Platyhelminthes (3) Nematoda (3)

Annelida (4) Arthropoda (8) Minor phyla (1) Mollusca (5) Echinodermata (3)

Hemichordata (1)

Prochordata (2) Agnatha (1) Pisces (6) Amphibia (4) Reptilia (5) Aves – beak & feet (2)

Mammalia (2)

SECTIONS: (5 items) Hydra T.S, Planaria T. S, Ascaris T.S, Earthworm T.S, Nereis T S, Branchiostoma T S.

OSTEOLOGY:

Shark – vertebra

Frog – typical, 7th, 8th, 9th vertebrae and urostyle.

Rabbit vertebrae – atlas, axis. Pectoral girdle – bird, mammal.

Pelvic girdle – rabbit.

Bird – synsacrum, sternum.

MOUNTINGS:

Earthworm – setae (a few loose setae), Nereis – parapodium, Prawn- appendages, Honey bee – Mouth parts, Honey bee- pollen basket, Cockroach-mouth parts, Cockroach- salivary apparatus.

Plant bug – mouthparts, Shark – placoid scales.

DISSECTIONS:

Earthworm – nervous system (Minor)

Cockroach – nervous system (Major)

Prawn – nervous system (Major)

Mullet- Alimentary canal

(Labelled sketches of mountings and dissections to be drawn in the record)

VIRTUAL DISSECTION

Frog\Calotes-Viscera, Arterial system

V SEMESTER B. Sc. ZOOLOGY DEGREE PROGRAMME (PRACTICALS)

Practical II

Code: 6B02 ZLG (P)

**Lecture Hours 8/week in the 5th semester with 4 credit and
Examination in the 6th semester**

**Cytology and Immunology, Environmental Science and Conservation biology, Genetics,
Developmental Biology, Evolution, Ethology and Zoo geography**

Cytology and Immunology

1. Study of microscope. (Minor)
2. Micrometry -Measurement of microscopic objects. (Minor)
3. Study of mitotic stages – Onion root tip squash preparation. (Major)
4. Study of meiosis – Grasshopper testis squash. (demo)
5. Staining of buccal epithelial cells. (Minor)
6. Staining of blood film to study blood cells. (Major)
7. Determination of blood groups. (Minor)
8. Centrifugation- cell fractionation and separation of nuclei. (demo)
9. Isolation of mitochondria from the given sample.
10. Buccal smear – Identification of Barr Body

Environmental Science and Conservation biology

1. Estimation of dissolved oxygen using Winkler's method. (Major)
2. Estimation of dissolved carbon dioxide in water. (Major)
3. Qualitative analysis of fresh water / marine plankton. (Minor)
4. Analysis of soil fauna. (Minor)
5. Measurement of salinity
6. Measurement of water PH.

Genetics.

1. Simple problems based on gene interaction, linkage and multiple alleles in animals.
2. Drosophila salivary gland preparation to study giant chromosomes. (demo)
3. Study of genetic disorders.
 - A. Down's syndrome
 - B. Turner's syndrome
 - C. Klinefelter's syndrome
 - D. Edwards syndrome
 - E. Patau syndrome
 - E. Neurofibromatosis.
4. Study of Polytene chromosomes and lamp brush chromosomes using photographs

Developmental Biology

Study of slides/models/specimens with neat labelled sketches and notes

1. Frog – blastula C S, gastrula V S, neurula V S. (any two)

2. Chick embryo – Primitive streak, 24 hrs, 33 hrs and 48 hrs.
3. Mammalian foetus with placenta.

Evolution and Zoogeography

1. Problems from Hardy Weinberg equilibrium
2. Identification of organism and their evolutionary significance.
Limulus
Peripatus
Hemichordata
3. Study of zoogeographical realms and distribution of animals using map or Globe..

VI SEMESTER B.Sc. ZOOLOGY DEGREE PROGRAMME (PRACTICALS)

Lecture Hours 8/week and Credit:4

PRACTICAL III

CODE: 6B03 ZLG (P)

**BIOCHEMISTRY, BIOPHYSICS, PHYSIOLOGY, BIOSTATISTICS,
BIOINFORMATICS & APPLIED ZOOLOGY**

I. BIOCHEMISTRY & BIOPHYSICS

1. Qualitative Analysis.

A) Reactions of carbohydrates:

(i) General test for carbohydrates- Molisch's test.

(ii) Tests for monosaccharides – Benedict's test, Fehling's test, Moore's test, Rapid furfural test, Seliwanoff's test, Barfoed's test– (Any 3 tests).

(iii) Test for non-reducing disaccharides – Hydrolysis test.

(iv) Test for polysaccharide – Lugol's iodine test.

B) Tests for proteins–Ninhydrin test, Biuret test, Nitric acid test, Millon's test, Sodium nitroprusside test – (Any 3 tests).

C) Tests for lipids – Solubility test, Spot test, Acrolein test, Emulsification test, Saponification test, Sudan test – (Any 3 tests).

(Testing of 3 unknown samples to be a major experiment for practical exam)

2. Estimation of protein – Biuret method/ Estimation of glucose- orthotoludene method (Major)

3. Measurement of pH using pH paper and pH meter. (Minor)

4. Colorimetry –

a) Preparation of standard curve and estimation of solute concentration in a sample. (Major)

b) Determination of absorption maxima. (Minor)

5. Chromatography – Determination of R_f value and identification of amino acid (demonstration)

6. Microtomy – Preparation of serial sections (demo)

II. BIOSTATISTICS

1. Simple problems in statistics – mean, median, mode, mean deviation & standard deviation for grouped and ungrouped data.

(Minor)

2. Construction of simple and percentage Bar diagram, Pie diagram & Histogram. (Minor)

3. Use of computers for diagrammatic and graphic representation of data- bar diagram (3 types), pie diagram and frequency curve. (Demonstration)

III. BIOINFORMATICS (demonstration only)

DNA and Protein pair wise sequence alignment by FASTA & BLAST.

3D structure visualization of protene with Py Mol ,Ras Mol or other suitable software

IV. APPLIED ZOOLOGY

Identification of pests (up to order and generic characters): Spodoptera, Sitophilus, Tribolium. Leptocorisa

Identification of fish (up to sub-class and species characters): *Cirrhinus mrigala*, *Labeo rohita*, *Labeo calbasu*, *Catla catla*, *Channa striatus*, *Mystus vittatus*, *Pampus argenteus*, *Harpadon nehereus*.

V. PHYSIOLOGY

Measurement of blood pressure using sphygmomanometer.

WBC counting using haemocytometer.

Urine analysis for abnormal constituents (glucose, albumin).

Measurement of human pulse rate.

Estimation by haemoglobinometer (sahli's haemoglobinometer- demonstration)

Total RBC count using Haemocytometer. – (demo)

B. Sc. Zoology Degree Programme
General Scheme of Question Papers
Core Courses 1&2 (Protista and Non Chordata I &II)

Time : 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- 1x8= 8 marks
- II. Essay (Answer 1 out of 2)- 1x8=8 marks
- III. Short essay (2 out of 3)-2x4=8 marks
- IV. Short note (5 out of 9)-5x2=10 marks
- V. Short answers (4 out of 6)-4x1=4 marks
- VI. Objective/ fill in the blanks/ MCQ/ Match the following- Answer=2 marks.
(a bunch of 4 questions , each bunch carries 1 mark)

Core Course 3&4 (Chordata I &II)

Time : 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- 1x8= 8 marks
- II. Essay (Answer 1 out of 2)- 1x8=8 marks
- III. Short essay (2 out of 4)-2x4=8 marks
- IV. Short note (4 out of 7)-4x2=8 marks
- V. Short answers (6 out of 8)-6x1=6 marks
- VI. Match the following =2 marks.

Core Course 5 (Biochemistry and Endocrinology)

Time : 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- 1x8= 8 marks
- II. Essay (Answer 1 out of 2)- 1x8=8 marks
- III. Short essay (2 out of 4)-2x4=8 marks
- IV. Short note (6 out of 8)-6x2=12 marks
- V. Short answers (Answer all 4)-4x1=4 marks

Core Course 6 (Biophysics, Biostatistics and Methodology)

Time : 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- 1x8= 8 marks
- II. Essay (Answer 1 out of 2)- 1x8=8 marks
- III. Short essay (2 out of 4)-2x4=8 marks
- IV. Short note (6 out of 8)-6x2=12 marks
- V. Short answers (answer 4)-4x1=4 marks

Core Course 7 (Cell Biology and Immunology)

Time : 3 Hours

Max. Marks: 40

Part.A Cell Biology

- | | |
|--------------------------------------|--------------|
| I. Essay (answer 1 out of 2) | -1x8=8 marks |
| II. Essay (1 out of 2) | -1x8=8 marks |
| III. Short Essay-(Answer 2 out of 4) | -2x3=6 marks |
| IV.Short note (6 out of 8) | -6x1=6 marks |
| V.Objective. Answer 4: | -4x1=4 marks |

Part. B Immunology

- | | |
|--------------------------------------|---------------|
| VI. Short essay. (Answer 1 out of 2) | -1x4=4 marks |
| VII. Short notes (Answer 2 out of 4) | -2x2= 4marks. |

Core Course 8 (Hereditary Science)

Time : 3 Hours

Max. Marks: 40

- | | |
|--------------------------------------|----------------|
| I.Essay (1 out of 2) | -1x8=8 marks |
| II. Essay (answer 1 out of 2) | -1x8=8 marks |
| III.Short essay (2 out of 4) | -2x4=8 marks |
| IV.Short notes (Answer 6 out of 10) | - 6x2=12 marks |
| V.Objectives (Answer 4 questions) | - 4x1=4 marks |

Core Course 9)(Comparative Animal Physiology and Human Physiology

Time; 3 Hours

Max. Marks: 40

- | | |
|--------------------------------|----------------|
| I.Essay (Answer 1 out of 2) | - 1x8= 8 marks |
| II. Essay (Answer 1 out of 2) | - 1x8=8 marks |
| III. Short essay (2 out of 3) | -2x4=8 marks |
| IV.Short note (6 out of 8) | -6x2=12 marks |
| V. Short answers (answer 4) | -4x1=4 marks |

Core Course 10 (Molecular Biology and Bio Informatics)

Time; 3 Hours

Max. Marks: 40

Section A. Molecular Biology

- | | |
|--|----------------|
| I.Essay (Answer 1 out of 2) | - 1x8= 8 marks |
| II. Short essay (Answer 1 out of 3) | - 1x4=4 marks |
| III. Short notes (3 out of 5) | -3x2=6 marks |
| IV. Short answers (answer 2 out of 4) | -2x1=2 marks |

Section B. Bio Informatics

- | | |
|-----------------------------------|---------------|
| V. Essay (Answer 1 out of 2) | -1x8=8 marks) |
| VI. Short essay (1 out of 2) | -1x4=4 marks. |
| VII. Short notes (3 out of 5) | - 3x2=6 marks |
| VIII. Short Answers (2 out of 4) | -2x1=2 marks |

Core Course 11 (Environmental Science and Conservation Biology)

Time; 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- II. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- III. Short essay (2 out of 4)- $2 \times 4 = 8$ marks
- IV. Short note (6 out of 8)- $6 \times 2 = 12$ marks
- V. Short answers (answer 4)- $4 \times 1 = 4$ marks

Core Course 12 (Developmental Biology, Teratology and Gerontology)

Time : 3 Hours

Max. Marks: 40

- I. Essay (1 out of 2)- $1 \times 8 = 8$ marks
- II. Essay (answer 1 out of 2)- $1 \times 8 = 8$ marks
- III. Short essay (2 out of 4)- $2 \times 4 = 8$ marks
- IV. Short notes (Answer 6 out of 10)- $6 \times 2 = 12$ marks
- V. Objectives (Answer 4 questions)- $4 \times 1 = 4$ marks

Core Course 13 (Ethology, Evolution and Zoogeography)

Time; 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- II. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- III. Short essay (2 out of 4)- $2 \times 4 = 8$ marks
- IV. Short note (6 out of 8)- $6 \times 2 = 12$ marks
- V. Short answers (answer 4)- $4 \times 1 = 4$ marks

Core Course 14 (Applied Zoology)

Time; 3 Hours

Max. Marks: 40

- I. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- II. Essay (Answer 1 out of 2)- $1 \times 8 = 8$ marks
- III. Short essay (2 out of 4)- $2 \times 4 = 8$ marks
- IV. Short note (6 out of 8)- $6 \times 2 = 12$ marks
- V. Short answers (answer 4)- $4 \times 1 = 4$ marks

Continuous Assessment of core courses
20% of total Mark is allotted for internal assessment i.e 10 marks

For Theory Courses.

Test papers (minimum 2) : 5 Marks

Assignment /Seminar/Viva : 2.5 Marks

Attendance : 2.5 Marks

(For attendance 75%-0.5; 76-79% 1. Mark; 80-84% 1.5 Mark, 85-90% 2.0 Mark and >90% 2.5 Marks.)

Scheme of Practical Examinations
Practical.I

Time: 3 Hours

Max. Marks: 40

- Major dissection with display - 12 marks
- Minor dissection/ Mounting (with or without sketch)-5 marks
- Spot items (6 items) - 6x3= 18 marks.
- Record- 5

Continuous Assessment (Max Marks 10):

- Lab. Skill - 2.5 Marks
- Attendance- 2.5 Marks
- Record- 5.0 Marks.

(For attendance 75%-0.5; 76-79% 1.0. Mark; 80-84% 1.5 Marks, 85-90% 2.0 Mark and >90% 2.5 Marks.)

Practical II

Time: 3 Hours

Max. Marks :40

- 1.Major Question (from cytology/ Ecology) - 10 marks
- 2.Minor . 7 marks
- 3.Genetic Problem. 3 marks
- 4.Spot items (5 items)- 5x3 marks 15 marks
- Record. 5 mark

Continuous Assessment.

- Lab. Skill 2.5 marks
- Attendance 2.5 marks
- 3.Record 5.0 marks

(For attendance 75%-0.5; 76-79% 1.0. Mark; 80-84% 1.5 Marks, 85-90% 2.0 Mark and >90% 2.5 Marks.)

Practical III

Time: 4 Hours

Max. Marks :40

- 1.Major Experiment - 10 marks
- 2.Minor . 5 marks
- 3.Statistical Problem. 3 marks
- 4.Spot items (4 items)- 4x3 marks 12 marks
- 5.Field work Report 5 marks
- Record 5. Marks

(Project evaluation is conducted along with Practical III as a separate paper)

Continuous Assessment.

- Lab. Skill 2.5 marks
- Attendance 2.5 marks
- 3.Record 5.0 marks

(For attendance 75%-0.5; 76-79% 1.0. Mark; 80-84% 1.5 Marks, 85-90% 2.0 Mark and >90% 2.5 Marks.)

Scheme of Project Evaluation

Total marks 25 and Credit 2

- **Internal Assessment (5 marks)**

Punctuality	1.mark
Use of data	1. Mark
Scheme/ organization of report.	1.5 marks
Viva-voce	1.5 marks

2. External (20 marks)

Relevance of topic,
Statement of objectives,
Methodology (reference/Bibliography). - 4 marks
Presentation, Quality of analysis/Use of statistical tools,
Findings and recommendations- 6.marks
Viva –voce - 10. marks

OPEN COURSES
ZOOLOGY OPEN COURSE 1
Code: 5D 01 ZLG
NUTRITION AND HEALTH
Lecture hours: 2 hours/week

No. of credits : 2

Aim and Objectives: This is designed as an open course for students from different programmes and hence is intended to introduce the fundamentals of the subject. The main objective is to convey the role of proper nutrition in human health. The student should also understand role of various nutrients in different stages of one's growth as well as in different physiological and pathological conditions.

Unit I. Basic concept of food, nutrition and health. (1 hr)

Unit II. Food Metabolism. Process of digestion- mechanical & chemical. Digestion in mouth, stomach and small intestine. Bacterial digestion. (3 hrs)

Unit III. Components of food – nutrients, their functions and sources. Carbohydrates , Proteins and Fats. Mention Protein Efficiency Ratio (PER). Fats and health – Mention Saturated, Poly unsaturated and Omega 3 fatty acids. Concept of balanced diet. Vitamins – Fat soluble vitamins – major food sources, deficiency symptoms. Mention toxicity. Water soluble vitamins – C, B1, B2, B3, B6, Folic acid and Cobalamine, Major food sources and deficiency symptoms. Mineral elements – Macro, Micro and Trace elements. Functions of Ca, P, Na, K, Mg, Fe and I.- only brief accounts. (8 hrs)

Unit IV. Therapeutic Nutrition. Diet modifications in Peptic ulcer, Diarrhoea, Jaundice, Hypertension, Coronary heart disease, Diabetes mellitus, Obesity and Gout. (8 hrs)

Unit V. Nutritional needs in infancy, childhood, adolescence, and old age and in physiological conditions like pregnancy and lactation. (8 hours)

Unit VI. Management of food resources. Healthy cooking practices. Household level food preservation and storage. (2 hrs)

Unit VII. Food adulteration and preservation: Types,intentional and incidental adulterants,Food laws and standards. Methods of food preservations, preservatives colours and emulsifiers. (4 hrs)

Unit VIII. Food and water borne diseases. (2 hrs)

REFERENCES

- Anita S P : Clinical Dietetics and Nutrition; Oxford Un'ty Press
Bamji, Rao & Reddy : Text Book of Human Nutrition; Oxford & IBH, 2003.
Chaney & Ross : Nutrition; Surjeet Publishers , Delhi.
M.Swaminathan : Advanced Text Book on Food and Nutrition; Bappco, Bangalore.
Mudabi S R & Rajagopal M V : Fundamentals of Food and Nutrition; New Age, Intl, 2003.
S.Paul : A Text Book of Bionutrition; CBS Publishers, New Delhi.
Sreelakshmi B : Dietetics; New Age Int'l

ZOOLOGY OPEN COURSE 2
APICULTURE AND SERICULTURE

Code: 5D 02 ZLG

Lecture hours: 2 hours/week No of credits : 2

Aim and Objectives: The course is designed to introduce students to two important applied fields in zoology, which is of great potential in the rural economy of India. Both beekeeping and silkworm rearing offer great employment opportunities in rural India and are major export oriented agro-industries.

The objective of the course is to provide an introductory knowledge in these fields so that interested students can take on these fields as a profitable hobby or even as a self employment venture. The knowledge gained can be used to replace the age-old practices in these fields with modern methods that are more productive and also give better quality products.

Section A – APICULTURE

Unit I. Introduction. Different species of honeybees. Organisation of bee colony. Adaptations of worker bee. Development of a bee. Bee as a pollinating agent. (3 hrs)

Unit II. Methods of Bee Keeping. Indigenous method – Fixed wall hive and its disadvantages. Modern method – Principle of movable frame hive; structure of Langstroth movable frame hive; its advantages. (5 hrs)

Unit III. Bee keeping equipments. Comb foundation, queen excluder, uncapping knife, smoker, hive tool, bee veil, bee brush, feeders and honey extractor. (2 hrs)

Unit IV Colony Management. Swarm prevention, uniting colonies, feeding methods, moving the colony, queen rearing and requeening. (3 hrs)

Unit V Enemies and Diseases. Wax moths, wax beetle, wasps, ants, king crow and bee eater. Nosema disease, Acarine disease and brood diseases. (2 hrs)

Unit VI Honey and Beeswax. Uses of honey as food, medicine and other uses. Storage and purity of honey. Refining honey. Uses of Beeswax (3 hrs)

Section B – SERICULTURE

Unit I Scope and significance as a rural agro based industry. (1 hr)

Unit II Moriculture. Brief account of planting systems and maintenance of gardens, pruning and harvesting. Fungal and bacterial diseases and their control. (3 hrs)

Unit III Biology of silkworm. Life history of Bombyx mori. Morphology of larva; silk glands, spinnerets, synthesis of silk proteins. Uni, bi and multivoltine breeds. Non mulberry silk worms. Diseases of silkworm. Muscardin, Pebrine, Flacherie. Prevention and control. Pests of silkworm. Uzi fly, ants and rodents. Control measures. (4hrs)

Unit IV Rearing Technology. Rearing appliances. Importance of disinfection. Methods of incubation. Selection of leaves for feeding. Rearing of early stage larvae and late stage larvae. Brushing, feeding, bed cleaning and spacing. Preparation for mounting, different mountages. Harvesting and sorting of cocoons. (6 hrs)

Unit V Silk Technology. Processing of cocoons. Reeling equipments. Uses of silk. (4 hrs)

REFERENCES

1. Sardar Singh : Beekeeping in India; ICAR, New Delhi.
- 2 Ullas S R & Narasimhan M N : Handbook of Practical Sericulture

3. Sulochana Shetty and Ganga : Sericulture.

ZOOLOGY OPEN COURSE 3

Code: 5D 03 ZLG

REPRODUCTIVE HEALTH AND SEX EDUCATION

Lecture hours :2 hours/week ,No of credits : 2

Aims and Objectives: This is designed as an open course for students from different programmes and hence is intended to introduce the fundamentals of the subject .The main objective of this course is to provide information about human reproductive system, gamatogenesis, adolescent problems sexual abuse infertility and sexually transmitted diseases to the students of various disciplines

1.Introduction (1 hrs)

Reproductive rights, Need for sex education

2.Human Reproduction (13hrs)

Male reproductive system: Structure of testis, male accessory organs, Spermatogenesis, Semen production and composition, Ejaculation; Female reproductive system: Oogenesis, Structure of Human ovary, Development of primary follicle, Structure of Graafian follicle, Fallopian tubes, Uterus, Vagina, The external genitalia, Mammary glands; Menstrual cycle, Fertilisation, Implantation, Pregnancy, Gestation, Placenta, Parturition, Lactation and its hormonal control. Puberty, Precocious puberty, Menarche, Menopause, Andropause.

3.Adolescence (1hr)

Stages of sexual growth, Adolescent problems.

4.Sexualabuses and myths (4hrs)

Premarital and extramarital sex, Sexual abuse and rape, Sexual perversions, Alternate orientations (Homosexuality, Lesbianism, Bisexuality Paraphilias), Oral sex, Animal sex, Cyber sex, Child abuse, Prostitution, Sexual myths, Sexual hygiene.

5.Prenatal Diagnosis (2hrs)

Different methods (invasive and non invasive). Female foeticide: Ethical issues and laws. (Mention Prenatal Diagnostic techniques – Prevention of misuse act –PNDT Act)

6.FertilityControl (4 hrs)

Natural methods, Artificial methods, Contraceptive devices and medications, Abortion, Legal termination of pregnancy, Vasectomy, Tubectomy, Vaccines and hormones in fertility control.

7.Infertility and assisted reproductive technologie (5hrs)

Physiological infertility, pathological infertility, causes and problems in male and female infertility. Assisted Reproductive Technologies (ART) – IVF, ET, AI, GIFT, ZIFT, ICSI, Embryo or oocyte donation, health hazards in ART, cryopreservation of blastocysts and ethics, designer baby and ethics.

8.Sexually transmitted infectious diseases (6hrs)

Symptoms, mode of transmission, diagnosis, treatment and prophylaxis of AIDS, Syphilis, Gonorrhoea, Herpes (genital), human papilloma virus and genital warts, hepatitis, gonococcal vulvo vaginitis, Trichomonal vaginitis. Mention the term venereal disease. Socio economic dimensions of STD.

. Topics for Assignments and Seminars

1. Sexual counseling.
2. Population explosion and birth control

References

1. Prakash Kothari : Common sexual problems and solutions, UBS Publishers and Distributors Ltd.
2. Kinsey, sex and fraud, Judith, Edward W. Eichel, John H. Court and J. Gordon, Editors Lochinvar : Huntington House Publications.
3. Lynn L. Long, Judith A. Burnett, R. Valorie Thomas: Sexuality counseling An integrated approach , Pearson, Merrill Prentice Hall.
4. Robert T. Francoeur: Becoming a sexual person, John Wiley and Sons.
5. Guyton & Hall: Textbook of Medical Physiology
6. Churchill Livingstone : Davidson's Principles and Practice of Medicine.
7. Vander, Sherman and Luciano : Human Physiology, McGraw Hill.
8. Vijayakumaran Nair, K.and Paul, P.I: Animal Physiology and Biochemistry,

Scheme of Examination

Open course

Max. Marks: 20

- I.Objectives (Answer 2 questions)- $2 \times 1 = 2$ marks
- II. Short notes (Answer 6 out of 10)- $6 \times 1 = 6$ marks
- III. Short essay (4 out of 8)- $4 \times 2 = 8$ marks
- IV.Essay (1 out of 3)- $1 \times 4 = 4$ marks

Continuous Assessment

For Open Courses. (5 Marks for Internal assessment)

Test papers (minimum 2) 2.5 Marks

Assignment /

Seminar/Viva 1.0 Mark

Attendance 1.5 Marks

(For attendance 75%-0.5; 76-90% 1.0 Mark and >90% 1.5 Marks.)

COMPLEMENTARY COURSES

COMPLEMENTARY (ZOOLOGY)

SCHEME COMPLEMENTARY (ZOOLOGY)

Sl. No	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01ZLG	Diversity of life-I	2	2	3	8	32	40
2	I	4C05ZLG-P	Practical	*	2	-	-	-	-
3	II	2C02ZLG	Diversity of life-II	2	2	3	8	32	40
4	II	4C05ZLG-P	Practical	*	2	-	-	-	-
5	III	3C03ZLG	Agriculture and Forest entomology	2	3	3	8	32	40
6	III	4C05ZLGP	Practical	*	2	-	-	-	-
7	IV	4C04ZLG	Medical Zoology	2	3	3	8	32	40
8	IV	4C05ZLGP	Practical	4	2	3	8	32	40

General Regulations for Complementary Course (Zoology)

The Complementary courses run in the first four semesters with one theory course in each semester and one practical course spread over the four semesters. However the practical exam will be conducted only at the end of the fourth semester. Each theory course carries 2 credits and 40 marks and the practical course 4 credits, i.e. a total of 12 credits with a total of 200 marks..

Attendance – 75% attendance is compulsory for theory as well as practical courses, failing which a student is not eligible to appear for university examinations.

Seminars/Assignments – These are part of the curriculum and are to be critically assessed for Continuous Assessment. Grades marks and should be awarded based on the content, presentation and the effort put in by the student.

Record – A practical record is compulsory for the course. Without a certified practical record, the student will not be allowed to appear for the practical examination. The practical record is to be valued internally and externally.

**1C 01 ZLG DIVERSITY OF LIFE I
PROTISTANS & NON CHORDATES**

Lecture hours: 2 hours/week.No. of credit :2

Aim and objectives: The syllabus is designed as a complementary course to students of other biological sciences. It aims to give an overall idea regarding the major animal phyla and the peculiar features of certain important groups and also to provide an exposure to the wide diversity existing in the animal kingdom.

Unit I – General characters of Protista

Distinction between ‘Plant protists’ and ‘animal protists’.

Examples of animal protists – *Amoeba*, *Paramecium*, *Vorticella*, *Trichonympha*

Essay - Locomotion in protista. (5 hrs)

Unit II- Outline classification of Kingdom Animalia. (1 hr)

a) Phylum Porifera – Salient features e.g., *Ascon* (1 hr)

b) Phylum Cnidaria – Salient features.

Class Anthozoa – Salient features e.g., *Adamsia*

Class Hydrozoa – Salient features e.g., *Physalia*

Class Scyphozoa – Salient features e.g., *Aurelia*

Coral forming cnidarians and their importance

Obelia – structural features and reproduction (4 hrs)

c) Phylum Platyhelminthes – Salient features

Class Turbellaria – Salient features e.g., *Planaria*

Class Trematoda – Salient features e.g., *Schistosoma*

Class Cestoda – Salient features – e.g., *Taenia solium*

Explain polyembryony and its significance in *Fasciola*. (3 hrs)

d) Phylum Nematoda – Salient features

Mention free living & parasitic nematodes (of plants and animals)(2 hrs)

e) Phylum Annelida – Salient features.

Class Polychaeta – e.g., *Nereis*

Class Oligochaeta – e.g. *Megascolex*

Class Hirudinea – eg. *Hirudinaria*

Megascolex – Study of external features, digestive, circulatory and excretory organs.

Mention vermiculture and its significance (3 hrs)

f) Phylum Arthropoda – Salient features

Type Study - *Penaeus* (Detailed study of larval stages not expected)

Class Crustacea – Salient features – eg: *Cancer*

Class Myriapoda – Salient features of *Scolopendra*

Class Insecta - Salient features. Eg: *Lepisma*, *Belostoma*

Class Arachnida - Salient features e.g.: *Heterometrus* (scorpion)

Beneficial insects – *Apis indica*, *Bombyx mori*, *Tachardia laca*.

(Mention apiculture and sericulture) (10 hrs)

g) Phylum Mollusca – Salient features

Class.Gastropoda – Salient features e.g.: *Pila*

Class Bivalvia – Salient features e.g.: *Perna*

Class Cephalopoda – Salient features e.g.: *Sepia*

An account of the economic importance of mollusca. (3 hrs)

h) Phylum – Echinodermata – Salient features

Asterias – External features, locomotion and water vascular system.

Examples: *Echinus*, *Holothuria* (3 hrs)

ASSIGNMENT / SEMINAR TOPICS (Only for Internal Evaluation)

1. Plant protists (*Euglena*, *Chlamydomonas*, *Volvox*)
2. Reproduction in Hydra.
3. Life cycle of *Taenia solium*.
4. Insect vectors.
5. Insect mouthparts – Biting and Chewing type.

REFERENCES

D.T.Anderson : Invertebrate Zoology, 2nd edition. Oxford U'ty Press.
Ekambarnath Ayyer : Manual of Zoology- vol I; S V Publishers.
Kotpal. R L : Modern Text Book of Zoology; Rastogi Publishers.
Michael A.Sleigh : Protozoa and other Protists; CBS Publishers, New Delhi.
Parker and Haswell : Text Book of Zoology Vol-1; Mac Millan.

2C 02ZLG DIVERSITY OF LIFE – II
CHORDATE FORM AND FUNCTION

Lecture hours: 2 hours/week.No of credits : 2

Aim and Objectives : The course is meant to provide to give the student outline knowledge of the complexities of vertebrate structure and function, besides providing a glimpse into the diversity of vertebrates. The fundamentals of early development are included for a general understanding of the processes involved.

Unit I. Introduction- Fundamental chordate characters. Classification into Subphylum Urochordata , Cephalochordata and Vertebrata. Mention Ascidia and Branchiostoma. (3 hrs)

Unit II. Subphylum Vertebrata. Classification as given below with important diagnostic features and brief account of examples.

A) Superclass Pisces – diagnostic characters. Chondrichthyes and Osteichthyes. *Scoliodon sorrakowah* – external morphology, structure and working of digestive, respiratory, circulatory, nervous and urino-genital systems.

Examples – *Trygon, Mugil, Etroplus, Rastrelliger, Sardinella, Channa*. (8 hrs)

B) Superclass Tetrapoda – diagnostic features. Structure of typical pentadactyl limb.

i) Class: Amphibia; Orders Apoda, Urodela and Anura.

Examples: *Ichthyophis, Ambystoma, Bufo*.

ii) Class Reptilia: Orders- Chelonia, Squamata and Crocodilia

Examples: *Chelone, Chamaeleo, Typhlops, Hydrophis*.

Poison apparatus and venom of snakes. Identification of poisonous snakes of Kerala.

iii) Class Aves: Ratite and Carinate groups. Flight adaptations in birds.

Modification of respiratory organs- air sacs and syrinx.

Examples: *Struthio, Casarius, Pavo, Columba, Aptenodytes*.

iv) Class Mammalia: Order - Monotremata : Examples : *Ornythorhynchus*

Order: Marsupialia. Example *Macropus*.

Order: Chiroptera- Example: *Pteropus*

Order: Primates: Examples *Macaca, Hylobates, Homo*.

Order: Carnivora: Examples *Panthera sp.*

Order: Artiodactyla: Example *Axis*.

Order: Perissodactyla: Example *Equus*.

Order Proboscida: Example *Elephas*.

Adaptations of aquatic mammals (whales and dolphins.)

Brief account of dentition in mammals. (15hrs)

Unit III. Comparative Anatomy. Comparative account of the heart and aortic arches in pisces, amphibia, reptilia, aves and mammalia. (4 hrs)

Unit IV. Early chordate development. Structure of mammalian egg and sperm. Types of eggs based on quantity and distribution of yolk. Types of cleavage. Brief accounts of blastulation, gastrulation and germ layer formation in Branchiostoma.

Embryonic membranes and their functions. (5 hrs)

SEMINAR / ASSIGNMENT TOPICS (Only for Internal evaluation)

- 1 Aquatic adaptations of fishes.
- 2 Economic importance of fishes
- 3 Structure of vertebrate eye and ear.
- 4 Structure of feather

5 Types of feathers.

REFERENCES

Parker and Haswell : A Text Book of Zoology, Vol 2;Orient Longman.

Ekambarnath Ayyer : Manual of Zoology- Vol II; S V Publishers.

Jordan and Verma : Chordate Zoology; S.Chand & Co.

Kotpal R L : Vertebrate Zoology; Rastogi Publications.

Verma and Agarwal : Chordate Embryology; S.Chand.

3C 03ZLG AGRICULTURAL AND FOREST ENTOMOLOGY

Lecture hours: 3 hours/week.No. of credits: 2

Aims and Objectives: This course introduces the fundamentals of applied entomology and is meant to enhance the study of related core subjects like botany. The objective is to give the student a broad understanding about the role of insects in human life. A concise account of insecticides, and their hazards would help develop the needed awareness in this area.

A. INSECTS OF AGRICULTURAL IMPORTANCE

Unit I: Introduction to entomology. Salient features of class Insecta. An outline classification of insects, Major insect orders – Thysanura, Odonata, Isoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera. Insect development: Different types of larvae- oligopod, polypod and apodous. Holometabolous and Hemimetabolous development. (05 hrs)

Unit II. Definition of pests. Classification of pests: Key pests (regular, persistent); Occasional pests (regular, sporadic); Potential pests. Factors governing pest outbreak – need for pest control – pest monitoring, surveillance and forecasting. Economic Threshold Level – Economic Injury Level. (03 hrs)

Unit III: Brief life history, damage caused and control measures of the following Paddy pests - *Leptocoryza acuta*, *Spodoptera mauritia*, *Tryporyza incertulas*, Coconut pests - *Oryctes rhinoceros*, *Rhynchophorus ferrugineus*, *Opisina arnocella*, Mango pests - *Batocera rufomaculata*, *Idiocerus niveosparsus*, Pests of vegetables - *Epilachna dodecastigma*, *Aulacophora foveicollis*, *Dacus* Pest of tea - *Helopeltis antonii*, Pest of rubber - *Aspidiotus destructor*, Pests of stored products - *Sitophilus oryzae*, *Bruchus chinensis*. (10 hrs)

Unit IV: Pest Management and Its components: Physical, Mechanical, Cultural, chemical, biological, Genetic and regulatory methods. Physical methods: Heat, cold, humidity, light and sound energy. Mechanical methods: Hand destruction, exclusion and trapping. Cultural methods : Good tillage, racking and hoeing, pruning, fertilization, water management, mulching, detashing, timely harvest etc. Chemical methods: Classification of insecticides - Stomach poisons, contact poisons and fumigants. Organic insecticides – a) Plant extracts – Nicotine, Pyrethroids, Rotenoids, Neem products. b) Synthetic products – Organochlorine compounds (DDT, BHC, Endosulfan, Aldrin, Endrin, Dieldrin); Organophosphorous compounds (Dichlorvos, Monochrotophos, Parathion, Malathion.); Carbamates. Insect attractants, repellents and feeding deterrents. Biological methods: Parasites, pathogens and predators. Genetic method: Male sterile techniques. Regulatory methods: Quarantines, legislation. Integrated Pest management – brief account (12 hrs)

Unit V: Pesticide application technology. Impact of pesticides in agro-ecosystem, compatibility, safety and hazards in the use of pesticides – pesticide poisoning. Impact of global warming on pests. Natural pesticides. Integrated Pest Management – Issues and options – Ecofriendly Integrated Pest Management – Indigenous/Traditional technologies. (4 hrs)

Unit VI: Beneficial insects. Honey bees- modern method of Apiculture using movable frame hives. Adaptations of queen and worker bees. Economic importance of bees as pollinators. Importance of honey and bees wax. Sericulture: Types of Silkworms, Life cycle, diseases and

uses of silkworm. Lac cultivation. Life history of *Laccifer lacca*. Host plants. Brief account of lac cultivation: pruning, Inoculation, cropping and yield. Uses of lac. (08 hrs)

B. FOREST ENTOMOLOGY

Unit I: Pests of standing trees: Life history, damages caused and control measures of *Hoplocerambyx spinicornis* (Sal sapwood borer), *Hyblaea parea* (teak defoliator), *Dihammus cervinus* (canker grub of teak). (03 hrs)

Unit II: Pests of felled timber. Symptoms of attack and control measures of - Wood borers like *Stromatium barbatum* and *Aeolesthes*, *Dinoderus brevis* (bamboo borer), *Lyctus* (powder post beetle). (03 hrs)

Unit III: Inests pest and diseases of plantation: Rubber, Eucalyptus, Mangrove species, Bamboo and teak (03 hrs)

Unit IV: Nursery pests: brief account on Army worm, cut worms, white grubs, Scrab beetles, defoliating caterpillars, psyllids and termites. (03 hrs)

REFERENCES

- Ayyar, T.V.R. 1963. Hand Book of Economic Entomology for South India – Govt. Press, Madras.
- David, B.V. and M.C. Muralirangan and M. Meera. 1992. Harmful and Beneficial Insects – Popular Book Depot, Madras, 304 p.
- David, B.V. and T. Kumaraswami. 1982. Elements of Economic Entomology – Popular Book Depot, Madras, 536 p.
- Dhaliwal, G.S. and B. Singh. 1998. Pesticides – The ecological impact in developing countries – Commonwealth Publishers, New Delhi.
- Dhaliwal, G.S. and E.A. Heinrichs. 1998. Critical issues in pest management – Commonwealth Publishers, New Delhi, 287 p.
- Dhaliwal, G.S. and Ramesh Arora. 1998. Principles of Insect Pest Management – Kalyani Publishers, New Delhi, 297 p.
- Grout, R.A. 1963. The Hive and the Honey Bee – Dadant and Sons Inc, Hamilton, Illinois, 556 p.
- Metcalf, C.K. and W.P. Flint. 1970. Destructive and Useful Insects : Their Habits and Control – Tata McGraw Hill Pub. Co., New Delhi 1074p.
- Pradhan, S. 1983. Agricultural Entomology and Pest Control – Indian Council of Agricultural Research, New Delhi, 267 p.
- Singh, S. 1975. Bee Keeping in India – Indian Council of Agricultural Research, New Delhi, 214p.
- Srivastava, K. P. 2003. A text book of Applied Entomology. Vol. II. Kalyani Publishers, Ludhiana, pp. 497.

4C 04 ZLG MEDICAL ZOOLOGY

Lecture hours: 3 hours/week, No. of credits: 2

Aim and Objectives: This course is designed to introduce a very important applied aspect of biology, which has a direct bearing on human health and well being. At the end of the course, the student should have a clear understanding of the various causative organisms and factors and also how and what preventive measures can be adopted against these.

Unit I. Diseases –Mention communicable diseases, non communicable diseases; hereditary and nutritional diseases, metabolic diseases, allergic diseases, zoonotic diseases, occupational diseases, sexually transmitted diseases, diseases transmitted through blood transfusion, gerontological diseases and autoimmune diseases. (03 hrs)

Unit II. Parasitic Diseases: Brief life cycle (stressing infective stage and mode of infection), pathogenicity and prophylaxis of the following pathogenic Protists: Entamoeba histolytica, Plasmodium vivax. Helminthiasis: Brief life history, mode of infection, pathogenicity and prophylaxis of the following parasites: Schistosoma haematobium, Ancylostoma duodenale, Ascaris lumbricoides and Wuchereria bancrofti. Disease causing arthropods: Clinical manifestations, treatment and prophylaxis of – Sarcoptes scabi, Demodex folliculorum.

(15 hrs)

Unit III. Viral, Bacterial and fungal diseases. Very brief accounts of causative organism, symptoms, lab diagnosis and prophylaxis of Rabies, Chicken pox, Hepatitis, AIDS, Tetanus, Cholera, Typhoid, Mycosis, (05 hrs)

Unit IV. Inherited Diseases. Genetic basis of inherited diseases. Normal human karyotype; numerical and structural aberrations of chromosomes. Aneuploidy, deletion (terminal and interstitial), inversion (peri and para centric), translocations (balanced, unbalanced and robertsonian) Clinical features and causes of Trisomy 21 (mention maternal age effect), Turner's syndrome, Klinefelter's Syndrome, and Cri du chat syndrome. Clinical symptoms, cause and mode of inheritance of Neurofibromatosis, Myotonic muscular dystrophy (Autosomal dominants); Albinism, Phenylketonuria, Alkaptonuria, Sickle cell anaemia (autosomal recessives); Haemophilia, Colour blindness (X linked) Mention Alzheimer's disease as an example of multifactorial trait.

(15 hrs)

Unit V. Life style related diseases. Mention the causative environmental factors in Hypertension, cardiovascular diseases, Diabetes mellitus and Obesity. Mention the role of heredity as a predisposing factor.

(05 hrs)

Unit VI. Immunity and diseases. Immune response: Primary, Secondary, Humoral, and Cell mediated. Autoimmune diseases: Type 1 Diabetes Mellitus, Myasthenia Gravis. Mention graft rejection. Reasons for autoimmune responses.

(05 hrs)

Unit VII. Cancer. Types of cancer. Characteristics of cancer cells. Carcinogens. Oncogenes and Anti oncogenes.

(03 hrs)

Unit VIII. Diagnostic Tools and Techniques. Brief accounts of EEG, ECG, Ultra Sonography, Amniocentesis, Chorionic Villus Biopsy. (03 hrs)

REFERENCES

Anil Aggarwal : Modern Diagnostics; National Book Trust.

Chakravarthy & Chakravarthy: Hand Book of Clinical Pathology.

Chatterjee K D: Parasitology- Protozoology and Helminthology; Chatterjee Medical Publishers. Kolkatta.

Darla Wise & Gordon Carter: Immunology, A comprehensive Review; Ane Books, N.Delhi.
Harsh Mohan: A Text Book of Pathology; Jaypee.
Mange & Mange: Basic Human Genetics; Rastogi Publications.
Nandini Shetty : Immunology: Introductory Text Book; New Age.
Sapti R C : Medical Zoology; Vishal Publishers, Jalandhar.

4C05ZLG (P) PRACTICAL

Lecture hours: 2 hours/week in each semester (I to IV), No. of credits: 4

TAXONOMY. Study of the following specimens in the laboratory by making simple sketches and preparing notes stating the scientific names, classification, morphological and adaptive features, biological significance, economic importance etc

Protista (2) Cnidaria (3) Helminthes (3) Annelida (3) Arthropoda (6) Mollusca (3)

Echinodermata (2) Pisces (4) Amphibia (3) Reptilia (3) Aves (1) Mammalia (1).

BENEFICIAL ORGANISMS: Study of the following specimens with simple sketches and notes on its economic value.

Apis indica

Bombyx mori

Pinctada

Perna viridis

Sardinella

Etroplus

MEDICAL ZOOLOGY: Study of the any four specimens of parasites with simple outline sketches and notes of importance. (Hosts, pathogenicity, infective stage, mode of infection, prophylaxis)

Identification of any four genetic diseases from photographs. Relevant notes to be recorded.

Instead of drawings, photocopies of pictures may be pasted in the record.

- Trisomy 21 - Turner's syndrome
- Albinism - Neurofibromatosis
- Sickle Cell Anaemia (using photograph/ drawings of RBC)

ENTOMOLOGY: Identification of four pests of crops and one wood borer. Brief account of the nature of damage, stage causing damage, control measures etc. to be recorded.

MOUNTING. The record should carry neat, labelled diagrams.

- Earthworm - body setae (in situ).
- Prawn - appendages.
- Honey - bee mouthparts.
- Shark - placoid scales.

EXPERIMENTS

1. Staining of bacteria
2. Preparation of blood smear to identify formed elements.
3. Urine analysis for glucose and albumin and ketone bodies.
4. Determination of blood group.

ZOOLOGY COMPLEMENTARY
Scheme of Question Papers for Theory Examinations.

Time : 3 hours
Total Marks: 32

- I. Essay question – (Answer 1 out of 2) (1x6=6 Marks)
- II. Essay Question – (1x6= 6 Marks)
- III. Short essays - (Answer 4 out of 6) (4x3= 12 Marks).
- IV. Short answers, 3 or 4 sentences –(Answer 6 out of 9) (6x1= 6 Marks).
- IV. One word answers/ fill in the blanks/ MCQ/Match the following Mark 1/set (2 sets of 4 questions each)

Scheme of Practical Examinations (4 credit courses) (32 Marks)

Time : 3 hours

Total Marks: 32

- I. Experiment (with written procedure) 12 Marks
- II. Mounting (with diagram) 6 Marks
- III Spot items (5 items) Marks 2 each
(2 from taxonomy, 1 each from Medical Zoology, Beneficial organisms and Entomology)
- IV. Record. 4 Marks.

CONTINUOUS ASSESSMENT

(20% of the Total Marks 40 i.e. 8 Marks is allotted for continuous Assessment)

For Theory Courses.

Test papers (minimum 2) 4 Marks

Assignment /Seminar/Viva 2 Marks

Attendance 2 Marks

For Practical Courses

Lab skill : 2 Marks:

Record : 4 Marks

Attendance: 2 Marks

(For attendance 75-79% 0.5 Mark; 80-84% 1 Mark, 85-90% 1.5 Mark and >90% 2 Marks.)

**COMPLEMENTARY (BIOLOGICAL TECHNIQUES)
SCHEME COMPLEMENTARY (BIOLOGICAL TECHNIQUES)**

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01BGT	General Laboratory Techniques	2	2	3	8	32	40
2	I	4C05BGTP	Practical	*	2	-	-	-	
3	II	2C02BGT	Laboratory Equipments and Techniques	2	2	3	8	32	40
4	II	4C05BGTP	Practical	*	2	-	-	-	-
5	III	3C03BGT	Preparation of Biological Specimens	2	3	3	8	32	40
6	III	4C05BGTP	Practical	*	2	-	-	-	-
7	IV	4C04BGT	Advanced Biological Techniques	2	3	3	8	32	40
8	IV	4C05BGTP	Practical	4	2	3	8	32	40

**General Regulations for Complementary Course
(Biological Techniques)**

The Complementary courses run in the first four semesters with one theory course in each semester and one practical course spread over the four semesters. However the practical exam will be conducted only at the end of the fourth semester. Each theory course carries 2 credits and 40 marks and the practical course 4 credits, i.e. a total of 12 credits with a total of 200 marks.

Attendance: 75% attendance is compulsory for theory as well as practical courses, failing which a student is not eligible to appear for university examinations.

Seminars/Assignments: These are part of the curriculum and are to be critically assessed for Continuous Assessment. Grades marks and should be awarded based on the content, presentation and the effort put in by the student.

Record – A practical record is compulsory for the course. Without a certified practical record, the student will not be allowed to appear for the practical examination. The practical record is to be valued internally and externally.

I SEMESTER

1C 01BGT GENERAL LABORATORY TECHNIQUES

Hours: 2 hours / week, No of credits: 2

Aim and Objectives: The course is designed Lecture to introduce the student to the basic laboratory techniques, which can augment his understanding of the core courses. The student is expected to develop an understanding of the various materials and methods used in routine lab work.

Unit I: Distilled Water: Types of distilled water (grade-3, grade-2 and grade-1) and their uses. Ion-exchangers: Brief account only. (2 hrs)

Unit II: Cleaning and sterilizing glassware: Cleaning of new glassware; general and special cleaning procedures; cleaning of pipettes and burettes; preparation of cleaning solutions (any two) Sterilization of glassware: Sterilization by heat (dry heat and moist heat), by chemicals and by radiations (brief account only) (4 hrs)

Unit III. Solutions: Definition of solute and solvent; preparation of molar, molal, normal and percentage solutions; define ppb and ppm. pH: Definition; methods for determining pH of water samples- pH indicator paper and pH indicator solutions; significance of determining pH in Biological laboratories. pH meter - Working mechanism; various types of electrodes- glass electrode and reference electrode (calomel electrode) Buffer solutions: Definition, buffer solutions commonly used in Biology laboratories-Acetate, phosphate and TRIS (brief account only) (9 hrs)

Unit IV Organic solvents: Brief accounts on ethanol, methanol, ether, chloroform, benzene and xylene. (2 hrs)

Unit V Tissue techniques: Tissue techniques for histological and histochemical studies; fixation, washing, dehydration, clearing, infiltration, embedding (paraffin method)

Fixatives: Aims of fixation; chemical fixatives-simple and compound fixatives (their preparation and uses only)Microtomy: Microtome- rotary microtome & cryostat; brief account on working mechanism and uses of rotary microtome; problems associated with microtomy (mention reasons and remedies)

Stains: Brief account on auxochrome and chromophore groups; mordants and lakes.

Histochemical stains, (their preparation methods and uses only).Special stains used in animal histological studies: Haematoxylin and Eosin, their preparation methods and staining procedure. (13 hrs)

Unit VI. Microbiological techniques: Culture media preparation-mention solid and liquid culture media; artificial culture media (any one medium for bacteria, protozoan, fungi, and algae): sterilization of culture media (brief account only). Staining of bacteria-simple, differential (gram staining and acid fat staining), negative and special staining techniques (procedure and uses only.) (4 hrs)

Unit VII. Blood grouping ABO and Rh: Principle and methodology (2 hrs)

REFERENCES:

1. Nandini Shetty, 1999. Immunology. New age Int.
2. G.P.Talwar &S.K. Gupta, 1993. A hand book of practical and Clinical Immunology. Vol-I & II, CBS Publ. & Distributors.
3. Desmonds T. & Nichol, 1996. An Introduction to Genetic Engineering :
4. Ignacimuthu, 1996. Applied Plant Biotechnology : Tata Mc. Graw Hill Publ. Comp.
5. Chatwal G.R., 1995. Analytical Chromatography :
6. Puri B.L., L.R.Sharma & M.S.Pathania, 1994. Principles of Physical Chemistry: Shobhanlal

Naginchand & co.

7. Tewari K.S.T., S.N Mehrotra & N.K. Vishnoi, 1994: A Text Book of Organic Chemistry: Vikas Publ.
8. De Robertis E.D.P. & E.M.F. De Robertis, 1990. Cell and Molecular Biology. Wavelry Int.Publ.
9. Practical Biochemistry –Principles and Techniques :Ed. By Wilson John K. & Walker (1996) Cambridge Univ. Press
10. Sadasivan S. & A.Manikandan, 1996. Biochemical Methods (II Edition):New age int.
11. Wadher B.J. & Bhoosreddy G.L. (1995). Experiments with Micro organisms: Himalaya Publ., Delhi
12. Wadher B.J. & Bhoosreddy G.L. 1995. Manual of Diagnostic Microbiology. Himalaya Publ., Delhi.
13. Sharma P.D., 1997. Microbiology (2nd. Ed.) : Rastogi.
14. Subrahmanyam N.S., 1996. Laboratory Manual of Plant Taxonomy : Vikas Pub.
15. Reinet J. & Y.P.S. Bajaj, 1997. Plant Cell, Tissue & Organ Culture : Narosal Publ. House.
16. Subramanian N.S.1996.Biophysical Chemistry –Principles and Techniques. Vikas Pub. Co.
17. Jenes W.Knudsen, 1996. Biological Chemistry-Principles & Preserving Harper Int. Illustrating Plant & Animals London
18. Michael J. Pelczar, E.C.S.Chan & Noel R. Kreig, 1993. Microbiology-Concepts & Applications Mc. Graw Hill Inc., New York.
19. Eugene P. Odum, 1996. Fundamentals of Ecology : Nataraj Publications/ WB Saunders comp. USA.
20. Gupta P.K., 1997. Elements of Biotechnology: Rastogi Pub.
21. Mukherjee K.L., 1998. Medical Lab. Technology-Vol. I,II & III: TMH
22. Sharma V.K., 1991. Techniques in Microscopy & Cell Biology : TMH
23. Jayaram J., 1996. Lab. Manual in Biochemistry : New Age Int.
24. Sarada Sunderaraj, 1996. College Microbiology : Vardhana Pub. Bangalore.
- 25 Vogel, 1996. Vogel's T.B. of Quantitative Chemical Analysis : E.L.B.S. (5th. Ed.)
26. Humason G.L., 1972. Animal Tissue techniques : W.H. Freeman & Co.
27. Das H K, 2008. Biotechnology (3rd ed). Wiley India Publ.
28. Gupta, P.K. (1999). Elements of Biotechnology, Rastogi Publications , Meerut.

II SEMESTER

2C 02 BGT LABORATORY EQUIPMENTS AND TECHNIQUES

Lecture hours: 2 hours/ week, No of credits : 2

Aim and Objective: The course is designed to introduce the student to some common equipments routinely used in biology labs. The objective is to give a sound knowledge on the basic principles involved so that the student can put to optimum use the equipments in his core and complementary lab work.

Unit 1. Microscope : Description and uses of light and phase-contrast microscope ; brief account on ocular micrometer, stage micrometer and camera lucida; some common problems associated with microscopy, use of oil immersion objective, mention immersion oil, very brief account on electron microscopy; magnification and resolution; factors influencing resolution . (6 hrs)

Unit II. Temperature sensing devices: Thermometer & thermocouple, incubator, hot air oven, water bath, magnetic stirrer (brief account on their working mechanism & uses. (6 hrs)

Unit III. Chromatographic techniques: Methods and applications of paper chromatography , a brief account on thin layer and column chromatography, mention HPLC. (5 hrs)

Unit IV. Electrophoresis: Methods and applications of paper and gel electrophoresis. (5 hrs)

Unit V. Colorimeter and spectrophotometer: Principles and uses. (3 hrs)

Unit VI. Centrifuge: Principles and uses; types of centrifuges-clinical & ultracentrifuge. (3 hrs)

Unit VII. Balances: Two pan balances-chemical and physical; Single pan balances; chances of errors in weighing-lever arm error and scale deflection error. (5 hrs)

Unit VIII. Computer: Components of computer system; brief account on how to use a computer (mention Windows Operating System) and applications of computer in Biological Laboratories (brief account only); introduction to internet (very brief account only). (3 hrs)

REFERENCES:

1. Nandini Shetty, 1999. Immunology. New age Int.
2. G.P.Talwar & S.K. Gupta, 1993. A hand book of practical and Clinical Immunology. Vol-I & II, CBS Publ. & Distributors.
3. Desmonds T. & Nichol, 1996. An Introduction to Genetic Engineering :
4. Ignacimuthu, 1996. Applied Plant Biotechnology : Tata Mc. Graw Hill Publ. Comp.
5. Chatwal G.R., 1995. Analytical Chromatography :
6. Puri B.L., L.R.Sharma & M.S.Pathania, 1994. Principles of Physical Chemistry: Shobhanlal Naginchand & co.
7. Tewari K.S.T., S.N Mehrotra & N.K. Vishnol, 1994: A Text Book of Organic Chemistry: Vikas Publ.
8. De Robertis E.D.P. & E.M.F. De Robertis, 1990. Cell and Molecular Biology. Wavelry Int.Publ.
9. Practical Biochemistry –Principles and Techniques :Ed. By Wilson John K. & Walker (1996) Cambridge Univ. Press
10. Sadasivan S. & A.Manikandan, 1996. Biochemical Methods (II Edition):New age int.
11. Wadher B.J. & Bhoosreddy G.L. (1995). Experiments with Micro organisms: Himalaya Publ., Delhi
12. Wadher B.J. & Bhoosreddy G.L. 1995. Manual of Diagnostic Microbiology. Himalaya Publ., Delhi.
13. Sharma P.D., 1997. Microbiology (2nd. Ed.) : Rastogi.
14. Subrahmanyam N.S., 1996. Laboratory Manual of Plant Taxonomy : Vikas Pub.

15. Reinett J. & Y.P.S. Bajaj, 1997. Plant Cell, Tissue & Organ Culture : Narosal Publ. House.
16. Subramaniyan N.S. 1996. Biophysical Chemistry –Principles and Techniques. Vikas Pub. Co.
17. Jenes W. Knudsen, 1996. Biological Chemistry-Principles & Preserving Harper Int. Illustrating Plant & Animals London
18. Michael J. Pelczar, E.C.S. Chan & Noel R. Kreig, 1993. Microbiology-Concepts & Applications Mc. Graw Hill Inc., New York.
19. Eugene P. Odum, 1996. Fundamentals of Ecology : Nataraj Publications/ WB Saunders comp. USA.
20. Gupta P.K., 1997. Elements of Biotechnology: Rastogi Pub.
21. Mukherjee K.L., 1998. Medical Lab. Technology-Vol. I, II & III: TMH
22. Sharma V.K., 1991. Techniques in Microscopy & Cell Biology : TMH
23. Jayaram J., 1996. Lab. Manual in Biochemistry : New Age Int.
24. Sarada Sunderaraj, 1996. College Microbiology : Vardhana Pub. Bangalore.
25. Vogel, 1996. Vogel's T.B. of Quantitative Chemical Analysis : E.L.B.S. (5th. Ed.)
26. Humason G.L., 1972. Animal Tissue techniques : W.H. Freeman & Co.
27. Das H K, 2008. Biotechnology (3rd ed). Wiley India Publ.
28. Gupta, P.K. (1999). Elements of Biotechnology, Rastogi Publications , Meerut.

III SEMESTER

3C 03 BGT PREPARATION OF BIOLOGICAL SPECIMENS

Lecture hour: 3 hours / week.No of credits : 2

Aim and Objectives. The course is intended to give basic knowledge about the preparation of lab specimens for biology museums and also for other lab needs.

The student should get a basic idea about the various procedures, the chemicals and reagents used and also the suitable methods of displaying the preserved specimens.

Unit I. Herbarium techniques: Collection of plant specimens (methods and equipment required); preservation, mounting and storage techniques (9 hrs)

Unit II. Collecting animal specimens: Marine, inter-tidal, freshwater and terrestrial zones (factors effecting zonation, equipment required for collecting animal specimens and collecting methods in each zone). (6 hrs)

Unit III. Preparation of museum specimens (animal): Some display methods including wet (in liquid preservatives- formalin/alcohol) and dry (on microslides and in display boxes) preparations. (Brief accounts only). Preparation of life cycle of specimens for museum display (in formalin) – one invertebrate (mosquito) one vertebrate (frog) specimen. (6hrs)

Unit IV. Vertebrate skeletal techniques : General methods; clearing and staining techniques (using Alizarin stain); brief account on X-ray technique and dermestid technique; a brief account of standard skeletal techniques (freshing, maceration, boiling, degreasing, mounting etc.) (6 hrs)

UNIT V. Taxidermy: Methodology (of mammals and birds) (3 hrs)

Unit VI. . Maintenance of living organisms: Aquarium and terrarium (4 hrs)

Unit VII. Cell division in animal and plant cells: Different stages of mitosis (in onion root tip cells) and meiosis (in grasshopper testes cells); sources of materials to show cell division; preparation of permanent slides to demonstrate various stages in cell division, use of chemicals to arrest cell division (brief account only). (8 hrs)

Unit VIII. Preparation of blood smear: Preparation of blood film – thick and thin smear; staining of blood smear with Leishman's stain; identification of WBC. (6 hrs)

Unit IX. Biochemical (quantitative) estimation. Blood sugar, blood urea, serum bilirubinany one method each; mention their clinical significance. (6 hrs).

REFERENCES:

1. Nandini Shetty, 1999. Immunology. New age Int.
2. G.P.Talwar &S.K. Gupta, 1993. A hand book of practical and Clinical Immunology. Vol-I & II, CBS Publ. & Distributors.
3. Desmonds T. & Nichol, 1996. An Introduction to Genetic Engineering :
4. Ignacimuthu, 1996. Applied Plant Biotechnology : Tata Mc. Graw Hill Publ. Comp.
5. Chatwal G.R., 1995. Analytical Chromatography :
6. Puri B.L., L.R.Sharma & M.S.Pathania, 1994. Principles of Physical Chemistry: Shobhanlal Naginchand & co.
7. Tewari K.S.T., S.N Mehrotra & N.K. Vishnol, 1994: A Text Book of Organic Chemistry: Vikas Publ.
8. De Robertis E.D.P. & E.M.F. De Robertis, 1990. Cell and Molecular Biology. Wavelry Int.Publ.
9. Practical Biochemistry –Principles and Techniques :Ed. By Wilson John K. & Walker (1996) Cambridge Univ. Press
10. Sadasivan S. & A.Manikandan, 1996. Biochemical Methods (II Edition):New age int.

11. Wadher B.J. & Bhoosreddy G.L. (1995). Experiments with Micro organisms: Himalaya Publ., Delhi
12. Wadher B.J. & Bhoosreddy G.L. 1995. Manual of Diagnostic Microbiology. Himalaya Publ., Delhi.
13. Sharma P.D., 1997. Microbiology (2nd. Ed.) : Rastogi.
14. Subrahmanyam N.S., 1996. Laboratory Manual of Plant Taxonomy : Vikas Pub.
15. Reinett J. & Y.P.S. Bajaj, 1997. Plant Cell, Tissue & Organ Culture : Narosal Publ. House.
16. Subramaniyan N.S.1996.Biophysical Chemistry –Principles and Techniques. Vikas Pub. Co.
17. Jenes W.Knudsen, 1996. Biological Chemistry-Principles & Preserving Harper Int. Illustrating Plant & Animals London
18. Michael J. Pelczar, E.C.S.Chan & Noel R. Kreig, 1993. Microbiology-Concepts & Applications Mc. Graw Hill Inc., New York.
19. Eugene P. Odum, 1996. Fundamentals of Ecology : Nataraj Publications/ WB Saunders comp. USA.
20. Gupta P.K., 1997. Elements of Biotechnology: Rastogi Pub.
21. Mukherjee K.L., 1998. Medical Lab. Technology-Vol. I,II & III: TMH
22. Sharma V.K., 1991. Techniques in Microscopy & Cell Biology : TMH
23. Jayaram J., 1996. Lab. Manual in Biochemistry : New Age Int.
24. Sarada Sunderaraj, 1996. College Microbiology : Vardhana Pub. Bangalore.
- 25 Vogel, 1996. Vogel's T.B. of Quantitative Chemical Analysis : E.L.B.S. (5th. Ed.)
26. Humason G.L., 1972. Animal Tissue techniques : W.H. Freeman & Co.
27. Das H K, 2008. Biotechnology (3rd ed). Wiley India Publ.
28. Gupta, P.K. (1999). Elements of Biotechnology, Rastogi Publications , Meerut.

IV SEMESTER

4C 04BGT ADVANCED BIOLOGICAL TECHNIQUES:

Lecture hours: 3 hours/ week, No of credits: 2

Aim and Objectives: This course is meant to give the student an exposure to some of the advanced biological techniques that are currently used for various kinds of studies. The objective is to familiarize the student with of the modern innovative techniques and terminologies currently used.

Unit I. Restriction enzyme and their uses (3 hrs)

Unit II. Hybridisation Techniques: Southern blotting techniques; Northern blotting techniques; Western blotting techniques; DNA finger printing (10 hrs)

Unit III. Brief account on: cDNA synthesis & cloning, PCR, Real time PCR, RAPD, RFLP, AFLP, isolation of total RNA and DNA (8 hrs)

Unit IV. ELISA methodology and applications (3 hrs)

Unit V. Tissue culture: Methodology and applications (Plant tissue culture; embryo-culture in plants; cell culture in animals - brief account only) (6 hrs)

Unit VI. Immunological techniques: Structure of immunoglobulin; types of immunoglobulin; visualization of antigen-antibody reactions (brief account on precipitation & agglutination techniques, RIA and immunoelectrophoresis) (7 hrs)

Unit VII. Production of antibodies (any one method procedure only-) Monoclonal antibodies; Preparation method (any one method) and applications, mention hybridoma technology. (5 hrs)

Unit VIII. Introduction to Bioinformatics (2 hrs)

Unit IX. Types and sources of radiation. Effects on biological systems. Isotopes – definition, isotopes of common biological use; techniques for detection of isotopes-(autoradiography and Geiger counter methods) – brief accounts. (10 hrs)

REFERENCES:

1. Nandini Shetty, 1999. Immunology. New age Int.
2. G.P.Talwar &S.K. Gupta, 1993. A hand book of practical and Clinical Immunology. Vol-I & II, CBS Publ. & Distributors.
3. Desmonds T. & Nichol, 1996. An Introduction to Genetic Engineering :
4. Ignacimuthu, 1996. Applied Plant Biotechnology : Tata Mc. Graw Hill Publ. Comp.
5. Chatwal G.R., 1995. Analytical Chromatography :
6. Puri B.L., L.R.Sharma & M.S.Pathania, 1994. Principles of Physical Chemistry: Shobhanlal Naginchand & co.
7. Tewari K.S.T., S.N Mehrotra & N.K. Vishnol, 1994: A Text Book of Organic Chemistry: Vikas Publ.
8. De Robertis E.D.P. & E.M.F. De Robertis, 1990. Cell and Molecular Biology. Wavelry Int.Publ.
9. Practical Biochemistry –Principles and Techniques :Ed. By Wilson John K. & Walker (1996) Cambridge Univ. Press
10. Sadasivan S. & A.Manikandan, 1996. Biochemical Methods (II Edition):New age int.
11. Wadher B.J. & Bhoosreddy G.L. (1995). Experiments with Micro organisms: Himalaya Publ., Delhi
12. Wadher B.J. & Bhoosreddy G.L. 1995. Manual of Diagnostic Microbiology. Himalaya Publ., Delhi.
13. Sharma P.D., 1997. Microbiology (2nd. Ed.) : Rastogi.
14. Subrahmanyam N.S., 1996. Laboratory Manual of Plant Taxonomy : Vikas Pub.

15. Reinett J. & Y.P.S. Bajaj, 1997. Plant Cell, Tissue & Organ Culture : Narosal Publ. House.
16. Subramaniyan N.S. 1996. Biophysical Chemistry –Principles and Techniques. Vikas Pub. Co.
17. Jenes W. Knudsen, 1996. Biological Chemistry-Principles & Preserving Harper Int. Illustrating Plant & Animals London
18. Michael J. Pelczar, E.C.S. Chan & Noel R. Kreig, 1993. Microbiology-Concepts & Applications Mc. Graw Hill Inc., New York.
19. Eugene P. Odum, 1996. Fundamentals of Ecology : Nataraj Publications/ WB Saunders comp. USA.
20. Gupta P.K., 1997. Elements of Biotechnology: Rastogi Pub.
21. Mukherjee K.L., 1998. Medical Lab. Technology-Vol. I, II & III: TMH
22. Sharma V.K., 1991. Techniques in Microscopy & Cell Biology : TMH
23. Jayaram J., 1996. Lab. Manual in Biochemistry : New Age Int.
24. Sarada Sunderaraj, 1996. College Microbiology : Vardhana Pub. Bangalore.
25. Vogel, 1996. Vogel's T.B. of Quantitative Chemical Analysis : E.L.B.S. (5th. Ed.)
26. Humason G.L., 1972. Animal Tissue techniques : W.H. Freeman & Co.
27. Das H K, 2008. Biotechnology (3rd ed). Wiley India Publ.
28. Gupta, P.K. (1999). Elements of Biotechnology, Rastogi Publications , Meerut.

4C05BGT (P) PRACTICAL

Lecture hours: 2 hours/week in all semesters (I to IV) No. of credits: 4,

Total Marks: 32

I. Preparation method of the following:- (Demonstration)

- a) Standard buffer solution- Acetate and Phosphate
- b) Fixatives – Bouin's, Carnoy's, Schaudinn's.
- c) Stains – Cytological, anatomical, histological and histochemical (one each)
- d) Paraffin blocks of tissues for sectioning- fixing, washing, dehydration etc.

Record should carry notes of the preparation methods.

II. Operation of the following equipments)

- a) Compound microscope b) Phase contrast microscope c) Colorimeter
- d) Spectrophotometer e) pH meter f) Hot air oven
- f) Incubator g) Incubator h) Water bath
- i) Autoclave j) Distillation apparatus k) Deioniser
- l) Analytical balance (2 pan) m) Electrical balance (monopan)

- n) Microtome o) Magnetic stirrer p) Centrifuge

Record should carry sketches and notes on the principle and uses.

III. Experiments)

Colorimetry- To find the concentration of given sample solution using standard graph. (major)

b) Spectrophotometry- To find wavelength at which maximum % transmission occurs in the given sample solution (major).

c) Double staining- To stain the given slide of animal tissue using haematoxylin-eosine (demo)

d) Microtomy – To take serial sections of the given tissue and spread them on glass slide. (minor)

e) Micrometry- Measure dimensions of microscopic objects. (Minor)

f) Scientific drawing – To draw specimens using camera lucida. (Minor)

g) Vital staining – staining of buccal epithelium and mitochondria. (Minor)

h) Staining – smear preparation and staining of bacteria (minor)

i) Detection of abnormal constituents of urine – glucose, albumen, ketone bodies.(major)

IV. Method of preparation of museum specimens

a) Animal specimens – any 5

b) Plant specimens – any 5

Record should carry sketches and notes on method of preparation.

**Biological Techniques Complementary
Scheme of Question Papers for Theory Examinations.**

Time : 3 hours

Total Marks:32

- I. Essay question – from type study/General topics(Answer 1 out of 2) (1x6=6 Marks)
- II. Essay Question –from Taxonomy (Answer 1 out of 2) (1x6= 6 Marks)
- III. Short essays - (Answer 4 out of 6) (4x3= 12 Marks).
- IV. Short answers,3 or 4 sentences –(Answer 6 out of 9) (6x1= 6 Marks).
- IV. One word answers/ fill in the blanks/ MCQ/Match the following Mark 1/set
(2 sets of 4 questions each)

Scheme of Practical Examinations (4 credit courses) (32 Marks)

Time : 3hours

Total Marks: 32

- I. Experiment (with written procedure) 12 Marks
- II. Mounting (with diagram) 6 Marks
- III Spot items (5 items) Marks 2 each
- IV. Record. 4 Marks

CONTINUOUS ASSESSMENT

(20% of theTotal Marks 40 i.e. 8 Marks is allotted for continuous Assessment)

For Theory Courses

Test papers (minimum 2) 4 Marks

Assignment / Seminar/Viva 2 Marks

Attendance 2 Marks

For Practical Courses

Lab skill : 2 Marks:

Record : 4 Marks

Attendance : 2 Marks

(For attendance 75-79% 0.5 Mark; 80-84% 1 Mark, 85-90% 1.5 Mark and >90% 2 Marks.)

**3. COMPLEMENTARY (PHYSIOLOGY)
SCHEME COMPLEMENTARY (PHYSIOLOGY)**

Sl. No.	Sem	Course Code	Name of the Course	Credit	Hours/Week	Exam Hrs.	Max. Marks		
							Int	Ext	Total
1	I	1C01PLY	Biological Chemistry	2	2	3	8	32	40
2	I	4C05PLYP	Practical	*	2	-	-	-	
3	II	2C02PLY	Cell Biology	2	2	3	8	32	40
4	II	4C05PLYP	Practical	*	2	-	-	-	-
5	III	3C03PLY	Human Physiology-I	2	3	3	8	32	40
6	III	4C05PLYP	Practical	*	2	-	-	-	-
7	IV	4C04PLY	Human Physiology-II	2	3	3	8	32	40
8	IV	4C05PLY	Practical	4	2	3	8	32	40

**General Regulations for Complementary Course
(Physiology)**

The Complementary courses run in the first four semesters with one theory course in each semester and one practical course spread over the four semesters. However the practical exam will be conducted only at the end of the fourth semester. Each theory course carries 2 credits and 40 marks and the practical course 4 credits, i.e. a total of 12 credits with a total of 200 marks..

Attendance – 75% attendance is compulsory for theory as well as practical courses, failing which a student is not eligible to appear for university examinations.

Seminars/Assignments – These are part of the curriculum and are to be critically assessed for Continuous Assessment. Grades marks and should be awarded based on the content, presentation and the effort put in by the student.

Record – A practical record is compulsory for the course. Without a certified practical record, the student will not be allowed to appear for the practical examination. The practical record is to be valued internally and externally.

I SEMESTER
1C01 PLY BIOLOGICAL CHEMISTRY
Lecture hours: 2hours/week

Aims & Objectives:-

The course is meant to give a comprehensive idea about the basic concepts of biochemistry and augment the core courses of the student.

Unit I - Introduction

The Chemical elements of living matter-biological molecules, Protoplasm-Colloidal nature covalent bonds, Polar and non-polar molecules, Non-covalent bonds, ionic bonds, hydrogen bonds. (3 hours)

Unit II - Water

Significance as a medium, structure, The life supporting properties of water-dipolar nature, dissociation of water, concept of PH buffers,-Henderson-Hasselbach equation. (5 hours)

Unit III -Proteins, Peptides and amino acids

Classification of amino acids, Primary, secondary and tertiary structures of proteins, Biological functions of Protein. (6 hours)

Unit IV - Carbohydrates

Monosaccharides, disaccharides and polysaccharides, trioses, tetroses, pentoses, hexoses aldoses and ketoses, heteropolysaccharides-biological functions of carbohydrates. (6 hours)

Unit V- Fats & Fatty acids

Classification of fatty acids, Simple fats, saturated and unsaturated fats , classification of lipids, lipid micelles (4 hours)

Unit VI- Bioenergetics

The laws of thermodynamics and concept of entropy, free energy (2 hours)

Unit VII –Enzymes

Enzymes as biological catalysts. IUB classification. The properties of enzymes, enzyme inhibition, co-enzymes, Michaelis – Menten equation. (4 hours)

Unit VIII - Basal metabolism

Interrelationship between carbohydrates, proteins and lipid metabolism, role of liver in metabolism. Glycolysis, glycogenesis, glycogenolysis, Krebs cycle, beta oxidation of fatty acids-deamination, transamination and decarboxylation of amino acids. (6 hours)

REFERENCES

Awapara J : Introduction to Biological chemistry; Prentice-Hall, India.
Nelson : Leninger's Principles of Biochemistry; Ane Books.
Rastogi : Biochemistry; Tata McGraw Hill.
Srivastava H S : Elements of Biochemistry; Rastogi Publications.
Veerakumari L : Biochemistry; MJP Pub

II SEMESTER
2CO2PLY CELL BIOLOGY
Lecture hrs: 2 hrs /week

Aim and objectives:-

To give an over view of the basic concepts and techniques involved in the study of cells and to provide an insight in to the complexity of the cellular machinery.

Unit –I

Introduction to the study of cell biology- The discovery of cells, Basic properties of cells, Cell theory and its modern concept, Two fundamentally different classes of cells-characteristics that distinguish prokaryotic and eukaryotic cells, Mycoplasma, Viruses.

(2 hrs)

Unit- II

The structure and functions of Plasma membrane, an overview of membrane functions, a brief history of studies on plasma membrane structure, the chemical composition of membrane. The structure and function of membrane proteins, The movement of substances across cell membrane- passive and active transport.

(6hrs)

Unit -III

Aerobic respiration and the Mitochondrion, Mitochondrial structure and function-Oxidative metabolism in mitochondrion, The machinery and metabolism of ATP formation. (3 hrs)

Unit -IV

Cytoplasmic membrane system-structure function and membrane trafficking, an overview of the endomembrane system-The Endoplasmic reticulum -structure and function, The golgi complex-glycosylation in golgi, movement of material through golgi complex, types of transport vesicles-COP I, COP II and clathrin coated vesicle, Lysosome, Peroxisome and Glyoxysomes, Plant cell vacuoles and chloroplast.

(7 hrs)

Unit -V

The cell nucleus, Chromosomes, Giant chromosomes, Control of gene expressions in prokaryotes and eukaryotes, DNA replication, Nucleolus, Ribosomes-various types of ribosomes, Biological functions of ribosomes, Transcription and Translation. (8 hrs)

Unit -VI

The cytoskeleton and cell motility-structure and functionof microtubule, microfilament and intermediate filaments, Centriole, cilia and flagella .

(5 hrs)

Unit -VII

Cellular reproduction, Cell cycle –M-phase,mitosis and Cytokinesis, Meiosis. (5 hrs)

REFERENCES

- De Robertis : Cell and Molecular Biology; Holt-Saunders.
Gupta : Cell and Molecular Biology; Rastogi Pub.
Karp : Cell Biology; McGraw Hill.
Powar : Cell Biology; Himalaya Publishing House
Verma & Agarwal: Cytology; S. Chand.

III SEMESTER
3C 03 PLY HUMAN PHYSIOLOGY I
Lecture hrs: 3hrs/week

Aim and objectives:-

The syllabi in two parts aims to provide a comprehensive idea of the physiological features of the human body. At the end of the 2 part course, the student should have a clear idea about the functioning of the various systems in the human body- Topics on first aid and public health awareness is intended to give the student a basic idea in these applied areas.

Unit I- Nutrition

The constituents of food, Dietary requirement of carbohydrate, proteins, fats, vitamins and minerals, essential and non essential amino acids, balanced diet, Malnutrition ,infant nutrition, effect of nutrition on early growth and development, deficiency diseases, physiology of digestion, structure of digestive glands and mode of secretion, The absorption and metabolism of nutrients, Gastro- Intestinal hormones, Gastric movements, Disorders of alimentary canal . Nervous and hormonal control of digestion. (10 hrs)

Unit II- Respiration

Definition, Mechanism of respiration, physiology of gaseous exchange in lungs & tissues. Neuro-physiological control of respiration-oxyhaemoglobin curve, Effect of temperature & pH on oxyhaemoglobin curve, respiratory volume, respiratory disturbances- apnoea, dyspnoea, hypoxia, hypo & hypercapnea, asphyxia, carbon monoxide poisoning. Acclimatisation-adaptation to high altitude. physiological problems of diving mammals, oxygen toxicity. (10 hrs)

Unit III- Body fluids & circulation

Blood-composition & function. Importance of analysis of blood ESR, anaemia, leucopenia, polycythemia. blood groups, blood clotting mechanism. Lymph & lymphatic system. Spleen-structure &function. Heart- structure &functions. Conducting system of heart, cardiac cycle and its control. cardiovascular problems-artetiosclerosis, ischaemia, angina pectoris, atherosclerosis, ASD, VSD, myocardial infarction, coronary thrombosis, ventricular fibrillation, blood pressure. (10 hrs)

Unit IV- Excretion

Histology of human nephron, physiology of urine formation. counter current mechanism. kidney diseases, stones in kidney and urinary tracts. Renal hypertension, nephrosis, nephritis, renal failure. Brief note on dialysis. (9 hrs)

Unit V-Nervous coordination

Types of neurons. giant nerve, fibers, transmission of nerve impulse, neurotransmitters, sympathetic & parasympathetic system. Motor and sensory areas of brain. physiology of vision, hearing & balancing. cutaneous sense receptors. (10 hrs)

Unit VI-Human immune system

Specific and non specific defences. The lymphocytes and immunity. Humoral & cell mediated immunity. (3 hrs)

Unit VII- Homeostasis

Homeostasis, temperature regulation & pyrexia. (2 hrs)

IV SEMESTER
4 CO 4 PLY HUMAN PHYSIOLOGY II
Lecture hours -3 hours /week

Unit I - Locomotion

Skeletal joints, bones of limbs

Muscle –structure, sarcotubular system, contractile proteins.

Electrochemical changes responsible for contraction & relaxation of muscle.

Muscle twitch, tetanus, isometric & isotonic contraction.

Action potential curve. all or none law. Fatigue, rigor mortis. (12 hrs)

Unit II- Reproduction

Reproduction & development. Structure of ovary and testis

Structure of ovum and sperm. Oogenesis and spermiogenesis, human menstrual cycle and hormonal control. fertilization, cleavage, blastocyst formation, implantation, placenta, hormonal control of pregnancy, gestation, parturition and lactation. (12 hrs)

Unit III- Endocrine glands

Endocrine glands, structure, hormones and their function. (10 hrs)

Unit IV-First aid

Artificial respiration. First aid for burns, snake bite, drowning & accidents. (5 hrs)

Unit V-Ageing

Physiological basis of ageing. (5 hrs)

Unit VI-Public health and awareness

Smoking and its effects

Alcoholism and its effects

Drug addiction and its effects

Cancer and carcinogens

Sexually transmitted diseases

Hepatitis, HIV, communicable diseases-water borne and air borne diseases. (10 hrs)

REFERENCES

Chatterjee CC : Human Physiology vol -I & II; Medical Allied Agency

Hoar W S : General and Comparative Physiology; Prentice Hall.

Park & J E Park : Social and Preventive Medicine.

Rastogi S C : Essentials of Animal Physiology; New Age Int'l Pub.

Subramaniam.S, Madhavankutty K, Singh S D. : Textbook of Human Physiology; S Chand.

4C O5 PLY(P) PRACTICAL

Microtechniques

Study of compound microscope
Stage and ocular micrometers

Cytology

Squash preparation of onion root tip to study mitotic stages(minor)
Squash preparation of grasshopper testis/Tredescantia anther for meiotic stages.(Minor)
Smear preparation of buccal epithelium(minor)
Preparation of blood smear and differential count of WBC(major)
Total count of WBC by hemocytometre. (Demo)
Total count of RBC by hemocytometre. (Demo)

Biochemistry

Glucose estimation by calorimeter. (Major)
Protein estimation by calorimeter. (Major)
Paper chromatographic separation of amino acids. (Minor)
Qualitative test for carbohydrates. (Major)
Qualitative test for protein. (Major)
Qualitative test for fat. (Major)

Physiology

Effect of temperature/ pH on salivary amylase activity. (Minor)
Estimation of oxygen consumption by cockroach (Respirometre). (Demo)
Detection of normal & abnormal constituents of urine. (Major)
Detection of blood groups. (Minor)
Determination of coagulation time. (Minor)
Determination of blood pressure using sphygmomanometer. (Demo)
Cardiac efficiency test. (Minor)

Histology

Study of permanent slides (Any five items) – Epithelial tissue, Muscle, Cartilage, Bone, Nervous tissue, etc.

PHYSIOLOGY COMPLEMENTARY
Scheme of Question Papers for Theory Examinations.

Time : 3 hours

Total Marks:32

- I. Essay question – from type study/General topics(Answer 1 out of 2) (1x6=6 Marks)
- II. Essay Question –from Taxonomy (Answer 1 out of 2) (1x6= 6 Marks)
- III. Short essays - (Answer 4 out of 6) (4x3= 12 Marks).
- IV. Short answers,3 or 4 sentences –(Answer 6 out of 9) (6x1= 6 Marks).
- IV. One word answers/ fill in the blanks/ MCQ/Match the following Mark 1/set
(2 sets of 4 questions each)

Scheme of Practical Examinatins (4 credit courses) (32 Marks)

Time : 3hours

Total Marks: 32

- I. Experiment (with written procedure) 12 Marks
- II. Mounting (with diagram) 6 Marks
- III Spot items (5 items) Marks 2 each
- IV. Record. 4 Marks.

CONTINUOUS ASSESSMENT

(20% of theTotal Marks 40 i.e. 8 Marks is allotted for continuous Assessment)

For Theory Courses.

Test papers (minimum 2) 4 Marks

Assignment / Seminar/Viva 2 Marks

Attendance 2 Marks

For Practical Courses

Lab skill : 2 Marks:

Record : 4 Marks

Attendance: 2 Marks

(For attendance 75-79% 0.5 Mark; 80-84% 1 Mark, 85-90% 1.5 Mark and >90% 2 Marks.)

MODEL QUESTION PAPERS

B.SC ZOOLOGY

CORE COURSES

First Semester B.Sc Degree Examination
Core Course in Zoology
1BO1ZLG :Protista and Non Chordata-I

Time: 3Hours

Maximum Marks: 40

I. Answer any one

(1x8= 8 marks)

1. Explain the canal system found in sponges.
2. Classify Phylum Platyhelminthes up to classes giving salient features and examples.

II. Answer any one

(1 x8= 8 marks)

3. Describe reproduction in Paramecium.
4. What is metagenesis? Explain the phenomenon in Obelia.

III. Answer any two

(2x4=8 marks)

5. Describe the structure of Amphiblasula and compare it with that of Parenchymula.
6. Why are Ctenophores so called?. Give the external morphology of Pleurobrachia.
7. With a labeled diagram, describe the structure of Obelia medusa.

IV. Answer any five

(5x2=10 marks)

8. What are coral forming Cnidarians? Mention its importance.
9. Briefly describe the locomotion in Paramecium.
10. Give four diagnostic features of Nematoda.
11. Differentiate between Polyp and Medusa.
12. Give an account of polymorphism in Physalia.
14. Describe the salient features of Phylum Rotifera.
15. Explain the mode of infection of (a) Ancylostoma (b) Enterobius (c) Wuchereria.
16. Describe the salient features of Phylum Porifera. Give an example.
17. Describe the osmoregulation of Paramecium.

V. Answer any four.

(4x1=4)

18. Distinguish Osculum and Ostia.
19. What is pseudocoel?. Give an example.
20. Write the Phyla of Euplectella and Dugesia.
21. What is Cnidocytes?. Mention its function.
22. What is a digenetic organism?.
23. What is polyembryony?

VI Answer the following:

(2x1=2)

24. a) _____ is commonly known as Bell animalcule.
- b) Comb plates are seen in Phylum-----.
- c) Adamsia is a cnidarians belonging to class-----.
- d) Schistosoma is commonly known as-----

25. Match the following:

- | | |
|----------------|-------------|
| i) Mesozoa | Parasites |
| ii) Nematoda | Sponges. |
| iii) Trematoda | Dicyema. |
| iv) Porifera | Round Worm. |

II Semester B.Sc. Degree Examination
CORE COURSE IN ZOOLOGY
Protista and Non-Chordata .II

Time: 3 Hours

Max. Marks: 40

I. Answer any one:

(1x8= 8 marks)

1. Describe the respiratory system of *Penaeus* and add a note the mechanism of respiration.
2. Give a detailed account of the structure and function of water vascular system in *Asterias*.

II. Answer any one :

(1x8=8 marks)

3. Explain the circulatory system of *Pila* and its mechanism of circulation.
4. Classify Phylum Annelida down to classes with salient features of each class and examples.

III. Answer any two:

(2x4= 8 marks)

5. With the help of a diagram, describe the structure and function of parapodium of *Nereis*.
6. Describe the organs of pallial complex of *Pila*.
7. Describe the distribution and affinities of *Peripatus*

IV. Answer any five:

(5x2=10 marks)

8. Give the economic importance of Mollusca.
9. Explain the structure and working of kidney of *Pila*.
10. Enumerate the special features of Crustacea.
11. Give an account of *Balanoglossus*.
12. Write down the salient features of Gastropoda.
13. What are Trilobites? Mention their evolutionary significance.
14. Describe the external features of Star fish.
15. Describe the special features of Class Ophiuroidea.

V. Answer any four:

(4x1 =4 marks)

16. Write any two examples of class Arachnid a.
17. Mention the function of hepatopancreas.
18. Trace the course of water in the respiratory system of *Pila*.
19. Difference between true coelom and pseudocoel.
20. Mention the class to which *Nautilus* is assigned.
21. What is the Organ of Bojanus? . Mention its function

VI. Answer the following:

(2x1= 2 marks)

22. Fill in the blanks:

- a) Study of Mollusca is termed as _____.
- b) *Pila* uses _____ - for rasping the food.
- c) _____ is the sexual part in the body of *Heteronereis*
- d) *Holothuria* is commonly known as _____

23. Match the following:

- | | | |
|--------------------|---|--------------------|
| a) <i>Limulus</i> | - | <i>Ciddippid</i> . |
| b) <i>Neanthes</i> | - | Nauplius |
| c) <i>Phoronis</i> | - | Trilobite |
| d) <i>Penaeus</i> | - | Trochophore |
| | - | Actinotrocha |

MODEL QUESTION PAPER
III Semester B.Sc. Zoology Degree Programme (Theory)
Zoology Core Course- 3
3B03ZLG Chordata –I

Time : 3 hrs

Marks 40

Instruction: Draw diagrams wherever necessary

I Essay: **Answer any one**

1x8=8 Marks

1. Write an essay on Reptilian adaptation
2. Describe the digestive system of Branchiostoma

II Essay: **Answer any one**

1x8=8 Marks

3. Give an account on amphibian classification to orders with suitable examples.
4. Comment on the accessory respiratory structures in fishes with examples

III Short Essay: **Answer any two**

2x4=8 Marks

5. Write a note on salient feature of Urochordata
6. Comment on migration in fishes
7. Write a note on snake venom
8. Sketch and label the heart of frog

IV Paragraph: **Answer any four**

4x2=8 Marks

9. Distinguish Agnatha and Gnathostomata
10. Explain the aquatic adaptations of fishes
11. Comment on retrogressive metamorphosis with examples.
12. Write a note on morphology of shark.
13. Classify super class Pisces to classes with examples.
14. Describe the structure of poison apparatus of snake.
15. Comment on land turtles.

V **Answer any Six** (in One or two sentences)

6x1=6 Marks

16. What is venous heart? Give an example.
17. What are chelonians? Give an example.
18. Comment on ammocoetes larva.
19. What is double circulation?
20. Write briefly on sensory cranial nerves of amphibians.
21. Write on acidian test.
22. Write on bush frog.
23. Comment on caecilians in Kerala.

VI **Match the following**

2 Marks

A

Fangs
Salamander
Ductus cuvieri
Oikopleura

B

Urodela
Ascidiacea
Poison gland
Venous system

MODEL QUESTION PAPER
IV Semester B.Sc. Zoology Degree Programme (Theory)
Zoology Core Course- 4
4B04ZLG Chordata –II and Comparative Anatomy

Time : 3 hrs

Marks 40

Instruction: Draw diagrams wherever necessary

I. Essay: Answer any one

1x8=8 Marks

1. Write an essay on flight adaption in Birds.
2. Describe different types dentition in Mammals.

II Essay: Answer any one

1x8=8 Marks

3. Give an account on adaptations of aquatic mammals.
4. Comment on the digestive system of Oryctolagus.

III Short Esssay: Answer any two

2x4=8 Marks

5. Distinguish Artiodactyla and Perissodactyla.
6. Comment on Chiroptera and their adaptations.
7. Comment on aortic arches in Frog and shark
8. Explain different types of vertebrae in Vertebrata

VI Paragraph: Answer any four

4X2=8 Marks

9. Describe the structure of arterial system of Oryctolagus
10. Comment on Carnivore mammals in India.
11. Comment on reptilian characters of Archaeopteryx.
12. Differentiate Ratitae and Carinatae.
13. Comment on antlers.
14. Write on jaw suspensoria.

V Answer any six (in One or two sentences)

6x1=6 Marks

15. What are Monotrematodes?
16. Write on carnivores in Kerala.
17. Why Archaeopteryx called connecting link of reptiles and aves?
18. Comment on Metatherian animals.
19. Write names of different types of feathers of birds
20. In which animal groups, Prosonephric kidneys are common?
21. Names different types of scales found in animal kingdom.
22. Names the three species of elephants still live in Animal Kingdom.
23. Write the name freshwater dolphins in India.

VI Match the Following

2 Marks

- | | |
|----------------------|------------------|
| A | B |
| 24. Dr. Salim Ali | Apes |
| 25. Eutheria | Ornithology |
| 26. Carnassial Teeth | African Elephant |
| 27. Loxodonta | Carnivores |

Model Question papers
V Semester B. Sc. Zoology Degree Programme Zoology . Core Course -5
5B05ZLG BIOCHEMISTRY AND ENDOCRINOLOGY

Time: 3 hours

Maximum marks: 40

I Answer **any two** :

(2x8 = 16)

1. Describe the structure of DNA .Briefly explain the A, D, C and Z forms of DNA also.
2. Explain the mechanism of enzyme action. Mention enzyme activation and inhibition.
3. Describe the biological importance of different vitamins.
4. Explain kreb's cycle showing structural details.

II Answer **any two**:

(2x4 =8)

5. Briefly explain the biological significance of macro, micro and trace elements.
6. Briefly explain the classification of hormones based on the chemical nature.
7. Describe electron transport system.
8. What are the biological importances of proteins?

IIIAnswer **any six)**

(6x2 = 12)

9. Differentiate between glycogenesis and glycogenolysis.
10. What are nucleotides? Give the structure of AMP.
11. Distinguish between competitive and allosteric inhibition.
12. Mention the biological functions of prostaglandins.
13. Describe any two types of glycosidic bonds.
14. Explain the concept of free energy.
15. What is deamination. Give an example.
16. Enumerate any 4 biological functions of water.

IVAnswer **any four** :

(4x1 = 4)

17. ----- is a pancreatic hormone.
18. ----- is an essential fatty acid.
19. ----- is a multi-enzyme system.
- 20.----- a secondary structure of proteins.

V Semester B. Sc. Zoology Degree Programme Zoology Core Course -6
5B06ZLG BIOPHYSICS, BIOSTATISTICS & METHODOLOGY

Time: 3 hours

Maximum marks: 40

I. Answer any two:

(1x8 = 8)

1. Explain the principle of paper and column chromatography with the help of figures. Enumerate their applications also.

2 Describe the various methods of preservation of biological specimen.

II. Answer any two :

(1x8 = 8)

3 Explain principle of centrifugation. Describe any 4 type of centrifuges and 2 types of centrifugations.

4 Describe the sampling methods used in biostatistics.

III Answer any two :

(2x4= 8)

5. Explain principle and applications of phase contrast microscope.

6. Describe the various types of microtome and their uses.

7. Explain the key steps of scientific methods.

8. Describe any 2 types of measures of central tendency giving equations to calculate them.

IV Answer any six:

(6x2 = 12)

9. What is meant by limit of resolution of a microscope?

10. What are the applications of electrophoresis?

11. Explain the calibration of a pH meter.

12. Distinguish between bar diagram and histogram.

13. Describe the uses of camera lucida.

14. Explain sampling error and chi - square test.

15. Describe methods to calculate mean of grouped and ungrouped methods.

16. What is meant by autoradiography?

V Answer any four:

(4x1=2)

17. UV rays are ----- radiations.

18. ---- is the unit of speed of centrifuge.

19. Limit of resolution of Electron microscope is -----.

20. ----- is used to take measurement of microscopic objects.

V Semester B. Sc. Zoology Degree Programme
Core Course in Zoology
5B 07ZLG: Cell Biology and Immunology

Time-3 Hrs

Marks: 40

Part A- Cytology

- I Answer any one of the following (1X8=8)
- 1.Explain Gametogenesis
 2. Explain the structure and functions of Polytene and Lamp brush chromosomes
- II. Answer any one of the following (1X8=8)
3. Explain the structure of Golgibodies.Comment on its major functions
 4. Compare and contrast spermatogenesis and Oogenesis
- III.Answer any two of the following (2X3=6)
- 5.Define parthanogenesis.Differentiate between Arrhenotoky, thelytoky
 6. Write a short note on Ribosomes .Differentiate between pProkaryotic and eukaryotic ribosomes
 7. Write a paragraph on cell cycle
 8. Define crossing over. Write its significance
- IV.Answer any 6 of the following (6X1=6)
- 9.Metastasis
 - 10.Crossing over
 - 11.Pore complex
 - 12.Vital stains
 - 13.Cell theory
 14. Prokaryotic cell
 15. Fibroblasts
 16. Golgi complex
- V.17. Answer all of the following (4X1=4)
- a) Which one of the following eukaryotic cell structures does not contain DNA?
 - i. nucleus ii. mitochondrion iii.chloroplast iv.Endoplasmicreticulum
 - b) Which of the following is not an accurate description of a chromosome?
 - i. It is a colored body localized in the nucleus. li. It is a protein and nucleic acid complex.
 - ii. It is the cellular structure that contains the genetic material
 - iii. In eukaryotes, it is composed of many DNA molecules attached end to end
 - c) Which of the following cells secrete histamine?
 - i. i.Macrophages ii.Plasma cells iii. Fibroblst iv. Mast cell
 - d) Acrosome of sperm is formed from
 - i. Ribosome ii. Centriole iii. Golgi bodies iv. Lysosome

Part B-Immunolgy

VI. .Answer any two of the following

19..Aanaphylaxis,

20.Autoimmune reactions

21.Major Histocompatibility Complex

22.Cell mediated immunity

(2X2=4)

VII. .Answer any one of the following

23.Explain the structure of antibody.Mention different types.

24.Explain Hypersensitivity reactions

(1X4=4)

V Semester B. Sc. Zoology Degree Programme
Core Course in Zoology
5B08 ZLG: HERIDITORY SCIENCE

Time-3 Hrs

Marks: 40

I. Answer any one of the following

1. Explain multiple allelism
2. Explain mutation

(1X8=8)

II. Answer any one of the following

3. Explain any five recessively inherited disorders in human
4. Explain linkage and crossing over

(1X8=8)

III. Answer any two of the following

5. Explain any two dominantly inherited disorder in man.
6. Explain chromosome banding
7. Explain sex linked inheritance
8. Explain Epistasis

(2X4=8)

V. Answer any six of the following

9. Pharmacogenetics
10. Polygenic inheritance
11. Erythroblastosis foetalis
12. Non disjunction
13. Barr body
14. SRY genes
15. Test cross
16. Mutagens
17. G-Banding
18. Gynandromorphism

(6X2=12)

IV. Answer any four of the following

19. If one parent has type A blood and the other parent has type B blood, what blood type will the offspring denoted by the white square and circle have?

- a. Type A .bType B. cType AB. dType O.

20. Hemophilia is a sex linked recessive trait in humans. If a father and a son are both hemophiliacs, but the mother is normal, her genotype must be: c

- a. XHXH b..XhY c. XhXh d. X HXh

21. X/A ratio in super females is

- a) 1.5 b) 1.0 c) 0.6 d) 0.5

22. Holandric genes occur exclusively on

- a) x - chromosomes b) y – chromosomes c) autosomes d) both x and y chromosomes

(4X1=4)

MODEL QUESTION PAPER
V SEMESTER B. Sc. DEGREE EXAMINATION
Core Course in Zoology

5B09 ZLG: Comparative Animal Physiology and Human Physiology

Time: Three Hours

Maximum marks: 40

Answer any one of the following

(1x8=8)

- 1) Explain the EM structure of muscle fibres and explain the physiolog and biochemistry of muscle contraction.
- 2) Write an essay on the origin, conduction and regulation of heart beat in myogenic heart.

Answer any one of the following

(1x8=8)

- 3) Write an essay on osmotic and ionic regulation in freshwater and marine animals.
- 4) Write an essay on nerve impulse transmission

Answer any two of the following (2 X 4 = 8)

5. Briefly explain the blood coagulation mechanism
6. Give an account of propagation of nerve impulses in myelinated neurons
7. Explain the mechanism of neural control of respiration

Answer any six of the following (6 X 2 = 12)

8. Give the importance of fibers in food.
9. Write notes on Alzheimers disease.
10. Distinguish between isotonic and isometric contraction.
11. Write notes on any two cardiovascular problems.
12. Write any four adaptations of animals to temperature extremes.
13. Distinguish between osmoregulators and osmoconformers
14. What is salutatory conduction ?
15. Write the Importance of bioluminescence.

Answer the following questions in a word or sentence. (4 X 1=4)

16. Name a bioluminescent fish
17. Name the hormone secreted by kidney
18. Respiratory pigment containing Copper is
19. Type of epithelium which lines trachea.

MODEL QUESTION PAPER
SIXTH SEMESTER B. Sc. DEGREE EXAMINATION
Core Course in Zoology
6B10 ZLG: MOLECULAR BIOLOGY AND BIOINFORMATICS

Time: Three Hours

Maximum marks: 40

[Answers may be written either in English or in Malayalam.

Give illustrations wherever necessary.]

Section A Molecular Biology

I. Answer any one

8 marks

- 1 Explain regulation of protein synthesis. Give a note on post translational modifications .
- 2 Write an essay on genetic engineering.

II. Answer any one

4 marks

- 3 DNA replication is semi-conservative. Explain.
- 4 write notes on regulation of gene expression on prokaryotes

III. Answer any three

3x2=6 marks

- 5 What is wobble hypothesis? What is its significance?
- 6 What are the role s of molecular chaperones?
- 7 What are the characteristics of genetic code?
- 8 Cloning vectors
- 9 causes and types of DNA damage

IV. Answer TWO of the following 2x1=2marks

10) PCR is conceived by

- A. Paul Berg B Nirenberg C. Hershey Chase D. Karry Mullis.

11) Which one of this is not a restriction endonuclease?

- A. Eco R I B Hind III C. DNA ligase D. Bam H1

12) Extrachromosomal bacterial DNA is called

- A. Cosmid B Plasmid C. Vector D. None of these

13) A mRNA encoding more than one protein is known as

- a. What are jumping genes?
- b. What is Si RNA.?
- c. what are ribozymes?
- d. What is central dogma?

Section B: Informatics & Bioinformatics

V. Answer any one

8 marks

14 What are primary and secondary databases? Explain in detail.

15 Define genomics. Describe about different classes of genomics. What are the applications of genomic analysis and studies?

VI. Answer any one

4 marks

16 Discuss on searching biological database

17 Describe the role of internet in bioinformatics

VII. Answer any three

3x2=6 marks

18 What is multiple sequence alignment?

19 Write short notes on BLAST

20 What is PDB? Why is it used as a structural database?

21 Comment on any two tools in proteomics

22 What is microarray? What are its uses?

VIII. Answer any two of the following 2x1=2 marks

23) GenBank is run by

A. EBI B. NCBI C. EMBL D. DDBJ.

24) Which one of these is not a protein database?

A. SWISSPROT B. KEGG

C. BLOCKS D. PIR

25) FASTA is a

26) Expand URL

MODEL QUESTION PAPER
SIXTH SEMESTER B. Sc. DEGREE EXAMINATION
Core Course in Zoology

6B11 ZLG:ENVIRONMENTAL SCIENCE AND CONSERVATION BIOLOGY

Time: Three Hours

Maximum marks: 40

[Answers may be written either in English or in Malayalam. Give illustrations wherever necessary.]

I. Answer any one **8 marks**

1. Explain the properties of population. Add a note on growth curves
2. Write an essay on ecological succession.

II. Answer any one **8marks**

3. Define biodiversity. Explain the different levels of diversity.
4. Comment on the various threats to biodiversity.

III. Answer any two **2x4=8 marks**

5. Briefly discuss on the relationship of biosphere to other spheres of environment
6. What are the types of freshwater resources?
7. How do human interactions affect environmental components?
8. Describe briefly the negative interactions

IV. Answer any six **6x2=12 marks**

9. What are the prerequisites for sustainable development?
10. Laws of limiting factors
11. What are ecological pyramids
12. Comment on the importance of mangroves in the ecosystem
13. What are the protected ecosystems?
14. Distinguish between gaseous and sedimentary cycles
15. Describe the features of desert biome
16. What are the remedial measures for noise pollution?

V. Answer the following **1mark**

17. What is EIA?
18. What are vulnerable species?
19. Name any two hotspots
20. a) A network of food chains in the ecosystem is called
- b) In India the Wild life protection Act was enacted in the year.....
- c)monitor environmental accumulation of chemicals
- d) The tendency of biological systems to resist and to remain in a state of equilibrium is called

VI Semester B. Sc. Degree Examination
Core Course in Zoology
6B12 ZLG:Developmental Biology, Teratology and Gerontology

Time-3 Hrs

Marks:40

I. Answer any one of the following

- 1.Explain the organogenesis of eye in frog.
2. Classify egg based on amount and distribution of yolk.Explain different types of cleavage in animals. (1X8=8)

II. Answer any one of the following (1X8=8)

- 3.Explain Hormonal control in amphibian metamorphosis
- 4.Explain regeneration in animals

III. Answer any two of the following

5. Explain Assisted Reproductive Techniques
- 6.Explain fate map
- 7.Explain the structure of 33 hour chick embryo
- 8.Explain spemanns constriction experiment. (2X4=8)

IV. Answer any 6 of the following

- 9.Vitellogenesis
- 10.Determinate egg
- 11.Hox genes
- 12.Blastocyst
- 13.Teratogen
- 14.Immunity theory of ageing
- 15.Exogastrulation
- 16.Grey crescent
- 17.Area opaqua
- 18.Zona pellucid (6X2=12)

V. Answer any four of the following

- 19.Which one of the following animal shows spiral cleavage
a.Star fish b.branchiostoma c.Planocera d.frog
20. Vital stain methods for fate map is discovered by
a.Sprat b.Vogt c.Spemann d.Gurdon
- 21.Which of the following is tertiary egg membrane?
a.Zona pellucida b.Corona radiate c.Vitelline membrane d.shell membrane
22. The heart is derived from
(a) ectoderm (b) mesoderm (c) endoderm (d) epidermal ectoderm (4X1=4)

VI SEMESTER B. Sc. DEGREE EXAMINATION
Core Course in Zoolgy.
6B13ZLG :ETHOLOGY, EVOLUTION AND ZOOGEOGRAPHY

Time: Three Hours

Maximum marks: 40

I. Answer any one of the following (1X8=8)

- 1) Write an essay on different types of learning in animals
- 2) Write an essay on evidences of evolution

II. Answer any one of the following (1X8=8)

- 3) Write an essay on Darwin's theory of Natural selection. Also comment on Neo Darwinism.
4. Explain the morphology and anatomic evidence of organic evolution

III. Answer any two of the following (4 X 2 = 8)

- 4) Urey-Miller experiment.
- 5) Social organization of honey bees
- 6) Give an account on the factors affecting animal distribution
- 7) Explain industrial melanism

IV. Answer any six of the following (2X6=12)

- 8) Write an account of fauna of Australian region
- 9) Circadian rhythm
- 10) Germplasm theory
- 11) Batesian Mimicry
- 12) Discontinuous distribution
- 13) What are Oceanic islands ? Give example.
- 14) Give an account of concept of molecular clock
- 15) Distinguish between divergent and convergent evolution

V. Answer the following questions in a word or sentence. (1X 4=4)

- 16) Use and disuse theory was proposed by
- 17) Give an example for Continental Island
- 18) Pheromone secreted by silk moth is
- 19) Golden ages of Reptiles

VI Semester B. Sc. Degree Examination
Core Course in Zoology
6B 14 ZLG: Applied zoology

Time: 3 Hours.

Max. Marks: 40

I. Answer any one

(1x8=8 Marks)

1. Write an essay on Pearl culture.
2. Write an essay on Prawn culture and induced breeding.

II. Answer any one.

(1x8=8 Marks)

3. Define biological control. Explain any two successful biological control measures.
4. Describe the life cycle, pathogenecity and control measures of Plasmodium vivax.

III. Answer any two.

(2x4=8 Marks)

5. Describe the Insect pest of stored grains.
6. Explain the duties of worker bees.
7. Describe the life cycle and pathogenesis of Wuchereria.
8. Explain life cycle and infestation of Spodoptera.

IV Answer any six.

(6x2=12 Marks)

9. Pasteurization of milk.
10. Artificial insemination.
11. Sunandini is an indigenous breed of cattle.
12. Milk spoilage.
13. Systemic poison
14. One exotic breed of Fowl.
15. Mussel culture.
16. Fish byproducts.

V. Answer any four.

(4x1=4 Marks)

17. The scientific name of Pearl Oyster is-----.
18. The study of insect is -----.
19. Infected female Anopheles mosquito injects----- into the human body.
20. Filariasis is caused by

i. a) Tap worm b) Hook worm c) Ascaris d) Wuchereria.

**MODEL QUESTION PAPERS FOR OPEN COURSES
5D 01 ZLG NUTRITION AND HEALTH (OPEN COURSE)**

Time: 2 Hours

Total Marks: 20

Multiple choice questions

1. Match the thefollowing: (1 Mark)

- | | |
|----------------------------|------------|
| a).Sun shine vitamine - | Vitamine A |
| b) Diabetes mellitus - | Calcium |
| c)Water soluble vitamine - | Vitamine D |
| d) Bone - | Glucose |

2. Fill in the blanks: (1 Mark)

1. -----vitamin is needed for a healthy immune system.
2. -----is the best source of Omega 3 oils.
3. -----mineral is essential for healthy red blood cells
4. -----vitamin is needed to prevent birth defect.

II Answer any six. (6x1=6 Marks)

3. Why are vitamins and minerals called micronutrients?
4. Why are some vitamins considered to be antioxidants ?
5. What does vitamin C do for you ?.
6. Why is folate a very important vitamin?.
7. What can occur with vitamin A deficiency?.
8. What is Diabetes mellitus?.
9. What is Nyctolopia?.
10. Name two protein deficiency diseases.
11. What is therapeutic nutrition?.
12. Name two polyunsaturatedfatty acids.

III. Answer any four: (4x2=8 Marks)

13. What is dietary fibre?.
14. What DRIs refers to ?.
15. What is Osteoporosis?.
16. Distinguish between Agmark and ISI.
17. Account on food adulteration.
18. Give a note on household food preservation.
19. What are the diet modifications in diabetes mellitus and hypertension?.
20. Give an account on the nutritional needs in infancy.

IV. Answer any one: (1x4=4 Marks)

21. Explain the role of minerals in health and nutrition.
22. Briefly discuss the role of diet during illness.
23. Write an account of fat soluble and water soluble vitamins.

5D 02 ZLG: APICULTURE AND SERICULTURE (OPEN COURSE)

Model question paper

Time: 2 Hours

Maximum Marks:20

Objective Questions.

1.Match the following:

(1 Mark)

- | | | |
|-------------|---|---------------|
| a). Sericin | - | Honey |
| b) Stifling | - | Microsporidia |
| c) Fructose | - | Killing pupae |
| d) Nosema | - | Silk gum. |

2. Fill in the blanks:

(1 Mark)

- a) Scientific name of Indian bees is-----
- b) Chief protein component of silk is -----
- c) Morus indica is the scientific name of a -----
- d) Fertile male bees are called -----

II. Answer any six:

(6x1=6 Marks)

- 3. Define apiary.
- 4. Brief on bee venom.
- 5. Where is pollen basket seen and give its function.
- 6. Give an account of Flacherie.
- 7. Name any four species of honey bees.
- 8. What are Univoltine breeds.
- 9. Comment on Uzi fly.
- 10. Write a note on silk glands.
- 11. Enlist the uses of silk.
- 12. Brief on brood diseases of honey bee.

III. Answer any four:

(4x2=8 Marks)

- 13. Comment on processing of cocoons in silk technology.
- 14. What are the pests of silkworm and their preventive methods?
- 15. Comment on the principle of movable frame bee hive.
- 16. Illustrate the organization of a bee colony.
- 17. Brief on different bee keeping equipments.
- 18. Comment on importance of disinfection in silkworm rearing.
- 19. Give a note on the morphology of silkworm larva.
- 20. Give an account of honey and beeswax.

IV. Answer any one:

(1x4= 4 Marks)

- 21. Describe the diseases and enemies of honey bees.
- 22. Illustrate the different methods of bee keeping.
- 23. Write an essay on various steps in silkworm rearing technology.

SDO3 ZLG REPRODUCTIVE HEALTH AND SEX EDUCATION (OPEN COURSE)

Time: 2Hours

(Max. Marks: 20)

I. Objective questions.

1. Match the following:

(1 Mark)

- | | | |
|----------------|---|----------------|
| a) Infertility | - | Western blot |
| b) AIDS | - | Parturition |
| c) Pap's smear | - | Azoospermia |
| d) Child birth | - | Cervix cancer. |

2. Fill up the blanks:

(1 Mark)

- World AIDS day is-----.
- Warts on human skin is caused by -----.
- The organism causing Syphilis is -----.
- The site of fertilization in human is -----.

II .Answer any six:

(6x1=6 Marks)

- Mention the hormones related to sex.
- Describe the adverse effect of smoking.
- Prenatal diagnostic techniques.
- What is sex reversal?.
- What is paternity test?.
- What is artificial insemination?.
- Pre Natal Diagnosis Act.
- Lesbianism.
- What is ovulation?.
- What is CVS?.

III. Answer any four:

(4x2=8 Marks)

- Menstrual cycle.
- Various contraceptive methods
- Hormonal control of lactation.
- Describe vasectomy
- Cyber sex.
- Role of hormone in fertility control
- Spermatogenesis.
- Endocrine disorders of man.

IV. Answer any one:

(4x1=4 Marks)

- Write an essay on sexually transmitted diseases.
- Write an essay on adolescent sex issues.
- Write an essay on assisted reproductive techniques.

**I Semester B.Sc. Degree Examination,
COMPLEMENTARY COURSE IN ZOOLOGY
1C01 ZLG: Diversity of Life- I**

Time: 3 Hours

Max. Marks: 32

I. Essay (answer any one):

(1x6=6 marks)

- 1) Explain the various modes of locomotion in Protists.
- 2) Enumerate the salient features of Phylum Cnidaria.

II. Essay (answer any one):

(1x6=6 marks)

- 3) Describe the Water vascular system in Star fish. Add a note on its locomotion.
4. Comment on the respiratory system of Prawn.

III. Short essay (answer any four):

(4x3= 12 marks)

5. Differentiate between the morphological characters of male and female Prawn.
6. Explain the excretory system of Earthworm with the help of a neat and labelled diagram.
7. Draw and label the parts of Scolex of Taenia. Describe each part and add their function.
8. Describe the structure of Obelia medusa with the help of a diagram.
9. Explain sexual dimorphism shown by Ascaris and its pathogenesis.
10. Explain the circulatory system of Prawn with the help of a labelled diagram.

IV. Short answers (answer any six)

(6x1= 6 marks)

11. What are pinacocytes?
12. What is meant by coenosarcs?
13. What are trimorphic colonies?
14. What is velum?
15. What is statocysts?
16. Write the function of statocyst.
17. What are Tiedmans bodies?
18. What do you know about ommatidium?
19. Which are the larval forms of Sponges ?

V. Answer the following:

(2x1=2

marks)

20. Choose the right answer from the options given:

- a) Binary fission is the characteristic feature of
 - a) Platyhelminth b) Annelida c) Protista d) Arthropoda
- b) Amoebiasis is caused by
 - a) Entamoeba b) Paramecium c) Trypanosoma d) None of these
- c) A free living protist is
 - a) Paramecium b) Trypanosoma c) Plasmodium d) None of these
- d) Coelom of Aschelminthes is
 - a) Eucoelom b) Pseudocoel c) Haemocoel d) Enterocoel.

21. State whether the statements are true or false

- a) The linear repetition of body parts in an animal's body is metagenesis
- b) The process of using earthworms to decompose organic waste is vermiculture
- c) Alternation of sexual and asexual generations is metamerism
- d) Cnidarians are coelomate animals

II Semester B.Sc. Degree Examination
COMPLEMENTARY COURSE IN ZOOLOGY
2C02 ZLG: Diversity of Life II : Chordata Form and Function

Time: 3 Hours

Max. Marks: 32

I. Answer any one:

(1x6=6 marks)

- 1) Describe the digestive system of shark with help of a neat diagram.
2. Describe the Urinogenital system of shark.

II. Answer any one:

(1x6= 6 marks)

3. Compare the heart of Frog and Man.
4. Give an account of the different types of chordate eggs.

III. Answer any four:

(4x3=12 marks)

5. Enlist the salient features of urochordata and cephalochordate citing examples.
6. Explain the structure of a mammalian sperm.
7. What are the adaptations of aquatic mammals?
8. Write an account of snake venom.
9. Describe the structure of human egg with the help of a diagram.
10. Describe the structure of coeloblastula and stereoblastula.

IV. Answer any six:

(6x1=6 marks)

11. Triploblastic condition
12. Spiral valve
13. Heterocercal fin
14. Internal carotid artery.
15. Neoteny.
16. Gastrulation
17. Name the embryonic membranes.
18. Plastron
19. Holoblastic cleavage.

V. Answer the following:

(2x1= 2 marks)

20. Match the following:

- | | |
|-----------------------|-------------|
| a) Egg laying mammals | 1) Macaca |
| b) sting ray | 2) Trigon |
| c) Domestic horse | 3) Platypus |
| d) Arboreal mammal | 4) Equus |

21 Fill in the blanks:

- a) Bats belong to order-----.
- b) Scientific name of Indian mackerel is-----.
- c) Ampulla of Lorenzini is seen in-----
- d) Abdominal pouch of Kangaroo is called-----.

**III Semester B.Sc. Degree Examination
COMPLEMENTARY COURSE IN ZOOLOGY
3C03 ZLG: Agricultural and Forest Entomology**

Time; 3 Hours

Max. Marks 32

I. Answer any one

(1x6=6 marks)

1. Write an essay on various cultural and mechanical measures employed against insect pests.
2. Describe the different types of organic insecticides.

II. Answer any one

(1x6=6 marks)

3. Describe the various adaptations of worker bees.
4. Describe the biology, nature of damage caused and control measures of
 - a) *Spodoptera mauritia*
 - b) *Batocera rufomaculata*

III. Answer any four:

(4x3=12 marks)

5. Write an account of integrated pest management.
6. Discuss the merits and demerits of biological pest control.
7. What are systemic insecticides?. Give any two examples.
8. What is insecticide residue?.
9. Give the scientific names of
 - a) Red palm weevil
 - b) Rice weevil
10. Mention any four salient features of the order Isoptera.

IV. Answer any six:

(6x1=6 marks)

11. Define pest.
12. Name any two causes of pest outbreak.
13. What is the damage caused by cut worm?.
14. What are chemosterilants?. Give one example.
15. Differentiate oligopod and apodous larvae.
16. Give the scientific names of any two pests of vegetables.
17. What is a potential pest/.Give one example.
18. Mention any two legal measures adopted to control insect pests.
19. Which are the two strains of Lac insects cultivated in India.

V. Answer the following:

(2x1=2marks)

20. Match the following:

a) Isoptera	Stomach poison
b) Nicotine	Fumigant
c) Hemimetabolous	Termite
d) Methyl bromide	<i>Leptocoriza acuta</i>
	Organic compound

21. a) -----is a feeding deterrent
- b) Scientific name of Lac insect is -----
- c) Pollen brush
- d) Name a timber pest.

IV Semester B.Sc. Degree Examination
COMPLEMENTARY COURSE IN ZOOLOGY
4C04 ZLG: Medical Zoolgy

Time: 3 Hours

Max. Marks: 32

I. Answer any one:

(1x6=6 marks)

1. Define STD. Give a brief account of diseases transmitted through blood transfusion.
2. Describe briefly the life history of Plasmodium vivax. Comment on its pathogenesis and mode of infection

II. Answer any one:

(1x6=6 marks)

3. Define sex linked inheritance. Illustrate It with major sex linked traits found in man.
4. Define autoimmunity. Briefly explain the components of immune system.

III. Answer any four:

(4x3=12 marks)

5. Explain Lab diagnosis and Prophylaxis o chicken Pox.
6. What is Cri-du-Chat syndrome?. Mention its clinical symptoms.
7. What are zoonotic diseases?. Give two examples.
8. Distinguish between communicable and non-communicable diseases.
9. What are plasma cells?. Mention their physiological significance.
10. What are the clinical manifestations of Sarcoptes Scabi.

IV. Answer any six:

(6x1= 6 marks)

11. Define allergy. Give one example.
12. What is translocation?
13. Name two fungal diseases in man.
14. What is myotonic muscular dystrophy.
15. Explain Obesity.
16. Mention the application of ECG in diagnosis.
17. What is Sarcoma?.
18. Enumerate the symptoms of Rabies.
19. What is graft rejection.

V. Answer the following:

(2x1=2marks)

20. Match the following:

- | | |
|----------------|------------------------|
| a) Alzheimer's | - tumour |
| b) Neoplasm | - immunity |
| c) Phagocytes | - Multifactorial trait |
| d) Goiter | - Bacterial disease |
| | - Nutritional disease. |

21. a) -----is a non-communicable disease

i) Hepatitis B

ii) Cholera

iii) Atherosclerosis

b) The causative organism of filariasis is -----

c) AIDS is caused by

i) RNA virus

ii) DNA virus

iii) Bacteriophage

d)----- is a numerical chromosomal abnotmality.

COMPLEMENTARY PHYSIOLOGY
I Semester B.Sc Degree Examination, November
COMPLIMENTARY COURSE IN PHYSIOLOGY
1C01PLY:Biological chemistry

Time: 3Hrs

Max.Marks:32

Essay (Answer **any one**).

(1X6=6)

1. Describe the biological functions of carbohydrates. Differentiate aldo sugars & keto sugars with examples.
2. Explain different mechanisms for enzyme inhibition.

Essay (Answer **any one**).

(1X6=6)

3. Explain the molecular structure & dipolar nature of water. Write a note on its significance as a medium.
4. Describe Kreb's cycle.

Answer **any four**.

(4X3=12)

5. Write down the pathway of fatty acid oxidation.
6. Explain the theories of enzyme action.
7. Explain the buffering action of amino acids.
8. Derive Henderson- Hasselbach equation.
9. Write a note on the secondary structure of protein.
10. Differentiate saturated & unsaturated fatty acids.

Answer **any six** (In 3 to 4 sentences).

(6X1=6)

11. What are colloids?
12. Define prostaglandins.
13. Write a note on polarity in water.
14. What is mean by deamination?
15. Describe the chemistry of protoplasm.
16. What are pentose sugars?
17. Define gluconeogenesis.
18. Add notes on lock & key hypothesis.

Answer the following.

Match the following:

- | | |
|--------------------------|-----------------|
| a) Ketoses | Haemoglobin |
| b) Polysaccharides | Fructose |
| c) Quarternary structure | Nucleotide |
| d) DNA | Glycosidic bond |

Choose the correct answer.

(2X1=2)

- a) Competitive inhibitors. I) Increases V_{max} & K_m iii) Increases V_{max} IV)Decreases V_{max} & K_m v) Increases K_m
- b) Enzymes involved in transfer of electrons.I.Hydrolases ii) Ligases
iii.Oxidoreductase iv) Transferases.
- c) Secondary structure of protein is maintained by,
i.Glycosidic bond ii) Hydrogen bond
iiiVan der Wall's bond iv) Salt bridge
- d) ATP yield by the complete oxidation of glucose to CO_2 is,
i.30 ii) 20 iii.25 iv) 15

II Semester B.Sc Degree Examination, November
COMPLIMENTARY COURSE IN PHYSIOLOGY
2C02PLY:CELL BIOLOGY

Time: 3Hrs

Max.Marks:32

I Essay (Answer **any one**).

1. Describe various types of ribosomes. Mention its role in protein synthesis.
2. Describe active & passive transport in detail.

II Essay (Answer **any one**).

3. Explain cell cycle.
4. Describe electron transport system in mitochondrion.

(1X6=6)

III Answer **any four**.

5. What is cell theory?
6. Differentiate mitosis & meiosis.
7. Explain the features of tight & gap junctions.
8. Describe the double helical model of DNA.
9. Describe the role of centrioles in cell division.
10. Write a note on nuclear pore complex.

(4X3=12)

IV Answer **any six** (In 3 to 4 sentences).

11. Nucleolar organizer.
12. Mitochondrial ribosomes.
13. GERL.
14. Autophagosomes.
15. Unit membrane model.
16. Spectrin.
17. SER.
18. Any four lysosomal enzymes.

(6X1=6)

V Answer the following.

19. Fill in the blanks.
 - a) In cell cycle DNA replication occurs in Phase.
 - b) The process by which cell secretes macromolecules by using a vesicle to the plasma membrane is called the.....
 - c) is a cell adhesion molecule.
 - d) Endomitosis occurs in type of chromosomes.

20. Match the following.

- | | |
|--------------------|-------------------------|
| a) Residual body | mRNA |
| b) Vimentin | Barr body |
| c) Heterochromatin | Lysosome |
| d) Transcription | Intermediate filaments. |

(2X1=2)

**III SEMESTER BSc DEGREE EXAMINATION
MICROBIOLOGY
COMPLIMENTARY PHYSIOLOGY
3C 03 PLY: HUMAN PHYSIOLOGY I**

Time: 3 hours

Total marks: 32

I. Answer any one:

- 1) Describe the physiology of nerve impulse conduction
- 2) With the help of a diagram describe the functions of heart (1x6=6)

II. Answer any one:

- 3) Explain the physiology of respiration
- 4) Describe the histology of human nephron & the process of urine formation (1x6=6)

III. Answer any four:

- 6 Gastro intestinal hormones
- 7) Neuro transmitters
- 8) Photo pigments
- 9) Any four cardio vascular diseases
- 10) Distinguish between sympathetic ¶sympathetic nervous system
- 11) Define E S R .Mention its clinical significance (4x3=12)

IV. Answer any six of the following

- 12) Oxygen toxicity
- 13) Distinguish between anaemia & leukemia
- 14) Mention the clinical significance of echocardiogram
- 15) Malnutrition
- 16) Pace maker of heart
- 17) Define acidosis
- 18) Oxy hemoglobin curve
- 19) Sensory area of brain (6x1=6)

V. Answer the following

20) Match the following

- | | |
|---------------|-------------------------|
| a) Thrombosis | Pacemaker |
| b) Pepsin | Intra vascular clot |
| c) Ischaemia | Gastric enzyme |
| d) SA node | insufficient blood flow |

21. a) Pepsin act only at a pH of.....
b)High WBC count is termed as.....
c) Saltatory nerve impulse conduction is characteristics of.....
d) Pacinian corpuscle of skin can detectstimuli (2x1=2)

**IV SEMESTER BSc DEGREE EXAMINATION
MICROBIOLOGY
COMPLIMENTARY PHYSIOLOGY
4CO4 PLY: HUMAN PHYSIOLOGY II**

Time: 3 hours

Total marks: 32

I. Answer any one:

1. Give an account of the electrochemical changes responsible for muscle contraction.
2. Describe the fertilization, cleavage, and blastocyst formation. (1x6=6)

II. Answer any one:

3. Explain the structure and function of pituitary gland.
4. Write a note the skeletal joints and bones of limbs. (1x6=6)

III. Answer any four:

5. Give an account of smoking and its effects.
6. Write a note on sexually transmitted diseases.
7. Give an account of first aid for snake bite.
8. Describe the structure of graffian follicle.
9. Give an account of physiological basis of ageing.
10. What are carcinogens? Give two examples. (4x3=12)

IV. Answer any six:

11. HIV
12. All or none law.
13. Sarco tubular system.
14. Muscle twinch
15. Passive smoking.
16. Cleavage.
17. Synovial joints.
18. Implantation. (6x1=6)

V. Answer the following

19. Match the following

- | | | |
|------------------|--------------|---------|
| a) Lactic acid - | Pars nervosa | |
| b) Pituitary - | Muscles | |
| c) AIDS - | Fatigue | |
| d) Sarcoplasm - | HIV | |
| | Epinephrine | (2x1=2) |

COMPLEMENTARY BIOLOGICAL TECHNIQUES
I Semester B Sc Degree Examination
COMPLEMENTARY COURSE IN BIOLOGICAL TECHNIQUES
1C01 BGT: General Laboratory Techniques

Time : 3 Hours

Max. Marks: 32

- I. Answer any one (6 x 1=6)
1. Write an essay on any two staining procedures used in histochemical studies.
 2. Give an account of Gram staining and acid-fast staining techniques. Mention their uses.
- II. Answer any one (6 x 1=6)
3. Explain the various methods of cleaning and sterilization of glassware in the laboratory.
 4. Give an account of the preparation of media for culturing different types of microorganisms
- III. Answer any four (3 x 4=12)
5. Describe the parts of glass electrode of pH meter.
 6. What is a buffer solution ? Mention any two standard buffers and their preparation.
 7. Describe the preparation of Bouins fluid, Carnoys fluid and buffered formalin
 8. Write the working mechanism of ion exchanger. Mention the uses of de-ionized water.
 9. Explain the uses of distilled water
 10. What is microtomy ? Explain the working of rotary microtome.
- IV . Answer any six (1 x 6=6)
11. Define fixation. Mention the aims of fixation.
 12. Mention any two dehydrating agents.
 13. What is auxochrome ? Give an example.
 14. Mention any two uses of cryostat
 15. Differentiate between molarity and molality.
 16. How do you prepare percentage solutions in the laboratory.
 17. What are neutral stains ? Give an example.
 18. Distinguish between mordant and lake
- V. Answer all questions
19. **Match the following** (1 mark)
- | | | |
|--------------------|---|-------------|
| i. Blood group | - | Lipid |
| ii. Sudan Black B | - | Embedding |
| iii. Carnoys fluid | - | Landsteiner |
| iv. Paraffin | - | Fixative |
20. Fill in the blanks: (1 mark)
- a. -----is the technique of measurement of microscopic objects.
 - b. Phenolphthalein turns-----in acidic pH.
 - c. A group of atoms attached to the chromophore which modifies the ability of that chromophore to absorb light is called-----
 - d. The process that destroys or eliminates all viable microbes including resistant bacterial spores from a fluid or solid is called-----.

II Semester B Sc Degree Examination
COMPLEMENTARY COURSE IN BIOLOGICAL TECHNIQUES
2C02 BGT: Preparation of Biological Specimens

Time : 3 Hours

Max. marks: 32

I. Answer any one

(6 x 1=6)

1. Describe the optical parts of a compound microscope. Mention their functions
2. Give an account on the working mechanism of temperature sensing devices and their uses.

II. Answer any one

(6 x 1=6)

3. Write an essay on paper chromatography. Add a note on its applications
4. Describe the components of a desktop computer system. Add a note on applications of computer in biological laboratories

III. Answer any four

(4 x 3=12)

5. Give an account on single pan balances and types of errors in weighing.
6. Illustrate the working principle of spectrophotometer.
7. Discuss the reasons and remedies associated with microtomy.
8. Add a note on HPLC.
9. Describe the working principle and uses of phase contrast microscope
10. Distinguish between thin layer and column chromatography.

IV . Answer any six

(1 x 6=6)

11. Mention the applications of electron microscope
12. Comment on oculometer.
13. What are the factors influencing resolution of a microscope ?
14. Differentiate between thermocouples and thermostats.
15. Briefly mention the principle of centrifugation.
16. What is R_f value ? How is it calculated ?
17. What is camera lucida?
18. What is oil immersion lens? Mention its advantages.

V. Answer all questions

19. Match the following

(1 mark)

- | | | |
|--------------------|---|-------------------|
| i) Lever arm error | - | Waterbath |
| ii) RAM | - | Spectrophotometer |
| iii) Grating | - | Computer |
| iv) Thermostat | - | Balance |

20. Fill in the blanks:

(1 mark)

- a) -----is used in the eyepiece of a microscope for measuring microspecimens.
- b) Percentage absorbance or percentage transmittance of light through coloured solutions is the working principle behind the equipment-----
- c) In electron microscope electrons are emitted by angun
- d) Thermocouple consists of two dissimilarjoined together at one end.

III Semester B Sc Degree Examination
COMPLEMENTARY COURSE IN BIOLOGICAL TECHNIQUES
3C03 BGT: Preparation of Biological Specimens

Time : 3 Hours

Max. marks: 32

I. Answer any one

(6 x 1=6)

Describe the method of preparation of thin and thick blood film using Leishman's stain. Mention its significance

Give an account of estimations of blood sugar and bilirubin. Briefly mention their clinical significance.

II. Answer any one

(6 x 1=6)

3. Give an account of general methods employed in museum preparation of vertebrate skeletal materials.

4. Describe the procedure for preparation of permanent slides to demonstrate the various stages of meiosis in grasshopper testis.

III. Answer any four

(4 x 3=12)

5. Describe briefly the maintenance of living organisms in Aquarium and terrarium.

6. Describe various insect collection equipments

7. Explain steps involved in killing and preserving a butterfly specimen.

8. Briefly describe the method of preparation of different stages in the life cycle of frog in formalin for museum display.

9. Explain dermestid technique. Mention its use.

10. Briefly explain the storage of herbarium specimens.

IV. Answer any six

(1 x 6=6)

11. What is vasculum? Mention its use.

12. Define taxidermy. Comment on its significance.

13. Mention the factors affecting zonation in marine environment.

14. Define voucher specimen

15. Mention the reference range for total bilirubin in human blood

16. What is degreasing? Mention any two degreasing agents.

17. Differentiate between eosinophil and neutrophil

18. How sponges are collected and preserved in a museum.

V. Answer all questions

19. Match the following

(1 mark)

i) Aceto-orcein Herbarium

ii) Arsenic soap- Ammonia² -

iii) Voucher specimen-Taxidermy

iv) Degreasing-Meiosis

20. Fill in the blanks:

(1 mark)

a) Diakinesis is found in ----- stage of meiosis

b) Formalin is a

c) -----is an agranulocyte.

d) -----is a mitotic inhibitor.

IV Semester B Sc Degree Examination
COMPLEMENTARY COURSE IN BIOLOGICAL TECHNIQUES
4C04 BGT: Advanced Biological Techniques

Time : 3 Hours

Max. marks: 32

I. Answer any one (6 x 1=6)

- 1) Describe the structure of immunoglobulin. Add a note on the different types of immunoglobulin
- 2) What is monoclonal antibody. How is it produced in the laboratory. Mention its applications.

II. Answer any one (6 x 1=6)

- 3) With a neat labeled diagram explain DNA fingerprinting? Write notes on its applications in forensic science.
- 4) Explain the different steps involved in Polymerase Chain Reaction. Add a note on its applications

III. Answer any four (4 x 3=12)

5. Explain autoradiography. Comment on its significance in biology.
6. Describe the procedure involved in the isolation of DNA
7. Explain Southern blotting.
8. Give a brief account on restriction enzymes
9. What are the essential features of a culture medium in animal tissue culture ?
10. Briefly describe competitive ELISA

IV . Answer any six (1 x 6=6)

11. What is real time PCR.
12. Briefly mention immunoprecipitation.
13. What is AFLP.
14. Name two culture media for animal cell culture.
15. What is explant?
16. Define radioimmunoassay.
17. Define cell lines
18. What is HAT medium ?
19. Name four isotopes used to study cell metabolism.

V. Answer all questions

20. Match the following (1 mark)

- | | | |
|----------------|-----------------------------|---|
| i) callus | - gene cloning | |
| ii) cDNA | -tissue culture | - |
| iii) myeloma | - Restriction endonucleases | |
| iv) palindrome | - hybridoma | |

21. Fill in the blanks: (1 mark)

- a) ----- Immunoglobulin is present in saliva and tears.
- b) ----- is a population of genetically homogenous individuals
- c) ----- is used as a common isotope in plant study
- d) -----is used to clone unknown DNA that flanks known sequences.