

KANNUR UNIVERSITY

(Abstract)

B.Sc Zoology-Scheme & Syllabus of Core,Complementary and Open Courses under Choice Based Credit Semester System for Under Graduate Programme-implemented with effect from 2009 admission-Orders Issued.

ACADEMIC BRANCH

No.Acad/C2/1308/2007

Dated, K.U.Campus. P.O ,10- 07-2009.

- Read: 1.Minutes of the meeting of the Board of Studies in Zoology (UG) held on 27-05-2009.
2. Minutes of the meeting of the Faculty of Science held on 16-06-2009.
3. U.O No.Acad/C2/3838/2008 (i) dated 07-07-2009
4. Letter dated29-06-2009 from the Chairman, BOS in Zoology (UG).

ORDER

1.The Board of Studies in Zoology (UG) vide paper read(1) above has prepared finalised and recommended the Scheme and Syllabus of Zoology Core,Complementary and Open Courses under Choice Based Credit Semester System for implementation from 2009 admission.

2. The recommendations of the Board in restructuring the syllabus is considered by the Faculty of Science vide paper read (2) and recommended for the approval of the Academic Council.

3. The Regulations for Choice based Credit Semester System is implemented in this University vide paper read (3).

4. The Chairman, BOS in Zoology (UG) vide paper read (4),forwarded the restructured scheme and syllabus of Zoology Core,Complementary(Zoology,Physiology and Biological Techniques) and Open Courses under Choice Based Credit Semester System, prepared by the Board of Studies in Zoology(UG) for implementation with effect from 2009 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 scheme and syllabus of Zoology Core,Complementary and Open Courses restructured in line with Choice Based Credit Semester System, with effect from 2009 admission, subject to ratification by the Academic Council.

6. The restructured scheme and syllabus of Zoology Core, Complementary (Zoology, Physiology and Biological Techniques) and Open Courses under Choice Based Credit Semester System, implemented with effect from 2009 admission is appended.

7. The Scheme and Syllabus of Complementary Courses offered for this Programme will be available along with the syllabus of Core Courses of the Complementary subject.

8. The affiliated Colleges are not permitted to offer Complementary Courses in violation to the provisional/permanent affiliation granted by the University. Changes in Complementary Courses are permitted with prior sanction /revision in the affiliation order already issued in this regard.

9. If there is any inconsistency between the Regulations for CCSS and its application to the Scheme & Syllabus prepared, the former shall prevail.

10. Orders are issued accordingly.

To: Sd/-
REGISTRAR

1. The Principals of 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 Regr
3. DR/AR I Academic
4. Central Library
5. SF/DF/FC.

Forwarded/By Order

SECTION OFFICER



KANNUR UNIVERSITY

Course Structure

and

Syllabus

FOR

UNDERGRADUATE PROGRAMME

IN

ZOOLOGY

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Course Structure
B.Sc Zoology

SEMESTER 1

No	Title of the Course	Hours /week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	4	4	3
4	Core Course 1	2	2	2
5	Core Course Practical	2	*	*
6	Complementary 1 (Course I)	4	3	3
7	Complementary 2 (Course I)	4	3	3

SEMESTER 2

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	4	4	3
4	Core Course 2	2	2	2
5	Core Course Practical	2	*	*
6	Complementary 1 (Course II)	4	3	3
7	Complementary 2 (Course II)	4	3	3

SEMESTER 3

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (Additional Language)	5	4	3
3	Core Course 3	3	3	3
4	Core Course Practical	3	*	*
4	Complementary 1 (Course III)	5	3	3
5	Complementary 2 (Course III)	5	3	3

SEMESTER 4

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (Additional Language)	5	4	3
3	Core Course 4	3	3	3

4	Core Course Practical	2	4	3
5	Complementary 1 (Course IV)	5	3	3
6	Complementary 2 (Course IV)	5	3	3

SEMESTER 5

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 1	2	2	3
2	Core Course 5	4	4	3
3	Core Course 6	4	4	3
4	Core Course 7	4	4	3
5	Core Course 8 Elective	3	4	3
6	Core Course Practical II	8	*	*

SEMESTER 6

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 2	2	2	3
2	Core Course 9	5	4	3
3	Core Course 10	4	4	3
4	Core Course 11	4	4	3
5	Core Course Practical II	*	4	3
6	Core Course Practical III	8	4	4
7	Core Course 12 Project	2	2	*
8	Core Course 13	*	2	*

The Hour/Credit distribution for Complementary Theory/Practical examination shall be decided by the Board of Studies concerned.

Scheme Core(Zoology)

No	Semester	Course Code	Title of the course	Hours/Week	Credits
1	I	1B01ZLG	Methodology and Perspectives of Science	2	2
2	II	2B02ZLG	Evolution and Ethology	2	2
3	III	3B03ZLG	Cytology and Immunology	3	3
4	IV	4B04ZLG	General Informatics and Bioinformatics	3	3
5	IV	4B01ZLG(P)	Practical I	2	4
6	V	5B05ZLG	Diversity of Life I	4	4
7	V	5B06ZLG	Environmental Biology & Zoogeography	4	4
8	V	5B07ZLG	Biochemistry & Biophysics	4	4
9	V	5B08ZLG	Elective	3	4
10	VI	6B09ZLG	Diversity of Life II	5	4
11	VI	6B10ZLG	Genetics, Molecular Biology & Biotechnology	4	4
12	VI	6B11ZLG	Physiology & Developmental Biology	4	4
13	VI	6B02ZLG(P)	Practical II	8	4
14	VI	6B03ZLG(P)	Practical III	8	4
15	VI	6B12ZLG	Project	2	2
16	VI	6B13ZLG	Field Work	*	2

Electives

1	V	5B08ZLG	A.Human Genetics	3	4
2	V	5B08ZLG	B.Biodiversity,Conservation & Management	3	4

Scheme Complementary (Zoology)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	1C01ZLG	Diversity of Life-I	2	2
2	II	2C02ZLG	Diversity of Life-II	2	2
3	III	3C03ZLG	Agricultural and Forest Entomology	3	2
4	IV	4C04ZLG	Medical Zoology	3	2
5	IV	4C05ZLG	Practical	2	4

Scheme Complementary (Physiology)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	1C01PLY	Biological Chemistry	2	2
2	II	2C02PLY	Cell Biology	2	2
3	III	3C03PLY	Human Physiology I	3	2
4	IV	4C04PLY	Human Physiology II	3	2
5	IV	4C05PLY	Practical	2	4

Scheme Complementary (Biological Techniques)

No	Semester	Course	Title of the course	Hours /	Credits
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		Code		Week	
1	I	1C01BGT	General Laboratory Techniques	2	2
2	II	2C02BGT	Laboratory Equipments and Techniques	2	2
3	III	3C03BGT	Preparation of Biological Specimens	3	2
4	IV	4C04BGT	Advanced Biological Techniques	3	2
5	IV	4C05BGT	Practical	2	4

Scheme Open Courses

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	5D01ZLG	Health and Nutrition	2	2
2	II	5D02ZLG	Apiculture and Sericulture	2	2
3	III	6D01ZLG	Aquaculture	2	2
4	IV	6D02ZLG	Wildlife conservation and Management	2	2

General Regulations for B.Sc Zoology Programme

The B.Sc Zoology (Core) programme is a 120-credit programme spread over 6 semesters. The core subject has 11 theory courses (which includes 1 elective course), 3 practical courses, a group project and field study component. Besides the Core, Common and Complementary courses, the student should also obtain 4 credits from Open courses, 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. Grades 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 individually by the external examiner 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 graded internally in the 6th semester. 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

grading of records, to be done internally, should be based on the effort and promptness of the student in lab work.

1B 01 ZLG METHODOLOGY AND PERSPECTIVES IN SCIENCE

Lecture hours:2 hours/week

No of credits :2

Aims and Objectives – This course is meant to introduce the methodology and perspectives of science in general 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.

UNIT 1. SCIENCE AND SCIENCE STUDIES (02 hrs)

What is science; what is not science. Laws of science and basis of scientific laws. Science as a human activity, scientific attitude, science disciplines. Revolutions in Science. (Industrial revolution, Green revolution, Blue revolution, White revolution) Science and Technology

UNIT II. METHODS AND TOOLS IN SCIENCE (04 hrs)

What is scientific method. Key steps of scientific method. Posing a question; formulation of hypothesis; Null and Alternative Hypothesis; Hypothetico-deductive model. Significance of verification (proving), Corroboration and falsification (disproving); Peer reviews. Importance of Models, Simulations and Virtual testing.

UNIT III. EXPERIMENTATION IN SCIENCE (06 hrs)

Design of an experiment; observation; data collection; independent and dependent variables; importance of Pilot Study. Necessity of units and dimensions; repeatability and replication; randomisation

Controls – negative and positive controls.

Types of experiments. Experiments to test a hypothesis, to measure a variable, or to gather data by preliminary and explorative experiments.

Francesco Redi's experiment to disprove spontaneous generation.

UNIT IV. ANALYSIS OF DATA (10 hrs)

A) Biostatistics – definition, role of statistics in life sciences.

Sample and sampling - sample size, sampling errors, brief account of sampling methods.

Presentation of data- a) Graphic representation: histogram, frequency polygon, and frequency curves. b) Diagrammatic representation: line diagram, bar diagram and pie diagram.

B) Analysis of data: a) Measures of central tendency – mean, median and mode.

b) Measures of dispersion – range, mean deviation and standard deviation.

C) 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, goodness of fit.

UNIT V. ETHICS IN SCIENCE (02 hrs)

Sharing of knowledge; transparency and honesty. Publications and patents;

Plagiarism.

Unit VI. METHODS IN ZOOLOGY (12 hrs)

A) Importance of classification in biology. Taxonomy- definition, principles, procedures and rules of taxonomy- a brief account of Linnaean hierarchy. Zoological nomenclature- ICZN, Species concept. Two Kingdom and Five Kingdom classification.

Identification- preparation of taxonomic key- simple dichotomous key, bracketed key, intended key. Sketching and labelling of biological specimens. Dissections.

B) Preparation of Zoological specimens

Collection- aquatic organisms (plankton nets), soil organisms (Berlese Funnel)

Insects (nets and traps)

Preservation- wet preservation (formalin, alcohol), dry preservation (microslides, display boxes) Labelling – General rules and significance

Taxidermy – brief account.

Culturing lab organisms – paramecium culture, drosophila culture.

ASSIGNMENT / SEMINAR TOPICS [Only for internal evaluation]

□ Great experiments in science

- Great scientists and their inventions
- Evolution of scientific experiments
- Robotics

REFERENCES

1. Graeme Ruxton & Nick Colegrave - Experimental Design for the Life Sciences. (2nd edition) – . Oxford University Press.
2. Khan I A and Khanum A - Fundamentals of Biostatistics, Ukaaz Pub., Hyderabad
3. Jasra P K, Raj P - Biostatistics, Krishna Prakasan Media Pvt.Ltd.
4. Lewis A I - Biostatistics- Reinhold Pub.Corporation.
5. Collins H and T. Pinch – The Golem: What Everyone Should Know About Science. Cambridge University Press (1993)
6. Bass Joel E et al- Methods for Teaching Science as Inquiry; Allyn & Bacon,09
7. T C Narendran – An Introduction to Taxonomy; ZSI Publ.
www.sciencebuddies .org
www.wikipedia.org

2B 02 ZLG EVOLUTION AND ETHOLOGY

Lecture hours: 2 hours /week

No. of credits: 2

Aims 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.

SECTION A . EVOLUTION – (26 hours)

Unit I. Origin of life on earth – Theories, modern approaches – Oparin concept, Urey-Miller experiment. (3 hrs)

Unit II Evidences of organic evolution. Morphological and anatomical, physiological and biochemical, embryological and palaeontological (4 hrs)

Unit III Theories of organic evolution Lamarckism and its criticism, Weismann's Germplasm theory, Darwin's Theory of Natural Selection and its criticism, Mutation theory of de Vries, Punctuated evolution (5 hrs)

Unit IV. Modern concept of organic evolution. Genetic basis of variation. Hardy – Weinberg Equilibrium. Forces contribution to evolution – recombination,

mutation, gene flow, genetic drift and natural selection (mention industrial melanism). (5 hrs)

Unit V Nature of evolution. Species concept and speciation, isolation and isolating mechanisms, pre adaptation. Adaptive radiation with special reference to Darwin's finches (4 hrs)

Unit VI. History of life on earth – Geological time scales, fossils, fossilisation and fossil dating (C 14 and Pb method) (3 hrs)

Unit VII Molecular evolution – Neutralist hypothesis, concept of molecular clock, Mithochondrial Eve hypothesis (2 hrs)

SECTION B . ETHOLOGY (10 hrs)

Unit I -History and scope (1 hr)

Unit II -Motivation – Lorenz's and Deutsch's models (1 hr)

Unit III -Neural mechanism – Role of hypothalamus and other brain centres in behaviour (1 hr)

Unit IV- Role of hormones in behaviour (1 hr)

Unit V -Learning – Types of learning – Habituation, conditioned reflex, insight learning, latent learning, imprinting. (2 hrs)

Unit VI -Sociobiology social groups – advantages and disadvantages. Insect societies e.g. Honeybee (mention bee dance). Social groups in mammals . Example -Elephants. (4 hrs)

TOPICS FOR SEMINAR/ASSIGNMENT (Only for internal evaluation)

EVOLUTION : 1) Stages in evolution of horse.
2) Evolution of man.
3) Dinosaurs

ETHOLOGY

- 1) Biological clocks
- 2) Hibernation and aestivation
- 3) Social organization in termites
- 4) Social life in primates
- 5) Navigation and homing instincts

REFERENCES

1. P.S.Verma & V.K. Agarwal : Concept of Evolution; S. Chand & Co.
2. Strickberger M W: Evolution; Jones & Barlett.
3. Kavitha : Organic Evolution; A I T B S Pub. New Delhi.
4. Volpe E P : Understanding Evolution; Universal Bookstall, New Delhi.

5. Aubrey Manning & Dawkins: An Introduction to Animal Behaviour; Cambridge.
6. Prasad: Animal Behaviour; CBS Pub.
7. Reena Mathur : Animal Behaviour; Rastogi Pub.

3B 03 ZLG CYTOLOGY AND IMMUNOLOGY

Lecture hours: 3 hours/ week

No. of Credits: 3

Aims 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 (45 hours)

Unit I : Introduction

History and scope of cell biology, cell theory and its modern concept.

Mycoplasma, virus, viroids, virions and prions. Prokaryotes and eukaryotes.
(2 hrs)

Unit II : Histological techniques

A. Tools and Techniques : (Principle, working methodology and applications).
Microscopy – Light microscope (use of oil immersion objective. Camera
Lucida and micrometry.

B. 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, Janus green, methylene blue, rhodamine. Stains for electron microscopy – uranyl acetate, lead acetate.
(5 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. Plasma membrane modifications (microvilli, desmosomes, gap junctions, plasmodesmata) and their role in cell adhesion. Transmembrane transport -passive, active (Na⁺ K⁺ pump) and vesicular transport. (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 Lamp brush chromosomes – mention puffs and bands, Endomitosis. (2 hrs)

Unit IV Cell Division

Cell cycle – G₁, S, G₂ and M phases – check points of cell cycle – use of colchicine

Meiosis – details of synaptonemal complex, crossing over, chiasma, terminalisation.

Spermatogenesis and Oogenesis. (5 hrs)

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. (4 hrs)

Unit VII Cell Growth and Aging

Changes due to aging. Apoptosis. Theories of aging. (2 hrs)

Unit VIII 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. (3 hrs)

SECTION B – IMMUNOLOGY (10 hours)

Unit I. Basic concepts. Immunity, Infection, Natural and Acquired immunity, Active and Passive immunity, Immune response - Cell Mediated and Humoral. (2 hrs)

Unit II. Antigens, Haptens and Antibodies. Typical structure of antibody; Classes of antibodies and their functions. Antigen-antibody reactions – precipitation, agglutination, complement fixation, opsonisation. Primary and secondary immune responses. (4 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. (4 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

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

4B 04 ZLG GENERAL INFORMATICS AND BIOINFORMATICS

Lecture hours: **3** hours/week

No. of credits: **3**

Aims and Objectives. This course aims to update and expand basic informatics skills and to equip the student to effectively utilise the digital knowledge resources in their chosen discipline. The section on Bioinformatics is aimed at introducing they basics of this modern branch with the aiming of focusing on its interdisciplinary nature.

SECTION A. GENERAL INFORMATICS (25 hours)

Unit I. The modern personal computer- Standard specifications. (02 hrs)

Unit II. Overview of operating systems and major application softwares- Office packages, Browsers, Antivirus packages. The free software debate. Social, ethical and technical superiority issues. (06 hrs)

Unit III. Internet as a knowledge repository. Academic search techniques. Course management with MOODLE. Digital libraries. National services such as INFLIBNET. (06 hrs)

Unit IV. IT and society – Cyber ethics, Cyber crime, Privacy issues; Information overload. IT for disabled – Speech activated and thought activated computers. Special devices and software for disabled. (07 hrs)

Unit V. Health Issues – Guide lines for the proper use of computers and Internet. (02 hr)

Unit VI. Artificial intelligence; Virtual reality. (02 hr)

SECTION B: BIOINFORMATICS (30 hours)

Unit I. Overview of Bioinformatics (02 hrs)
Introduction: Definition, history, development and scope, tasks

Unit II. Major databases in Bioinformatics (08 hrs)
Primary databases:
Nucleotide sequence databases – Mention EMBL, DDBJ, Genbank
Protein sequence databases – Mention Swiss Prot, PIR, MIPS
Metabolite databases – Mention KEGG, EcoCye
Secondary databases: Mention PROSITE, PRINTS, Blocks

Unit III. Database Search Engines (05 hrs)
Mention Entrez at NCBI of USA, SRS at EBI of England, STAG at DDBJ

of Japan

Unit IV. Sequence Similarity Search (05 hrs)

Pair wise sequence alignment: Mention BLAST, FASTA, Multiple sequence alignment: Mention CLUSTAL W, CLUSTAL X

Unit V. Micro arrays -- Data analysis tools and methods (02 hrs)

Unit VI. Genomics -DNA sequencing, applications (Brief account) (02 hrs)

Unit VII. Proteomics - Tools and applications (Brief account) (02 hrs)

Unit VIII. Metabolomics - Tools and applications (Brief account) (01 hr)

Unit IX. Applications of Bioinformatics (01 hr)

Unit X. Ethical issues in Bioinformatics (02 hrs)

- Accuracy and error
- Appropriate uses and users
- Privacy and confidentiality

REFERENCES

1. V.Rajaraman – Introduction to Information Technology; Prentice Hall.
2. Alan Evans, Kendal Martin et al – Technology in Action; Pearson Prentice Hall.
3. Jin Xiong – Essential Bioinformatics; Cambridge University Press.
4. Neelam Yadav – A Handbook of Bioinformatics; Anmol Publications.

Web Resources:

- www.computerhistory.org
- www.learnthenet.com
- science data bases.

4B 01 ZLG(P) (PRACTICAL)

Lecture hours: **2** hours/week

No. of credits: **4**

PRACTICAL –1. METHODOLOGY, INFORMATICS, CYTOLOGY

Methodology

1. Simple problems in statistics – mean, median, mode, mean deviation & standard deviation. (Minor)
2. Construction of Bar diagram, Pie diagram & Histogram. (Minor)
3. Use of computers for graphic representation of data. (Demo)
4. Preparation of whole mounts – insect leg, wing, lepidopteran scales, fish scales etc.(Minor)
5. Preparation of simple taxonomic key. (Minor)

Cytology and Immunology

1. Study of microscope. (Minor)
2. Use of camera lucida. (Minor)
3. Micrometry -Measurement of microscopic objects. (Minor)
4. Study of mitotic stages – Onion root tip squash preparation. (Major)
5. Study of meiosis – Grasshopper testis squash. (demo)
6. Staining of buccal epithelial cells. (Minor)
7. Staining of blood film to study blood cells. (Major)
8. Determination of blood groups. (Minor)
9. Centrifugation- cell fractionation and separation of nuclei. (demo)

Informatics

1. Preparation of questionnaire for data collection (example: incidence of diabetes/cancer)

5B 05 ZLG DIVERSITY OF LIFE – I

PROTISTA AND NON CHORDATA

[TAXONOMY, ADAPTATIONS AND FUNCTIONAL ANATOMY OF
PROTISTANS AND NONCHORDATES]

Lecture Hours : 4 hours/week

No. of Credits : 4

Aims and Objectives: The course is designed to give a comprehensive understanding of Protistan and Non chordate phyla. The main objectives are to make the student aware of the amazing diversity, to understand how these different components are interlinked and also their phylogenetic relationship.

Section A: KINGDOM PROTISTA (15 hours)

Type study: *Paramecium*: Morphology and structural organization, locomotion, nutrition, excretion, osmoregulation and reproduction; conjugation in detail.

Characteristic features and classification of Kingdom Protista down to phyla

[Brief account of the major groups of ‘protozoan protists’ given below]

Phylum Sarcomastigophora examples: *Amoeba*, *Noctiluca*,
and *Trichonympha*

Phylum Apicomplexa example: *Plasmodium*

Phylum Ciliophora examples: *Vorticella*

Parasitic Protista – Life cycle (Stressing infective stage & mode of infection); pathogenicity, diagnosis, treatment and prophylaxis of *Entamoeba histolytica* & *Plasmodium vivax*. (Mention *P. falciparum*, *P. ovale* and *P. malariae*). Also mention *Leishmania* and *Trypanosoma*.

General essay -- Locomotion in Protista.

Section B: KINGDOM ANIMALIA

Salient features of the major Phyla of animals and their diversity

(Study of animal diversity with typical examples from each group, 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.)

MESOZOA - A brief account. (01 hr)

METAZOA

Phylum **PORIFERA** (03 hrs)

Salient features of the following classes-

Class Calcispongiae example: *Leucosolenia*

Class Demospongiae example: *Spongilla*

Class Hyalospongiae example: *Euplectella*

Give an account of canal system in sponges.

Brief accounts of amphiblastula, parenchymula and gemmule

Phylum **CNIDARIA [=COELENTERATA]** (05 hrs)

Type: *Obelia* morphology and life cycle

Classification down to classes with salient features of the classes

Class Anthozoa example: *Adamsia*, *Madrepora*

Class Hydrozoa example: *Halistemma*, *Physalia*

Class Scyphozoa example: *Rhizostoma*

Phylum **CTENOPHORA** (01 hr)

Salient features of *Pleurobrachia*

ACOELOMATA

Phylum **PLATYHELMINTHES** (04 hrs)

Salient features of the following classes

Class Turbellaria example: *Dugesia (=Planaria)*

Class Cestoda example: *Taenia saginata*

Class Trematoda example: *Schistosoma*

Life cycle and pathogenicity of *Fasciola hepatica*.

PSEUDOCOELOMATA

Super phylum **ASCHELMINTHES** (08 hrs)

Phylum **Nematoda [=Nemata]** characteristic features.

Nematode parasites. Life history, pathogenicity, and prophylaxis of *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Wuchereria bancrofti*.

Mention the significance of *Cenorhabditis elegans*

COELOMATA

Phylum **ANNELIDA** (03 hrs)

Salient features of the following classes

Class Polychaeta example: *Nereis*

Class Oligochaeta example: *Megascolex*

Phylum **HEMICHORDATA**

(01 hr)

Salient features and example: *Balanoglossus*

ASSIGNMENT/SEMINAR TOPICS (Only For Internal Evaluation)

1. Reproduction in Protista
2. Nutrition in Protista.
3. Corals, coral reefs and their ecological importance.
4. Parasitic tapeworms and nematodes.
5. Vermiculture.
6. Insect pests
7. Insect vectors

8. Mouthparts of insects.
9. Economic importance of molluscs.
10. Mussel culture.
11. Excretory organs in invertebrates.

REFERENCES.

1. D.T Anderson - Invertebrate Zoology, 2nd edition; Oxford University Press.
2. Michael A Sleight - Protozoa and Other Protists, CBS Publishers and Distributors, New Delhi.
3. Hyman – Invertebrate volumes, McGraw Hill Publ.
4. Ekambaranath Iyer – Invertebrate Zoology, Vol 1; S V Publishers.
5. Parker & Haswell : Text Book of Zoology Vol-1; Mac Millan & Co.
6. E J W Barrington : Invertebrate Structure and Function ; Thomas Nelson.
7. Chatterjee – Parasitology: Protozoology and Helminthology ; Chatterjee Medical Publishers.
8. Nayar K K – General and Applied Entomology, TMH Publ.
9. R L Kotpal – Modern Text Book of Zoology; Rastogi Publ.
10. Pechenik J – Biology of Invertebrates; TMH.

5B 06 ZLG ENVIRONMENTAL BIOLOGY & ZOOGEOGRAPHY

Lecture hours: 4 hours /week

No. of credits: 4

Aims and Objectives : To give the students a solid base in the basic concepts of environmental studies. Chapters on environmental laws and environmental issues are to help provide an understanding of the major environmental issues that have attracted global attention and need immediate corrective measures. The topics in biodiversity should help realize the current status regarding biodiversity and the need for conservation measures.

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.

SECTION A- ENVIRONMENTAL BIOLOGY- (60 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. (6 hrs)

Unit II. Ecosystem Energetics – Fundamental concepts relating to energy. Solar energy and photosynthesis production. Chemosynthetic production.

Energy flow in the ecosystem. Laws of thermo dynamics. Energy based classification of ecosystem; concept of productivity; food chain; food web, trophic levels and trophic structure. Ecological pyramids. (8 hrs)

Unit III. Biochemical cycles. Basic types – Gaseous cycle- Carbon & Nitrogen cycles. Sedimentary cycle – Phosphorous cycle. Recycling pathways and recycling index. (8 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 periodically. Ecological succession- Basic types of succession. Process in succession. (4 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, Hydro sphere 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)

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

Unit X. 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 (4 hrs)

Unit XI. Global environmental Issues.

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. (8 hrs)

SECTION B . ZOOGEOGRAPHY – (12 HOURS)

Unit I. Animal distribution –cosmopolitan, discontinuous, bipolar and isolated distribution. Factors affecting distribution – Barriers to animal distribution (2 hrs)

Unit II. Zoogeographical Realms - Mention the areas included, physical features and fauna of the following regions – Palaeartic, Nearctic, Neotropical, Ethiopian, Oriental and Australian realms. Brief account of the biogeography of India – Western Ghats and Himalayas. (8 hrs)

Unit III. Insular fauna – Continental Islands – e.g. British Isles. Oceanic islands – Galapagos. (2 hrs)

Topics for Seminar/Assignments. (Only for internal evaluation)

1. Population Explosion.
2. The Earth summit – 1972

3. Geneva convention - 1996
4. The Kyoto protocol- 1997
5. World summit on Sustainable Development – 2002
6. Chipko Movement.
7. Project Tiger
8. National Parks/Wildlife Sanctuaries / Biosphere Reserves
9. Bhopal Gas Tragedy
10. Anthropogenic effects of Biogeochemicals.
11. Non-conventional Energy Sources.

REFERENCES.

1. Aravind Kumar : Text Book of Environmental Science; APH Pub Corporation (New Delhi).
2. Chapman & Reiss: Ecology- Principles and Applications; Cambridge.
3. Chatterjee B: Environmental Laws- Implementation and Problems.
4. Sharma P D : Environmental Biology; Rastogi Pub.
5. Varma PS & Agarwal VK : Environmental Biology; S. Chand.
6. Trivedi R K: Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards; Enviromedia.
7. Odum E P and Barret : Fundamentals of Ecology; Thomson.
8. Smith RL : Ecology and Field Biology; Harper Collins.
9. Townsend CR : Essentials of Ecology; Blackwell Science.
10. Darlington PJ Jr. : Zoogeography- The Geographical Distribution of Animals;

5B 07 ZLG BIOCHEMISTRY AND BIOPHYSICS

Lecture hours: 4 hours/week

No. of credits: 4

Aims and Objectives: The course is intended to give the student a basic understanding of the fundamental concepts in biochemistry and biophysics, 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. It is also to introduce the student to some of the more important tools and processes that now form a part of routine lab procedures.

SECTION – A : BIOCHEMISTRY (50 Hours)

Unit -I: Biochemistry and the living state – mention micro, macro and trace elements – their biological significance. (02 hrs)

Unit – II: Water – molecular structure – dipolar nature – dissociation of water – concept of pH – buffers – Handerson Hassel Bach equation.
Biological functions of water (03 hrs)

Unit -III: Macromolecules:

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

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

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

(d) Nucleic acids and Nucleotides – structure of nitrogen bases – nucleosides, nucleotides, structure of DNA , different forms DNA, different types of RNA , Biologically important nucleotides – NAD, NADP, FAD, ATP, cyclic AMP, CTP, GTP, UTP (20 hrs)

Unit – IV; Enzymes and hormones: Nomenclature, classification, concept of active sites, mechanism of enzyme action, effect of pH, substrate concentration, temperature and activators, enzyme inhibition, concept of free energy, kinetic theory, Michaelio-Menten equation, isozymes and coenzymes. Classification of hormones based on chemical nature and mechanism of hormonal action. (07 hrs)

Unit – V: Metabolism: Basal metabolism, BMR- method of calculation; Factors effecting metabolism.

Energy metabolism- Carbohydrate metabolism – glycolysis, glycogenolysis,

glycogenesis, glucogenesis, gluconeogenesis. (Mention Pentose Phosphate pathway). Protein metabolism – deamination, transamination, decarboxylation, transmethylation. Lipid metabolism – oxidation of glycerol and fatty acids; Biosynthesis of fatty acids; Krebs’s cycle, electron transport and oxidative phosphorylation. (18 hrs)

SECTION B: 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

(e) X-ray crystallography

(f) Autoradiography

(g) pH – meter

(h) Spectrophotometer

(i) Microtome

(j) Kymograph

(k) Centrifuge – different types of centrifuge – different types of centrifugation – Cell fractionation. (17 hrs)

Unit- II: Radiation Biology – units of radiation – ionising and non-ionising radiations – radioisotopes – applications – biological effects of radiation (03 hrs)

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

REFERENCES:

1. David Nelson and Michael Cox : Lehninger, Principles of Biochemistry , W H Freeman & Co. New York.
2. Awapara J: Introduction to Biological Chemistry, Prentice-Hall of India
3. Cohn E E and Stumpf P K: Outlines of Biochemistry, Wiley Eastern
4. Rangnatha Rao K: Text Book of Biochemistry, Prentice-Hall of India
5. Roy K N: A Text Book of Biophysics; New Central Book Agency
6. Ackerman E: Biophysical Science; Prentice Hall Inc.
7. Srivastava HS: Elements of Biochemistry; Rastogi Pub..
8. Abraham Mazur & Harrow: Text Book of Biochemistry; Saunders Toppan.
9. Pranab Kumar Banerjee: Introduction to Biophysics; S.Chand.

5B 08 ZLG – A.HUMAN GENETICS (*Elective*)

Lecture hours:3 hrs/week

No. of credits:4

Aims and objectives: Studies in human genetics have become a frontier area in biology since the completion of the Human Genome Project, which has opened up whole new fields in applied genetics. The course is aimed at introducing some of the relevant fields connected with this subject.

At the end of the course, the student should have a broad understanding of the various factors that contribute to congenital problems and to what extent their incidence can be reduced, and in case of occurrence, be managed. A very concise account of genetic services should help making informed choices.

Unit I. Human Chromosomes: History and Nomenclature of Human

Chromosomes: - Denver Conference 1960, London Conference 1963, Chicago Conference 1966, and Paris Conference 1971. Mention ISCN reports of '78, '81, '91 and '95.

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. (10 hrs)

Unit II. 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, polydactyly.
- D) Autosomal Recessive diseases – Alkaptonuria, PKU, Albinism, Cystic Fibrosis, Sickle Cell Anaemia, Thalassaemia, Lesch Nyhan Syndrome.
- E) Sex-linked Diseases – Colour blindness, Haemophilia, Duchenne Muscular Dystrophy, Holandric traits.
- F) Multi factorial Traits- Congenital heart diseases- ASD, VSD, Diabetes, Clubfoot, Alzheimer's disease. (15 hrs)

Unit III. Immunogenetics – Structure and diversity of antibodies, genetic basis of antibody diversity (somatic recombination theory) Major Histocompatibility Complex, HLA typing, Autoimmune diseases. (6 hrs)

Unit IV. Pharmacogenetics and Ecogenetics– definition, gene loci influencing drug metabolism, example: porphyria. Ecogenetics of lung diseases. (4 hrs)

Unit V. Cancer Genetics- Proto oncogenes, oncogenes (cellular and viral), anti oncogenes. Chromosomal abnormalities associated with malignancies like chronic myelocytic leukemia and retinoblastoma. (5 hrs)

Unit VI. Genetics and Society-.Human Genome Project – future prospects and ethical considerations. Eugenics, Euthenics, Euphenics. Forensic genetics – DNA Fingerprinting. Gene therapy. (5 hrs)

Unit VII. Genetic Services – Pedigree Construction – symbols used in pedigree construction. Buccal smear test, Ultrasonography, Amniocentesis, Chorionic Villi Sampling, Foetoscopy, Assisted Reproductive Techniques. 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. (8 hrs)

REFERENCES

1. Mange and Mange :Basic Human Genetics; Rastogi Pub.
2. Human Genetics : Elof Axel Carlson; TMH.
3. Gerald J. Stein : Human Genetics.
4. Bhatnagar, Kothari and Mehta: Essentials of Human Genetics; Orient Longman.
5. Verma and Agarwal : Concepts of Human Genetics; S. Chand
6. Sanjay Mandal : Fundamentals of Human Genetics ; New Age Int'l.
7. David Latchman (Editor): Basic Molecular and Cell Biology (3rd Ed); BMJ Publishing Co.

5B 08 ZLG-B. BIODIVERSITY, CONSERVATION AND MANAGEMENT (*Elective*)

Lecture hours : **3** hours / week

No of Credits: **4**

Aims and Objectives. This course is designed to give the student an introduction to one of the frontier areas of zoology, which has gained worldwide interest in the new millennium. A comprehensive coverage of all important aspects of the subject has been attempted. The objective is to raise the students awareness in this all important field by discussing the importance of biodiversity, the causative factors leading to biodiversity depletion and also to introduce him/her to the various measures needed to overcome the crisis, not only at the government level, but also at community and individual levels.

Unit I - What is Biodiversity

Brief history of Biodiversity: Principle features - from the beginning to the present day; diversification; extinction (brief account on extinct species)

Elements of Biodiversity: Species diversity – definition; value of species (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 (brief account on economic values; spiritual values; scientific and educational values; spiritual value and ecological values)

Genetic diversity - definition; measuring genetic diversity (mention basic methods for molecular analysis of genetic diversity - electrophoresis, RFLP, RAPD, SSR, AFLP, DNA sequencing); importance of genetic diversity. (12 hrs)

Unit II - Threats to Biodiversity:

Mass extinction: Extinction episodes of the past – a brief account on cretaceous tertiary extinction and Permian extinction

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.

(15 hrs)

Unit III - Conservation of Biodiversity:

Conserving ecosystems: Protected ecosystems – mention the six basic categories of protected areas (Strict nature reserve, Wilderness area; National park, National monument, Habitat/species management area, Protected landscape/seascape, Managed resource protected area.); modified ecosystems; cultivated ecosystems; built ecosystems; restoring ecosystems – Brief account on basic steps for restoring

an ecosystem (set a goal; determine strategy and methods; remove the source of degradation; restore the physical environment and restore the biota.)

Conserving populations:

Providing resources – Food, water, physical environments;

Controlling threats – overexploitation, indirect threat by humans, consumers,

Direct manipulations – Translocations, artificial breeding

Ex situ conservation: Zoos and gardens; ex situ-in situ interface; conservation of domesticated species.

Priority setting in Conservation & Management of Biodiversity:

Selection of areas; selection of species; selection of nations; selection of tasks; causes of actual problem to be recognized. (15 hrs)

Unit IV - Man and Biodiversity

Difference in values: Urban-rural; women-men; anthropocentrism versus biocentrism.

Economics and biodiversity conservation: The benefits – goods and services; The costs; distribution of benefits and costs.

Conservation and politics: International agencies (a brief account on major international agencies);

Environmental treaties (mention important environmental treaties);

Role of governments (brief account on developing and enforcing environmental regulations).

Nongovernmental organizations (NGOs) – mention important international, national, state level and regional NGOs

Effective conservation through empowering communities.

Duties of individuals-the most important factor/catalyst in biodiversity conservation.

(12 hrs)

6B 09 ZLG DIVERSITY OF LIFE – II

CHORDATA

[TAXONOMY, DIVERSITY, STRUCTURE AND ADAPTATIONS OF CHORDATES]

Lecture hours: 5 hours/week

No. of credits: 4

Aims 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. The comparative anatomy topics are intended to provide a broad understanding of the different classes, as the study of types is limited.

Introduction (03 hrs)

Chordate characters (fundamental, general and advanced); chordates versus non-chordates; diversity of chordates; classification as mentioned below with salient features of each group.

Subphylum 1 **UROCHORDATA** (03 hrs)

Affinities; add a note on neoteny (paedogenesis)

Classification down to classes

Class: Ascidiacea example: *Ascidia* [morphology and retrogressive metamorphosis]

Class Larvacea- example: *Oikopleura*

Class Thaliacea- example: *Doliolum*

Subphylum 2 **CEPHALOCHORDATA** (04 hrs)

Example: *Branchiostoma* [= *Amphioxus*] morphology, primitive, degenerate and specialized features (affinities and systematic position to be emphasized)

Subphylum 3 **VERTEBRATA** (01 hr)

Division 1 **AGNATHA** (02 hrs)

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

Division 2 **GNATHOSTOMATA**

Super class **PISCES** (15 hrs)

Type study– *Scoliodon sorrakowah*

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

Class Chondrichthyes [cartilaginous fishes]

Order Selachii examples: *Pristis*, *Trygon*

Order Holocephali example: *Chimaera*

Class Osteichthyes [bony fishes]

Order Crossopterygii [coelacanth] example: *Latimeria*

Order Dipnoi [lung fishes] examples: *Neoceratodus*, *Protopterus*,
Lepidosiren (Mention their distribution)

Order Acanthopterygii [spiny-rayed fishes] examples: *Mugil*, *Rastrelliger*

General essay – Accessory respiration in fishes

Super class **TETRAPODA**

Class **AMPHIBIA** (05 hrs)

Classification of Amphibia down to orders with examples

Order Apoda examples: *Ichthyophis*, *Uraeotyphlus*

Order Urodela examples: *Necturus*, *Ambystoma*, mention Axolotl

Order Anura examples: *Bufo*, *Rhacophorus*

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

Class **REPTILIA** (07 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*

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*.

Identification key for poisonous snakes

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

Order Crocodilia examples: *Crocodylus*, *Gavialis*, *Alligator*

Subclass Euryapsida

Subclass Synapsida

General topics. – 1) Biting mechanism of viper. 2) Snake venom and antivenin.

Class **AVES** (10 hrs)

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*)

General topics –1) Flight adaptations in birds. 2) Bird migration. 3) Types of feathers.

Class MAMMALIA (25 hrs)

Type study: *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), *Dasybus* (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 (15 hours)

Development of 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 suspensoria.

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

ASSIGNMENT / SEMINAR TOPICS (Only For Internal Evaluation)

1. Migration in fishes.
2. Marine, estuarine and fresh water edible fishes.
3. Methods of fish preservation
4. By products of fisheries.
5. Scales of fishes.
6. Tail fin of fishes
7. Snakes of Kerala
8. Dinosaurs.
9. Beak and feet of birds.
10. Mammals of Kerala forests.

REFERENCES:

1. Ekambarnath Iyyer – Manual of Zoology, Vol II; S V Publishers.
2. R L Kotpal – Vertebrate Zoology; Rastogi Publ.

3. Jordan and Verma : Chordate Zoology; S. Chand & Co.
4. Hyman : Comparative Anatomy of Vertebrates; Mc Graw Hill
5. Young J Z : Life of Vertebrates – Oxford University Press.
6. Parker and Haswell : A Text Book of Zoology Vol 2; Mac Millan.
7. Weichert : Anatomy of Chordates; Orient Longman.
- 8 Salim Ali : Book of Indian Birds; BNHS.

6B 10 ZLG GENETICS, MOLECULAR BIOLOGY & BIOTECHNOLOGY

Lecture hours: **4** hours/week

No. of credits: **4**

Aims and Objectives: The course offers a comprehensive understanding in an area that includes certain applied frontier areas 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.

Section A – GENETICS (36 hours)

Unit I. Introduction: Short account of alleles (wild and mutant), homozygosity, heterozygosity, back cross and test cross. (01 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. (05 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. (06 hrs)

Unit IV. Linkage and Crossing Over. Linkage groups. Complete and incomplete linkage. Disruption of linkage through crossing over and recombination. Factors affecting crossing over. Significance of crossing over. 3-point test cross and construction of linkage map in drosophila. (05 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.

(08 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.

(08 hrs)

Unit VII. Cytoplasmic inheritance. General characteristics, example: shell coiling in *Limnaea* and kappa particles in paramecium. (03 hrs)

Section B – MOLECULAR BIOLOGY & BIOTECHNOLOGY. (36 hours)

Unit I. The concept of gene. Regulatory and housekeeping genes; cistron, muton, recon; split gene, jumping gene and overlapping gene. (02 hrs)

Unit II. The Genetic material. Experiments to prove DNA as genetic material – Griffith's transformation experiment, Avery & co-workers experiments, Hershey and Chase experiment. Conrat & Stanley's experiment on TMV to show RNA as genetic material. (04 hrs)

Unit III. DNA replication and Repair. The semi conservative method of DNA replication. Role of enzymes- DNA Pol, ligase, helicase, topoisomerase, SSBPs, primase etc. Messelson and Stahl experiment.
DNA Repair: Types of mistakes and agents causing mistakes.
Mechanism of repair- mismatch repair, dimer repair (light induced and dark repair), recombinational repair and SOS repair. (04 hrs)

Unit IV. Organisation of Genome: Definition, viral genome (DNA and RNA containing), prokaryotic, eukaryotic and mitochondrial genomes.
Brief account of nucleosome concept of chromatin (03 hrs)

Unit V. Gene action. Central Dogma of Molecular Biology. Reverse transcription by retroviruses, example HIV. Characteristics of genetic code. (03 hrs)

Unit VI. Protein synthesis. Various steps in transcription, processing of m RNA, and translation. Wobble hypothesis. (03 hrs)

Unit VII. Regulation of Gene Action. The Operon concept. Examples of inducer and repressor operons. (03 hrs)

Unit VIII. Recombinant DNA technology. Definition and scope of biotechnology and genetic engineering. Restriction Endonucleases. Slicing, splicing and cloning of genes
Cloning vectors – plasmid, (pBR322, pUC8), phage (lambda phage), Artificial chromosomes (BAC, YAC). Transfer of rDNA into host cell. Identification of transformed cells by marker genes. Genetic engineering and human welfare. (10 hrs)

Unit IX. Hybridisation Techniques. Brief accounts of somatic cell hybridisation, hybridoma technology and monoclonal antibodies. Southern Blot, Northern Blot and Western Blot. DNA fingerprinting. (04 hrs)

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.

1. Strickberger : Genetics; Macmillan.
2. Rastogi V B : Fundamentals of Molecular Biology; Ane Books.
3. John Ringo : Fundamental Genetics; Cambridge University Press.
4. Verma & Agarwal: Genetics; S. Chand & Co.
5. Sambamurthy : Genetics; Narosa Pub.
6. Miglani, Gurubachan: Basic Genetics; Narosa pub.
7. Gupta P K : Cytology, Genetics and Molecular Biology; Rastogi.
8. Gupta P K : Elements of Biotechnology; Rastogi.
9. Gardner, Simmons and Snustad : Principles of Genetics; John Wiley Sons.
10. David Latchman (Editor): Basic Molecular and Cell Biology (3rd Ed); BMJ Publishing Co.

6B 11 ZLG PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY

Lecture hours: **4** hours/week

No. of credits: **4**

Aims 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.

SECTION A – PHYSIOLOGY (32 hours)

Unit I. Nutrition (05hrs)

Nutritional deficiencies and imbalances – Kwashiorkor, Marasmus, obesity.

Defects of modern food habits.

Detailed mechanism of secretion of various digestive juices. Role of GI hormones.

Mention Ryle's tube, gastric acidity and ulcers, flatulence, fasting and its significance. Gastric movements and vomiting.

Unit II. Respiration (06 hrs)

Alveolar ventilation. Diffusion of gases through respiratory membrane; factors affecting gas exchange; surfactant and stabilization of alveoli. Oxygen transport and dissociation curve. Carbon dioxide transport. Haldane effect.

Neurophysiological control of respiration.

Unit III. Circulation (05hrs).

Clotting factors and blood coagulation- intrinsic and extrinsic pathways, anti clotting factors, thrombosis. Hormonal regulation of circulation- vasoconstrictor agents (epinephrine, norepinephrin, angiotensin, vasopressin), vasodilator agents (bradykinin, serotonin, histamine and prostaglandins)

Unit IV. Excretion (06 hrs).

Ultra structure of glomerulus and tubule. Juxta glomerular apparatus. Regulation of kidney function- counter current multiplier system, hormonal control. Renal regulation of pH. Renal failure with its effects on body fluids-oedema, acidosis. Haemodialysis. Micturition, innervation of bladder , micturition reflex .

Unit V. Muscles (06hrs).

EM structure of myofibrils and filaments, sarco tubular system, contractile proteins, Electrical, chemical and morphological changes and ionic fluxes during contraction of striated muscle fibre. Electrophysiology of muscle, threshold and spike potential. Latent and refractory period. Simple muscle twitch and its recording. Tonus and tetanus.

Electrical and mechanical properties of heart muscles, pace maker and conducting system. Myocardial infarction, coronary angioplasty and angiography.

Unit VI. Nervous co ordination (03hrs).

Impulse propagation, saltatory conduction, synaptic transmission, neuro transmitters,

Unit VII. Sports physiology –effects of exercise, Yoga and meditation. (01 hr.)

SECTION B – DEVELOPMENTAL BIOLOGY (40 hours)

Unit I. Egg, Cleavage and Blastulation- Types of eggs, classification based on amount and distribution of yolk, egg membranes, mosaic and regulative eggs. Cleavage types- radial (star fish), spiral (*Planocera*), holoblastic equal (*Branchiostoma*), and unequal(frog), meroblastic discoidal (chick), and superficial (insect). Blastula formation, types of blastula- coelo-, stereo-, and discoblastulae and blastocyst. (03 hrs)

Unit II. Cell Differentiation & Gene Action During Development – Cell differentiation- totipotency and pluripotency of embryonic cells, dedifferentiation and redifferentiation in embryonic development, controlled gene expression during development, homeotic genes, Hox genes in vertebrates. (05hrs)

Unit III. Development of Frog – Structure of egg, fertilization, Cleavage, blastulation, importance of grey crescent, fate map, gastrulation, neurulation, formation of notochord, mesoderm and coelom. Organogeny of brain, eye, heart and aortic arches. Hormonal control of amphibian metamorphosis (10 hrs)

Unit IV. Development of Chick – Fertilization, Cleavage, blastulation , gastrulation, Development up to 48hrs with salient features of 18 hrs, 24 hrs, and 33 hrs of incubation. Development and functions of extra embryonic membranes. (08 hrs)

Unit V. Development of Man – Structure of ovum and sperm, cleavage, blastocyst formation, implantation, development and functions of foetal membranes, placenta. (04 hrs)

Unit VI. Regeneration – types of regeneration, events in regeneration, physiological changes involved and factors influencing regeneration. (02 hrs)

Unit VII. Experimental Embryology

1. Vital staining, marking with carbon particles, radioactive tracers, fate of blastomeres and construction of fate maps.
2. Cell lineage studies in *Planocera*
3. Experiments on sea urchin embryo leading to gradient concept.

4. Inductive interaction in development – primary organizers and induction with special reference to amphibian development.
 5. Transplantation experiments involving dorsal lip and optic cup during metamorphosis of frog's tadpole.
 6. Exogastrulation in frog blastula, removal of egg membranes, independent, dependent and progressive differentiation.
 7. Embryonic stem cells and stem cell research.
 8. Cloning experiments in animals – ethical issues in human cloning.
- (08 hrs)

ASSIGNMENT / SEMINAR TOPICS. (Only for internal evaluation)

1. Structure of bird egg.
2. Menstrual cycle.
3. Role of hormones in parturition and lactation.
4. History of embryology
5. Digestive glands and their secretions.
6. Vitamins and their functions.
7. Respiratory pigments.
8. Types of muscles.
9. Respiratory pigments.

REFERENCES.

Physiology & Immunology

1. Guyton : Text Book of Medical Physiology; W.B Saunders.
2. Hill & Wyse : Animal Physiology; Harper & Row.
3. Agarwal R A. : Animal Physiology and Biochemistry; S.Chand.
4. Chatterjee C C : Human Physiology- vol I &II; Medical Allied Agency.
5. S C Rastogi : Essentials of Animal Physiology (New Age Int'l Pub.)
6. Hoar W S : General and Comparative Physiology; Prentice Hall.

Development Biology

1. Patten : Foundations of Embryology
2. Balinsky : Introduction to Embryology; Saunders Toppan
3. Mc. Even : Vertebrate Embryology
4. T Subramonian : Molecular Developmental Biology; Narosa.
5. Roberts Rugh : Frog Reproduction & Development. TMH Edn.
6. P.S. Verma & V.K. Agarwal. : Chordate Embryology S. Chand & Co.
7. Patten : Early Embryology of the Chick, McGraw Hill
8. Bruce M Carlson : Foundations of Embryology (6th Edn) ; Mc Graw Hill.

***6B02 ZLG(P)- PRACTICAL II**

Lecture hours: **8** hours/week(Exmn in the 6th Semester)

No. of credits: **4**

PRACTICAL -II. PROTISTA, NONCHORDATA & CHORDATA

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 OSTEOLOGY, neatly labelled scientific diagrams should be drawn.

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 (in situ), *Nereis* – parapodium, Prawn- appendages, Honey bee
– Mouth parts, Plant bug – mouthparts, Shark – placoid scales, Frog – brain.

DISSECTIONS:

Earthworm – nervous system (Minor)

Cockroach – nervous system (Major)

Cockroach – salivary apparatus (Minor)

Prawn – nervous system (Major)

Frog – arterial system on one side (Major)

Shark / Frog – 10th cranial nerve (showing origin)- (Major)
(Labelled sketches of mountings and dissections to be drawn in the record)

6B 03 ZLG(P) PRACTICAL –III

Lecture hours: **8** hours/week

No. of credits: **4**

BIOCHEMISTRY, BIOPHYSICS, PHYSIOLOGY, GENETICS, ECOLOGY, & DEVELOPMENTAL BIOLOGY.

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. (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. (Minor)
6. Microtomy – Preparation of serial sections (demo)

PHYSIOLOGY.

1. Total RBC count using Haemocytometer. –(demo)
2. Differential count of WBC. (Major)
3. Detection of normal and abnormal constituents of urine. (Minor)
4. Demonstration of invertase activity (in vitro) in the digestive tract of cockroach/ hepatopancreas of crab. (demo)

ECOLOGY.

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)

GENETICS.

1. Simple problems based on gene interaction, linkage and multiple alleles in animals.
2. *Drosophila* salivary gland preparation to study giant chromosomes. (demo)

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

1. Frog – cleavage, 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.

B.Sc ZOOLOGY PROGRAMME

GENERAL SCHEME OF QUESTION PAPERS

2 credit courses

Core course I - Methodology & Perspectives in Science

Time : 2 hours

Total weight : 16

- | | |
|--|----------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions) | Weight 1 each |

Core course II – Evolution and Ethology

Time : 2 hours

Total weight : 16

- | | |
|--|----------------|
| I. Essay question (From Evolution)– (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions) | Weight 1 each |

3 and 4 credit core courses

Course III – Cytology and Immunology

Time : 3 hours

Total weight : 25

Section – A. Cytology

- | | |
|---|---------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4 |
| II. Essay question – (Answer 1 out of 2) | Weight 4 |
| III. Short essay – (Answer 3 out of 5) | Weight 2 each |
| IV. Short answers, in 3 or 4 sentences – (Answer 4 out of 7) | Weight 1 each |
| V. One word answers/ fill in the blanks/ MCQ/
match the following (2 sets of 4 questions each) | Weight 1 each |

Section –B. Immunology

- VI. Short essays (Answer 2 out of 4) Weight 2 each
VII. One word answer/fill in blanks/MCQs
(1 set of 4 questions) Weight 1

Course IV General Informatics and Bioinformatics

Time : 3 hours

Total weight : 25

Section A- General Informatics

- I. Essay question (Answer 1 out of 2) Weight 4
II. Short essays (Answer 2 out of 4) Weight 2 each
III. Short answers, in 3 or 4 sentences (Answer 2 out of 5) Weight 1 each
IV. One word answer/ fill in the blanks
(1 set of 4 questions) Weight 1

Section B- Bioinformatics

- V. Essay question (Answer 1 out of 2) Weight 4
VI. Short essay (Answer 2 out of 4) Weight 2 each
VII. Short answers, in 3 or 4 sentences (Answer 4 out of 7) Weight 1 each
VIII. One word answers/ fill in the blanks
(2 sets of 4 questions each) Weight 1 each

Course V. Diversity of Life –I

Time : 3 hours

Total weight : 25

- I. Essay question from Types, Life cycles (Answer 1 out of 2) Weight 4
II. Essay question from General essays, Taxonomy topics
(Answer 1 out of 2) Weight 4
III. Short essays (Answer 4 out of 7) Weight 2 each
IV. Short answers, in 3 or 4 sentences (Answer 7 out of 10) Weight 1 each
V. One word answers/fill in blanks/match the following/ MCQ
(2 sets of 4 questions each) Weight 1 each

Course VI. Environmental Biology & Zoogeography

Time : 3 hours

Total weight : 25

Section A – Environmental Biology

- I. Essay question (Answer 1 out of 2) Weight 4.
II. Essay question (Answer 1 out of 2) Weight 4
III. Short essays (Answer 3 out of 5) Weight 2 each
IV. Short answers, in 3 or 4 sentences (Answer 4 out of 7) Weight 1 each
V. One word answers/ fill in blanks/match the following
(2 sets of 4 questions each) Weight 1 each

Section B –Zoogeography

- VI. Short essays (Answer 2 out of 4) Weight 2 each
VII. One word answer/ fill in the blanks/ MCQ
(1 set of 4 questions) Weight 1

Course VII. Biochemistry and Biophysics

Time : 3 hours

Total weight : 25

Section A – Biochemistry

- | | |
|--|---------------|
| I. Essay question (Answer 1 out of 2) | Weight 4 |
| II. Short essays (Answer 3 out of 5) | Weight 2 each |
| III. Short answers, in 3 or 4 sentences (Answer 5 out of 7) | Weight 1 each |
| IV. One word answer/fill in blanks/ MCQ
(2 sets o 4 questions each) | Weight 1 each |

Section B – Biophysics

- | | |
|--|---------------|
| V. Short essays (Answer 2 out of 4) | Weight 2 each |
| VI. Short answers, in 3 or 4 sentences (Answer 2 out of 5) | Weight 1 each |
| VIII. One word answer/ fill in blanks/ MCQ
(2 sets of 4 questions each) | Weight 1 each |

Course VIII. (Elective)

Time : 3 hours

Total weight : 25

- | | |
|---|---------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4 |
| II. Essay question – (Answer 1 out of 2) | Weight 4 |
| III. Short essay – (Answer 4 out of 7) | Weight 2 each |
| IV. Short answers, in 3 or 4 sentences – (Answer 7 out of 10) | Weight 1 each |
| V. One word answers/ fill in the blanks/ MCQ/
match the following (2 sets of 4 questions each) | Weight 1 each |

Course IX. Diversity of Life –II

Time : 3 hours

Total weight : 25

- | | |
|---|---------------|
| I. Essay question – from Type study/Taxonomy
(Answer 1 out of 2) | Weight 4 |
| II. Essay question– from General topics/Comparative Anatomy
(Answer 1 out of 2) | Weight 4 |
| III. Short essays. (Answer 4 out of 7) | Weight 2 each |
| IV. Short answers, in 3 or 4 sentences. (Answer 7 out of 10) | Weight 1 each |
| V. One word answer/ fill in blanks/ match the following
(2 sets of 4 questions each) | Weight 1 each |

Course X. Genetics, Molecular Biology and Biotechnology

Time : 3 hours

Total weight : 25

Section A – Genetics

- | | |
|---------------------------------------|---------------|
| I. Essay Question (Answer 1 out of 2) | Weight 4 |
| II. Short essays (Answer 2 out of 4) | Weight 2 each |

III. Short answers, in 3 or 4 sentences (Answer 3 out of 5)	Weight 1 each
IV. One word answer/ fill on blanks/MCQ (1 set of 4 questions)	Weight 1.
Section B – Molecular Biology & Biotechnology	
V. Essay question (Answer 1 out of 2)	Weight 4
VI. Short essays (Answer 2 out of 4)	Weight 2 each
VII. Short answers, in 3 or 4 sentences (Answer 4 out of 7)	Weight 1 each
VIII. One word answer/ fill in blanks/ MCQ etc. (1 set of 4 questions)	Weight 1

Course XI. Physiology & Developmental Biology

Time : 3 hours

Total weight : 25

Section A – Physiology

I. Essay question (Answer 1 out of 2)	Weight 4
II. Short essay (Answer 2 out of 4)	Weight 2 each
III. Short answers, in 3 or 4 sentences (Answer 2 out of 5)	Weight 1 each
IV. One word answer/fill in blanks/ MCQs etc. (1 sets of 4 questions)	Weight 1.

Section B – Developmental Biology

VI. Essay question (Answer 1 out of 2)	Weight 4
VII. Short essays (Answer 3 out of 5)	Weight 2 each
VIII. Short Answers, in 3 or 4 sentences (Answer 2 out of 5)	Weight 1 each
IX. One word answer/fill in blanks/match the following etc. (2 set of 4 questions)	Weight 1 each

SCHEME OF PRACTICAL EXAM

PRACTICAL – I

Time : 3 hours.	Total weight : 13
I. Major question (from Cytology/Methodology)	Weight 4
II Statistical problem	Weight 2
III Graphic representation of data	Weight 2
III Taxonomic Key preparation/Whole mount preparation	Weight 2
IV Spot items (3 items)	Weight 1 each

PRACTICAL - II

Time :3 hours	Total weight : 13
I. Major dissection with display	Weight 5
II. Minor dissection / Mounting (With or without sketch)	Weight 3
III Spot items (5 items)	Weight 1 each

PRACTICAL - III

Time :4 hours	Total weight : 15
I. Major experiment	Weight 4

II Minor experiment	Weight 3
III. Genetics problem	Weight 2
IV Spot items (5 items)	Weight 1 each
V. Viva voce (based on Practical II & III)	Weight 1

Project evaluation (external) at the time of practical III. Weight 2.

Field work report (Internal evaluation) in 6th semester Weight 1.

CONTINUOUS ASSESSMENT [for each practical separately]

Lab skill	Weight 1
Viva	Weight 1
Record	Weight 2
Attendance	Weight 1

(75 – 79% D, 80 - 84% C, 85 – 89% B, >90% A grade)

Sd/-
P.A.Junaid,
Chairman,BOS

Zoology(UG).



KANNUR UNIVERSITY

Course Structure

and

Syllabus

FOR

ZOOLOGY

(COMPLEMENTARY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Complementary (Zoology)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	1C01ZLG	Diversity of Life-I	2	2
2	II	2C02ZLG	Diversity of Life-II	2	2
3	III	3C03ZLG	Agricultural and Forest Entomology	3	2
4	IV	4C04ZLG	Medical Zoology	3	2
5	IV	4C05ZLG	Practical	2	4

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 the practical course 4 credits, i.e. a total of 12 credits.

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 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.

1C 01 ZLG DIVERSITY OF LIFE I

PROTISTANS & NON CHORDATES

Lecture hours: 2 hours/week

No. of credit : 2

Aims 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

1. Ekambarnath Ayyer : Manual of Zoology- vol I; S V Publishers.
2. D.T.Anderson :Invertebrate Zoology, 2nd edition. Oxford U'ty Press.
3. Michael A.Sleigh : Protozoa and other Protists; CBS Publishers, New Delhi.
4. Kotpal. R L : Modern Text Book of Zoology; Rastogi Publishers.
5. 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

Aims 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, Casaurius, 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

1. Ekambarnath Ayer : Manual of Zoology- Vol II; S V Publishers.
2. Kotpal R L : Vertebrate Zoology; Rastogi Publications.
3. Jordan and Verma : Chordate Zoology; S.Chand & Co.
4. Parker and Haswell : A Text Book of Zoology, Vol 2; Orient Longman.
5. 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. Characteristics of class Insecta. Major insect orders – Coleoptera, Lepidoptera, Isoptera, Heteroptera, 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. Causes of pest outbreak (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 foveicolis*, *Dacus*
Pest of tea - *Helopeltis antonii*, Pest of rubber - *Aspidiotus destructor*,
Pests of stored products - *Sitophilus oryzae*, *Bruchus chinensis*. (10 hrs)

Unit IV: Insect control: Physical, Mechanical, Cultural and Legal measures. Chemical control – 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. Sterility method in insect control. Hazards of insecticides. Guidelines for the safe use of insecticides. LD 50 value, insecticide resistance, residual effect and pest resurgence. Biological control methods. Merits and demerits of BC. Integrated Pest management – brief account. (16 hrs)

Unit V: 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.

(04 hrs)

B. FOREST ENTOMOLOGY

Unit I. Nursery pests: mention the damage caused, the preventive and remedial measures of white grubs (*Holotricha* and *Mimela*), cut worms (*Agrotis*), defoliators (*Acrida*, *Catantops*) and termites. (04 hrs)

Unit II: Pests of standing trees: Life history, damages caused and control measures of *Hoplocerambyx spinicornis* (Sal sapwood borer), *Hyblaea purea* (teak defoliator), *Dihammus cervinus* (canker grub of teak). (04 hrs)

Unit III: 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). (04 hrs)

Unit IV: Lac cultivation. Life history of *Laccifer laca*. Host plants. Brief account of lac cultivation, extraction and purification. Uses of lac. (04 hrs)

REFERENCES

1. Nayar K K et al : General and Applied Entomology; T M H Publ.
2. Kumar : Insect Pest Control.
3. Ramakrishna Ayyar T V: Handbook of Economic Entomology for South India.
4. Deepak Kumar Verma : Applied Entomology; Mittal Pub., New Delhi.
5. Bibin Bihari : Forest Entomology; Bishen Singh Mahendrapal Singh Pub., Dehra Dun.
6. Vasantharaj David and Kumaraswami : Elements of Economic Entomology; Popular Book Depot.

4C 04 ZLG MEDICAL ZOOLOGY

Lecture hours: 3 hours/week

No. of credits: 2

Aims 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

1. Mange &Mange : Basic Human Genetics; Rastogi Publications.
2. Darla Wise & Gordon Carter: Immunology, A comprehensive Review; Ane Books, New Delhi.
3. Harsh Mohan : A Text Book of Pathology; Jaypee.
4. Chakravarthy & Chakravarthy : Hand Book of Clinical Pathology.
5. Sapti R C : Medical Zoology; Vishal Publishers, Jalandhar.
6. Anil Aggarwal : Modern Diagnostics; National Book Trust.
7. Chaterjee K D : Parasitology- Protozoology and Helminthology; Chatterjee Medical Publishers. Kolkatta.
8. Nandini Shetty : Immunology: Introductory Text Book; New Age.

4C04ZLG(P) PRACTICAL

Lecture hours: 2 hours/week

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

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. (2 credit courses)

Time : **2** hours

Total weight : **16**

- | | |
|---|----------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions each) | Weight 1 each |

Scheme of Practical Examinations (4 credit courses)

Time : **3**hours

Total weight : **12**

- | | |
|---|---------------|
| I. Experiment (with written procedure) | Weight : 4 |
| II. Mounting (with diagram) | Weight : 3 |
| III Spot items (5 items)
(2 from taxonomy, 1 each from Medical Zoology, Beneficial organisms and Entomology) | Weight 1 each |

CONTINUOUS ASSESSMENT

For Theory Courses.

Test papers (minimum 2)	Weight :2
Assignment	Weight :1
Seminar/Viva	Weight :1
Attendance	Weight :1

For Practical Courses

Lab skills	Weight 1
Record	Weight 2
Viva	Weight 1
Attendance	Weight 1

(For attendance 75-79% -D; 80-84% C, 85-90% B and >90% A grade.)

Sd/-
P.A.Junaid,
Chairman,BOS Zoology(UG).



KANNUR UNIVERSITY

Course Structure

and

Syllabus

FOR

PHYSIOLOGY

(COMPLEMENTARY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Complementary (Physiology)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	1C01PLY	Biological Chemistry	2	2
2	II	2C02PLY	Cell Biology	2	2
3	III	3C03PLY	Human Physiology I	3	2
4	IV	4C04PLY	Human Physiology II	3	2
5	IV	4C05PLY	Practical	2	4

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 the practical course 4 credits, i.e. a total of 12 credits.

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 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.

1C 01 PLY BIOLOGICAL CHEMISTRY

Lecture hours: 2 hours/week

No. of credits: 2

Aims and 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 : Protoplasm

Biochemistry and the living state, colloidal nature, phase change, energy transformation in living cells, self-regulation of cell reactions. (2 hrs)

Unit II- Water

Significance as a medium, molecular structure, intermolecular association, dipolar nature, dissociation of water, concept of pH, buffers, Henderson – Hasselbach equation. (6 hrs)

Unit III- Proteins, peptides & amino acids.

Structure of amino acids, classification of amino acids, Primary, Secondary, tertiary & quaternary structures of proteins. The biological functions of proteins. Importance of amino acid sequence of proteins. (6 hrs)

Unit IV- Carbohydrates :

Monosaccharides, disaccharides, Polysaccharides, trioses, tetroses, pentoses, hexoses, aldoses and ketoses, heteropolysaccharides Biological functions of carbohydrates. (6 hrs)

Unit V- Simple fats, Saturated & unsaturated fatty acids, phosphoglycerides, waxes, steroids, prostaglandins, lipid micelles. (6 hrs)

Unit VI- Enzymes

IUB classification & naming, theories of enzyme action, enzyme inhibition, co-enzymes, Michaelis-Menten equation. (4 hrs)

Unit VII- Metabolism of carbohydrates, lipids & Proteins.

Basal metabolism – interrelationship between carbohydrate, protein & lipid metabolism – role of liver in metabolism to be stressed.

Glycolysis, glycogenesis, glycogenolysis, Krebs's cycle, beta oxidation of fatty acids, break down of glycerol, synthesis of triglycerides, deamination, transamination and decarboxylation of amino acids (Metabolism individual amino acids not expected) (6hrs)

REFERENCES

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

2C 02 PLY CELL BIOLOGY

Lecture hours:2 hours /week.

No. of credits:2

Aims and Objectives -To give an overview of the basic concepts and techniques involved in the study of cells and to provide an insight into the complexity of the cellular machinery

Unit I- Introduction- Cell theory and it's modern concept scope of cytology, cellular physiology & Molecular biology. (1 hr)

Unit II- Tools and Techniques

1. Fixation :

Common fixatives such as buffered formalin, Ethanol, Bouin's solution, Carnoy's fluid etc.

2. Staining :

Common histological stains-Haematoxylin, eosin, Leishman's stain, vital stains-Neutral red & Janus green .

3. Electrophoresis

SDS polyacrylamide gel electrophoresis – one dimensional.

4. X-ray diffraction

5. Radio isotope tracer technique and autoradiography

6. Camera lucida

7. Cell fractionation (7 hrs)

Unit III- The cell and its components

1. Structural organization of Prokaryotes and Eukaryotes.

2. Plasma membrane

- Membrane proteins
- Chemical makeup of fluid mosaic model
- Membrane skeleton
- Specialization of plasma membrane at cell surface.
- Unit membrane concept
- Modes of transport across plasma membrane (4 hrs)

3. Endoplasmic reticulum

Different types of ER, origin and functions of ER. (1 hr)

4. Ribosomes

Various types of ribosomes in prokaryotes and mitochondria, chemical composition of the ribosomal units, free and attached ribosomes, biogenesis of ribosomes. (2 hrs)

5. Golgi bodies-Morphology, chemical composition & functions. (1 hr)

6. Lysosomes

Structure and chemical makeup, types of lysosomes, polymorphism, enzymes in lysosomes, functions of lysosomes, concept of GERL. (1 hr)

7. Micro bodies

Peroxisomes, glyoxysomes & their functioning; a brief note on origin of microbodies. (1 hr)

8. Centrioles & basal bodies. Structure, chemical composition & functions. (1 hr)

9. Cilia & flagella- Structure, chemical composition & functions (1 hr)

10. Microtubules & Microfilaments

Cytoskeletal agents – formation of mitotic apparatus – contractility and other function (only very brief account) (1 hr)

11. Mitochondria

Structure, chemical composition, enzymes in mitochondria, oxidative phosphorylation, respiratory chain, a brief note on chemiosmotic theory, role of mitochondria DNA, RNA & ribosomes, origin of mitochondria. (2 hrs)

12. Interphase nucleus

General structure, function, nucleocytoplasmic index, nuclear envelope nuclear pore complex, chromatin, nucleoplasm. Nucleolus-structure chemical composition nuclear cycle, nucleolar organizer functions. (4 hrs)

13. Number, structure, morphological variation, euchromatin & heterochromatin, Barr bodies, histones, nucleosomes, polytene chromosomes structure, puffs & bands, endomitosis & formation of polytene chromosomes, Lampbrush chromosomes – general structure & loops. (3 hrs)

14. Genetic Material.

Molecular structure of DNA & RNA double helical model of DNA. DNA replication. (2 hrs)

Unit IV. Cell division, Cell cycle.

Mitosis, Meiosis

Cell cycle

(4 hrs)

REFERENCES

1. De Robertis : Cell and Molecular Biology; Holt-Saunders.
2. Gupta : Cell and Molecular Biology; Rastogi Pub.

3. Karp : Cell Biology; McGraw Hill.
4. Powar : Cell Biology; Himalaya Publishing House
5. Verma & Agarwal: Cytology; S. Chand.

3C 03 PLY HUMAN PHYSIOLOGY -I

Lecture hours: **3** hours/week.

No of credits : **2**

Aims 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, Balanced diet, Malnutrition, Infant nutrition, breast feeding, effect of nutrition on early growth & development, Deficiency diseases; phase of secretion of gastric juices, structure of digestive glands and mode of secretion. Gastrointestinal hormones, Gastric movements, vomiting, acidity, Coordinating and control of digestive activity – Nervous & hormonal control. Coprophagy (symbiotic digestion) (10 hrs)

Unit II. Respiration

Definition, Mechanism of respiration, Physiology of gaseous exchange in lungs and tissues. Neurophysiological control of respiration, Oxyhaemoglobin curve. Effect of pH and, temperature on oxyhaemoglobin curve. Affinity of O₂ towards foetal haemoglobin and myoglobin, respiratory disturbances-mention apnoea, dyspnoea, hypoxia, hypo-& hypercapnia, asphyxia, carbon monoxide poisoning, Acclimatization- adaptations to high attitude, Physiological problems of diving mammals, O₂ toxicity. (10 hrs)

Unit III. Body fluids & Circulation.

Blood : Plasma (Composition & functions). Importance of analysis of blood ESR, anaemia, leucopenia, polycythemia, leukemia,

Lymph-lymphatic system & function, functions of spleen; Haemodynamic principle.

Cardiac rhythm – Pacemaker, Heart beat, pulse, Blood pressure. Conducting system of heart. Cardiac cycle and its control.

Clinical significance of hypertension, echocardiogram. Cardiovascular problems & disease – ASD, VSD, atherosclerosis, arteriosclerosis, Ischaemia, angina pectoris, myocardial infarction, coronary thrombosis, ventricular fibrillation, mitral stenosis, cardiac arrest. (10

hrs)

Unit IV. Excretion

Histology of human nephron & physiology of urine formation. Counter current mechanism. Hormonal control of renal function. Role of kidney in homeostasis-Renal & body fluid changes during water balance & salt balance. Mention kidney diseases. Clinical importance of analysis of human urine (albumin, glucose, blood & bile pigments. Stones in kidney and urinary tracts. Renal hypertension, nephrosis, nephritis, renal failure (mention oedema, acidosis and uraemia) Brief note on dialysis. (10 hrs)

Unit V. Nervous co-ordination

Types of neurons(unipolar, bipolar, multi[polar, myelinated and non myelinated nerve fibres) Giant nerve fibres.

Transmission of nerve impulse. Neurotransmitters. Sympathetic and Parasympathetic system. Motor & Sensory areas in brain. Physiology of vision, hearing and balance. (10 hrs)

Unit VI. Thermoregulation in man:

Cutaneous sense reception, mechanism of Thermal balancing – Nervous and Chemical control. Brief account of Pyrexia. (4 hrs)

4C 04 PLY HUMAN PHYSIOLOGY – II

Lecture hours: **3** hours/week

No of credits : **2**

Unit I. Locomotion

Skeletal joints & bones of limbs.

EM structure of myofibrils, & myofilaments

Sarcotubular system.

Contractile proteins

Electro chemical changes responsible for contraction & relaxation of muscles

Muscles twitch, tetanus, isometric & Isotonic contraction, Action potential Curve, All or None law, fatigue, rigor mortis. (10 hrs)

Unit II Reproduction & Development

Structure of ovary and testis.

Human menstrual cycle & hormonal control.

Structure of ovum & sperm.

Fertilization, cleavage, blastocyst formation, implantation. Placenta.

Hormonal control of pregnancy, gestation, parturition & lactation.

(15 hrs)

Unit III. Endocrine glands

Structure of endocrine glands, hormones & their functions. (15 hrs).

Unit IV. First aid

- Artificial respiration
First aid for – burns
 - snake bite
 - drowning
 - accidents (3 hrs)
- Unit V.** Physiological basis of ageing. (2 hrs.)

Unit VI. Public health & awareness

- Smoking & its effects
Alcoholism & its effects
Drug addiction & its effects
Cancer and carcinogens.
Sexually transmitted diseases.
Hepatitis, HIV, Communicative diseases
Water borne, airborne diseases (9 hrs.)

SEMINAR TOPICS. (Only for Internal Evaluation)

1. Formed elements of blood.
2. Structure of human heart.
3. Composition of urine
4. Structure of neuron.
5. Structure of synapse and neuromuscular junction.

REFERENCES.

1. Chatterjee CC : Human Physiology vol -I & II; Medical Allied Agency
2. Hoar W S : General and Comparative Physiology; Prentice Hall.
- 3.. Rastogi S C : Essentials of Animal Physiology; New Age Int'l Pub.
4. Park & J E Park : Social and Preventive Medicine.
5. Subramaniam.S, Madhavankutty K,
Singh S D. : Textbook of Human Physiology; S Chand.

4C04 PLY(P) PRACTICAL

Lecture hours: 2 hours/week

No. of credits: 4

- I. Micro techniques
 - Study of compound microscope
 - Camera Lucida
 - Stage and ocular micrometers
- II. 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)
 - Vital staining of rectal ciliates (demo)
 - Preparation a blood smear and differential count of WBC (Major)
- III. Biochemistry
 - Glucose estimation by colorimeter (Major)
 - Protein estimation by colorimeter (Major)
 - Paper chromatographic separation of amino acids (demo)
 - Qualitative tests for starch, sugar, protein and fat (2 tests each) – (Major)
- IV. Physiology
 - Effect of temp/pH on salivary amylase activity (Minor)
 - Effect of temp on heart beat of frog (demo)
 - Estimation of oxygen consumption by cockroach (respirometer) – (demo)
 - Detection of normal and abnormal constituents of urine (urea, glucose, albumen, bile pigments & blood) – (Major)
 - Determination of blood groups (A, B, AB, O & Rh) (Minor)
 - Determination of blood pressure using sphygmomanometer (demo)
- V. Histology
 - Study of permanent slides (any 5 items)
 - Epithelial tissues, muscles, cartilage, bone, nervous tissue etc.

PHYSIOLOGY COMPLEMENTARY

Scheme of Question Papers for Theory Examinations. (2 credit courses)

Time : 2 hours

Total weight : 16

- | | |
|---|----------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions each) | Weight 1 each |

Scheme of Practical Examinations (4 credit courses)

Time : 3hours

Total weight : 12

- | | |
|--|---------------|
| I. Major experiment (with written procedure) | Weight 4 |
| II Minor Experiment | Weight 3 |
| III Spot Items (5 items) | Weight 1 each |
- (Spot items may be chosen representing the different sections of the practical syllabus)

CONTINUOUS ASSESSMENT

For Theory Courses.

Test papers (minimum 2)	Weight :2
Assignment	Weight :1
Seminar/Viva	Weight :1
Attendance	Weight :1

(For attendance 75-79% -D; 80-84% C, 85-90% B and >90% A grade.)

For Practical Courses

Lab skills	Weight 1
Record	Weight 2
Viva	Weight 1
Attendance	Weight 1

Sd/-

P.A.Junaid,
Chairman,BOS Zoology(UG).



KANNUR UNIVERSITY

Course Structure

and

Syllabus

FOR

BIOLOGICAL TECHNIQUES

(COMPLEMENTARY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Complementary (Biological Techniques)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	1C01BGT	General Laboratory Techniques	2	2
2	II	2C02BGT	Laboratory Equipments and Techniques	2	2
3	III	3C03BGT	Preparation of Biological Specimens	3	2
4	IV	4C04BGT	Advanced Biological Techniques	3	2
5	IV	4C05BGT	Practical	2	4

General Regulations for Complementary Courses

(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 the practical course 4 credits, i.e. a total of 12 credits.

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 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.

1C 01BGT GENERAL LABORATORY TECHNIQUES

Lecture hours: 2 hours / week

No of credits : 2

Aim and Objective. The course is designed 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)

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 and 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 and 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)

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) and 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 bilirubin- any one method each; mention their clinical significance. (6 hrs).

4C 04BGT ADVANCED BIOLOGICAL TECHNIQUES:

Lecture hours: 3 hours/ week

No of credits : 2

Aims 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.

4C04BGT(P) PRACTICAL

Lecture hours: **2** hours/week

No. of credits: **4**

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-

- a) 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. (2 credit courses)

Time : 2 hours

Total weight : 16

- | | |
|---|----------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions each) | Weight 1 each |

Scheme of Practical Examinations (4 credit courses)

Time : 3hours

Total weight : 12

- | | |
|--|---------------|
| I. Major experiment (with written procedure) | Weight 4 |
| II Minor Experiment | Weight 3 |
| III Spot Items (5 items) | Weight 1 each |
- (Spot items may be chosen representing the different sections of the practical syllabus)

CONTINUOUS ASSESSMENT

For Theory Courses.

Test papers (minimum 2)	Weight :2
Assignment	Weight :1
Seminar/Viva	Weight :1
Attendance	Weight :1

(For attendance 75-79% -D; 80-84% C, 85-90% B and >90% A grade.)

For Practical Courses

Lab skills	Weight 1
Record	Weight 2
Viva	Weight 1
Attendance	Weight 1

Sd/-

P.A.Junaid,
Chairman,BOS Zoology(UG).

Course Structure

and

Syllabus

FOR

OPEN COURSES

(Zoology)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Open Courses(Zoology)

No	Semester	Course Code	Title of the course	Hours / Week	Credits
1	I	5D01ZLG	Health and Nutrition	2	2
2	II	5D02ZLG	Apiculture and Sericulture	2	2
3	III	6D01ZLG	Aquaculture	2	2
4	IV	6D02ZLG	Wildlife conservation and Management	2	2

5D 01 ZLG NUTRITION AND HEALTH

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 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. Food standards in India, Agmark and ISI. Common adulterants in milk and milk products, vegetable oils, pulses, coffee, tea and spices. Chemical, pesticide, bacterial and fungal contamination. (4 hrs)

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

REFERENCES.

1. S.Paul : A Text Book of Bionutrition; CBS Publishers, New Delhi.

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

5D 02 ZLG APICULTURE AND SERICULTURE

Lecture hours :2 hours/week

No of credits : 2

Aims 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 V 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. (4 hrs)

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.

6D 01 ZLG AQUACULTURE

Lecture hours : 2 hours / week

No. of credits : 2

Aims and Objectives. The course is designed to give a basic knowledge about this applied field of biology. Aquaculture is now seen as a very important field, which can provide much needed protein to an ever-growing world population. The objective of this course is to make students realize the potential of aquaculture, the basic techniques used in scientific farming of aquatic organisms and the various avenues for aquaculture.

Unit I. Brief history of aquaculture – scope and importance of culturing economically important aquatic organisms. (1 hr)

Unit II. Prawn culture – Common cultivable species (*Penaeus monodon*, *P. indicus*, *Macrobrachium rosenbergii*), their distribution, feeding habits, growth and breeding biology.

Traditional prawn filtration. Improved technology for prawn culture, seed production – eye stalk ablation. Common diseases. (6 hrs)

Unit III. Mussel culture – Mussel resources and their distribution along Kerala coast. Seed production – natural collection and artificial production. Induced spawning and rearing. Different culture methods, harvesting and processing.(4 hrs)

Unit IV. Pearl culture – Pearl resources and distribution in India. Induced pearl formation.

Culture techniques – preparation of nuclei, host implantation, rearing and harvesting. Types of pearls. (4 hrs)

Unit V. Pisciculture – Different types of fish ponds, Pond maintenance and improvement – liming, manuring (organic and inorganic fertilizers), feeding. Factors effecting fish culture – physical, chemical and biological factors.

Fresh water fish culture – cultivable species, major carps, exotic carps, gouramy, tilapia.

Composite fish culture, Paddy cum fish culture.Brackish water fish culture – *Mugil*, *Chanos*, *Etroplus*.Ornamental fish culture – Biology, Artificial breeding and rearing techniques of gold fish, cichlids etc. (15 hrs)

Unit VI. Fish preservation and processing – Chilling, freezing, freeze drying, salting, smoking, and canning.

Fish by products – fish meal, fish oil, fish protein concentrate, isinglass, fish manure, fin rays, chitin, chitosan, biochemical and pharmaceutical compounds.
(4 hrs)

Unit VII. Fish diseases – Bacterial, viral, fungal and other pathogens of fishes
(2 hrs)

REFERENCES.

1. Kurien and Sebastian : Prawn and Prawn Fisheries in India.
2. Sing VPP and Ramachandran : Fresh Water Fish Culture; ICAR, New Delhi.
3. Tripathi S D : Technique of Composite Fish Culture; IIT Karaghpur.
4. Govindan T K : Fish Processing Technology; Oxford and IBH.
5. James : Handbook on Aqua Farming: Molluscs; CMFRI, Kochi.
6. Alikunhi : Fish Culture in India.

6D 02 ZLG WILDLIFE CONSERVATION AND MANAGEMENT

Lecture hours: 2 hours / week

No. of credits: 2

Aims and Objectives. The course is designed as an open course for students of other programmes and is therefore aimed at providing the basic knowledge about the different aspects of wild life conservation and management, which has become a topic of wide discussion all over the world..

The main objective of this course is to create an awareness regarding the rich faunal diversity of our country, the threats faced by our fauna and also the measures that are being adopted to protect our wildlife.

UNIT I. Introduction (3hrs)

Definition of wildlife

History and tradition of conservation in India

Importance of conservation – Ecological, Educational, Scientific, Ethical, Commercial, Aesthetic, Recreational

UNIT II. Threats to Wildlife (5hrs)

Factors leading to endangered status – habitat destruction (qualitative and quantitative), isolation of population and inbreeding depression, hunting, competition. Wildlife trade.

Exotic species as threat to native species a) animals (Tilapia and African catfish as examples) b) plants (mention weeds like Lantana, Mikania).

Extinction. Examples of some extinct species and reasons for extinction – Cheetah, Dodo, Passenger pigeon.

UNIT 3. Conservation Methods (5 hrs)

In – situ Conservation (Protected Areas): Wildlife Sanctuaries, National parks, Biosphere Reserves.

Protected areas in Kerala.

Mention major forest types (Evergreen, Semi evergreen, MDF, DDF and Shoala forests)

Ex-situ conservation – Zoos – captive breeding; Modern zoo concept – safari, nocturnal zoo. Gene banks

UNIT III. Techniques for Wildlife Study (4hrs)

Study of animal evidence in the field (Animal signs) – impression of foot on soil, droppings, feeding signs, calls, scent mark, wallows, shelter.

Marking and tagging of animals. Radio telemetry, Remote sensing, Wildlife photography

UNIT IV. Wildlife policy and legislation (3 hrs)
Indian Board of Wildlife; Wildlife Protection Act 1972; CITES, IUCN; Red Data Book (Criteria for treating a species as endangered); Convention on Biodiversity.

UNIT 6. Conservation projects (3 hrs)
Project Tiger, Project elephant, Gir Lion sanctuary project, Crocodile breeding project

UNIT 7. Conservation organizations (3 hrs)
UNEP, UNDP, FAO, WWF, BNHS.
Mention Chipko movement and Silent Valley movement

Unit 8. Bionomics of Wild Animals (10 hrs)
Brief account of distribution, habitat and biology of the following endangered fauna

1. Mammals :
 - a) Primates: Slender Loris, Lion tailed macaque, Rhesus macaque, Nilgiri langur, Golden Langur
 - b) Carnivores: Tiger, Asiatic Lion, Panther, Leopard cat, Malabar civet, Palm civet.
 - c) Herbivores: Asian elephant, One horned rhinoceros, Wild buffalo, Nilgiri Tahr.
2. Birds: Jerdon's courser, Great Indian Bustard, Great Indian Hornbill, Pea fowl.
3. Reptiles: Green sea turtle, Gharial, Saltwater crocodile (*Crocodylus porosus*); Mugger crocodile (*Crocodylus palustris*); Rock python, Reticulate python, King cobra.
4. Amphibians: Malabar Tree Toad.
5. Fishes: Sharks (*Scoliodon*, *Zygaena*, *Pristis* –low fecundity and excess harvesting).
6. Invertebrates: Atlas moth, Southern birdwing.

REFERENCES

1. Nair S M : Endangered Animals of India and their Conservation; National Book Trust.
2. Rajesh Gopal: Fundamentals of Wildlife Management; Justice Home.
3. Aron N H : Wildlife Ecology; Freeman & Co.
4. Hosetti B B: Concept of Wildlife Management; Daya Pub. House.
5. VB Saharia: Wildlife in India; Nataraj Pub.

OPEN COURSES

**Aquaculture
Apiculture & Sericulture
Wildlife Conservation and Management
Health and Nutrition.**

Time : 2 hours
Total weight : 16

- | | |
|--|----------------|
| I. Essay question – (Answer 1 out of 2) | Weight 4. |
| II. Short essay - (Answer 3 out of 5) | Weight 2 each. |
| III. Short answers – 3 or 4 sentences –(Answer 4 out of 7) | Weight 1 each. |
| IV. One word answers/ fill in the blanks/ MCQ etc
(2 sets of 4 questions) | Weight 1 each |

CONTINUOUS ASESSMENT

Test papers (minimum 2)	Weight :2
Assignment	Weight :1
Seminar/Viva	Weight :1
Attendance	Weight :1
(75-79% D; 80-84% C, 85-90% B and >90% A grade.)	

**Sd/-
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