

Ph. D DEGREE (ZOOLOGY)

With effect from 2014- 2015

COURSE – I: PAPER I: RESEARCH METHODOLOGY

Unit – I. Principles and Applications:

Microscopy – Principles, construction and biological use of Phase contrast, Fluorescence, Transmission and Scanning Electron Microscopes. UV visible spectrophotometer, Atomic Absorption Spectrophotometer, Centrifuge – Low, High and Ultra centrifuge – pH Meter.

Unit – II. Separation and Analytical Techniques:

Electrophoresis: Principles, Methods and application of paper, Cellulose and Immuno Electrophoresis, Poly Acrylamide Gel Electrophoresis.

Chromatography: Principles Methods and Application of Paper Chromatography, Thin Layer Chromatography (TLC), Gas Chromatography (GC), Gas Liquid Chromatography (GLC), High Performance Liquid Chromatography (HPLC), Ion-Exchange Chromatography - Trace Techniques – Geiger Muller Counter, Scintillation Counter and Autoradiography.

Unit – III. Histology and Histochemical Methods

Histological Preparation of Tissues for Light and Electron Microscope, Histology – kinds of fixatives – Characteristics of fixatives: dyes and their mode of action – Staining, Mounting of tissues – detailed schedule for making permanent slides of microtome sections.

Unit – IV. Data Process and analysis:

Classification of computer – Input and Output devices – Software packages used for statistics – Major Biological databases – Web Browsing – Major Web Site for Journals and Scientific Informations.

Biostatistics: Correlation, Coefficient, Simple Linear Regression, Student – T Test, Chi – Square Test, F – Test, ANOVA – One way, Two way and Multiple way.

Unit – V. Research Methods and thesis writing:

Scientific Writing – Choosing the problem for Research – Source of Information of methods of literature collection of review. Preparation of Index Card, Preparation of scientific manuscript, Thesis Writing – Proof correction – Impact Factor – Citation Index – H – Index.

References:

1. Anderson, Durston and Polle. 1970, Thesis and Assignment writing. Wiley Eastern Ltd.
2. Bajpai, P.K. 2010. Biological Instrumentations and Methodology (Tools and Techniques of Biology) S. Chad and Company Ltd. New Delhi.
3. Culling, C.P.A 1974. Hand book of Histopathological and Histochemical Techniques. Butterworths, London.
4. Kothari, C.R. IInd Edition (2004). Research Methodology, Methods and Techniques. New Age International (P) Ltd, Publishers, New Delhi.
5. Jenod H. Zar (1999). Biostatistical analysis by, Prentice Hall International, Inc. Press, London.
6. Kothori, C.R, 1989. Research Methodology – Methods and Techniques. Wiley Eastern Ltd.
7. Khandpur, R.S. (1990) Handbook of Biomedical Instrumentation, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India.
8. Slayter, R.J, 2000. Radioisotopes in biology – a practical approach. IRL Press, Oxford.

COURSE – II: PAPER - II - ADVANCED TECHNIQUES IN ZOOLOGY

UNIT - I

DNA, RNA and protein separation techniques-Southern blotting, Northern blotting and Western blotting techniques, polymerase chain reaction, Construction of Genomic Library, Sequencing of Nucleic acids, Measuring Nucleic acid and Protein interaction, Flow Cytometry, Fluorescence *in-situ* hybridization(FISH) & Genomic in situ hybridization (GISH) techniques.

UNIT – II

Cryopreservation – Manipulation of reproduction in animal – Transgenic animals – applications of molecular markers – Human welfare – Techniques used in vaccine production. Method and applications of DNA fingerprinting, Bioethics.

UNIT- III

Animal cell culture: Importance of Serum and Serum Free Media. Culturing and Sub Culturing of Animal Cells. In Vitro Transformation of Animal Cells, Primary and Secondary established cell lines, cloning of Animal cells, cell Line Preservation, cell line characterization, Manipulation of cultured cells, Passing cells, Stem Cell culture, Hematopoiesis embryonic stem cell culture, Measurement of cell death and cell viability.

UNIT – IV

Production of polyclonal and monoclonal antibodies – precipitin reactions and preparation of precipitin curve – immunodiffusion, radial immunodiffusion, double immunodiffusion-immunoelectrophoresis- rocket electrophoresis – haemagglutination – bacterial agglutination – passive agglutination - agglutination inhibition – radio immunoassay enzyme linked immunosorbent assay – elispot assay – immuno precipitation – immuno fluorescence.

UNIT – V

Synthesis, properties & characterization of nanomaterials – Nanomaterials and biosystem interaction – Applications of nanobiotechnology in early medical diagnostics, drug targeting & drug delivery.

References

1. Paul Robinson.J 1993, Handbook of Flow Cytometry Methods, Willey-Liss New York
2. Shanmugam. S., 2010, Nanotechnology, MJP publishers, Chennai,
3. Dubey.R.C. 2009, A Text book of Biotechnology, S.Chand & Co., New Delhi.
4. Subbiah Balaji. 2010,Nanotechnology, MJP publishers, Chennai,
5. Goldsby,R.A., Kindt.T.J., Osborne, B.A., and Kuby, J. 2003, Immunology,5th Ed. W.H.Freeman and Company, New York.
6. Bajpai, P.K. 2010, Biological Instrumentations and Methodology (Tools and Techniques of Biology) S.Chand and Company Ltd., New Delhi
7. Khandpur, R.S. 1990 Handbook of Biomedical Instrumentation, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India.
8. Sambrook, J and Rossell D.W. 2007, Molecular Cloning: A Laboratory Manual, 3rd Edition, Vol. 1,2,3:, Churchill Press
9. Bronzino.j.D, 2006, Tissue Engineering and Artificial Organs, Taylor & Francis Group, LLC
10. David Reisner.E, 2009, Bionanotechnology-Global Prospects, Taylor & Francis Group, LLC

COURSE III/ PAPER-III- FRONTIERS IN ZOOLOGY

Unit I

Environmental Pollution (air, water and soil) – causes and remedies – environmental impact assessment – Environmental laws – Environmental Education, Planning and Management– Bioremediation.- Bio-Indicators and Molecular markers. Renewable and Non-renewable sources of energy, Conventional and Non-conventional, Solar & Tidal energy – Biogas production – Nuclear energy – Indian nuclear power plants. Biodiversity – Types, measures of diversity – Bio – diversity conservation laws. Remote sensing and GIS – Basic concepts.

Unit II

DNA sequencing and Human genome project, DNA finger printing RT-PCR, Gene Detection of genetic diseases using DNA recombinant technology, screening and counseling – Human gene therapy - Animal cell culture-Primary and established cell line-Stem cell therapy. DNA methylation, antisense RNA, Transposons,. Cloning technique and its application in Biology, knock out genes– Ethical issues. Reproductive technologies related to human in vitro fertilization.

Unit III

Somatic mutation and oncogenes – Induction of mutation by mutagens, teratogens and carcinogens. Biofertilizers – composting – Biopesticides – SCP – Production and sources. Methods involved in the production of Protein- transgenic plants and animals and their uses. Production of recombinant protein, insulin and growth hormone. Protein Engineering – Enzyme Technology – Terminator genes.

Unit IV

Organization and expression of immunoglobulin gene. Vaccine – Whole organism vaccines, submit vaccines, recombinant vaccines, DNA vaccines, edible vaccines, synthetic peptide vaccine, multivalent submit vaccine, - development of AIDS and malaria vaccines. Applications of RIA, immunofluorescence, ELISA, Western blot and monoclonal antibodies in diagnosis of various diseases. Molecular Diagnostics: Karyotyping - FISH –RFLP -HLA, tissue typing and organ transplantation.

Unit V

Aquaculture : Environmental and Social issues in Coastal Aquaculture – Environmental Management of Shrimp farms – Induced breeding in fish and prawn –monosex - Sex reversal – Use of pituitary, HCG, LHRH, Synthetic hormones, their analogs – administration route – injection – feed – implants – Hybridization –Chromosome manipulations- Polyploids- Gynogenesis and Androgenesis – Environmental and Nutritional probiotics in the management of diseases, Cryopreservation of gametes and embryos.

Reference Books :

1. ABBAS, A.K.,LICHTMAN, A.K.,POBER , J.S.(1998) Cellular and Molecular Immunology. III Edition W.B.Saunders Company, U.S.A.
- 2.BENJAMIN LEWIN. (1999) Genes VII. Oxford University Press, New York.
- 3.BRANDEN, C., TOOZE, J. (1999) Introduction to protein structure. II Edition, Garland Publishing , Inc., New York.
- 4.DESMOND, S.T., NICHOLL. (1994) An introduction to genetic engineering Cambridge University Press, New York.
- 5.JONATHAN GRAVES, DUNGAN REAVEY (1996) Global Environmental Change. Plant,Animal and Communities. Long man.
- 6.HAWKINS, J.D. (1996) Gene structure and expression. III Edition. Cambridge University Press, New York.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

1-AQUACULTURE AND FISHERIES

UNIT-I Basics of Aquaculture

Introduction-Indian and World Aquaculture- Role, Constraints, remedial measures and other related problems - Importance of Aquaculture – Importance of Fisheries- Fishery products and by-products.

UNIT-II Capture fisheries

Major inland capture fishery resources in India- Lake and reservoir fisheries – Nursery system in Estuaries and Brackish water and its fishery resources in India-Marine major and minor fishery resources in India and World - fin and shell fishes.

UNIT-III Culture fisheries

Finfish and Shell Fish Culture: Monoculture- Polyculture- extensive, intensive- Integrated fish farming – Paddy cum fish culture – Fish and Prawn culture in freshwater ponds. Culture in Brackish water ponds - Culture of Pearl oyster, Green mussel and Lobster – Ornamental fish culture.

UNIT-IV Live Feed Culture

Taxonomy of Live feeds – General collecting methods- Culture and nutritional value of Rotifers, Artemia , Copepods and Daphnia and its status- Enumeration of fish food organisms.

UNIT-V Techniques in Aquaculture

Fish population studies; age and growth determination - Cryopreservation techniques for Live feeds – Bio-enrichment techniques – Applied Genetics of cultivable fishes – Recent techniques in fish biotechnology.

REFERENCES:

1. Pillay T.V.R.1995. Aquaculture Principles and Practices. Fishing News Books, Blackwell Science Ltd., Oxford.
2. Jhingran V.J., 1991. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
3. Shanmugam.K, 1990. Fishery Biology and Aquaculture. Leo Pathippagam, Madras – 600 083.
4. Biswas S.P., 1993. Manual of Methods in Fish Biology. South Asian Publishers Pvt. Ltd., New Delhi.
5. Santhanam.R, 2013,Fisheries Science.. Astral International (P) Ltd. New Delhi
6. Govindan T.K. 1985. Fish Processing and Technology. Oxford and IBH Pub.Co., Ltd., New Delhi.
7. Srivastava, C.B.L., 2006. A Text book of Fishery Science and Indian Fisheries. Kitab Mahal, Allahabad.
8. V.R.P.Sinha, 2002, Fisheries research planning and Management in developing countries- - International Books and Periodicals services(IFS)- New Delhi.
9. L.A.McEvoy and J.G.Stottrup, 2006-Live feeds in Marine Aquaculture – Blackwell publishing company, UK.
10. S., Mercy T.V. Anna, Swain Saroj Kumar 2013.Ornamental Aquaculture. Felix, Astral International(P) Ltd. New Delhi

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

2. RECENT ADVANCES IN ENTOMOLOGY

Unit I: Taxonomy and Biodiversity

Position of insects in animal kingdom-their origin, phylogeny and distribution: history and basis of insect classification; distinguishing characters of insect orders and economically important families; Insect collection methods and techniques-preservation-mounting-labeling techniques. Taxonomic structural and economic diversity, dominance of insects and reason.

Unit II: Insect Physiology

Fundamentals of insect physiology, different system (digestive, respiratory, excretory, circulatory and nervous system), their structure and function,

Unit III: Pest Ecology & Agricultural Entomology

Pest – definition and its ecology, pest status, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest, Economic injury level, economic threshold, action threshold, pest spectrum, pest complex, carrying capacity, secondary pest outbreak, pest surveillance and sampling. Insects and climate. Population dynamics of pests. Pests of field crops and stored food.

Unit IV: Insect toxicology

Classification and mode of action of insecticides; Metabolism or degradation of pesticides- Pesticides registration, pesticide industries and markets. Insecticide resistance and health hazards. Resurgence. Bioassay-LC₅₀ and LD₅₀. Dose-response relationship; Group characteristics of insecticide, structure and function of organochlorine, organophosphorus, carbamate, pyrethroid, bio-insecticides-plant origin, Nereistoxin, neonicotinoids, fumigants and IGRS – Naturelytes. Modern trends in the use of pesticides.

Unit V: Integrated pest management

Definition of IPM, components and concept of IPM, problems with pesticides, prophylactic measures-cultural, mechanical, physical and chemical methods. Biotechnological advances on pest management –biological control-parasitoidis, predators and pathogens. Antifeedants, hormones, semiochemicals-kariomones, host-plant resistance and genetic manipulation, insect quarantine; non-insect pests and their control.

Reference book

1. Ambrose, D.P. (2004). General Entomology. Kalyani Publishers, New Delhi.
2. Chapman, R.F. (2013). The Insects: Structure and function, (5th edition) Cambridge University press, UK
3. Nayer, K.K Anathakrishnan, T.N. and B.V.David(1989). General and Applied Entomology. Tata Mcgraw Hill Publications, New Delhi.
4. Rajendra singh and Sachan (2012). Elements of Entomology, Rastogi Publications, Meerut, New Delhi
5. Srivastava, K.P. (1993). A Text Book of Applied Entomology. Vol. I & II, Kalyani Publishers, New Delhi.
6. Temphare, D.B. (2009). Modern Entomology. Himalaya Publishing House, Mumbai
7. Vasantharaj David, B. and Ramamurthy V.V.(2011). Elements of Economic Entomology, Namurutha Publications Chennai.
8. Imms, A.D.,(1994).A general text book of entomology, Chapman & Hall, UK
9. Triplehorn, C.A. and Johnson, N.F. (2004). Borror and DeLong's Introduction to the study of insects, Saunders college Publications, USA
10. Snodgrass, R.E.,(1993). Principles of Insect Morphology, Cornell Univ. Press, USA.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

3-GENERAL ENDOCRINOLOGY

Unit I: Pituitary Gland

General properties of hormones –classification of hormones-mechanism of hormonal action-hypothalamic hormones-pituitary gland-structural organization-pituitary hormones functions-hypothalamic control-disorders of pituitary gland.

Unit II: Thyroid Gland

Thyroid gland-functional anatomy –synthesis, secretion and metabolic effects of thyroid hormone-effects of thyroid on reproduction –Hypo and hyperthyroidism parathyroid-structure secretion and metabolism of parathyroid hormones-effects of hypo and hyperparathyroidism-parathyroidectomy.

Unit III: Pancreas and Adrenal gland

Physiological anatomy of pancreas –synthesis, secretion and metabolism of insulin and glucagon-mechanism of action – functions of pancreatic polypeptide-function of insulin and glucagon –adrenals-functional anatomy of adrenal gland-hormones of adrenal cortex and medulla-functions of cortical and medullary hormones.

Unit IV: Reproductive Endocrinology

Functional mechanism-anatomy and histology of mammalian testis and ovary-male and female sex accessory organs-hormones of testis and ovary-estrus and menstrual cycle-hormones of pregnancy-parturition-lactogenesis and lactation-factors controlling spermatogenesis and oogenesis-infertility-hormonal disorders.

Unit V: Insect and Crustacean Endocrinology

Crustacean endocrine organs-endocrine regulation of moulting, growth, reproduction. Insect neuro endocrine organs –endocrine regulation of moulting, growth, metamorphosis and reproduction.

Reference Book

1. Harris, G.W. and B.T.Donovan, (Ed) 1968. The pituitary gland Vol.3
2. Williams, R.M., 1974. Text book of Endocrinology, 5th ED
3. Bentley, P.J. 1982, Comparative Vertebrate Endocrinology, Cambridge University Press.
4. Michel, P., 1968. Endocrine and Human Behaviour, Oxford University Press, New York.
5. Turner, C.D., 1996. General Endocrinology, 4th Ed, W.B. Saunders Co., London.
6. Bentley, P.J. 1985. Comparative Endocrinology, S.Chand and Co., Ltd.,
7. Barrington, E.J.E., 1968. An introduction to General and Comparative Endocrinology Academic Press London.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

4-TOXICOLOGY

Objectives

To make the students to understand the various types of toxicants, assessment methodology and its impact on living organisms.

Unit I: Methods of Toxicology

Bio-assay test –single species test-multi species test-acute toxicity test-subacute toxicity test – chronic toxicity test-determination of LC50 value –pathological techniques-autopsy and histology-histopathology-histochemistry-cytochemistry-morphometric methods.

Unit II: Absorption Distribution and excretion of toxicants

Definition and scope of toxicology –chemical interaction-membrane permeability-diffusion, filtration and engulfing by cells-absorption-membranous barrier –distribution-storage depots – excretion.

Unit III: Physiological, Bio-chemical and Target organ Toxicology

Mechanism of Toxicity-receptor mediated events –disturbance of excitable membrane function-biochemical profiles-enzyme activities- genotoxicity-dermatotoxicity-haematotoxicity-haemolymphotoxicity-neurotoxicity-nephrotoxicity - reproductive toxicity-endocrine toxicity-tissue specificity –mechanism of action.

Unit IV: Bio-Transformation of Toxicants

Definition –general principles –degradation reaction-Phase I and Phase II reactions-determining factors-complex nature of bio-transformation-bioinactivation and bioactivation –antidotes –mechanism of antidotal actions-assessment of antidotal efficacy-chelation.

Unit V: Chemical and Environmental toxicology

Toxic chemicals: pesticides-automobile emission –heavy metals-fertilizers-food additives-animal, plant and mushroom toxins-sources and its effects.

Environmental pollutants-contaminants-toxicants-sources-abiotic degradation –photolysis and hydrolysis-biotic degradation-bioaccumulation-behavior of toxicants in the environment-effects of xenobiotics on populations-community level-ecosystem level.

Text Books

1. Sharma, P.D. 1996. Environmental biology and toxicology. Rastogi publication, Meerut, India.
2. LU, F.C. 1985 Basic Toxicology. Hemisphere publication. Corporation, Washington, N.Y. London
3. Gupta, P.K. and Salunka, D.K. 1985. Modern toxicology. Vol I and II, Metropolitan, New Delhi
4. Sood, A. 1999. Toxicology. Sarup & sons, New Delhi
5. Subramanian, M.A., 2004. Toxicology principles and methods, MJP publishers, 47, Nallathambi st., Triplicane Chennai, 600 005.

Reference Books

1. Bulter, G.C. 1978. The principles of Ecotoxicology scope. 12, ICSO Scope John Wiley and sons, Chichester.
2. Finney D.J. 1971 analysis, Cambridge University, Press
3. Adrien Albert 1981. Selective Toxicity. University Press Cambridge
4. Gupta, P.K. and V.Raviprakash 1988. Advance in Toxicology and Environmental Health. Jagmandar Book Agency, New Delhi.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

5- RECENT TRENDS IN BIOTECHNOLOGY

Unit 1: Molecular Cloning:

Vectors in Molecular Biology - Modifying Enzymes - Polymerase chain reaction - DNA/Protein sequencing Mutagenesis - Transposable Elements - Genomic, cDNA Library construction and screening - Map based cloning.

Unit-II: Cloning in Microorganisms:

Cloning Techniques; Cloning in *E-coli*- Cloning in *Bacillus subtilis* - Cloning in Yeast
Specialized vectors: Artificial chromosomes, Operons - Expression of cloned genes, site directed mutagenesis, fusion proteins - Degradative plasmids.

Unit III: Cloning in higher Organisms:

DNA mediated transformation, Gene transfer by viral transduction Genetic manipulation in mammals - DNA transfer to other vertebrates - Gene transfer in plants - Direct and indirect gene delivery systems - plant viruses as vectors.

Unit IV: Applications of Genetic Engineering:

Nucleic acid sequences as diagnostic tools - New drugs for genetic Diseases combating infectious diseases - Protein engineering - Production of interferon's - DNA vaccines, Interleukins, monoclonal antibodies, Cell culture products. Transgenic animal, protoplast isolation and culture: Somatic hybridization, hybrid technology, transgenic plants: Germplasm conservation.

Unit V: Recent advances in Biotechnology:

DNAi Protein microarrays - DNA/ Protein Markers - DNA finger printing - Gene knock out - RNAi and Gene silencing - Metagenomics Bioethics and IPR.

Reference:

1. Bowtell, D and Sambrook, J (2003). DNA Microarrays: A Molecular cloning manual. Edited by Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, New York.
2. Glick, BR., Pasternak, J (1998) Molecular Biotechnology: Principles and Applications of recombinant DNA, ASM Press, Washington D.C, U.S.A.
3. Grandi, G (2004) Genomics, Proteomics and Vaccines. Wiley press, New York.
4. Hannon, GJ (2008) RNAi: A guide to gene silencing. Cold Spring Harbour laboratory Press, New York.
5. Kirby, LT (1990) DNA finger printing: An introduction. Stockton press.
6. Lewin, B (2004). Genes V III. Pearson, Prentice Hall Press, Wood bridge, Canada.
7. Twyman, R.M., Old. R.W. (2001) Principles of Gene Manipulation Black well Science Limited, Bristol, U.K.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

6- BIOREMEDIATION AND WASTE WATER MANAGEMENT

Objectives: To impart knowledge on the management of waste water from polluted sources and remedial measures using biological organisms.

Unit I: Bioremediation principles

Bioremediation-Definition, Insitu bioremediation, Intrinsic bioremediation, Engineered insitu bioremediation, Exsitu bioremediation, principles of bioremediation-Rapid growth and metabolism-Genetic plasticity-metabolic pathways for the degradation of xenobiotics, hydrocarbons, dyes-standard biotreatability protocols-quantification of biodegradation.

Unit II: Phytoremediation

Phytoremediation, phytoextraction, Phytotransformation, Phytoremediation of organics-organics that can be phytoremediate-plants Exudates in organic phytoremediation, phytoremediation of metals-metals in the soil environment - Bioactivity of metals-mechanism of metal tolerance, Advantages and limitations of phytoremediation.

Unit III: Microbial bioremediation

Microbes in the degradation of waste- Treatment of solid and liquid industrial wastes - microbial degradations of xenobiotics-Anaerobic bioremediation of hydrocarbons, phenols, chlorophenolic compounds, Polycyclic Aromatic Hydrocarbons(PAH) , Heterocyclic compounds, cyanide, dyes, radioactive waste.

Unit IV: Waste water treatment technologies

Sewage and waste water treatment systems-primary, secondary and tertiary treatments, Bioreactors for waste water treatments-types and design, Development and optimization of membrane bioreactors process for use in sanitary and industrial sewage treatment.

Unit V: Bioremediation and Metagenomics

Metagenomics: Environmental Genomics, ecogenomics or community genomics, the study of genetic material recovered directly from environmental samples and future applications in bioremediation-Genetically modified organisms and biosafety-a general account.

Reference:

1. R.C.Dubey(2012). A textbook of Biotechnology. S.Chand & Company Ltd., New Delhi
2. J.B.E.Weis, S.J.Ergas, , D.Y.Y.Change and E.D.Schroeder(1998). Bioremediation principles.McGraw-Hill Inc.
3. S.V.S Rana(2010). Environmental Biotechnology. Ratogi Publications, Meerut, India.
4. T.Leisinger, A.M.Cook, R.Hulter and Nuesch,J(1981). Microbial Degradation of xenobiotics and recalcitrant compounds. Academic press, London
5. M.H.Fulekar(2005). Environmental Biotechnology, Oxford IBH Publishing corporation
6. M.H. Fulekar(2010) Bioremediation technology recent advances Springer.
7. S.N.Jogdan(2010) Environmental Biotechnology. Himalaya Publishing House, New Delhi.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

7- MOSQUITO CONTROL

Unit-I

Scope of medical entomology, Classification of arthropoda, medical and public health importance- Types of vector- mechanical vector and biological vector- Biological, mechanical or passive and accidental transmission – Classification of medically important arthropods.

Unit-II

General classification, Taxonomy and Morphology of mosquito. Life history of Mosquito in general, differences in various stages of *Anopheles* and *Culex* - Biology, life cycle and public health importance of *Culex*, *Aedes* and *Anopheles* species.

Unit-III

Methods of collection and collection equipments - Hand picking, beating and sweeping, aerial netting, trapping- Mosquito breeding sites, preservation method and Insecticides sprayer types- Spray technique, Indoor residual spraying, conditions for use and effectiveness, criteria for selective application, selection of insecticides.

Unit- IV

Mosquito control-Need for mosquito control, Goals of mosquito control, Preventive control, curative control, chemical control, biological control, genetic control, integrated control, hormonal control and environment control. Selection of target area, insecticides, requirements of equipments, manpower and materials- spray timing- space spraying.

Unit- V

Malaria survey and National Malaria Eradication Programme (N.M.E.P), National Malaria Control Programme (N.M.C.P) difference between N.M.E.P and N.M.C.P)- Vector control strategies- supervision, process and performance indicator, Community participation, safe use of pesticides, use of fogging as a vector control measure, thermal fogging. Insecticide formulations used under NVBDCP.

Text Book:

1. B.K. Tyagi, 2003. Medical Entomology, Scientific Publishers (India), Jodhpur.
2. M.M. Trigunayat. 2002. A manual of practical entomology, Scientific Publishers (India), Jodhpur.
3. T.V. Sathe, A.T.Sathe and J.Mahendra, 2011. Mosquito borne diseases. Manglam publishers & Distributors, Delhi- 110053.
4. C.K. Jayaram Paniker. 2012. Text book of Medical Parasitology Jaypee Brothers, Medical Publisher Ltd. New Delhi.
5. G.K. Rathnaswamy. 2007. A Hand book of Medical Entomology and Elementary Parasitology. S.Viswanathan (Printers & Publishers) Pvt. Ltd.
6. M.W. Service. Medical Entomology for students. 2000. Cambridge University Press.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

8-SERICULTURE

Unit I. Life Cycle and History of silkworm, *Bombyx mori* : Egg, larva, pupa and adult. Classification of silkworms (sericigenous insects): Geographical distribution, moultnism, voltinism, cocoon colour and shape. Insect egg: Morphology and structure, oviparity, ovoviviparity and viviparity, polyembryony, parthenogenesis and pedogenesis.; Metamorphosis in insects: Importance, types and hormonal influence. Byproducts of sericulture industry and their utilization

Unit II. Basic principles of crop production; farming systems; planting seasons. Anatomy of mulberry leaf, stem and root; Weeds of mulberry garden: Taxonomy and their characteristics. Mulberry cultivars and their characters. Floral biology of mulberry. Soil suitability, problematic and reclamation measures. Leaf harvesting and preservation. Food plants of non mulberry silkworms.

Unit III. General account of silkworm egg production and demand. Importance of quality seed cocoon production. Pests and diseases of silkworm and their management seed areas and selected seed rearers; seed legislation act. Physical and commercial characteristics of cocoons. Cocoon sorting, cocoon stifling – objectives and methods, cocoon preservation and cocoon cooking – objectives and methods.

Unit IV. Grainage Location and capacity; model grainage; grainage equipments and their uses; disinfection and hygiene. Seed cocoon markets, norms for purchase of bivoltine and multivoltine seed cocoons, procurement and transportation of seed cocoons. Environmental requirements for silkworm egg production; planning for hybrid silkworm egg production. Grainage activities of Sorting, selection and preservation of seed cocoons, sex separation at pupal stage.

Unit V. History of Nanotechnology, Current and Future Perspectives of research work, Immune system in insects with special reference to *Bombyx mori*. Reference to Nano medicine, Silkworm as a Model Organism, Nano medicine: Applied in Non-medical Contexts, Socioeconomic Challenges, Social Issues Relating to Nano medicine. Economic Impacts. Ethical Issues in Nanotechnology

Reference

1. A.K. Dhote Sericulture for Prosperity. National council of educational research and training, September, New Delhi, 1994.
2. Eikichi Hiratsuka (2000) Silkworm Breeding. Oxford & IBH Publications, New Delhi.
3. Elcio P. Guimaraes, John Ruane, Beate D. Scherf, Andrea Sonnino and James D. Dargie
4. (2007) Marker-Assisted Selection, FAO, Rome.
5. Falconer, D.S. (1972) Introduction to Quantitative Genetics. Oliver & Boyd, Edinburgh.
6. Fatima, D.; Mani, A.; Narayanan, L.M.; Selvaraj, A.M. and Armugama, N. (1997)
7. Immunology and Microbiology. Saras Publication, Nagercoil.
8. Govindan, R.; Chinnaswamy, K.P.; R.; Krishnaprasad, N.K. and Reddy, D.N.R. (2000) Non-Mulberry Sericulture, Silk Technology and Sericulture Economics and Extension. Vol.3 – Proceedings of NSTS – 1999, UAS, Bangalore.
9. The Chemistry of Nano material: Synthesis, Properties & Applications, Vol I &II by CNR Rao, Springer 2006.
10. There's Plenty of Room at the Bottom: An Invitation to Enter a Newfield of Physics – Richard Feynman, Free on line book. <http://www.zyvex.com/nanotech/feynman.html>.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

9-ADVANCES IN BIOMEDICAL SCIENCE

Phytotherapy:

Plants and phytochemicals in clinical use- traditional treatments for diseases and ailments- Bioactive phytochemical entities and their classification and applications- Isolation and identification of phytochemicals from plants.

Zootherapy:

Animals in medicinal use-traditional medicine- products of animals in Medicinal use- Bioactive peptides in animals – Isolation and characterization and identification of bioactive peptides.

Chelation therapy:

Toxicology of heavymetals, organ toxicity and their biomarkers- Oxidative stress-Synthetic antidotes, types, mechanism – Natural antidotes types, mechanism of actions- antioxidants and their applications in health and disease.

Diabetology:

Types of diabetes-ultrastructure of pancreas, insulin, glucagon, Carbohydrate metabolism, Causes of diabetes, Symptoms and prevention, treatment strategies, allopathic and herbal drugs.

Cancer:

Definition, benign, Malignant-tumors, Types of cancer, invasion and metastasis. Molecular basis of cancer-oncogenes and tumor suppressor genes. Carcinogenesis. Phytoconstituents-alkaloids, flavonoids etc., and their methods of extraction-Decoction-maceration, percolation-infusion-Hot continuous extraction (Soxhlet)-Counter current extraction, Sonication, application and advantage.

References:

1. Traditional herbal medicine. Willow J.H. Liu- Editor, 29-March-2011-Science-448Pages
2. Zootherapy. Canadian institute of Zootherapy. Publisher- Canadian institute of Zootherapy. 1986.
3. Glick and Pasternak, Molecular Biotechnology. 2002. Blackwell publisher USA.
4. Endocrinology and humanbehaviour, 1998. Oxford university press.UK
5. Gilman et al 2002. The pharmacological basis for thereapeutics. Mc Graw hill publishers.
6. Murray et al. Harpers Biochemistry. 2003, TATA McGraw Hill
7. Basic of Toxicology by Chrisk and Kent 1998. Jhon willy and sons publisher
8. Moeular and Biochemical toxicology by Robert C Smart and Ernest Hodgson, 2013. Jhon willy and sons publisher

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

10-VERMIBIOTECHNOLOGY

Unit I: Biology and Ecology of Earthworms

Biology-growth and reproduction of earthworms, *Lampito mauritii* and *Perionyx excavatus*, Rearing conditions required-food requirements. Bouche's classification-Epigeic, anecic and endogenic; humus formers and humus feeders.

Unit II: Vermiculture and Vermicomposting

Vermicomposting –Definition, selection of suitable species, vermicomposting materials, vermicomposting techniques, requirements-moisture, pH, temperature food supply-small scale and large scale, nutrient quality of vermicomposts-Field application of vermicomposts, Microbes-earthworm role in vermicomposting.

Unit III: Soil Organisms and Humification

Soil organisms- The living community, organic matter in soil –decomposition-cellulose, hemicelluloses, lignin –Role of earthworm in decomposition, nutrients cycle-C,N,P-Humic substances-Earthworm as indicators of environmental contamination.

Unit IV: Earthworm-Microbes-Plant Relationship

Micro-organisms-As food for earthworms, dispersal of micro organism by earthworms, microbial decomposition, nutrient mineralization, effect of earthworms on soil structure-physical, chemical and biological aspects, plant productivity-Microbes-earthworms-plant symbiosis.

Unit V: Vermicomposting in India

Prospects and problems of waste management and vermicomposting, prospects and problems of waste land management and vermiconservation, vermitechnology development at national and international level, economic importance-Pharmaceutical products.

References:

1. Lee, K.E.(1985). Earthworm: Their Ecology and Relationship with Soil and Land Use. Academic press, Sydney.
2. Edward, CA and Bohlen,P.J(1996). Biology and Ecology of Earthworm. 3rd Ed. Chapman and Hall, London.
3. Ranganathan, I.S.(2006). Vermitechnology-From Soil Health to Human Health. Agrobios. India.
4. Parthasarathi,K.(2010). Earthworms-Life cycle, Compost and Therapy. Lap Lambert Academic Publishing AG & Co, Germany.
5. Edwards, CA Arancon, NQ and Sherman, R(2011). Earthworms, Organic Wastes and Environmental Management. CRC press, UK.
6. Chaudhari, P. and S.M.Singh (2014). Biology and Ecology of Tropical Earthworms. Discovery Publishing House Pvt. Ltd. New Delhi.

COURSE IV/PAPER IV – AREA OF SPECIALIZATION

11-RECENT ADVANCES IN NEUROSCIENCE

Unit I Neurons:

Introduction to Neurons- The neuron Doctrine – The NISSL and Golgi stains-components of neurons classification and types of neuron-Cytology of neurons-Dendrites structure and function-Axons structure and functional aspects. Ultra structure myelination and synapses.

Unit II Glial cells

Structure and function of glial cells-Different types of glial cells-astrocytes, oligodendrocytes and schwann cells-types of astrocytes-Importance of astrocytes in glutamate metabolism and blood brain barrier. Functions of other glial cells. Oligodendro cytes and microglial cells –Microglial phenotypes-overview of glial and neuronal relationship in the CNS. Glial-neuronal interplay in the CNS.

Unit III Neurophysiology

Tools in electrophysiological studies of the brain in animals, animal activity monitoring Different types of mazes and their application in studies on behaviour, learning and memory and cognitive aspects of animals Rotarod and paw fest-applications.

Unit IV Neuroanatomy

Gross anatomy of the adult brain. Organization of the nervous system. Subdivisions of the nervous system. Basic circuit of the synaptic action. Functional anatomy of cerebellum cerebral costex. Thalamus and limbic system.

Unit V Neurochemistry

Acetylcholine, serotonin catecholamines-(chemistry, synthesis, storage and release) GABA & Glycine synthesis and release. Receptors GABA and Glycine. Intracellular cell signaling –G. protein and second messengers.

Reference

1. Siegel, 2012, Basic neurochemistry (8th edition) Academic press
2. Squire, 2013, Fundamentals of neuroscience. (4th Edition). Elsevier
3. Kendel, 2013, Principle of neuroscience, (5th Edition) McGraw Hill
4. Verkhratsky, 2007, Glial neural biology, A text book, Wiley
5. John A., Kiernan, 1998, Barr's the human Nervous system (7th Edition) Lippincott-Raven
6. Water, J. Hendelman, 2000, Atlas of Functional, Neuroanatomy, C.R.C, Press.