

Ph.D. Zoology Course Work Syllabi – Paper – I

<b>Title of the paper</b>
<b>Research Methodology (15PHDZO1)</b>

**Objectives:**

1. The course aims to train students in the statistical analysis and presentation of the data.
2. To write the report / thesis / dissertation and or for publications in appropriate research journals,
3. The aim of the paper thus is to lay a strong foundation for the student for thesis writing, editing, analysis and interpretation of the generated data with hands on experience with model sums.

**Unit I**

Collection of data- diagrammatic representation :Bar, Pie diagrams; graphic representation-Histogram, frequency polygon; Measures of central tendency: Arithmetic mean, median & mode(direct methods and model sums) Measures of dispersion : Universe and population – delimiting population – sampling methods: random sampling, stratified random sampling – standard deviation – standard error – coefficient of variation: elucidation with model sums.

**Unit II**

Bivariate relationship: Types of Correlation and Karl Pearson's correlation coefficient: model sums with elucidation – Regression analysis: Components of regression equation – Confidence intervals of regression line. Fitting simple regression lines: model sums, calculations of equation and fitting of regression line, estimated and calculated Y. Comparison between correlation and regression.

**Unit III**

Probability- Theorems: Addition and Multiplication – Patterns of distributions: Poisson, Normal and Binomial; Test of significance - Comparison of means: Chi square test, student t test, ANOVA, model sums on one way ANOVA with interpretation of data.

**Unit IV**

Research: Selection of problem – stages in the execution of research: choosing a topic to publication – preparation of manuscript – report writing – format of journals – proof reading – sources of information : journals, reviews, books, monographs etc – How to write thesis and their standard format – standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

**Unit V**

Journals: Standard of research journals – paid and refereed journals – impact factor - citation index – choice of journals for publication. Information retrieval: access to archives and databases, search engines: Google, Pubmed, NCBI, etc., National Informatic Center - Online data base library.

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1. Davis, G.B. and C.A. Parkar 1997, Writing the doctoral dissertation. Barons Educational series, 2<sup>nd</sup> edition. Pp 160. ISBN : 0812098005.
2. Duncary, P. 2003. Authoring a Ph.D. thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp 256. ISBN 1403905843.
3. Saxena, S. 2001, MS office, Vikas Publishing House Pvt. Ltd. New Delhi 110014.  
S. Azhagumadhavan

Ph.D. Zoology Course Work Syllabi – Paper - II

Title of the paper
Clinical Biochemistry (15PHDZO2)

**Objective:** To study the lab setup and safety measures, to learn about the metabolic disorders, to know about drug design and their types.

**UNIT - I: Laboratory Setup and Safety:**

Requirements of setting up of clinical laboratory, SI units in clinical laboratory, Collection preparation, preservation, and handling of clinical samples, quality control, Safety measures in clinical laboratory. Formulation of clinical and diagnostic kits, Safety aspects.

**UNIT - II: Metabolic Disorders:**

Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.

Disorders of Lipid metabolism – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and diseases - hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

**UNIT – III: Neurological and Psychiatric Disorders:**

Schizophrenia – types, symptoms, antipsychotic drugs - Affective disorders - Unipolar and bipolar disorders, antidepressants , Alzheimer's disease, Wernicke-Korsakoff syndrome, dementia, Wilson's disease

**Ageing-** Physiological and biochemical changes in ageing. Different theories of ageing, importance of superoxide dismutase in ageing, plasticity and regeneration

**UNIT – IV:** Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. Digestive diseases – Malabsorption, creatorrhoea, diarrhoea and steatorrhoea- Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH. Disorders of acid-base balance and their respiratory and renal mechanisms

**UNIT – V:** Inborn errors of Metabolism- Disorders of amino acid metabolism – Phenylalaninaemia, homocystinuria, tyrosinemia; Disorders of nucleic acid metabolism- Disorders in purine/pyrimidine metabolism

Hormonal imbalances: Protein hormones, steroid hormones, adrenocorticosteroids

**Reference:**

1. Burger, A., Med. Chem.
2. Wilson and Gisvold, Organic Med. Pharmaceutical Chem.
3. Ariens, Drug Design, Academic press, NY, 1975.
- S. Azhagumadhavan

Ph.D. Zoology Course Work Syllabi – Paper - III

**Title of the paper**

**Biotechnology(15PHDZO3)**

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for *Agrobacterium tumefaciens*. Cloning vector for mammalian cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

Cell culture – Organ culture – Whole embryo culture- Embryo transfer – In vitro fertilization (IVF) technology – Dolly – embryo transfer in human. Transgenic animal. Human gene therapy – Cryobiology.

**Unit IV**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metabolites – Penicillin.

**Unit V**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM food. Biotechnology & Biosafety – IPR – Levels of biodiversity –  $\alpha_2$  and  $\beta_1$  biodiversity conservation.

**Reference:**

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3. Rebert F. Weaver – Molecular Biology II Edn., Tata McGraw-Hill, New Delhi.
4. Putohit, S.S. –Biotechnology Fundamentals and Application-Agrobios, Jothpur-2005.
5. Alberghina – Protein Engg. In Industrial Biotechnology – New Era Books, Bangalore,
6. Eun – Enzymology primer for recombinant DNA Technology, Glazer-Microbial Biotechnology.

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Probability- Theorems: Addition and Multiplication – Patterns of distributions: Poisson, Normal and Binomial; Test of significance - Comparison of means: Chi square test, student t test, ANOVA, model sums on one way ANOVA with interpretation of data – Introduction to MANIVA AND STASTICA - Use of statistical software's.

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Research: Selection of problem – stages in the execution of research: choosing a topic to publication – preparation of manuscript – report writing – format of journals – proof reading – sources of information : journals, reviews, books, monographs etc – How to write thesis and their standard format – standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

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Ph.D. Zoology Course Work Syllabi – Paper - II

**Title of the paper**

**Cancer Biology (15PHDZO2)**

**Objective:** To help the learner understand the basic concepts related to development, progression and therapeutic intervention of cancer.

**UNIT - I: Fundamentals of cancer biology**

Hall marks of cancer, different forms of cancers, Factors influencing human carcinogenesis: regulation of cell cycle, cell cycle check points, modulation of cell cycle in cancer, mutations. Tumor suppressor genes, apoptosis,

**UNIT - II: Carcinogenesis & Molecular basis of cancer:**

Theory of carcinogenesis - chemical and physical carcinogenesis. Metabolism of carcinogenesis. Radiation, mechanism of Ionizing Radiation.

Signal pathways and cancer - JAK-STAT, RAS-RAF, ERK, MAP Kinase, Wnt pathway, TGF  $\beta$  Signaling, mTOR, oncogenes. Identification of oncogenes, retroviruses and detection of oncogenes. Protooncogene/oncogene activity. Growth factors related to transformation, Telomeres and telomerase in cancer, Telomerase inhibitors, role of epigenetics in cancer.

**UNIT – III: Cancer metastasis**

Metastatic cascade, basement membrane disruption, Clinical significance of invasion, Tumor heterogeneity, three-step theory of invasion, Tumor angiogenesis, MMP and TIMPS, tumor cell invasion, cell adhesion molecules.

**UNIT – IV: Cancer detection techniques & Cancer therapy**

Cancer screening and early detection, animal models of cancer, Imaging, molecular tools for early diagnosis of cancer detection. Tumor biomarkers. Microarray and gene expression profiling, prediction of aggressiveness of cancer, advances in cancer detection.

**UNIT – V: Cancer therapy**

Different forms of therapy, chemotherapy, radiotherapy, Immuno therapy, Use of signal targets towards therapy of cancer, Cancer vaccines, Gene therapy.

**REFERENCE BOOKS:**

1. "Molecular biology of Cancer" 3/e, Lauren Pecorino Oxford University Press, 2012.
2. "The molecular biology of cancer" Stella Pelengaris and Michael Khan Blackwell publishing, 2006.
3. "Introduction to the cellular and molecular biology of cancer", 4/e, M.A. Knowles, P.Selby, Oxford University Press, 2005.
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Ph.D. Zoology Course Work Syllabi – Paper - III

Title of the paper
Biotechnology(15PHDZO3)

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for *Agrobacterium tumefaciens*. Cloning vector for mammalin cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

Cell culture – Organ culture – Whole embryo culture- Embryo transfer – In vitro fertilization (IVF) technology – Dolly – embryo transfer in human. Transgenic animal. Human gene therapy – Cryobiology.

**Unit IV**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metaolites – Penicillin.

**Unit V**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM food. Biotechnology & Biosafety – IPR – Levels of biodiversity –  $\alpha_2$  and  $\beta_1$  biodiversity conservation.

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Ph.D. Zoology Course Work Syllabi – Paper – I

Title of the paper
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**Unit II**

Bivariate relationship: Types of Correlation and Karl Pearson's correlation coefficient: model sums with elucidation – Regression analysis: Components of regression equation – Confidence intervals of regression line. Fitting simple regression lines: model sums, calculations of equation and fitting of regression line, estimated and calculated Y. Comparison between correlation and regression.

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Research: Selection of problem – stages in the execution of research: choosing a topic to publication – preparation of manuscript – report writing – format of journals – proof reading – sources of information : journals, reviews, books, monographs etc – How to write thesis and their standard format – standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

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D. MUTHU

Ref. No: 44341/Ph.D.K7/Zoology/Full Time/January 2015/Date:28.01.2015

Ph.D. Zoology Course Work Syllabi – Paper - II

**Title of the paper**

**Cancer Biology (15PHDZO2)**

**Objective:** To help the learner understand the basic concepts related to development, progression and therapeutic intervention of cancer.

**UNIT - I: Fundamentals of cancer biology**

Hall marks of cancer, different forms of cancers, Factors influencing human carcinogenesis: regulation of cell cycle, cell cycle check points, modulation of cell cycle in cancer, mutations. Tumor suppressor genes, apoptosis,

**UNIT - II: Carcinogenesis & Molecular basis of cancer:**

Theory of carcinogenesis - chemical and physical carcinogenesis. Metabolism of carcinogenesis. Radiation, mechanism of Ionizing Radiation.

Signal pathways and cancer - JAK-STAT, RAS-RAF, ERK, MAP Kinase, Wnt pathway, TGF  $\beta$  Signaling, mTOR, oncogenes. Identification of oncogenes, retroviruses and detection of oncogenes. Protooncogene/oncogene activity. Growth factors related to transformation, Telomeres and telomerase in cancer, Telomerase inhibitors, role of epigenetics in cancer.

**UNIT – III: Cancer metastasis**

Metastatic cascade, basement membrane disruption, Clinical significance of invasion, Tumor heterogeneity, three-step theory of invasion, Tumor angiogenesis, MMP and TIMPS, tumor cell invasion, cell adhesion molecules.

**UNIT – IV: Cancer detection techniques**

Cancer screening and early detection, animal models of cancer, Imaging, molecular tools for early diagnosis of cancer detection. Tumor biomarkers. Microarray and gene expression profiling, prediction of aggressiveness of cancer, advances in cancer detection.

**UNIT – V: Cancer therapy**

Different forms of therapy, chemotherapy, radiotherapy, Immuno therapy, Use of signal targets towards therapy of cancer, Cancer vaccines, Gene therapy.

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Ph.D. Zoology Course Work Syllabi – Paper - III

<b>Title of the paper</b>
<b>Biotechnology (15PHDZO3)</b>

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

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**Unit III**

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Ph.D. Zoology Course Work Syllabi – Paper - II

**Title of the paper**

**Cancer Biology (15PHDZO2)**

**Objective:** To help the learner understand the basic concepts related to development, progression and therapeutic intervention of cancer.

**UNIT - I: Fundamentals of cancer biology**

Hall marks of cancer, different forms of cancers, Factors influencing human carcinogenesis: regulation of cell cycle, cell cycle check points, modulation of cell cycle in cancer, mutations. Tumor suppressor genes, apoptosis,

**UNIT - II: Carcinogenesis & Molecular basis of cancer:**

Theory of carcinogenesis - chemical and physical carcinogenesis. Metabolism of carcinogenesis. Radiation, mechanism of Ionizing Radiation.

Signal pathways and cancer - JAK-STAT, RAS-RAF, ERK, MAP Kinase, Wnt pathway, TGF  $\beta$  Signaling, mTOR, oncogenes. Identification of oncogenes, retroviruses and detection of oncogenes. Protooncogene/oncogene activity. Growth factors related to transformation, Telomeres and telomerase in cancer, Telomerase inhibitors, role of epigenetics in cancer.

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Metastatic cascade, basement membrane disruption, Clinical significance of invasion, Tumor heterogeneity, three-step theory of invasion, Tumor angiogenesis, MMP and TIMPS, tumor cell invasion, cell adhesion molecules.

**UNIT – IV: Cancer detection techniques & Cancer therapy**

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Ph.D. Biotechnology Course Work Syllabi – Paper – I

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**Research Methodology (15PHDBT1)**

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**Reference:**

1. Davis, G.B. and C.A. Parkar 1997, Writing the doctoral dissertation. Barons Educational series, 2<sup>nd</sup> edition. Pp 160. ISBN : 0812098005.
2. Duncary, P. 2003. Authoring a Ph.D. thesis: how to plan, draft, write and finish a doctoral dissertation. Plaggrave Macmillan, Pp 256. ISBN 1403905843.
3. Saxena, S. 2001, MS office, Vikas Publishing House Pvt. Ltd. New Delhi 110014.

Ph.D. Biotechnology Course Work Syllabi – Paper - II

**Title of the paper**

**Clinical Biochemistry (15PHDBT2)**

**Objective:** To help the learner understand the basic concepts related to development, progression and understanding the biological metabolism.

**Unit – 1**

Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apo-lipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders.

**Unit – 2**

Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin.

Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.

**Unit – 3**

Disorders of carbohydrate metabolism: Diabetes mellitus, hypo-glycemias, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases.

Disorders of mineral metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hypophosphataemia and hyperphosphataemia.

**Unit - 4**

Inborn errors of metabolism:

- Disorders of amino acid metabolism-* Phenylalanemia, homocystinuria, tyrosinemia, phenylketonuria, alkaptonuria and albinism.
- Disorders of nucleic acid metabolism-* Disorders in purine/pyrimidine metabolism.

**Unit – 5**

Biochemical aspects of hematology: Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias, thrombosis and anemias. Detoxification in the body: enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion, Disorders of vitamins and trace elements.

**Reference:**

1. Textbook of Medical Biochemistry by MN Chatterjea and Rana Shinde, Jaypee Brothers.
2. Lehninger Principles of Biochemistry 5th Ed by David L. Nelson and Michael M. Cox, WH Freeman and Company.
3. Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed **By** LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
4. Medical Biochemistry (Paperback) by John W. Baynes and Marek Dominiczak. Publisher: Mosby.

Ph.D. Biotechnology Course Work Syllabi – Paper - III

<b>Title of the paper</b>
<b>Medical Biotechnology (15PHDBT3)</b>

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit -I**

Interferon & interleukins: Overview of interleukins, commercially available interleukins, interferons – α, β and γ.

**Unit -II**

Gene therapy – background, types of gene therapy (ex vivo & in vivo), choosing targets for gene therapy, vectors in gene therapy, retroviruses, adenoviruses, adeno-associated viruses, types of gene delivery, Weismann barrier (soma-to-germ line barrier), epigenetic inheritance, problems & ethics.

**Unit -III**

Monoclonal antibody based Pharmaceuticals: Antibody; biology, Development of MAB as therapeutics, Humanized antibodies Molecular structural Pharmacology & Clinical uses of antibody based Pharmaceuticals.

**Unit -IV**

Vaccines – Different types of vaccines. Active and Passive immunization. Production of toxoids, production of Recombinant vaccines.

**Unit -V**

Stem cells: Types, characteristics, tissue healing, therapy, application in Research and Industry.

**References:**

1. Practical Biochemistry, V th edition, Keith Wilson and Walker.
2. Tools in Biochemistry David Cooper.
3. Methods of Protein and Nucleic acid Research, Osterman Vol I – III.
4. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.

Ph.D. Biotechnology Course Work Syllabi – Paper - IV

<b>Title of the paper</b>
<b>Pharmaceutical Technology (15PHDBT4)</b>

**Objectives:**

1. To enable the students to learn basic and advanced facts in Pharmaceutical technology and to develop an understanding of the biological-efficacy of Drugs.
2. This programme will provide students with a solid foundation in Chemical engineering, Pharmaceutics, Pharmaceutical Chemistry, Pharmacology and Pharmacognosy and its immunopharmacological response through in-depth understanding about the Human physiology.

**Unit -I**

Routes of administration, Pharmacokinetics, Pharmacodynamics, Receptors, Mechanism of action of drugs, Factors modifying drug action, adverse drug reaction, drug interactions, Bioassay of drugs, drug discovery and development.

**Unit -II**

Pharmaceutical biotechnology: Concepts of Protein, peptide & gene deliveries: Their basics, success, limitation and application. Packaging materials of pharmaceutical products; Different types of packaging techniques of various dosage forms.

**Unit -III**

Screening methods for anti-fertility agents – Antidiabetic drugs – Anti anginal drugs – Cardiac glycosides – Analgesic activity – Antipyretic activity – Anti cancer activity – Evaluation of hepatoprotective agents – Anti ulcer drugs.

**Unit -IV**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**Unit -V**

Organization and personnel – Buildings and facilities – Equipment – Documentation – Production and in-process control – Packaging and labeling – Storage – Distribution – Disposal of bio medical waste.

**References:**

1. Hardman, J.G. and Limbird, L.E., “Goodman and Gilman’s: The Pharmacological Basis of Therapeutics” 10th Edition, Medical Publishing Division, 2001.
2. Das, M.M., “Pharmacology for Second Professional Students” 5th Edition, Books and Allied (P) Ltd, 2004.
3. EllisHarwood series in Pharmaceutical Technology
4. Anjaneyulu, Y. and Maraya, R., “Quality Assurance and Quality Management in Pharmaceutical Industry”, Pharma Book Syndicate, 2005.

### ANNEXURE-1

1. **Title of the Ph.D Programme :-** Biology of Etroplus suratensis(Bloch,1855) from Cauvery river of Lower anicut, Thanjavur District, Tamilnadu, India.

2. **Course work under CBCS Pattern,**

Paper 1 : ANATOMY AND PHYSIOLOGY OF FISHES - 15 PHD 201

Paper 2 : AQUACULTURE BIOTECHNOLOGY - 15 PHD 202

### Signature of the Committee Members

1. Dr.R.Pragashraj, Research advisor,

- 
2. Dr.R.Rajaram,  
Assistant Professor,  
Department of Marine Science,  
Bharathidasan University,Tiruchirappallai

- 
3. Dr.R.Sivakumar,  
Assistant Professor of Zoology,  
Govt. Arts college for Men, Kumbakonam

## **PAPER-1- ANATOMY AND PHYSIOLOGY OF FISHES - ISPHD 201**

### **UNIT - I**

General structure of fish – identification of fish – morphometric character – meristic characters – descriptive characters – key for fish identification.

### **UNIT - II**

Age and growth of fishes – determination of age of fish – otolith method – bone method – known age method – scale method – relationship between the structured for the age and size – growth of fishes – liner growth characteristics – determination of linear growth of length – Length weight relationship in fishes.

### **UNIT - III**

Fecundity – definition – identification of eggs – categories of eggs in the ovary of fish – types of eggs – classification of fishes on the manner of spawning – groups of fecundity – Types of fecundity – Analysis of fecundity and reproduction – methods of estimation of fecundity – Fluctuations in fecundity – Factors influencing fecundity.

### **UNIT - IV**

Fish nutrition – food & feeding – feeding habits – Herbivorous fish – Omnivorous fishes – Carnivorous fishes – Plankton feeders – bottom feeders – digestive system – Alimentary canal – Mouth and mouth cavity - pharynx- oesophagus – stomach – intestine – rectum – glands associated with alimentary canal – digestion in fishes.

### **UNIT - V**

Migration – Alimental – gametic – climatic – osmoregulation – factors affecting migration – Adaptation in fishes – Adaptation in shape and symmetry – locomotion – light – respiratory organs – offense and defense organs – sensory organs

- References:
1. Fundamentals of fish taxonomy- Jayaram, K.C. – Narendhra Publishing house.
  2. Applied Fisheries – Shammi and Khanna.- AGROBIOS.
  3. The fresh water fishes of the Indian Region,- Jayaram, K.C. – Narendhra Publishing house.
  4. Biodiversity and Taxonomy.- Kumar,B.A. - Narendhra Publishing



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## **PAPER-2- AQUACULTURE BIOTECHNOLOGY – 15 PHD E02**

### **UNIT – I**

Scope of Aquaculture – Aquaculture in India – Extensive, Semi intensive and Intensive Fish Culture Research Organizations – CIFT, CMFRI, NIOT, CIBA.

### **UNIT – II**

Cultivable fishes – carp culture – Catla, Rohu, Mrigal – Composite fish culture  
Integrated fish farming. Fish – Digestion, Respiration and Reproduction.

### **UNIT – III**

Fish Diseases – Bacterial, Fungal and Viral diseases – Control measures. Role Of microbes in fish culture – Probiotics – Fish feed technology.

### **UNIT – IV**

Fish Biotechnology – Role of PCR, ELISA in Diagnosis of fish diseases. RAPD Studies in fishes – DNA barcoding CO1 marker – Genomics – Proteomics.

### **UNIT – V**

Processing and Preservation of fishes – Marketing strategies – Role of MPEDA – Fisheries by products.

- References:
1. Fish and fisheries – Pandey and Shukla –Rastogi publications.
  2. Sustainable development of fisheries and live stock.- Khillare and Natarajan- Narendhra publishing house.
  3. Probiotic food- Tripathi,M.K.- Narendhra publishing house.
  4. Hand book of fisheries management- Badapanda, K.C.,- Narendhra publishing house.



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Ph.D. Zoology Course Work Syllabi – Paper – I

Title of the paper
Cancer Biology (16PHDZO1)

**Objective:** To help the learner understand the basic concepts related to development, progression and therapeutic intervention of cancer.

**UNIT - I: Fundamentals of cancer biology**

Hall marks of cancer, different forms of cancers, Factors influencing human carcinogenesis: regulation of cell cycle, cell cycle check points, modulation of cell cycle in cancer, mutations. Tumor suppressor genes, apoptosis,

**UNIT - II: Carcinogenesis & Molecular basis of cancer:**

Theory of carcinogenesis - chemical and physical carcinogenesis. Metabolism of carcinogenesis. Radiation, mechanism of Ionizing Radiation.

Signal pathways and cancer - JAK-STAT, RAS-RAF, ERK, MAP Kinase, Wnt pathway, TGF  $\beta$  Signaling, mTOR, oncogenes. Identification of oncogenes, retroviruses and detection of oncogenes. Protooncogene/oncogene activity. Growth factors related to transformation, Telomeres and telomerase in cancer, Telomerase inhibitors, role of epigenetics in cancer.

**UNIT – III: Cancer metastasis**

Metastatic cascade, basement membrane disruption, Clinical significance of invasion, Tumor heterogeneity, three-step theory of invasion, Tumor angiogenesis, MMP and TIMPS, tumor cell invasion, cell adhesion molecules.

**UNIT – IV: Cancer detection techniques & Cancer therapy**

Cancer screening and early detection, animal models of cancer, Imaging, molecular tools for early diagnosis of cancer detection. Tumor biomarkers. Microarray and gene expression profiling, prediction of aggressiveness of cancer, advances in cancer detection.

**UNIT – V: Cancer therapy**

Different forms of therapy, chemotherapy, radiotherapy, Immuno therapy, Use of signal targets towards therapy of cancer, Cancer vaccines, Gene therapy.

**REFERENCE BOOKS:**

1. “Molecular biology of Cancer” 3/e, Lauren Pecorino Oxford University Press, 2012.
2. “The molecular biology of cancer” Stella Pelengaris and Michael Khan Blackwell publishing, 2006.
3. “Introduction to the cellular and molecular biology of cancer”, 4/e, M.A. Knowles, P.Selby, Oxford University Press, 2005.
4. “Molecular biology of human cancers”, 2/e, Wolfgang Arthur Schulz, Springer, 2005.
5. “Molecular biology of cancer” F.Macdonald, C.H.J. Ford and A.G.Casson, Bios scientific Publishers, Taylor Francis, 2005.

Ph.D. Zoology Course Work Syllabi – Paper – II

Title of the paper
Biotechnology(16PHDZO2)

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for *Agrobacterium tumefaciens*. Cloning vector for mammalian cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

Cell culture – Organ culture – Whole embryo culture- Embryo transfer – In vitro fertilization (IVF) technology – Dolly – embryo transfer in human. Transgenic animal. Human gene therapy – Cryobiology.

**Unit IV**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metabolites – Penicillin.

**Unit V**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM food. Biotechnology & Biosafety – IPR – Levels of biodiversity –  $\alpha_2$  and  $\beta_1$  biodiversity conservation.

**Reference:**

1. Dubey, R.C.-A text Book of Biotechnology, S. Chand and Co., Ltd., New Delhi. 1996.
2. Gupta, P.K. – Biotechnology and genomic, Restage Publications, Meerut 2004.
3. Rebert F. Weaver – Molecular Biology II Edn., Tata McGraw-Hill, New Delhi.
4. D. Balasubramanian et al – Concepts in Biotechnology – Concepts in Biotechnology – Concepts in Biotechnology.
5. Putohit, S.S. –Biotechnology Fundamentals and Application-Agrobios, Jothpur-2005.

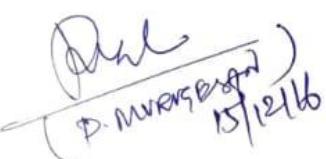
**A.V.V.M. SRI PUSHPAM COLLEGE (Autonomous), POONDI-613 503.**

**DEPARTMENT OF ZOOLOGY AND BIOTECHNOLOGY**

**Ph.D. PROGRAMME – SYLLABUS**

Subject Code	Title of the Paper	Credit
16PhDZO1	1. RESEARCH METHODOLOGY	6

- UNIT I** Library and research documentation – Methods of literature collection, online internet and website, technical papers, reviews, monograph, and abstract services, Information storage and retrieval, preparation of index card, preparation and presentation of research papers for journals, symposia and conferences. Scope, identification and selection of research problem – experimental approach designing of methodology Planning and execution of investigation – methods of editing and abstracting, preparation of manuscript and proof reading – thesis writing.
- UNIT II** Principles of microtechniques – fixatives and histological stains – fixation, tissue processing and staining, freezing microtomy (cryostat). Histochemistry – fixatives, histochemical stains – principles involved in identification of carbohydrates, proteins, lipids, enzymes and DNA. Electron Microscopy – SEM, TEM, STEM – Principles and applications – Histological preparation of tissues for SEM & TEM. Photography – Photomicrography – Principles and applications.
- UNIT III** Chromatography – Principles, types and applications – Paper, column, ion-exchange HPLC, TLC, GLC. Electrophoresis: Principles, types and application – Paper, Agar Gel, SDS-PAGE. Immunological Techniques: Antigen and antibody preparation and purifications – Immunodiffusion – Immuno electrophoresis, ELISA, Blotting Techniques – Southern and Western. Tracer techniques – Autoradiography and its applications, Radiation measuring devices, Geiger Muller counter, Scintillation counter – Principle and their applications.
- UNIT IV** pH meter – principles and applications, Centrifuge – Principles, types and applications, Spectrophotometer, Colorimeter, UV – Atomic calorimetry – Wet combustion, Comb Calorimeter, Manometry – Respirometer – Warburg's apparatus – Oxygen analyzer – Principles and applications.

  
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**UNIT V**

Statistical Methods and applications; Experimental designs – Sampling Probability Normal curve – Test of Significance – Student's 't' test – Chi-square test, 'F' test – Analysis of Variance – One way and Two-way and Multiple way of analysis – Correlation coefficients – Simple, Linear and Multiple correlations – Simple, Linear and Multiple Regression.  
Computer Application: Classification – Input and Output devices, main and auxillary memories, CPU – software and applications. Definition of operating systems of computers, coding, debugging, and testing.  
LOTUS: Data Entry and Graph generation  
WORDSTAR: Basic ideas of menu and editing the text, WINDOWS-MS WORD and EXCEL.

**Reference Books**

1. Anderson, Durston, Polle, 1970. Thesis and Assignment Writing, Wiley Eastern Limited.
2. Parsons, C.J., 1973. Thesis and Project Work: A Guide to Research and Writing, George Allen and Unwin Ltd., London.
3. Pearse, A.G.E., 1968. Histochemistry – Theoretical and Applied – Vols.I and II, Churchill Livingstone, London.
4. Longford, M., 1982. Step by step guide to Photography, Ebury Press, London.
5. Ouchterlony, O., 1968. Handbook of Immunodiffusion and Immunolectrophoresis, Ann Arbor Science Publishers, Michigan.
6. Larson, M.A., Ray, B., 1999. Laboratory techniques in Zoology, Butterworth and Co., London.
7. Rosnwy, D., Boywe, 1987. Modern Experimental Biochemstry, Addisson Wesley Publishing Co., Massachusetts, California.
8. Soog, A., Douglas, James, J., Leary, 1992. Principles of Instrumental Analysis, Saunders Golden Sunber Series.
9. Paulgilster, 1996. Finding it on the Internet, II Edition, John Wiley and Sons Inc., NY.
10. Rajagopalan, K., 1991. Essentials of Computer Fundamentals, CBS Publishers and Distributors, New Delhi.

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**DEPARTMENT OF ZOOLOGY AND BIOTECHNOLOGY**

**Ph.D. PROGRAMME – SYLLABUS**

Subject Code	Title of the Paper	Credit
16PhDZO2	2. AQUATIC BIOTECHNOLOGY	4

- UNIT I** Water resources – Physico-chemical characteristics – Temperature, pH – Turbidity, DO, CO<sub>2</sub>, alkalinity, micro and macronutrients – Primary productivity.
- UNIT II** Survey on shell and fin fishes (Commercially important) – Nutritional and Reproductive cycles – Hormonal regulation of reproduction – Induced spawning in fish and prawn.
- UNIT III** Characteristic features of microbes – Microbial culture – Microbial diseases (viral, bacterial and fungal) diseases of fish and prawn – Control measures – production of antibodies and vaccines.
- UNIT IV** Isolation of DNA from animal tissue – restriction enzymes – Separation of DNA – SDS Page – RFLP analysis – PCR amplification – DNA finger printing.
- UNIT V** Transgenic methods for animal cell – Transgenic fishes – Embryonic stem cell transfer technique – Advantages of transgenic fishes.

**Reference Books**

1. A text book of Applied Aquatic Biology - B.B. Hosetti and Arvind Kumar.
2. Marine Fisheries - Paul and Rao.
3. Microbiology – A. Mani *et al.*
4. Biotechnology – V. Kumaresan.
5. Biotechnology – Dubey.

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**DEPARTMENT OF ZOOLOGY AND BIOTECHNOLOGY**

**Ph.D. PROGRAMME – SYLLABUS**

Subject Code	Title of the Paper	Credit
16PhDZO3	3. BIODIVERSITY AND MARINE BIORESOURCES	4

- UNIT I** Biodiversity – Definition – Scope – Types of Biodiversity – Biodiversity of Tamil Nadu, Biodiversity of India – Global Biodiversity - Conservation and Management of Biodiversity – India is a Mega Biodiversity Centre.
- UNIT II** Introduction to Marine Environment; Marine Flora – Phytoplankton, seaweeds, sea grasses, mangroves and their characteristics and conservation of mangroves – Fauna and Flora of mangroves.
- UNIT III** Marine fauna – Zooplankton: Major marine invertebrates (Crustaceans and Molluscs); Vertebrates (Pisces) – characteristics and identification; Biology – Food and Feeding – Age and Growth – Reproductive Cycle of Crustaceans, Molluscs and Fishes.
- UNIT IV** Methods of surveying the living resources (Acoustic, Aerial and Remote sensing); Principal methods of exploitation (Indigenous and modern crafts and gears).
- UNIT V** Population dynamics – Principles of population dynamics; Unit stocks; Age and Size composition of the population; Abundance and density; Recruitment; Growth; Mortality (Fishing and Natural); Conservation and management – *in situ* and *ex situ*; IUCN categorization; Marine biosphere reserves; Marine parks – heritage sites.

**Reference Books**

1. Miller, R.I., 1994. Mapping the Diversity of Nature, Chapman and Hall.
2. Heywood, V.H., 1995. Global Biodiversity Assessment, UNEP, Cambridge University Press.
3. King, M., 1995. Fisheries Biology: Assessment and Management, Fishing News Books.
4. Agarwal *et al.*, 1996. Biodiversity and Environment, APH.
5. Carl, E., Bond, 1996. Biology of Fishes, 2<sup>nd</sup> Edition, W.B. Saunders Company, Philadelphia.
6. Naskar, K., and Mandal, R., 1999. Ecology and Biodiversity of Indian Mangroves, Daya.
7. Jeffrey, S. Levinton, C.D., 2001. Marine Biology: Function, biodiversity, ecology.
8. Artikeya, K., 2005. Biodiversity Extinction and Conservation.

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16 Ph D201 - 5 credit

## BIOCHEMISTRY AND MOLECULAR BIOLOGY

### UNIT 1 : Structure and Functions - Carbohydrates

Carbohydrates - Structure and classification of mono, di, oligo and polysaccharides and its metabolism, Glycolysis - Kreb's cycle - Gluconeogenesis - HMP Pathway.

### UNIT II : Structure and Functions - Lipids and protein

Lipids - Classification - Structure - Properties - Lipid Metabolism - Oxidation - Fattyacid and cholesterol Biosynthesis - Glyoxalate cycle - Classification of Protein , Structure, Properties, Metabolism of protein and functions.

### UNIT III : Chromatography

General Principles, instrumentation and applications of paper, thin layer, column, gas liquid, adsorption, partition, ion exchange, HPLC and molecular sieve chromatography.

### UNIT IV : Electrophoresis and Centrifugation

General Principles and instrumentation. Electrophoresis of proteins - native gels, gradient gels, SDS PAGE, Isoelectric focusing, 2-D PAGE. Electrophoresis of nucleic acids - Agarose gel electrophoresis, DNA sequencing gels, pulse - field gel electrophoresis, capillary electrophoresis.

Principle, instrumentation and applications of centrifugation. Preparative ultracentrifugation - differential centrifugation, density gradient centrifugation (rate-zonal & isopycnic). Analytical ultracentrifugation - molecular weight determination.

### UNIT V : Molecular Biology techniques :

Blotting techniques - Southern, Northern, Western blotting. Principle, applications of PCR, RT-PCR, In situ hybridization and fish.

### REFERENCES :

1. Instrumental Methods of Analysis, Williams, Merrit et al.
2. Scientific Foundations of Clinical Biochemistry, Williams and Marks.
3. Concepts in Biotechnology, ed; D.Balasubramanian. Costed IBN, University Press, India 1996.
4. Principles and Techniques in Practical Biochemistry. Wilson and Walker, 4th edition. Cambridge University Press.
5. Harper's illustrated Biochemistry, 27th Edition (2006) Robert K. Murray, Daryl K Granner, Victor W.Rodwell. McGraw -Hills.
6. Fundamentals of Biochemistry for Medical Students by Dr. Ambika Shanmugam.

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1b PhD 202 - 5 credit.

## ANIMAL BIO TECHNOLOGY & DIABATOLOGY

### Unit-1

Transgenic Animals Development and uses -mice, Cattle, goat, fish and sheep and transgenic pets. Tendered meat production. Transgenic breeding strategies - Molecular farming (Products with strategic importance). Insulin production using GMO. Embryonic stem cell preservation and its used in endangered animals.

### Unit-2

Use of nucleic acid probes and antibodies in clinical diagnosis and tissue typing. Mapping of human genome -HGP (Human Genome Project, RFLP, RAPD and its applications. Genetic engineering approaches for the correction of genetic disorders, Human cloning, Gene Silencing. Animal right activities Blue Cross in India - Society for prevention of Cruelty against animals. Ethical limits of Animals use - Human Rights and Responsibilities. Proteomics in disease biomarkers identification.

### Unit-3

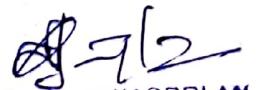
Signs and symptoms of diabetes mellitus - Courses of diabetes - prediabetes. Diabetic diet - glycemic index - myths and facts about diabetes - control of diabetes by diet - recommended diet.

### Unit-4

Diabetic retinopathy - Neuropathy - nephropathy - Ketoacidosis - Gestational diabetes. Screening - diagnosis - Therapy and Management of glycemia - Insulin therapy risk of intensive treatment - monitoring of blood glucose.

### Unit-5

Complications of diabetes - Hypoglycemia - Hyper glycemia - diabetic insipidus - post prandial glycemic control - glucose value - insulin pump - metabolic syndrome - genetic influence.



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## DOCTORAL COMMITTEE REPORT - Ph.D. PROGRAMME

Name of the Research Scholar : Mr. K.Vasanthakumar  
 Ref.No. : 16458/Ph.D.K7/Zoology/Full Time/July 2016.  
 Research Centre : Department of Zoology and Biotechnology,  
                          A.V.V.M. Sri Pushpam College(Autonomous),  
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 Research Advisor : Dr.K.JAYASEELAN,  
                          Assistant Professor,  
                          Department of Zoology and Biotechnology,  
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 Doctoral Committee Members : 1. Dr.S.Ramu,  
                                   Assistant Professor, Department of Zoology,  
                                  M.R.Govt. Arts College, Mannargudi.  
                                  2. Dr.K.Rameshkumar,  
                                  Assistant Professor, Department of Zoology,  
                                  Rajah Serfoji Govt. Arts College, Thanjavur.  
 Date of Meeting : 19.01.2017

Course work and credit recommended:  
 by the Doctoral Committee from the  
 syllabus offered by

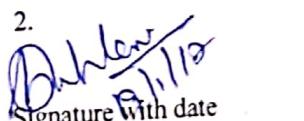
Department of Zoology and Biotechnology,  
 A.V.V.M. Sri Pushpam College(Autonomous),  
 Poondi-613 503, Thanjavur District.

S.No.	Subject Code	Title of the Paper	Credit
1.	16PhDZO1	Biochemical and Molecular Techniques	5
2.	16PhDZO2	Animal Biotechnology and Diabetology	5

Doctoral Committee Member:

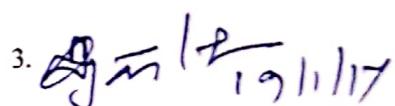
  
19/01/17

Signature with date  
Dr.S.RAMU

  
19/01/17

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Dr.R.RAMESHKUMAR

Research Advisor:

  
19/01/17

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Dr.K.JAYASEELAN

Dr. K. JAYASEELAN,  
 Assistant Professor,  
 Dept. of Zoology & Biotechnology,  
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 Poondi-613 503, Thanjavur (Dt).

Ph.D. Zoology Course Work Syllabi – Paper – I

<b>Title of the paper</b>
<b>Cancer Biology (16PHDZO1)</b>

**Objective:** To help the learner understand the basic concepts related to development, progression and therapeutic intervention of cancer.

**UNIT - I: Fundamentals of cancer biology**

Hall marks of cancer, different forms of cancers, Factors influencing human carcinogenesis: regulation of cell cycle, cell cycle check points, modulation of cell cycle in cancer, mutations. Tumor suppressor genes, apoptosis,

**UNIT - II: Carcinogenesis & Molecular basis of cancer:**

Theory of carcinogenesis - chemical and physical carcinogenesis. Metabolism of carcinogenesis. Radiation, mechanism of Ionizing Radiation.

Signal pathways and cancer - JAK-STAT, RAS-RAF, ERK, MAP Kinase, Wnt pathway, TGF  $\beta$  Signaling, mTOR, oncogenes. Identification of oncogenes, retroviruses and detection of oncogenes. Protooncogene/oncogene activity. Growth factors related to transformation, Telomeres and telomerase inhibitors, role of epigenetics in cancer.

**UNIT – III: Cancer metastasis**

Metastatic cascade, basement membrane disruption, Clinical significance of invasion, Tumor heterogeneity, three-step theory of invasion, Tumor angiogenesis, MMP and TIMPS, tumor cell invasion, cell adhesion molecules.

**UNIT – IV: Cancer detection techniques & Cancer therapy**

Cancer screening and early detection, animal models of cancer, Imaging, molecular tools for early diagnosis of cancer detection. Tumor biomarkers. Microarray and gene expression profiling, prediction of aggressiveness of cancer, advances in cancer detection.

**UNIT – V: Cancer therapy**

Different forms of therapy, chemotherapy, radiotherapy, Immuno therapy, Use of signal targets towards therapy of cancer, Cancer vaccines, Gene therapy.

**REFERENCE BOOKS:**

1. "Molecular biology of Cancer" 3/e, Lauren Pecorino Oxford University Press, 2012.
2. "The molecular biology of cancer" Stella Pelengaris and Michael Khan Blackwell publishing, 2006.
3. "Introduction to the cellular and molecular biology of cancer", 4/e, M.A. Knowles, P.Selby, Oxford University Press, 2005.
4. "Molecular biology of human cancers", 2/e, Wolfgang Arthur Schulz, Springer, 2005.
5. "Molecular biology of cancer" F.Macdonald, C.H.J. Ford and A.G.Casson, Bios scientific Publishers, Taylor Francis, 2005.

Ph.D. Zoology Course Work Syllabi – Paper – II

Title of the paper
Biotechnology(16PHDZO2)

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
2. To understand the recombination DNA technology.
3. To aware the programs of cell culture, preparations hormones and vaccines, engineered Hb, transgenic animals and Human genome project.
4. To study the Bio process Technology and their application.

**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for *Agrobacterium tumefaciens*. Cloning vector for mammalian cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

Cell culture – Organ culture – Whole embryo culture- Embryo transfer – In vitro fertilization (IVF) technology – Dolly – embryo transfer in human. Transgenic animal. Human gene therapy – Cryobiology.

**Unit IV**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metabolites – Penicillin.

**Unit V**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM food. Biotechnology & Biosafety – IPR – Levels of biodiversity –  $\alpha_2$  and  $\beta_1$  biodiversity conservation.

**Reference:**

1. Dubey, R.C.-A text Book of Biotechnology, S. Chand and Co., Ltd., New Delhi. 1996.
2. Gupta, P.K. – Biotechnology and genomic, Restage Publications, Meerut 2004.
3. Rebert F. Weaver – Molecular Biology II Edn., Tata McGraw-Hill, New Delhi.
4. D. Balasubramanian et al – Concepts in Biotechnology – Concepts in Biotechnology – Concepts in Biotechnology.
5. Putohit, S.S. –Biotechnology Fundamentals and Application-Agrobios, Jothpur-2005.
6. Alberghina – Protein Engg. In Industrial Biotechnology – New Era Books, Bangalore.

Ph.D. Zoology Course Work Syllabi – Paper – 1

**Title of the Paper**

**Research Methodology (17PHDZO1)**

**Objectives:**

1. The course aims to train student in the statistical analysis and presentation of the data.
2. To write the report / thesis / dissertation and or for publications in appropriate research journals.
3. The aim of the paper thus is to lay a strong foundation for the student for thesis writing, editing, analysis and interpretation of the generated data with hands on experience with model sums.

**Unit – I**

Collection of data- diagrammatic representation: Bar, Pie diagrams; graphic representation - Histogram, frequency polygon; Measures of central tendency: Arithmetic mean, median & mode (direct methods and model sums). Measures of dispersion: Universe and population - delimiting population – sampling methods: random sampling stratified random sampling- standard deviation- standard error- coefficient of variation: elucidation with model sums.

**Unit – II**

Bivariate relationship: Types of Correlation and Karl Pearson's correlation coefficient: model sums with elucidation – Regression analysis: Components of regression equation – Confidence intervals of regression line. Fitting simple regression lines: model sums, calculations of equation and fitting of regression line, estimated and calculated Y. Comparison between correlation and regression.

**Unit – III**

Probability – Theorems: Addition and multiplication – Patterns of distributions: Poisson, Normal and Binomial; Test of significance – Comparison of means: Chi square test, student t test, ANOVA, model sums on the way ANOVA with interpretation of data – introduction to MANIVA and STASTICA - Use of statistical software's.

**Unit - IV**

Research : selection of problems – stages in the execution of research: choosing a topic to publication – preparation of manuscript – report writing – format of journals – proof reading- sources of information: journals, reviews, books, monographs etc – How do write thesis and their standard format – standard organization of bibliography. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

**Unit – V**

Journals: standard of research journals – paid and refereed journals – impact factor – citation index – choice of journals for publications. Information retrieval: access to archives and databases, search engines: Google, PubMed, NCBI, etc., National information centre – online data base library.

**References:**

1. Davis, G.B. and C.A. Parkar 1997, Writing the doctoral dissertation. Barons Educational series, 2<sup>nd</sup> edition. Pp 160. ISBN : 0812098005.
2. Duncary, P. 2003. Authoring a Ph.D. thesis: how to plan, draft, write and finish a doctoral dissertation. Palgrave Macmillan, Pp 256. ISBN 1403905843.
3. Saxena, S. 2001, MS office, Vikas Publishing House Pvt. New Delhi, 110014.

Ph.D. Zoology Course Work Syllabi – Paper – 2

**Title of the Paper**

**Insect Toxicology (17PHDZO2)**

**Objectives:**

4. The course aim to train student in the structure and mode of action of important insecticides belonging to different groups, development of resistance to insecticides by insects, environmental pollution caused by toxic insecticides and their toxicological aspects.

**Unit - I**

Definition and Scope of Insecticide Toxicology: History of chemical control; pesticide use and pesticide industry in India.

**Unit - II**

Classification of Insecticides and Acaricides: Based on mode of entry, mode of action and chemical nature. Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrazoles, new promising compounds, etc.

**Unit - III**

Principles of Toxicology: Evaluation of insecticide toxicity; joint action of insecticides- synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity.

**Unit - IV**

Insecticide Metabolism: Pest resistance to insecticides, mechanisms and types of resistance, insecticide resistance management and pest resurgence.

**Unit - V**

Insecticide Significance and Environmental Implications: Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.).

**REFERENCES:**

- Gupta HCL.1999. *Insecticides: Toxicology and Uses*. Agrotech Publ., Udaipur
- Chapman, V.J.. Coastal Vegetation. IIInd edition. PergamonPress.New York
- Ishaaya I & Degheele (Eds.). 1998. *Insecticides with Novel Modes of Action*. Narosa Publ. House, New Delhi.

Ph.D. Zoology Course Work Syllabi – Paper – 3

**Title of the Paper**

**Agricultural Entomology (17PHDZO3)**

**Objectives:**

5. To study the Morphology, Anatomy and Physiology of the insect's body.
6. To study the Pathology of various microbes.
7. To study the insect resistance in crop plants, Gene transfer, Screening techniques.

**Unit - I**

Insect Morphology: Body wall structure, colouration and special integumentary structures, body tagmata, sclerites and segmentation. Head- Origin, structure and modification, types of mouthparts and antennae. Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications. Legs: structure and modifications. Abdomen- Segmentation and appendages.

**Unit - II**

Scope and Importance of Insect Anatomy and Physiology: Structure and physiology of different systems - digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands. Embryonic and post-embryonic development, types of metamorphosis.

**Unit - III**

History of Insect Pathology: Infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes. Use of insect pathogens in integrated management of insect pests. Identification of different groups of insect pathogens and symptoms of infection.

**Unit - IV**

Plant Resistance to Insects: History and importance of resistance, principles, classification, components, types and mechanisms of resistance. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects Chemical ecology, tritrophic relations, volatiles and secondary plant substances; basis of resistance.

**Unit - V**

Factors Affecting Plant Resistance Including Biotypes and Measures: Screening techniques, breeding for insect resistance in crop plants, exploitation of wild plant species, gene transfer, successful examples of resistant crop varieties in India and world.

**References:**

1. Chapman RF. 1998. *The Insects: Structure and Function*. Cambridge Univ. Press, Cambridge.
2. David BV & Ananthkrishnan TN. 2004. *General and Applied Entomology*. Tata-McGraw Hill, New Delhi.
3. Saxena AB. 2003. *Biological Control of Insect Pests*.

Ph.D. Zoology Course Work Syllabi – Paper – I

Title of the paper
Clinical Biochemistry (18PHDZO1)

**Objective:** To study the lab setup and safety measures, to learn about the metabolic disorders, to know about drug design and their types.

**UNIT - I: Laboratory Setup and Safety:**

Requirements of setting up of clinical laboratory, SI units in clinical laboratory, Collection preparation, preservation, and handling of clinical samples, quality control, Safety measures in clinical laboratory. Formulation of clinical and diagnostic kits, Safety aspects.

**UNIT - II: Metabolic Disorders:**

Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.

Disorders of Lipid metabolism – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and diseases - hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

**UNIT – III: Neurological and Psychiatric Disorders:**

Schizophrenia – types, symptoms, antipsychotic drugs - Affective disorders - Unipolar and bipolar disorders, antidepressants , Alzheimer's disease, Wernicke-Korsakoff syndrome, dementia, Wilson's disease

**Ageing-** Physiological and biochemical changes in ageing. Different theories of ageing, importance of superoxide dismutase in ageing, plasticity and regeneration

**UNIT – IV:** Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. Digestive diseases – Malabsorption, creatorrhoea, diarrhoea and steatorrhoea- Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH. Disorders of acid-base balance and their respiratory and renal mechanisms

**UNIT – V:** Inborn errors of Metabolism- Disorders of amino acid metabolism – Phenylalaninaemia, homocystinuria, tyrosinemia; Disorders of nucleic acid metabolism- Disorders in purine/pyrimidine metabolism

Hormonal imbalances: Protein hormones, steroid hormones, adrenocorticosteroids

**Reference:**

1. Burger, A., Med. Chem.
2. Wilson and Gisvold, Organic Med. Pharmaceutical Chem.

3. Ariens, Drug Design, Academic press, NY,1975.

S. Senthilkumar

Ref. No: 16917/Ph.D.K7/Zoology/Part Time/January 2018/Date:18.01.2018

**Ph.D. Zoology Course Work Syllabi – Paper - II**

**Title of the paper**

**Biotechnology(18PHDZO2)**

**Objectives:**

1. To study the concept and scope of Biotechnology and techniques in Biotechnology.
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**Unit I**

Concepts and scope of Biotechnology – Gene cloning – the basic steps – various types of restriction enzymes – ligase – linkers and adapters – cDNA – transformation – Selection of recombinants. Gene probe – Molecular finger printing – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western blotting.

**Unit II**

Plasmid biology – cloning vector based on E.coli, PBR322 and bacteriophage. Cloning vector for yeast. Cloning vector for *Agrobacterium tumefaciens*. Cloning vector for mammalin cells – Simian virus 40 – Gene transfer technologies.

**Unit III**

Cell culture – Organ culture – Whole embryo culture- Embryo transfer – In vitro fertilization (IVF) technology – Dolly – embryo transfer in human. Transgenic animal. Human gene therapy – Cryobiology.

**Unit IV**

Bioprocess and applications – Survey and uses of enzymes in industries – Isolation and purification of enzymes – Enzyme Immobilization techniques – Fermenters, their design and types – Down stream processing – Recovery of Fermented products; Commercial production of single cell protein (SCP) – Primary metabolites – Ethanol, Vitamins ;Secondary Metaolites – Penicillin.

**Unit V**

Bioremediation – bioremediation of hydrocarbons – industrial wastes – Heavy metals- Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM food. Biotechnology & Biosafety – IPR – Levels of biodiversity –  $\alpha_2$  and  $\beta_1$  biodiversity conservation.

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6. Eun – Enzymology primer for recombinant DNA Technology, Glazer-Microbial Biotechnology.

Ph.D. Zoology Course Work Syllabi – Paper – I

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Ph.D. Zoology Course Work Syllabi – Paper – II

<b>Title of the paper</b>
<b>Biotechnology(19PHDZO2)</b>

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4. Putohit, S.S. –Biotechnology Fundamentals and Application-Agrobios, Jothpur-2005.
5. Alberghina – Protein Engg. In Industrial Biotechnology – New Era Books, Bangalore.