



FATIMA MATA NATIONAL COLLEGE
(AUTONOMOUS)
KOLLAM

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SCHEME & SYLLABUS OF
B.Sc. Zoology
2015 Admission Onwards

1. Le Pont Mirabeau - Guillaume Apollinaire
2. Déjeuner du Matin - Jacques Prévert
3. Le Pélican - Robert Desnos
4. Noel - Théophile Gautier
5. Chanson d'Automne - Paul Verlaine
6. Pour faire le portrait d'un oiseau - Jacques Prévert

Reference books :

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet
3. Cours de langue et de civilisation française Vol I (Mauger Bleu)
4. A bouquet of French poems (Polyglot house) by Prof. T.P Thamby

Core Course III

15UZ0341: Methodology and Perspectives of Zoology

No. of credits: 2

No. of instructional hours per week: 3

Aim:

To introduce the methodology and perspectives of Science in general so as to enable the students to systematically pursue Zoology in relation to other disciplines that come under the fabric of Science.

Objectives:

- To learn the fundamental characteristics of science as a human enterprise
- To understand how science works
- To study the application of scientific methods independently

Module I Introduction to Science: (8 hrs)

Science- Definition, Major branches (Physical, Life and Earth science) Fields of science in biology, Scientific Methods (observation, prediction, experiment, hypothesis, Consistency, theory) Creativity in Science, Scientific theory, Scientific Law, Scientific Revolution, Scientific naming

Scientific temper, Empirism, Hypothetic deductive and inductive models, Simulation and virtual testing, Evidences and Proofs of Impact of science in human life - Positive and negative aspects. Science for nation building, Types of knowledge: Practical, Theoretical and Scientific knowledge, Information.

Module II Life Sciences (4 hrs)

Definition of life and its manifestations, Biology - The science of life, History of Biology in ancient times, Landmarks in the progress of Biology, Branches of Biology Nature and scope of Zoology, Opportunities for further studies in Zoology, Websites for Zoology studies (Specify few such as web of life, Encyclopaedia of life, Species 2000 etc.,)

Module III Experimentation in science: (9hrs)

Design of experiments-observation, data collection, nature and types of data (typical examples), treatment of data, data interpretation, significance of statistical tools in data interpretation. Experimentation: Selection of controls, Observational requirements, Instrumental requirements. Types of experiments: Experiment to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments.

Observations: Direct and indirect observations, Controlled and uncontrolled observations, Human and machine observations.

Sampling methods: Qualitative sample, Quantitative sample, Random sample, Non random samples. Bio ethics in science: (brief account only), publications and patents, Ethics in research, plagiarism

Module IV Data collection and presentation : (16 Hrs)

Introduction to Biostatistics: Variable and attribute; Population vs. sample; Census vs. sample survey; Arrangement of data; Frequency distribution. Graphical presentation of data: Line diagram; Bar diagram; Pie chart; Histogram.

Measures of central tendency: Arithmetic mean; Mode; Median.

Measures of dispersion: Variance; Standard deviation; Standard error of mean; Standard score.

Testing of hypothesis and goodness of fit: Null hypothesis, Level of significance, Probability,

Normal distribution, Error of inference, Student's t-test, Chi-square test.

Module V Tools and Techniques in Biology**(9Hrs)**

Scientific Drawing – Purpose and principles, Basic understanding on the principle and uses of the following: I) Microscopy a) Light microscopy ,b)Compound microscope ,c) Phase contract microscope, d) Dark field microscopy ,e) Fluorescence microscopy, f) Polarization microscopy ,g) Video microscopy ,h) Camera Lucida, II) Electron microscopy , a)Scanning (SEM), b) Transmission (TEM) , c)STEM ; Confocal microscope.

Instrumentation Techniques : PH meter, Separation Techniques (Centrifuges, Chromatography, Electrophoresis) Analytical Techniques (Colorimeter, Spectro photometer, X - ray Crystallography)

Module VI Nature and scope of Zoology:**(8 Hrs)**

Branches of Zoology, Research and career options in Zoology, Institutes of Zoological and Scientific importance in India- Location, major achievements and present activities (academic and scientific) [Zoological Survey of India, Wild life institute of India, Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology, Rajiv Gandhi Centre for Biotechnology, ICAR & CSIR,NIO,NIST, Centre for Cellular and Molecular Biology, National, Bioinformatics Centre and Library, Indian Institute of Sciences, Kerala Forest Research Institute, Indian Institute of Technologies, National Centre for Biological Sciences (NCBS), Ashoka Trust for Research in Ecology and the Environment, Jawaharlal Nehru Centre for Advanced Scientific Research, Stem Cell Institute, Institute of Genomics and Integrative Biology, National Institute of Immunology, Centre for DNA Fingerprinting and Diagnostics, Central Drug Research Institute, JNTBGRI , NCBS.

References

- 1 Gieryn, T.F. (1999) Cultural Boundaries of Science. University of Chicago press.
- 2 Graeme. D. Ruxton and Nick Colegrave. (2006) Experimental design for the life science, 2nd edition. Oxford University press.
- 3 Bowler Peter, J. and Iwan Rhys Morus (2005) Making modern Science: A Historical Survey. University of Chicago Press, Chicago.
- 4 Ernest Mayr (1982) The growth of Biological Thought: Diversity, Evolution and Inheritance Published by Harvard University Press.
- 5 Aggarwal S.K. (2009) Foundation Course in Biology – Students Edition.

- 6 Killick H.J. (1971) Beginning Ecology- Ibadan University Press.
- 7 Debbie Holmes, Peter Moody and Diana Dine (2006) Research Methods for the Biosciences. International student Edition. Oxford University Press.
- 8 Marie M. (2005) Animal Bioethics Principles and Teaching Methods Wageningen Academic Publishers.

Complementary Course V**15UCH331.4: ORGANIC AND BIOPHYSICAL CHEMISTRY I****No. of credits: 3****No. of instructional hours per week: 5****Module I – Mechanisms in organic substitution reactions (9 hrs)**

Electron displacement in organic compounds – Inductive, electromeric and mesomeric effects, influence of inductive effect on acidic and basic properties of organic compounds, hyperconjugation and steric effect. Reaction mechanism - Bond fission, rate determining step, nucleophilic substitution of alkyl halides, SN_1 , SN_2 reactions. Effect of structure on reactivity as illustrated by methyl, ethyl, isopropyl and tertiary butyl groups. Electrophilic addition to ethene and propene – Markownikoff's rule, free radical addition, peroxide effect.

Module II – Stereochemistry (9 hrs)

Optical isomerism, chirality, racemisation and resolution, relative and absolute configuration, asymmetric synthesis, optical isomerism due to restricted rotation. Geometrical isomerism, E and Z nomenclature. Aldoximes and ketoximes. Rotational isomerism. Rotation about carbon – carbon single bond, conformation of ethane, propane, butane cyclohexane, axial and equatorial bonds.

Module III – Carbohydrates (9 Hrs)

Classification, configuration, glyceraldehyde, erythrose, threose, ribose, 2-deoxy ribose, arabinose, glucose, fructose and mannose. Pyranoside structures of glucose and fructose, furanoside structure of fructose

**Language Course IX (Additional Language IV)
15UFR411.1: Culture and Civilization**

No. of credits: 4

No. of instructional hours per week: 5

AIMS:

This course is intended to familiarize the students with French culture and civilization with specific reference to Kerala culture.

OBJECTIVES:

1. To acquaint the students with French culture and civilization.
2. To comprehend, compare and understand better the civilization of one's native place.

SYLLABUS:

NAME OF TEXT: CONNEXIONS – Niveau 1 By Régine Mérieux and Yves Loiseau

Publisher : Didier

Module 4 : Se situer dans le temps

Unit 10 : Au jour le jour

Unit 11 : Roman

Unit 12 : Je te retrouverai

Articles on Kerala culture with special emphasis on festivals, tourist centres and cuisine.

Reference books :

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet
3. Cours de langue et de civilisation française Vol I (Mauger Bleu)

**Core Course IV
15UZO441: General Informatics & Bioinformatics**

No. of credits: 3

No. of instructional hours per week: 3

Aim of the course

To expand basic informatics skill and attitudes relevant to the emerging society and also to equip the student to effectively utilize the digital knowledge resources for the study of Zoology

Objectives of the course

- + To review the basic concepts and functional knowledge in the field of informatics
- + To create awareness about nature of the emerging digital knowledge society
- + To create awareness about social issues and concerns in the use of digital technology
- + To learn the nature, application and scope of Bioinformatics

General Informatics

34 hrs

Module I

4hrs

Introduction- Information systems- software ,Hardware & Data, Information Technology in Industry, Medicine ,Education, Research and Training, Entertainment & Arts ,Science & Engineering –IT in Global Positioning System(GPS),GIS

Module II: Internet and Networking

12hrs

Introduction LAN &WAN- The World Wide Web(WWW)-Browsing the web search engine –data mining Website related to the field of biology, Retrieval of information, Multimedia in biology, Application of Net work-Email,browsing,Chating(demonstration),Internet (demonstration).Basic concepts of IPR, copyrights and patents, Bio piracy, plagiarism, introduction to use of IT in teaching and learning, case study of educational softwares. Academic services – INFLIBNET, NICNET, BRNET

Module III**12hrs**

Social Informatics : IT and society – Issues and Concerns – digital divide, IT and development, new opportunities and new threats, cyber ethics, cyber crime, security, privacy issues, cyber addictions, information overload; health issues – guide lines for proper usage of computers, internet and mobile phones, Digital , Traditional Knowledge library of India.

Module IV**8 Hrs**

IT @ Service of society, e-governance application and state level, over view of IT application in medicine, Healthcare, Business, Commerce, Industry, Defence, Law, Crime detection, Publishing, Communication, Resource management, Weather forecasting , Education, Film and media

Bioinformatics**16hrs****Module IV****9 hrs**

Definition, Nature & Scope of Bioinformatics - Contrast between Bioinformatics and Computational Biology; Key Bio-sequences in Molecular Biology - DNA, RNA and Amino acid sequences - Popular Databases in Bioinformatics - NCBI, DDJB, PDB, OMIM; BLAST & FASTA sequence file formats, Approach of Comparative Biology based on sequence comparison - The basic idea of sequence comparison (algorithms not required) - idea of scoring matrices

Module V**9hrs**

The Blast search engine - important features - Idea of Multiple sequence alignment – Proteomics: Basic ideas of Protein Structure prediction- Concept of Homology Modeling- Idea of Molecular Phylogenetics - advantages and computational procedure (only description of use of a package such as Phylip)- Basic concepts of computer Aided Drug Discovery- General description of drug discovery pipeline- concept of Personalized medicine;

Bioinformatics tools: (i)Molecular Visualization Software - Rasmol (Basic features only) - (ii) ORF finding (iii) gene finding, (iii) BLAST (iv) Hydrophobicity Prediction (v) Single Nucleotide Polymorphism (SNP) prediction using GENSNIIP

References

- 1 . Alan Evans, Leslie Lamport et.al. Informatics Technology in action. Pearson, Delhi, Chennai and Chandigarh.

- 2 Alan Evans, Kendal Martin et.al. Technology in Action, Pearson Prentice Hall
- 3 . Alexis & Mathews Leon, Fundamentals of Information Technology, Leon Vikas, ISBN 08125907890
- 4 . Arthur M. Lesk. Introduction to Bioinformatics. Oxford publishers.
- 5 . Attwood, T.K., Parry, D. J. (2006) Introduction to Bioinformatics. SmithPearson Education Ltd. London.
- 6 . Barbara Wilson, Information Technology: The Basics, Thomson Learning
- 7 . Bryan Bergeron M.D. (2003). Bioinformatics Computing. Pearson Education Ltd. London
- 8 . Claverie & Notredame. (2003). Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd.
- 9 . Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education
- 10 George Beekman, Eugene Rathswohl, Computer Confluence, Pearson Education, ISBN 0-13-066185-6
11. Greg Perry, SAMS Teach Yourself Open Office. Org, SAMS , ISBN 0672326183
- 12 Jean M. Claverie and Notredam. Bioinformatics, a beginners Guide.
- 13 John Ray, 10 Minute Guide to Linux, PHI, ISBN 81-203-1549-9,
- 14 Mani, K. and Vijayaraj, N. Bioinformatics, A practical Approach Aparna Publication Coimbatore.
- 15 Mount, D. Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
- 16 Ramesh Bangia, Learning Computer Fundamentals, Khanna book Publishers, ISBN 818752252b,
- 17 Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.
- 18 Xiong, J. (2007) Essential bioinformatics. 2nd edition. Cambridge University press.
- 19 Westhead, D.R., Parish, J.H. and Twyman, R.M. (2003) Bioinformatics. Viva Books Private Limited, NewDelh.

- publications. Jaipur
17. Singh S.P. 1999. Advances in horticulture and forestry. Scientific public. Jodhpur.
 18. Sharma. V.K. 2004. Advances in horticulture, strategies production, plant protection and value addition-Deep and Deep Public. Delhi.
 19. Gupta P.K 2014-Elements of Biotechnology (Rastogi Publications).
 17. Ignacimuthu S.J. 1996-Applied Plant Biotechnology (Tata Mc Graw Hill)
 18. Sobti RC and Suparna S Pachauri 2009, Essentials of Biotechnology, Ane Books Pvt. Ltd.
 19. Victoriano Valpuesta 2004, Fruit and Vegetable Biotechnology, CRC Press. New York. Ane Books Pvt. Ltd
 20. Kumar H.D. 2000-Molecular Biology & Biotechnology (Vikas publishing).
 21. Misra S P (2009) Plant tissue culture , Ane Book Pvt. Ltd.

SEMESTER V

Core Course VI

15UZO541: Cell and Molecular Biology

No. of credits: 4

No. of instructional hours per week: 5

Aim

- * To educate the student on the basic structure and function of a cell and the principles of molecular biology and gene manipulation.

Objectives of the course

- * To study the ultra-structure of prokaryotic and eukaryotic cells.
- * To obtain a broad concept of gene expression and regulation.

Module I

(38 Hrs)

CELL and CELL ORGANELLES –Historical perspective, Ultra structural organization and functions of the following. Cell and its components: Basic types of cells- prokaryotic and eukaryotic, nature and comparison (self study) Ultra structural organization and functions: Plasma membrane- ultra structure- fluid mosaic model , functions of plasma membrane, trans-membrane transport. Cell communication- cell signaling and signal transduction, basic elements involved. Mitochondria- structure, functions, mention oxidative phosphorylation and electro transport chain. Endoplasmic reticulum - morphology, types, functions and formation. Golgi bodies - morphology, types, functions (role in secretion) and formation. Lysosomes- morphology, mention major groups of enzymes, classification, polymorphism and functions. Microbodies - morphology, major enzymes, peroxisomes and glyoxisomes functions. Ribosomes - different types, subunits, functions. Proteosomes - structure, ubiquitin - tagged protein degradation. Centrioles and basal bodies- structure and functions. Cytoskeleton- microtubules, microfilaments and intermediate filaments- examples and functions. interphase nucleus - gross structure and functions; nuclear envelope- pores and pore complexes;

nuclear lamina, formation of NE; nucleoplasm- nature and importance. Nucleolus - structure, nucleolar cycle, nucleolar organizer and functions. Chromatin - euchromatin and heterochromatin, nucleosomes, unit fibre, solenoid fibre, and higher order of organization, condensation and coiling. Chromosome - structure of a typical metaphase chromosome; giant chromosomes- polytene chromosomes, lamp brush chromosomes; endomitosis.

Module II **8hrs**
 Cell Communications: Cell surface receptors, Cell signaling and signal transduction. Cell Division: cell cycle- G_1 , S, G_2 , and M phases (mention G_0 , and D_0 stages and their significances); amitosis (brief account only). **Mitosis (self study). Meiosis:** description of all stages, synaptonemal complex, significance

Module III **2hrs**
 Biology of cancer: characteristics of cancer cells, dedifferentiation of cancer cells, theories of cancer, carcinogenesis, oncogenes and tumor suppressor genes

Module IV **2hrs**
 Aging: cellular and other changes, apoptosis, causes of aging, mention free radicals and superoxide dismutase (SOD).

Molecular Biology **40 hrs**

Module VI **16hrs**
Introduction: history, development and scope.

Nature of genetic material: search for the genetic material, Griffith's experiment, transformation, contributions of Avery, MacLeod and McCarty, Conrat & Stern's experiment with TMV, Hershey & Chase's experiment, transduction. Composition and structure of nucleic acids - Watson - Crick model of DNA, clover leaf model of tRNA, different types of DNA and RNA; DNA replication in prokaryotes and eukaryotes - Semi-conservative method, Messelson & Stahl experiment, replication machinery and mechanism; modification and repair of DNA.

Module VII **15hrs**
 Gene Expression: contributions of Garrod, one gene – one enzyme hypothesis, one gene one polypeptide hypothesis, central dogma of Molecular Biology, central dogma reverse, colinearity of genes and gene products. Genetic code - deciphering / cracking the GC, characteristics

of GC, codon assignment and wobble hypothesis. Mention contributions of Nirenberg and his associates, Khorana and his associates.

Transcription of RNAs - RNA polymerases, transcription factors, mechanism of transcription, post-transcriptional modifications of mRNA, rRNA and tRNA, reverse transcription, translation – machinery and mechanism; post translational modification of proteins; role of chaperones in protein normal folding and protection

Module VIII **5hrs**
 Gene regulation: in prokaryotes (inducible and repressive systems); operon concept – Lac operon and Trp operon

Module IX **4hrs**
 Bacterial Recombination: transformation, conjugation and transduction (general and specialized transduction)

REFERENCES

- ❖ Alberts B et al. Molecular Biology of the cell. Garland pubg .Inc; New York.
- ❖ Beker W M et al (2004). The World of cell. Pearson Edn ; Singapore.
- ❖ Bhaskaran K K & Biju kumar A. Cell Biology, Genetics & Molecular Biology. Manjusha.
- ❖ Darnell et al .Molecular Cell Biology. Scientific American Book.
- ❖ De Roberties ED etal. Cell and Molecular Biology TMH.
- ❖ Karp G (2005). Cell and Molecular Biology 4 th ed, John Wiley & Sons, Inc.
- ❖ Klein smith L J& Kish VM (1995). Principles of Cell and Molecular Biology. 2 Ed, Harper Collins College pubs..
- ❖ Varma P S & Agarwal VK . Cytology . S Chand & Co.
- ❖ Vijayakumaran Nair K& Jayaprakash M. Cell Biology, Genetics, Molecular Biology. Academica, TVM.
- ❖ Alberts, B. et al. Molecular Biology of the Cell. Garland Pubg. Inc., New York
- ❖ Beker, W. M. et. al. (2004) The World of Cell. Pearson Edn., Singapore
- ❖ Bhaskaran, K. K. & Biju Kumar, A. Cell Biology, Genetics & Molecular Biology. Manjusha

- ✧ Darnell, J. et al. Molecular Cell Biology. Scientific American Book
- ✧ De Robertis, E. D. P. et al. Cell and Molecular Biology TMH
- ✧ Freifelder, D. Molecular Biology. Narosa Publishing House, N. D.
- ✧ Karp G. (2005). Cell and Molecular Biology. 4 e, John Wiley & Sons, Inc.
- ✧ Kleinsmith, L. J. & Kish, V. M. (1995). Principles of Cell and Molecular Biology. 2e, Harper Collins College Pubs
- ✧ Micklos, D. A. & Freyer, G. A. (1990). DNA Science. Cold-Spring Harbour Lab Press.
- ✧ Primrose, S. B. et al. (2000). Principles of Gene Manipulation, 6e, Blackwell Science.
- ✧ Sadava, D. E. Cell Biology. Jones & Bartlett Publishers, London
- ✧ Sheeler, P. and Bianchi D. E. Cell Biology –Structure, Biochemistry and Functions.
- ✧ Snustad & Simons. (2003) Principles of Genetics. 3e, J W & S
- ✧ Strachan, I. & Read, A. P. (1999) Human Molecular Genetics. JW & S Veera Bala Rastogi. (2006). Fundamentals of Molecular Biology 1 e. Ane Books, India
- ✧ Verma, P. S. & Agarwal, V. K. Cytology. S. Chand & Co.
- ✧ Vijayakumaran Nair, K. & Jayaprakash, M. Cell Biology, Genetics, Molecular Biology. Academica, TVM.
- ✧ Vijg J. Aging of the Genome, Oxford University Press
- ✧ Watson, J.D. et al., Molecular Biology of the Gene, 4e, Benjamin Cummings

Core Course VII

15UZ0542: Genetics and Biotechnology

No. of credits: 4

No. of instructional hours per week: 4

Aim of the course

To educate the students on the underlying genetic mechanism operating in man and state of the art bio-techniques

Objectives of the course

- + To learn the mechanism of crossing over and inheritance patterns in man.
- + To understand the principles and techniques involved in DNA technology and get an overview of modern techniques like PCR, Hybridoma technology, gene therapy and Human cloning

Genetics

37hrs

Module 1

[8hrs]

Introduction, Mendel and his experiments, Correlation between Mendel's theory and chromosome behaviour (self study); genetic terminology- gene, allele, genotype, phenotype, genome; wild type and mutant type, test cross, back cross and reciprocal cross. Interaction of genes: Allelic, incomplete dominance, lethal and co-dominance, non-allelic, complementary gene action (self study); Co-epistasis (comb pattern in fowl), dominant (feather coat) and recessive (coat colour), polygenic action (skin colour), pleiotropism (one example). Multiple alleles- ABO Blood group system, Rh group and its inheritance.

Module II

8hrs

Linkage and crossing over: Linked genes, linkage groups, chromosome, theory of linkage, theory of chromosomal crossing over, factors affecting crossing over and its significance. Chromosome mapping (brief account only).

Sex Linkage: Characteristics of sex linked inheritance, sex linked inheritance of man (colour blindness and haemophilia), incompletely sex linked genes, holandric genes, sex limited genes and sex influenced genes.

Module III

8hrs

Sex Determination: Environmental factors on sex determination, mention genic balance theory, chromosomal mechanism of sex determination, (XX-XY, XX-XO, ZZ-ZW), sex determination in man, role of Y chromosome, Barr bodies, dosage compensation and Lyon hypothesis. Chromosome mosaicism. Mention inter sex, gynandromorph and hermaphrodite.

Module IV

6hrs

Mutation: Types of mutations - somatic, germinal, spontaneous, induced, autosomal and allosomal, euploidy and aneuploidy. Chromosomal mutation, Gene mutation, molecular basis of mutation, Factors causing mutation.

Module V

3hrs

Cytoplasmic inheritance: Mitochondrial DNA, kappa particles in *paramecium*, maternal effects in *Drosophila*.

Module VI

4hrs

Human Genetics: Karyotyping, normal chromosome complement, pedigree analysis, chromosomal anomalies in man, autosomal (eg. Down syndrome, Edwards syndrome), allosomal (eg. Klinefelters syndrome, Turner's syndrome) Biochemical genetics: Human biochemical genetics, biochemical pathway of phenyl alanine, tyrosine metabolism in normal man. Disorders-Phenylketonuria, Alkaptonuria, Tyrosinosis and Albinism.

Biotechnology

35 hrs

Module VII

8hrs

Introduction-Scope of biotechnology, Branches of biotechnology

Genetic engineering and recombinant DNA technology: History, Procedure of genetic engineering, (restriction endonucleases, ligases), major steps in cutting and joining of DNA, Vectors - plasmids, Cosmid, bacteriophage; probes, linkers, host cells, Method of recombinant DNA formation- transformation, transfection and non bacterial transformation.

Module VIII

5hrs

Genomic library, construction of genomic library and cDNA library, Polymerase Chain Reaction-basic steps and applications of PCR, DNA sequencing (Sanger method, Automated sequencing), patenting DNA sequences.

Module IX

5hrs

Blotting Techniques: Southern, Northern and Western blotting, DNA fingerprinting.

Module X

5hrs

Human Genome Project, hybridoma technology and monoclonal antibodies; gene transfer techniques (chemical treatment, electroporation, lipofection, microinjection, retro viral vector method, embryonic stem cell method and shot gun method); transgenic microbes, plants and animals.

Module XI

3hrs

Gene therapy: somatic gene therapy and germ line gene therapy; gene doping and its implications; DNA vaccines; Human cloning –therapeutic and reproductive cloning.

Module x

9hrs

Environmental biotechnology: Biotechnological methods of pollution detection, bioremediation, biotechnology and biodegradation, genetically engineered microbes in bio-treatment of waste, eco-friendly bioproducts for environmental health, bio-piracy, bio-pesticides and bio-fertilizers, organic farming and its merits. Green chemistry – designing a Green synthesis, basic principles of Green chemistry.

References

Genetics

- ▲ Benjamin Lewin. (2004). Genes VIII. Oxford University press, N.Y.
- ▲ Daniel J Fairbanks and W. Ralph Brooks. (1999) Genetics – principles and analysis. Jones and Bartlett Publishers, Massachusetts.
- ▲ Peter Snustad, D. and Michael, J. (2000). Principles of Genetics. John Wiley and Sons, Inc., N. Y
- ▲ Robert J. Brooker. (1999) Genetics-analysis and principles. Addison-Wesley, Menlo Park, California.
- ▲ Shukla. R.S and P.S.Chandel(2007) Cytogenetics, Evolution and Biostatistics. S.Chand & Company.
- ▲ Snustad and Simon (2003) Principles of genetics. 3e. John Wiley and Sons, New York.

- ▲ Strachan, I. and Read. (1999) Human molecular genetics. John Wiley and Sons, New York.

Biotechnology

- ▲ Bernard R. Glick and Jack J. Pasternak. (2003). Molecular biology. ASM Press, Washington DC
- ▲ Brown, T. A. (1995). Gene cloning. Chapman and Hall, London
- ▲ Daniel J. Fairbanks. (1999). Genetics. Ralph Brooks, Cole Publishing Company
- ▲ George M Malasinski and David Freifelder (1988) Essentials of Molecular Biology. Jones and Bartlett Publishers, London.
- ▲ Gerald Karp (1996). Cell and Molecular Biology - Concepts and Experiments. JohnWiley & sons, Inc. N.Y.
- ▲ Kingsman, S. M. and A.J.Kingsman. (1988). Genetic Engineering. Blackwell Scientific Publications, London
- ▲ MaxLevitan. (1988). Text Book of Human Genetics. Oxford university Press, N.Y.
- ▲ Old, R. W. and Primrose, S.B. (1994). Principles of Gene Manipulation. Blackwell Scientific Publications London
- ▲ Peter J Russell (1998) Genetics. The Benjamin cummines publishing co., Inc. Menlo Park, California.
- ▲ Taylor. D. J., Green, N. P. O. and Stout, G. W. (2008). Biological science. 3rd edition. Cambridge University press.
- ▲ William H Elliott and Daphne C Elliott. (1997). Biochemistry and Molecular Biology. Oxford University Press, N. Y.

Core Course VIII

15UZO543: Microbiology and Immunology

No. of credits: 4

No. of instructional hours per week: 4

Aim of the course

To update the student on the scope and importance of clinical immunology and create an awareness about the inherent dangers of microbes

Objectives of the course

- ◆ To enable the student to understand the principles and mechanisms of immunology
- ◆ To learn the malfunctioning and disorders of the immune system
- ◆ To get a broad understanding of microbes and their economic importance with special reference to pathogenic forms.

Microbiology

35hrs

Module I

14hrs

Introduction: history, development and scope Importance of microbes in various ways- beneficial, harmful, ecological and others.

Classification of microbes/ particles: broad classification- viruses- different groups, examples; mention viroids and prions, Mycoplasmas, Rickettsiae and Chlamydiae; Bacteria: 1. Archaea – significance of extreme life forms(Methanoarchaea , extreme halophiles and thermophiles); Eubacteria (=Bacteria) Major groups of Eubacteria: Bergey's system of classification; modern methods of classification of Eubacteria (outline only with familiar examples)- Nonphotosynthetic proteobacteria:- (Fermentative Rods and Vibrios) ex. Vibrio, Pasteurella (oxidative rods and cocci) eg. Pseudomonas, Azotobacter, Rhizobium; Chemo-lithotrophic bacteria:- eg. nitrifying, sulphur and iron bacteria; Firmicutes (eg. Staphylococcus) and Actinobacteria (Coryneform bacteria); Phototrophic bacteria (Cyanobacteria); Algae-(details not expected) Protista- different groups- examples: Plasmodium, Giardia;

Module II **9hrs**
Applied microbiology: various fields: emphasis on environmental, agricultural, medical, biotechnological, industrial and strategic fields.

Module III **2 Hrs**
Techniques in Microbiology- Replica plating, Staining, Streaking, Agar diffusion test, Fermentation test – tube (aerobic & anaerobic).

Module IV **10hrs**
Symbiotic microbes: microbes with other microbes, microbes with plants microbes with animals; microbe – human host interactions, normal human microbiota of various organs- mention any 3 examples, pathogenic microbes – mention any 3 examples, microbial toxins – mention any 2 examples. Microbial diseases in man (of skin, respiratory system etc.)- viral – chicken pox, measles, cold, herpes, hepatitis, poliomyelitis; bacterial – diphtheria, pneumonia, leprosy, ornithosis; fungal – aspergillosis, candidiasis and others – malaria

Immunology **37hrs**

Module IV **2hrs**
Introduction, history, development and scope.

Module V **3hrs**
Immunity: definition, classification of immunity. Innate (non-specific)- species, racial and individual IM with examples, acquired (specific)- active IM (natural and artificial) with examples, passive IM (natural and artificial) examples.

Module VI **6hrs**
Immune system: organs and tissues of the immune system. Primary (central) - thymus, bone marrow, bursa of Fabricii; secondary (peripheral)- spleen, lymph nodes, MALT etc. Cells lymphocytes – T cells and B cells – formation, development and maturation; plasma cells and null cells – natural killer cells, killer cells, lymphokine - activated killer cells; phagocytes / macrophages; antigen presenting cells – macrophages, B-lymphocytes, dendrite cells, Langerhans cells; follicular dendrite cells, neutrophils, eosinophils, basophils, mast cells. Mitogens – mention only

Module VII **14hrs**
Antigens (immunogens) (Ag): definition, complete antigens, haptens, antigenic determinants or epitopes; antibodies (Immoglobulins)- definition, general structure of Ig, Ig determinants, physico-chemical properties of Ig, classes of Ig- G, M, A, D, E; mention abnormal Igs; antigen – antibody reactions- mechanism (mention zone phenomenon), precipitation reactions, agglutination reactions, complement fixation, neutralization, opsonisation (brief accounts only) Complement system: definition, general features, major histocompatibility complex (MHC) (brief account only). Immune response- definition, types of immune responses- humoral immune response (antigen mediated immunity - AMI) and cellular immune response (cell mediated immunity - CMI)in detail .

Module VIII **12hrs**
Hyper sensitivity / allergy: definitions, classification- types I, II and III (Brief accounts only); immuno deficiency diseases (ID)- definition, primary IDs, disorders of immune mechanism (humoral, cellular and combined IDs), disorders of complements, disorders of phagocytosis, mention one example each, secondary IDs - mention example, an account of Acquired Immune Deficiency Syndrome (AIDS); Auto immunity-definition, mechanism, mention AI diseases; transplantation immunity-definition, classification of transplants, graft versus host reactions; graft rejection, mechanism of graft rejection, factors affecting graft survival; Immunisation and vaccination- definitions, vaccines; types of immunization- active immunization- killed and live attenuated vaccines, microbial extracts, vaccine conjugates, toxoids, recombinant vaccines, DNA vaccines; passive immunization- pooled normal human Igs, specific Igs (hyper antisera); combined immunization

References

- ★ Ananthanarayanan, R. & Panikar, J.: TB of Microbiology. Orient Longman
- ★ Chakraborty, P. A.: A TB of Microbiology. New Central Book Agency, Kolkata
- ★ Chapel, H. et al.:Essentials of Clinical immunology. 5 e., '06. Ane Books, India.
- ★ Gandhi. Microbiology and Immunology notes and cases – Blackwell Publishing.

- ★ Goldsby et al.: Immunology. 5 e., 2003. W H Freeman
- ★ Heritage, J. et. al. Introductory Microbiology. Cambridge University Press.
- ★ Hyda, R. M.: NMS Immunology. B. I. Waverly
- ★ Johnson, T. R. & Case, C. L.: Lab. Expts. In Microbiology. 2003. Addison Wesley.
- ★ Joshi, K. R.: Immunology. Agro Bios
- ★ Krieg, N. R. & Holt, J. G. Bergey's Manual of Systematic Bacteriology. Vols 1 – 4. (1984-89). Williams & Wilkins, Baltimore
- ★ Kuby, J.: Immunology. W. H. Freeman
- ★ Lydyard, P. M. et al.: Instant Notes in Immunology. Viva Books
- ★ Nagoaba, B. S. & Vedpathak, D. V.: TB of Immunology. '03. Paras Pub., Hyderabad
- ★ Pelczar, M. J., Reid, R. D. and Chan, E. C. S.: Microbiology, TMH.
- ★ Perry, J. J., Stanley, J. T. & Lory, S.: Microbial Life. 2002. Sinaeur Associates.
- ★ Playfair, J.H. L. et al.: Medical Immunology for students. Churchill Livingstone, UK
- ★ Rajeshwar Reddy, K. TB of Immunology. 2007. AITBS Publishers, India
- ★ Rao, A. S. Introduction to Microbiology, Prentice Hall of India.
- ★ Roitt, I. M.: Essential Immunology. Blackwell Scientific
- ★ Schiegel, H. G. General Microbiology, Cambridge University Press.
- ★ Shetty & Nandini: Immunology. Wiley Eastern
- ★ Talwar, G. P.: A Handbook of Practical Immunology. Vikas, New Delhi
- ★ Todd. Lecture notes on Immunology. Iowa State Uty. Press. Ane Books India
- ★ Tortora, G. et. al.: Microbiology- An Introduction. 2003. Addison Wesley
- ★ Wise, D. J. & Carter, G. R. Immunology. Iowa State Uty. Press. Ane Books India

Core Course IX 15UZO544: Practical II

No. of credits: 3

No. of instructional hours per week:

Aim of the course

To expertise the student to carry out routine hematological and microbiological techniques

Objectives of the course

- 1) To prepare and observe chromosomal arrangements during cell division
- 2) To study chromosomal aberrations in man
- 3) To gain abroad knowledge of conventional biotechnological procedures
- 4) To perform routine blood analysis.

Cell Biology and Molecular Biology

1. Staining of prokaryotic cells: (a) *Lactobacillus* from curd (b) Nitrogen fixing bacteria (*Rhizobium*) from root nodules of legumes
2. Staining of eukaryotic cells: buccal epithelial cells (observe Barr body)
3. Study of muscle cells - Insect
4. Study of cell organelles using models/slides
5. Mitosis: stages in onion (*Allium cepa*) root meristem (squash preparation)
6. Calculation of mitotic index and metaphase index in root meristem of *Allium cepa*
7. Meiosis: stages in testis of grass hopper (demonstration only)
8. Giant chromosomes in Diptera: (*Drosophila Chironomus* larvae) salivary gland cells (demonstration only)
9. Study of Cancer cells using permanent slides.

Genetics

1. Study of monohybrid cross using coloured beads.
2. Study of normal chromosome complement and karyotype of man.
3. Study of genetic syndromes and abnormal karyotypes of man (Klinefelter's syndrome, Turner's syndrome, Down syndrome and Edward syndrome).
4. Study of Barr body and its significance (in stained buccal epithelial cells).
5. Construction of Pedigree chart.
6. Study of ABO Blood groups and Rh Factor in humans
7. Study of phenotypic characters of male and female Drosophila.

Biotechnology

1. Extraction of DNA by diphenylamine method.
2. Polymerase Chain Reaction
3. Southern blotting and Northern blotting
4. Electrophoretic separation of proteins
(Demonstration in the Department / Visit to research institute / CD display)

Microbiology & Immunology

1. Gram staining
2. Collection of blood, and study of the effect of anticoagulant.
3. Total and differential count of blood cells.
4. Microscopic observation and study of stained preparations of any two microbes

Open Course

15UZO551.1: Human Health and Sex Education

No. of credits: 2

No. of instructional hours per week: 3

Aim of the course

To redress problem associated with health and sex thereby promoting fitness and well being.

Objectives of the course

- ♦ To make the student understand the importance of good health.
- ♦ To educate the student on clean sexual habits thereby warding off sexually transmitted diseases.

Module I

14hrs

Introduction to health, health as a state of wellbeing, health awareness, Immunity/immunization and vaccination, factors affecting health- food, balanced diet, food supplements, pathogens, pollution, sleep, exercise and stress. Physical health, reproductive health, adolescence, senescence. Mental health- mental illness and disabilities, symptoms and prevention of mental illness; alcoholism, tobacco addiction, de-addiction, lifestyle diseases. Community health- health centres, role of health centres. Spiritual health, yoga and meditation.

Module II

8hrs

Human reproductive system: Male reproductive system- structural details of testis and accessory structures, functions of testis, semen, hormonal control. Female reproductive system- structure of ovary, accessory structures, puberty, reproductive cycles and hormonal control, menstrual cycle, gestation period, hysterectomy, menopause.

Module III

7hrs

Events of human reproduction: Gametogenesis- spermatogenesis and oogenesis, ovulation, fertilization, embryonic development, parturition

SEMESTER VI

Core Course X

15UZ0641: Physiology and Biological chemistry

No. of credits: 4

No. of instructional hours per week: 5

Aim of the course

To improve the student's perspective of health and biology through in-depth study of human physiology

Objectives of the course

- ◆ To study the different system and the inherent disorders/ deficiencies involved therein.
- ◆ To learn the structure and functions of bio-molecules and their role in metabolism

Physiology

60hrs

Module I

6hrs

Nutritional Physiology: Introduction, types of nutrition, mechanical and chemical changes of food in the alimentary canal, balanced diet, nutritional disorders – PEM, vitamin deficiency, deficiency of iron, iodine and calcium, lifestyle diseases, role of fibres, nervous and hormonal control of digestion

Module II

8hrs

Circulatory Physiology: Blood- Composition and functions of blood plasma and formed elements, blood groups, mechanism of blood clotting, intrinsic and extrinsic pathways, disorders of blood clotting, anticoagulants, heartbeat, conducting system and pace maker, pulse and blood pressure, clinical significance, control of cardiac activity, common cardiovascular diseases – arteriosclerosis, atherosclerosis, Myocardial infarction, electrocardiogram, angiogram, angioplasty. Lymph and lymphatic system (brief account)

Module III

8hrs

Respiratory Physiology: Gas exchange, respiratory pigments- structure of haemoglobin, transport of O₂- Oxyhaemoglobin curve, Bohr effect, transport of CO₂ -carbonic acid, carbamino haemoglobin, bicarbonate and chloride shift, regulation of respiration – neural and chemical; respiratory disturbances – apnoea, dyspnoea, hypoxia, hypo and hyper capnia, asphyxia, carbon monoxide poisoning, bronchitis, asthma. Physiological effects of smoking.

Module IV

8hrs

Renal Physiology: Nephron – Structure, Urine formation, Role of hormone in urine formation and concentration, Counter-current multiplier system, Role of kidney in osmoregulation, composition of urine, abnormal constituents of urine, regulation of kidney functions, renal disorders – nephritis, haematuria, renal calculi, acidosis and alkalosis – Dialysis and kidney transplantation.

Module V

8 hrs

Muscle Physiology: Brief account of types of muscles, fast and slow twitch muscles, red and white muscles. Ultra structure of striated muscle fibre, muscle proteins, simple muscle twitch, summation, tetanus, tonus, All or None law, fatigue, oxygen debt, rigor mortis. Physiological and biochemical events in muscle contraction.

Module VI

6 hrs

Nerve Physiology: Neurons – structure, types of neuron (self study). Synapse and types of synapse, nerve impulse propagation, synaptic transmission. Reflex action, refractory period, neuro transmitters, electro encephalo gram. Nerve disorders – epilepsy, Alzheimer's disease, Parkinson's disease.

Module VII

5 hrs

Sensory Physiology: Structure of eye and ear (self study). Physiology of vision, visual elements and pigments, photo chemistry of vision. Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract. Structure of ear and mechanism of hearing, hearing impairments – deafness, labyrinthine disease. Olfactory, gustatory and tactile sense organs

Module VIII**3hrs**

Reproductive physiology: Male and female reproductive organs (self study). Reproductive Cycles(role of hormones), puberty, adolescence, pregnancy, parturition, lactation and birth control.

Module IX**8hrs**

Endocrinology: Endocrine glands in man, hormones and disorders, feedback mechanism, mechanism of hormonal activity.

Biological chemistry**30hrs****Module X****8hrs**

Biomolecules in relation to animals: micromolecules, macromolecules, water, buffer systems and importance; Carbohydrates-structure, classification- monosaccharides (trioses, tetroses, pentoses, hexoses, aldoses, ketoses), disaccharides and polysaccharides (homo and hetero polysaccharides); biological functions of carbohydrates. Lipids- classification- simple lipids, (neutral fats and waxes), conjugated lipids (phosphor lipids, sphingo lipids, glyco lipids, lecithins, cephalins, cerebrosides, gangliosides), derived lipids (fatty acids, steroids, prostaglandins), biological functions of lipids. Proteins - classification of proteins, amino acids- basic structure, structure of protein primary, secondary tertiary and quaternary structures, haemoglobin as atypical protein, biological functions of proteins.

Module XI**16hrs**

Metabolism in animals: Carbohydrate metabolism – glycogenesis, glycogenolysis, hexose monophosphate shunt, metabolic pathway of glucose- glycolysis, Krebs's cycle, electron transport series, chemi-osmotic theory, energetic; hormonal control of carbohydrate metabolism. Lipid metabolism – hydrolysis of lipid, beta oxidation, mention alpha and omega oxidation of fatty acids, hormonal control of lipid metabolism, hormonal control of lipid metabolism. Protein metabolism – deamination, transamination, formation of urea, hormonal control of protein metabolism.

Module XII**6hrs**

Enzymes: Chemical nature, mechanism of enzyme action, factors affecting enzyme activity, kinetics of enzyme action, Michaelis – Menten equation, iso enzymes, co-enzyme, co-factors, enzyme activation and inhibition.

References**Physiology**

- ★ Best and Taylor. (1990). Physiological basis of Medical Practice. Wilkins Co.
- ★ Eckert, R. and D. Randell. (1987). Animal Physiology, CBS Publishers and Distributors N. Delhi.
- ★ Ganong, W.F. (2003), Review of Medical Physiology, McGraw Hill, New Delhi.
- ★ Guyton, A.C. (1981). Text book of Medical Physiology, W.B. Saunders Co.
- ★ Hoar, W.S.(1975). General and Comparative physiology, Prentice Hall.
- ★ Mac. Eleroy, W.D. (1971). Cell Physiology and Biochemistry. Prentice hall of India Ltd.
- ★ Nagabhushanan, R., Kaobarkar M.S. and Sarojini, R. (1983). A text book of animal physiology, Oxford IBH Publishing Co., New Delhi.
- ★ Prosser, C.L. (1978). Comparative animal physiology. W.B.Saunders Co.
- ★ Rama Rao, V., First aid in accidents, Srikrishnan Brothers, Thambuchetty Street, Madras.
- ★ Schmidt-Nielson K. (2002). Animal Physiology, Prentice Hall India Ltd.
- ★ Sebastian, M.M. Animal Physiology. Dona Publications, Changanacherry.
- ★ St. John ambulance associations text books (a) First aid to the injured (b) A preliminary course of first aid to the injured.
- ★ Subramanyan, S. and Madhavankutty, K. (1977). The text book of physiology, Orient Longman Ltd., New Delhi.
- ★ Vander, A.J., Sherman, J.H. and Luciano D.S. (1998), Human Physiology, MacGraw Hill Publishing Co., New Delhi.

- ★ Withers P.C . (1992). Comparative animal physiology. Saunders College Publishing Biological chemistry
- ★ Chattergi and Shinde, Text book of Medical Biochemistry.
- ★ Conn, E.E., Stumpf, P.K., Bruening, G & Doi R.H. (1999). Outlines of Biochemistry, John Wiley and Sons, New York.
- ★ Jain, J.L et.al. (2005). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
- ★ Kaplan, L.A., Pesce, A.J. and Kazmierczak, S.E. (2003). Clinical Chemistry, Mosby London.
- ★ Keith Wilson and John Walker. (2000). Biochemistry and Molecular Biology 6th Edition, Cambridge University Press.
- ★ Mary K. Campbell .(2000). Biochemistry. Harcourt Brace College Publishers.
- ★ Murray, R.K., Granner, D.K., Mayers, P.A. and Rodwell. (2000) Harper's Biochemistry, Prentice Hall International, Inc.
- ★ Nelson, D.L. and Cox, M. (2000). Principles of Biochemistry, Macmillan Worth Publishers.
- ★ Talwar G.P., Srivastava L.M. (2003). Biochemistry and Human Biology, Prentice hall of India, New Delhi.
- ★ Thomas M. Devlin (2000). Biochemistry. John Wiley & Sons Inc. Publications
- ★ William, H. Elliott and Daphne C. Elliot. (1997). Biochemistry and Molecular Biology, Oxford University Press, N.Y.

Core Course XI
15UZ0642: Developmental Biology
and Experimental Embryology

No. of credits: 4

No. of instructional hours per week: 4

Aim of the course

To familiarize the student with the principle of developmental biology and provide him a bird's eye view of sophisticated embryological techniques

Objectives of the course

- ♦To study the various stages involved in the developing embryo
- ♦To study the initial developmental procedures involved in Amphioxus, Frog and chick
- ♦To procure information on state- of- the art experimental procedures in embryology.

Developmental biology 57hrs

Module I 4 hrs

Introduction, historical perspective (brief account), theories- Preformation, Epigenesis, Recapitulation and Germplasm. Subdivisions of Developmental biology. Spermatogenesis and oogenesis, structure of Graafian follicle, typical egg and sperm. Polarity of egg, egg envelopes; classification of eggs based on different criteria.

Module II

8hrs

Fertilization: Agglutination, sperm penetration, activation of egg, amphimixis; physiological and biochemical changes during and after fertilization. Parthenogenesis- introduction, natural and artificial parthenogenesis, arrhenotoky and thelytoky, obligatory and facultative, significance of parthenogenesis.

Module III

9hrs

Cleavage: types of cleavage - holoblastic and meroblastic; patterns of cleavage – radial, bilateral, spiral, rotational; cell lineage in Planocera (brief account only). Morula formation in microlecithal, mesolecithal,

macrolecithal eggs; blastulation - introduction, different types of blastula – stereo blastula, coeloblastula, discoblastula, periblastula, blastocyst. Presumptive organ forming areas and fate maps, eg. amphioxus, frog, construction of fate maps.

Module IV

3hrs

Gastrulation: introduction, brief account of morphogenetic movements – epiboly and emboly (invagination, involution, infiltration, ingression, delamination, convergence, divergence) concept of germ layers, derivatives of germ layers.

Module V

5 hrs

Cell differentiation : totipotency, pluripotency and unipotency of embryonic cells. Determination and differentiation in embryonic development. Gene action, drosophila as a model organism (brief account only), Homeotic genes and Hox genes.

Module VI

25hrs

Development: Amphioxus - cleavage, blastulation, gastrulation, neurogenesis, notogenesis, mesoderm and coelom formation. Frog -cleavage, blastulation, gastrulation, organogeny – development of brain, eye, heart; metamorphosis - ecological, morphological and physiological changes and hormonal control. Chick - cleavage, blastulation, gastrulation, study of 24 hrs chick embryo; development of extra- embryonic membranes in chick. Man - implantation, pregnancy, parturition. Placentation in mammals – different types of placenta, functions.

Module VII

3hrs

Teratology: definition, causes, infections, drugs and chemicals, metabolic imbalance, ionizing radiation, malnutrition, autoimmunization.

Experimental embryology

Module VIII

15hrs

Spemann's constriction experiments, organizers and embryonic induction, transplantation experiments involving optic cup, nuclear transplantation experiments in amphibians. In vitro fertilization and embryo transfer experiments in farm animals, In vitro fertilization and embryo transfer experiments in man and test tube babies; cloning experiments in animals mammals; prenatal diagnosis and sex determination methods –

amniocentesis chorionic villus sampling, ultra sound scanning. Embryonic and adult stem cell research and stem cell therapy.

References

- ★ P.C.Jain. (2007). Elements of Developmental Biology, 6th Edn. Rastogi Publications.
- ★ Agarwal, V.K. and Usha Gupta, S (1998). Chand's simplified course in zoology, chordate embryology and histology. S. Chand & Co Ltd.
- ★ Balinsky. B.I. (2004). An Introduction to Embryology. W.B. Saunders & Co.
- ★ Begley, D.J., Firth, J.A. and Houtt, J.R.S. (1980). Human Reproduction and developmental Biology, MacMillan Press Ltd.
- ★ Berry, A.K. (2008). An Introduction to Embryology. Emkay Publications.
- ★ Gibbs. (2006). Practical Guide to Developmental Biology. Oxford University Press.
- ★ Gilbert. S.F. (2000). Developmental Biology. Sinauer Associates, Inc. Publishers.
- ★ Goel, S.C. (1984). Principles of animal developmental biology. Himalaya Publ. House, Bombay.
- ★ Huettner, A.F. (1959). Comparative Vertebrate Embryology. MacMillan.
- ★ Mc Even. (1970). Vertebrate Embryology. Oxford-IBH
- ★ Nelson. (1960). Comparative Embryology of Vertebrates. MacMillan.
- ★ Rough. (1960). Frog- Reproduction and development. Oxford University Press.
- ★ Verma, P.S. and V.K. Agarwal (2007). Chordate Embryology. S. Chand & Co. Ltd.
- ★ Vijayakumaran Nair, K. and P.V. George (2002). A manual of Developmental Biology. Academica, Trivandrum.
- ★ Werner. A. Muller. (2008). Developmental Biology. Springer.
- ★ Wolpert, L. (1998). Principles of Development. Oxford University Press, N. Y.

Core Course XII
15UZ0643: Ecology, Conservation Biology,
Ethology, Evolution and Zoogeography

No. of credits: 3

No. of instructional hours per week: 4

Aim of the course

To enhance the student's concept of nature and her resources and appreciating the process and product of organic evolution

Objectives of the course

- ◆ To learn the principles, applications and management of environmental science.
- ◆ To study the inherent morphological and physiological bases of behavioural pattern exhibited by vertebrates
- ◆ To get an exhaustive knowledge of organic evolution with special reference to man.

Ecology 24 hrs

Module I

3 Hrs

Components of ecosystem: Environmental factors - abiotic factors, light, temperature, soil, water, air; biotic factors- autotrophs, phagotrophs and saprotrophs; ecosystem interaction and inter-relationship between biotic and abiotic factors.

Module II

6hrs

Biogeochemical cycles: Basic types of biogeochemical cycles - gaseous cycle-carbon and nitrogen cycles, mention sedimentary cycles (P and S), recycling pathways and recycle index. Limiting Factors- basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.

Module III

11 hrs

Habitat Ecology: Biosphere classification- lithosphere, hydrosphere and atmosphere –physical features, fauna and their adaptations of aquatic,

terrestrial and marine habitats (self study) Population ecology: Properties of population- density, natality, mortality, age distribution, biotc potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation. Community ecology: Definition and characters, species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity, succession (self study)

Module IV

4 hrs

Anthropogenic impact on ecosystem: Ionizing radiation and radioisotopes, ionizing radiation and human health, radiation accidents and other exposures, disposal of radioactive wastes, pesticides like DDT, endosulphan, furadan, insect repellants , e-wastes. Monitoring of pollutants – physical, chemical and biological. Sustainable development, Global environmental issues, GATT, Patents, Green house effects and climate changes , Acid rain, Global warming, Ozone depletion/thinning, Desertification and deforestation.

Conservation Biology

(10 Hrs)

Module V– Introduction

(2 Hrs)

Background - information for conservation initiations.(Habitat loss, and fragmentation Poaching of wild life and trade , Man wild life conflicts, Invasive Alien Species)Endangered and Endemic species (IUCN red list)

Module VI–Conservation Strategies

(Exsitu and Insitu conservation)

(8Hrs)

Exsitu conservation

The strategy of exsitu conservation, Methods of exsitu conservation, Long time captive breeding, Short term propagation and release , Animal translocations, Animal reintroduction, Zoos and botanical gardens, Conservation of biodiversity in seed banks, Gene banks and germ plasm-reserves ; On - farm conservation.

Insitu conservation:

Definition, Advantages and disadvantages , Strategies, National parks and sanctuaries, Biosphere reserves, Critical sites of protected areas and pollutions, Management of protected areas , Conservation beyond parks , sanctuaries and reserves

Ethology 10hrs
Module VII 10 hrs

History and scope of ethology: Motivation- models of motivation (Lorenz's psychohydraulic model and Deutsch's model); learning- types of learning (imprinting, habituation, conditioned reflex, unconditioned reflex, latent learning); neural mechanisms in behaviour role of hypothalamus and other brain centers, hormones and behavior; sociobiology- social groups –merits and demerits, properties of organized societies, social groups in mammals, social stress. Pheromones and chemical communications, human pheromones.

Evolution 22 hrs
Module VIII 4 Hrs

Theories of organic evolution: Lamarck's theory, it's criticism (Weisman's germplasm theory) Darwin's theory of natural selection (mention the contributions of Wallace). Mutation theory (self study)

Module IX 4hrs

Geological timescale, fossils, fossilization, paleontological evidences of evolution, fossil dating and significance of fossils.

Module X 10 hrs

Modern concept of organic evolution: (Neo Darwinism) - genetic basis of evolution- gene pool, gene frequency, mutation, role of mutation in evolution, neutral mutation (Kimura), genetic drift, genetic equilibrium; factors affecting genetic equilibrium and Hardy –Weinberg law. Natural selection: types of selection (brief account of the observation in Biston betularia), isolation and isolating mechanisms; speciation- sympatric speciation and allopatric speciation. Hybridization- adaptive radiation with special reference to Darwin's finches.

Module XI 6 hrs

Evolution of man: Organic and cultural, examples of trends in human evolution, fossil men brief accounts of Parapithecus, Propliopithecus, Dryopithecus, Ramapithecus, Australopithecus, Neanderthal, Cromagnon and Modern man.

Zoogeography 8 hrs
Module XII 4hrs

Animal Distribution: Geographic distribution of animals-cosmopolitan distribution, discontinuous distribution, bipolar distribution and isolated distribution, factors affecting animal distribution, barriers to animal distribution- physical and biological barriers.

Module XIII 4 hrs

Zoogeographical Realms: (brief account of each realm mention the areas included, physical features and fauna) Palaeartic region, Australian region, Ethiopian region, Nearctic region, Oriental region and Neotropical region. Biogeographical classification of India- Western Ghats, Eastern Ghats and Himalayas. Insular Fauna: Brief account of oceanic islands and continental islands (with one example each)

References

- ◆ Ahluwalia, V. K. and Malhotra, S. (2006). Environmental science. Ane Books Pvt. Ltd.
- ◆ Allbrook D.B. (1975). The Evolution of Man. Part I and II. Gage Edl. Pub. and Deep Publications.
- ◆ Andrews M.I. and Joy K.P. (1989). Ecology Evolution and Zoogeography. RobersK, Kerieyer Pubo., New York.
- ◆ Aravind Kumar. (2004). Text Book of Environmental Science. APH Associates, Inc.Publishers. Massachusetts.
- ◆ Atchia. M. and Tropp.S. (1995). Environmental Management, John Wiley .
- ◆ Bhatia .A.I. Current trends in Global EnvironmentNew India publishing Agency,
- ◆ Bishop.P.L. (2000). Pollution Prevention: Fundamentals and Practice,
- ◆ Brace, C.L. (1967). The stages of Human Evolution, Prentice Hall International.CambridgeUniversity Press.33.
- ◆ Chapman J.L.and M.J.. (1999). Ecology – Principles and Applications.
- ◆ Chatterjee B. (2003). Environmental Laws: Imple mentation problems.

- ◆ Chatterji.A.K., Introduction to Environmental biotechnology, Prentice Hall of India
- ◆ Chauhan, K.P.S. (1998). International Treaties on Biological Resources: Co Down to Earth, Centre for Science and Environment. Co. , NewDelhi.
- ◆ Colbert E.H. (1980). Evolution of the Vertebrates, John Wiley & Sons. Corporation, NewYork
- ◆ Cutter S.L. (1999). Environmental Risks and Hazards. Prentice Hall of India Private Limited, New Delhi
- ◆ Dadson E.O. (1960). Evolution: Process and Product. Reinhold Pub.
- ◆ Darlington P.J.Jr. (1980). Zoogeography: The geographical Distribution of DehradunDelhi.
- ◆ Dobzhansky T. , Ayala G.L., Stebbins G.L. and Valentine J.W. 1976
- ◆ Dobzhansky T. (1964). Genetics and the origin of species Oxford and IBH Pub. New Delhi
- ◆ Edward j Kormandy. Concepts of Ecology, Prentice Hall of India Private Ltd. New Delhi.
- ◆ Ehlich P.R. & holm R.W. (1973). The Proces of Evolution, Mc. Graw-Hill Inc.
- ◆ Enger E.D. and Smith B.E. (2004). Environmental Science. Mc. Graw Hill,
- ◆ Eugene P Odum. (2002). Fundamentals of Ecology. Natraj Publishers,
- ◆ George W. (1962). Animal geography, Heinemann Edl. Books Ltd, London.
- ◆ Houghton, J. (1999) Global Warming, Cambridge University Press.
- ◆ John Alock. (2001). Animal Behavior, an evolutionary approach, Sinauer
- ◆ Kluge. H. Bittner, A and Hohnholz.J.H. (1995). Environment Mangement.Ltd., Ontario

- ◆ Lull R.S. (1947). Organic Evolution Macmillan Pub. Co. New York.
- ◆ Manning Aubrey. (1995). Introduction to Animal Behaviour.
- ◆ Edward Arnold Marvel and Hamilton. Mechanism of Behavior. McGraw-Hill NewDelhi.
- ◆ Moody P.A. (1978) Introduction to Evolution, Ind. Ed. Kalyani Pub., New Delhi
- ◆ Oparin A.I. (1957). The Origin of Life on Earth, Oliver & Boyd, London. Private limited, New Delhi Publishers Ltd.
- ◆ Rajagopalan R. (2006). Environmental studies. From crisis to cure. Oxford
- ◆ Savage J.M. (1969). Evolution, Hold, Rinchart and Winston Inc. New Delhi.
- ◆ Scragg. A. (1999). Environmental Biotechnology, ELBS.
- ◆ Seragelglin. (1999). Biotechnology and Biosaftey. World Bank, Washington
- ◆ Sharma P.D. (2000).Environmental Biology.Rastogi Publications.
- ◆ Sharma, B.K. and Kaur,H, (1994). Environmental Pollution. GOEI Publishing
- ◆ Singh, B.P. et.al. (1988). Environment and Biotechnology. Today and Sons.St. Mary's Press and Book Depot., Changanassery.
- ◆ Stebbins G.L. (1977). Process of Organic Evolution, Prentic Hall Inc. Tomorrow printers, New Delhi.
- ◆ Trivedi R.K. Hand book of Environmental Laws, Rules,
- ◆ Trivedi, P.R. (2000). Global Biodiversity, Authors Press.University-Press.
- ◆ Varma P.S. and Agarwal V.K. (1993). Environmental Biology. S. Chand and Company
- ◆ Volpe E.P. (1985). Understanding Evolution. Ind. Repr. Universal Book Stall,

Core Course XIII

15UZO645: Practical III

No. of credits: 3

No. of instructional hours per week:

Aim of the course

To demonstrate basic principles in physiology

Objectives of the course

- ✦ To learn clinical procedures for blood & urine analysis
 - ✦ To make the student skillful in simple biochemical laboratory procedures. Physiology and Biological Chemistry Practicals: [Compulsory]
1. Measurement of oxygen consumption of cockroach using Fen's respirometer.[Experiment set up]
 2. Study of tonicity of blood cells
 3. Paper chromatographic separation of amino acids
 4. Estimation of haemoglobin of blood using Haemoglobinometer.
 5. Effect of temperature / pH on human salivary amylase activity
 6. Qualitative tests of sugars.
 7. Qualitative tests of proteins.
 8. Detection of abnormal constituents (glucose and albumin) in urine[two test each].
 9. Detection of excretory products – ammonia (Nessler's test), urea (Ammonia generation/ Biuret test) and uric acid (Phosphotungstic acid test)
 10. Preparation of blood smear and study of blood cells of man.
 11. Estimation of Cholesterol
 12. Digestion of starch and separation of maltose by dialysis.

Core Course XIV

15UZO646: Practical IV

No. of credits: 3

No. of instructional hours per week:

Developmental Biology and Experimental Embryology

1. Study of different types of eggs-Amphioxus, frog, chick, man- based on models/charts[Any three].
2. Study of blastula- Amphioxus, frog- slide / model [Any one]
3. Study of gastrula – Amphioxus/frog-yolk plug stage - slide / model. [Any one]
4. Mounting, sketch and label of 24hrs/48hrs chick blastoderm.[Any one]
5. Study of placenta(model/ specimen) – any two types.
6. Sperm motility in a fish /zebra fish
7. Embryonic development of the egg of zebra fish (demonstration only)

Ecology

1. Estimation of dissolved oxygen
2. Estimation of CO₂
3. Estimation of hardness of three different water samples.
4. Study of pond of an ecosystem.
5. Extraction of soil organisms- Berlese funnel, Baerman's funnel [Any one]
6. Construction of food web
7. Study of ecological adaptations – any three
8. Collection and observation of marine/Fresh water plankton .
9. Measurement of pH of different water samples using pH meter, pH paper and indicator solution.

Conservation Biology

10. Report on local biodiversity conservation and its efforts - Sacred groves/Medicinal gardens/Man groves (Report should be submitted by the students)

Ethology

11. Alarm pheromones in ants.

Evolution

12. Photo of Darwin and Lamark - Identify the scientist and mention the contribution .

Zoogeography

13. Study different zoogeographical realms with fauna.

Core Course XV

15UZO646: Project and Field study

No. of credits: 4

No. of instructional hours per week:

Aim of the course

To develop an aptitude for research in Zoology

Objective of the course

To inculcate proficiency to identify appropriate research topic and presentation Specifications

Topics of biological interest can be selected for the project.

Project is to be done by a group not exceeding 10 students.

Every student should submit typed (A4 paper, 12 Font, 1.5 Space), spirally bind project

report in duplicate to the department on the day of the examination of Practical II.

A copy duly attested by the supervising teacher and the Head of the Department must be

placed for ESE before a board of two Examiners.

The viva-voce based on the Project is conducted individually.

Project topic once chosen shall not be repeated by any later batches of students.

The project report may contain the following sections

1. Preliminary (Title page, declaration, Certificate of the supervising teacher, content etc.)

2. Introduction with relevant literature review and objective

3. Materials and Methods

4. Result

5. Discussion

6. Conclusion / Summary

7. References.

Field study

A total of eighteen hours (1hour/week) are allotted to field study in the fifth semester.

Field study of 4 days is compulsory. Students are directed to visit one research institute and one wild life sanctuary / ecosystem / museum / zoo, preferably with in the state of Kerala.

Scientifically prepared hand written study tour report must be submitted by each student for ESE on the day of the examination of Practical II.

Elective Course

15UZO661.1: Ornamental Fish culture (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Aim of the course

To make the student aware of the vast potentials involved in ornamental fish farming and trading

Objectives of the course

- ◆ To know about the diversity of ornamental fishes and the scope of culture and trade
- ◆ To Learn setting up and maintenance of aquarium
- ◆ To learn the culture breeding and marketing techniques of common indigenous ornamental fishes

Module 1 **7hrs**
History and importance of aquarium fish keeping. Design ,construction and maintenance of aquaria: aquarium fabrication- shape, size, volume, type of glass tanks, preparation of glass tank, strengthening and supporting of tank, fitting of tanks into room settings; aquarium floor setting – type and size of pebbles, gravels, granites used for bed setting and its advantages. Filters- biological, chemical and mechanical. Aquarium accessories like aerators, decoratives, lighting, heating and feeding trays,Public aquarium .

Module II **4 hrs**
Water quality management in aquarium systems – sources of water, containers,storage, temperature, pH, dissolved carbon dioxide, ammonia, hardness and turbidity ,Optimum water quality for tropical aquarium fish keeping.

Module III **6 hrs**
Aquarium plants: Uses of aquarium plants, different varieties of plants like Submergent plants (tubers, rooted plants,) and emergent plants , indoor plants and outdoor plants , selection of plants, planting techniques, propagation and maintenance of aquarium plants. Advantages of natural plants over artificial plants.

Module IV **11hrs**
Common ornamental fishes- indigenous and exotic species; Identification and biology of the common ornamental fishes. *Cyprinus carpio* (koi carp), *Molliensia sphenops* (black molly lyre tail), *Poecilia reticulata* (guppy), *Poecilia latipinna*, *Xiphophorus helleri* (red sword tail) *Xiphophorus maculatus* (red platy) *Pterophyllum scalare altum* (angel fish) *Carassius auratus* (Gold fish) *Betta splendens* (Siamese fighting fish) *Trichogaster leeri* (pearl gourami). Live bearers and egg layers. Sexual dimorphism in ornamental fishes.

Module V **7hrs**
Breeding and rearing of common ornamental fishes. Conditions for breeding- pH, temperature and sex ratio. Brood stock management- selection of brooders, maintenance and management of brood stocks. Selective breeding and hybridization techniques. Induced breeding. Colour enhancement techniques.

Module VI **7hrs**
Food and feeding - live feed and formulated feed. Preparation and culture

of live feed (*Artemia*, *Infusoria*, *Spirulina*). Control of algal growth, snails and other predators. Common disease of ornamental aquarium fishes - their causative agents - virus, bacteria, fungi, protozoa and nematode; symptoms, treatment and prophylactic measures.

Module VII **12hrs**
Indigenous ornamental fishes - Common indigenous ornamental fishes of western ghats- Identification and biology of the common ornamental fishes. *Cyprinid* *Sahyadriadenisonii* (*Puntius denisonii* - red line torpedo fish), *Haludaria fasciatus* (*Puntius fasciatus* - melan barb), *Dawkinsia filamentosa* (*Puntius filamentosus* - Indian tiger barb), *Hypselobarbuskurali* (*Puntius curmuca*), *Danio malabaricus* (Malabar danio);Loaches (*Nemacheilus triangularis*(Zodiac loach), *Lepidocephalus thermalis* (Malabar loach); *Cichlids*: *Etroplus maculatus* (yellow and orange chromides), *E. suratensis* (pearl spot), Anabantids: *Anabas testudineus* (climbing perch)and Catfishes : *Horabagrus brachysoma* (Yellowish catfish), *H. nigricollaris* (White collared imperial catfish).
Assignment: Students are to visit ornamental fish Farm and submit a report with photos.

References

- ▲ Arumugam. N. (2008). Aqua culture, Saras publications, Tamil Nadu, India.
- ▲ Axelord, H.R. (1967). Breeding aquarium fishes, T F H Publications.
- ▲ Dick Mills (1981). Aquarium Fishes, Arco publishing.
- ▲ Dick Mills and Gwynne Vevers, (1982). The Practical encyclopedia of fresh water Tropical Aquarium fishes, Salamander Books limited, London.
- ▲ Gahlawat, S.K., et.al. (2007). Manual of experimental Ichthyology, Daya publishing House, Delhi.
- ▲ Gerhard Brunner, (1973). Aquarium plants, T F H Publications, Inc. Ltd., Hongkong.
- ▲ Gupta. S. K. & P. C. Gupta, (2006). General and applied Ichthyology, S. Chand & Co.Ltd., New Delhi.
- ▲ Harishankar J. A & A. Biju Kumar, (1997). Aquarium Fishes, B. R. publishing Corporation, Delhi.
- ▲ Jorgen Hansen, (1979). Making your own aquarium, Bell and Hyman Ltd., London.

- ▲ Ramachandran. A., (2002). Breeding, Farming and management of ornamental fishes. School of Industrial Fisheries, Cochin University of Science and Technology, Cochin-
- ▲ Saroj. K. Swain, (2003). Aquarium care and maintenance, Publ. CIFA, ICAR, Orissa, India.
- ▲ Stephen Spotte, (1970). Fish and invertebrate culture, Wiley Inter Science, John Wiley & Sons, Inc., New York.
- ▲ Tom Lovell (1998). Nutrition and feeding of fish second Ed. Kluwer Academic publishers.
- ▲ Talwar.P.K., and Jhingran.A.G.,(1991). Inland fishes Oxford and IBH Publishing Co. PVT LTD, New Delhi.
- ▲ Web site: www. Ornamentalfish.org

Elective Course

15UZO661.2: Vermiculture and Apiculture (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Aim of the course

To promote self employment and self reliance among educated youth

Objectives of the course

- To learn the basic procedure and methodology of vermiculture
- To learn the scope and methodology of apiculture.

Vermiculture

24hrs

Module I

6hrs

Introduction: definition and scope of vermiculture. Nature and species of earthworms: habit categories – epigeic, endogeic and anecic, indigenous and exotic species (*Eudrillus eugeniae*/*Eisenia foetidae*/*Perionyx excavatus*/*Lampito mauritii*), identification of the above four species based on morphological characters.

Module II

10hrs

Methodology of vermicomposting: step by step methodology – containers for culturing, raw materials required, preparation of bed, environmental

pre-requisites, feeding, harvesting, and storage of vermicompost. Advantages of composting, precautions to be taken to prevent attack by pests and pathogens.

Module III

8hrs

Vermicompost profile and applied aspects: physical, chemical and biological parameters of vermicast, vermin enrichment, economic uses of vermiculture (biofertilizer, waste disposal, vermivash, poultry feed, vermi-remediation etc.

Apiculture

30hrs

Module IV

8hrs

Introduction and Scope: Definition and significance of the study. Caste system and Social behavior; common species of honeybees used, organization of bee colony, social life and adaptations of honeybees.

Module V

12hrs

Bee keeping methods and equipments: indigenous methods, extraction appliances, extraction of honey from the comb and processing, management and maintenance of an apiary, bee pastures

Module VI

10hrs

Diseases and economics: diseases (bacterial, fungal, protozoan, acarine, brood diseases), preventive and curative measures. Use of honey, bees wax, bee venom, nutrient profile of honey, marketing strategies.

Suggested topics for assignments / seminars Vermiculture

1. Report of field visits to commercial/professional units
2. Feasibility of maintaining a vermicomposting plant in the College maybe worked out
3. Awareness programmes on waste management through vermicomposting may be conducted for the local residence associations

Apiculture

1. Report of field visits

References

1. Cherian & Ramachandran Bee keeping in South Indian Govt. Press, Madras.
2. Gupta, K.C. Romance of bee keeping. Khadi Paristhan, Calicut.
3. Mary Appelhof. Worms eat my Garbage.
4. Mishra R.C. Perspectives in Indian Apiculture
5. Sathe, T.V. Vermiculture and Organic farming.

Elective Course

15UZO661.3: Dairy farming and Broiler farming (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Aim of the course

To promote and encourage the students to take up animal husbandry instead of crawling for white collar jobs

Objectives of the course

- ◆ To aid white revolution by improving the breeds of cattle
- ◆ To learn the proper and scientific methodology behind poultry farming

Dairy farming 27hrs

Module I 7hrs

Breeds of livestock and dairy farm: Breeds of Taurus (exotic) dairy cattle, breeds of zebu (Indian) cattle, breeds of dairy buffaloes; present status of dairy farming; planning to establish dairy farm, location of farm, different housing systems, dairy buildings, space requirements, economically setting a small farm.

Module II 5hrs

Nutritive values of common feeds, commercial and mixed feeds: Feeding and providing feed - feeds rich in minerals, feeds rich in protein, livestock tonics - hormones, thyroprotein, stilbestrol, urea for dairy cattle, toxic feeds, food-poisoning - Balancing the dairy ration - general rule for feeding dairy herd.

Module III 4hrs

Mechanism of reproduction: Male reproductive organs, female reproductive organs, role of hormones in male reproduction, role of hormones in female reproduction; care and management of newborn animals.

Module IV 6hrs

Artificial insemination: Advantages of artificial insemination over natural breeding, limitation of A.I, problems under Indian conditions; collection of semen - electro ejaculation, dilution of semen and cryopreservation, insemination, cleaning and sterilization of apparatus. Common parasites

in India and cure methods - External parasites and pest, reproductive diseases, milk borne diseases.

Module V 5hrs

Preparation and marketing of dairy products: Determining quality of milk, choosing market outlet, assembling dairy products from farms, co-operative action among creameries, hauling milk to city markets; Marketing fluid milk (i) Specific gravity of milk (ii) determination of specific gravity with a lactometer (iii) pasteurization of milk (iv) advantages of pasteurization; determining cost of distribution.

Broiler farming 27hrs

Module VI 5hrs

History, contribution to remove protein deficiency, role of broiler farm in urban and rural areas, employment potential, export potential. Poultry breeds, broiler strains available in India, day old chicks and their maintenance, hatchery potential; parental stocks and their maintenance

Module VII 5hrs

Poultry house, site, space requirement, types of houses-cage and deep-litter system, equipment for feeding and watering, lighting for poultry houses, ventilation.

Module VIII 5hrs

Nutrition of poultry birds, nutritional requirements according to age, starter feed, finisher feed, feed formulation. Availability of raw material for feed; use of antibiotics, aminoacids and minerals.

Module IX 5hrs

Brooding and rearing baby chicks, types of brooders, vaccination, summer management and monsoon management.

Module X 7hrs

Diseases and health management, common diseases caused by viruses, bacteria and worms, ranikhet, fowl pox, worms and other parasites, toxicosis and account of aspergillus, aflotoxin, Salmonella; deworming and insecticide treatment; machanised dressing methods; cold storage, avoiding aflotoxin.

Suggested topics for assignments / seminars

Dairy farming

1. Breeds of Taurus (exotic) dairy cattle, Breeds of zebu (Indian) cattle,

Breeds of dairy buffaloes.

2. Planning to establish dairy farm.
3. Setting a small farm.
4. Feeding and providing feed to dairy animals.
5. General rule for feeding dairy herd.
6. Role of hormones in male reproduction.
7. Role of hormones in female reproduction.
8. Care and management of newborn animals.
9. Advantages of Artificial insemination over natural breeding.
10. Common parasites in India and cure methods - External parasites and pest.
11. Reproductive diseases - Milk borne diseases.
12. Determining quality of milk.
13. Marketing fluid milk.

Broiler farming

1. Role of broiler farm to remove protein deficiency.
2. Role of broiler farm in employment potential and export potential.
3. Day old chicks and their maintenance.
4. Parental stocks and their maintenance.
5. Setting up of broiler farming.
6. Feed formulation. Availability of raw material for feed; Use of antibiotics, aminoacids and minerals.
7. Brooding and rearing baby chicks.
8. Summer management and monsoon management.
9. Diseases and health management.

References

Dairy farming

- ✦ Banerji, G.C. A text book of Animal husbandry, 1998. Oxford & IBH
- ✦ ICAR. Handbook of Animal Husbandry, 1990/97, ICAR, PUSA.

Broiler farming

- ✦ Gnanamani. Profitable Poultry Farming.
- ✦ Banerji, G.C. Poultry. Oxford & IBH.