


ANNAMALAI UNIVERSITY
 Accredited with "A+" Grade by NAAC
DEPARTMENT OF ZOOLOGY
 (UGC-SAP and DST-FIST Sponsored)

Ph.D. Degree in Zoology course work syllabus (2023 - 2024 onwards)

Course	Credits	Sub-Code	Sub. No	Sem.	Sub- Name
I	4	RC WOO1	101	1	RESEARCH METHODOLOGY
II	2	RC WOO2	102	1	RESEARCH AND PUBLICATION ETHICS
III	4	RC WOO3	103	2	ADVANCED TECHNIQUES IN ZOOLOGY
IV	4	RC WOO4	104	2	AQUACULTURE AND FISHERIES
			105	2	RECENT ADVANCES IN ENTOMOLOGY
			106	2	TOXICOLOGY
			107	2	MOSQUITO CONTROL
			108	2	SERICULTURE
			109	2	VERMICULTURE
			110	2	RECENT ADVANCES IN NEUROSCIENCE
			111	2	BIOREMEDIATION AND WASTE WATER MANAGEMENT
			112	2	GENERAL ENDOCRINOLOGY
			113	2	ADVANCES IN BIOMEDICAL SCIENCE
			114	2	RECENT TRENDS IN BIOTECHNOLOGY

Syllabus

Ph. D. DEGREE (ZOOLOGY)

Programme code: SZOO 91

(2023-2024 onwards)

COURSE – I: PAPER - I: RESEARCH METHODOLOGY

UNIT – I: Principles and Application:

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

UNIT – II: 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 – III: Colorimetry

Colorimetry: Principles and application of colorimeters-spectrophotometer-flame photometer-U.V. Spectrophotometer, Atomic Absorption Spectrophotometer and G.M.Counters.

UNIT – IV: pH Meters: Glass electrode, calomel electrode-construction and working principles-types of pH meters.

Monometry: Types of monometers - Warburg monometer-biological use of monometers.

UNIT – V: Scientific writing 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 Internation (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: RESEARCH AND PUBLICATIONS ETHICS

UNIT - I: PHILOSOPHY AND ETHICS

Introduction to philosophy: definition, nature and scope, concept, branches - Ethics: definition, moral philosophy, nature of moral judgements and reactions.

Scientific Conduct : Ethics with respect to science and research - Intellectual honesty and research integrity - Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP) - Redundant Publications: duplicate and overlapping publications, salami slicing - Selective reporting and misrepresentation of data.

UNIT - II: PUBLICATION ETHICS

Publication ethics: definition, introduction and importance - Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. - Conflicts of interest - Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types - Violation of publication ethics, authorship and contributor ship - Identification of publication misconduct, complaints and appeals - Predatory publisher and journals.

UNIT - III: OPEN ACCESS PUBLISHING

Open access publications and initiatives - SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies - Software tool to identify predatory publications developed by SPPU - Journal finger / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.

UNIT - IV: PUBLICATION MISCONDUCT

Group Discussion : a) Subject specific ethical issues, FFP, authorship b) Conflicts of interest c) Complaints and appeals: examples and fraud from India and abroad

Software tools : Use of plagiarism software like Turnitin, Urkund and other open source software tools.

UNIT - V: DATABASES AND RESEARCH METRICS

Databases : Indexing databases, Citation databases: Web of Science, Scopus, etc.

Research Metrics : Impact Factor of journal as per Journal Citations Report, SNIP, SJR, IPP, Cite Score - Metrics: h-index, g index, i10 Index, altmetrics.

References

1. Bird, A. (2006). *Philosophy of science*. Routledge.
2. MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
3. Chaddah, P. (2018) *Ethics in Competitive Research: Donotgetscooped; donotgetplagiarized*, ISBN:978-9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*. National Academies Press.
5. Resnik, D. B. (2011). *What is ethics in research & why is it important*. National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
6. Beall, J. (2012). *Predatory publishers are coming open access*. *Nature*, 489(7415), 179–179. <https://doi.org/10.1038/489179a>
6. Indian National Science Academy (INSA), *Ethics in Science Education, Research and Governance* (2019), ISBN:978-81-939482-1-7. <http://www.insaindiares.in/pdf/EthicsBook.pdf>

COURSE – III: PAPER – III: ADVANCED TECHNIQUES IN ZOOLOGY

UNIT – I: Electrophoresis and Chromatography

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 – II: Blotting techniques and PCR

DNA, RNA and protein separation techniques-Southern blotting, Northern blotting and Western blotting techniques, polymerase chain reaction, Construction of Genomic Library, Flow Cytometry, Fluorescence *in-situ* hybridization(FISH).

UNIT – III: In vitro fertilization (IVF) and Vaccine production

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- IV: Cell culture techniques

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 – V: Nanobiotechnology

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 – 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. Role of MPEDA, CIBA & GFA in Aquaculture.

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.

UNIT – III: Culture fisheries

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

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 : MORPHOLOGY & TAXONOMY

Advances in Morphology of Insects -Insect taxonomy -Molecular taxonomy -New methods in Insect collection and preservation -mounting-labeling techniques.

UNIT - II : INSECT PHYSIOLOGY

Advances in insect physiology- (digestive system , respiratory, excretory, circulatory, reproductive 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. Insect and climate. Population dynamics of pest. Pest of field crops and stored food .

UNIT - IV: BIORATIONALS IN PEST MANAGEMENT

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

UNIT - V: INSECTICIDE IN PEST MANAGEMET

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, pyrethriod, bio-insecticide-plant origin, Nereistoxin, neonicotinoids, fumigants and IGRS – Naturelytes. Modern trends in the use of pesticide .

Reference book:

1. Ambrose, D.P (2004). General Entomology , kalyani publishers . New delhi.
2. Chapman, R.F. (2013). The insects: Structure and Functions ,(5th edition).
3. Srivastava.K.P (2013).A Text Book of Applied Entomology. Vol. I & II, Kalyani publishers.Delhi
4. Rajendra singh and Sachan (2012). Elements of Entomology. Rastogi Publication, New delhi.
5. Temphare.D.B (2019). Morden entomology. Himalaya Publishing House, Mumbai.
6. Vasantharaj David.B and Ramamurthy V.V.(2011). Elements of Economic Entomology, Namurutha Publications Chennai.
7. Snodgrass, R.F., (2004)Principles of Insect Morphology, Cornell Univ. Press , USA .

COURSE – IV: PAPER – IV: AREA OF SPECIALIZATION

3. 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- - 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-neurotoxicity-nephrotoxicity - reproductive toxicity.

Unit - IV: Bio-Transformation of Toxicants

Definition –general principles –degradation reaction-Phase I and Phase II reactions-determining factors-complex nature of bio-transformation-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- 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.
6. Bulter, G.C. 1978. The principles of Ecotoxicology scope. 12, ICSO Scope John Wiley and sons, Chichester.
7. Finney D.J 1971 analysis, Cambridge University, Press
8. Adrien Albert 1981. Selective Toxicity. University Press Cambridge

COURSE – IV: PAPER – IV: AREA OF SPECIALIZATION

4. 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, classification of Diptera -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. Molecular techniques in Mosquito taxonomy, RFLP, RAPD, Microarrays, DNA Barcoding.

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 chemical, genetic control, integrated control, hormonal control and environment control. Selection of target area, insecticides, requirements of equipments, manpower and materials- spray timing- space spraying. Integrated vector management. Fogging as vector control measures, thermal fogging.

UNIT – V:

Malaria control programmes and strategies – National Malaria Eradication Programme (NMEP), National Malaria Control Programme (N.M.C.P), Modified Plan of Operation (MPO), Roll Back Malaria (RBM), Enhanced Malaria Control Programme (EMCP), National Vector Borne Diseases Control Programme (NVBDCP).

Text Book:

1. Tyagi, B.K. 2003. Medical Entomology, Scientific Publishers (India), Jodhpur.
2. Trigunayat. M.M. 2002. A manual of practical entomology, Scientific Publishers (India), Jodhpur.
3. Sathe, T.V., A.T.Sathe and J.Mahendra, 2011. Mosquito borne diseases. Manglam publishers & Distributors, Delhi- 110053.
4. Jayaram Paniker. C.K. 2012. Text book of Medical Parasitology Jaypee Brothers, Medical Publisher Ltd. New Delhi.
5. Rathnaswamy. G.K. 2007. A Hand book of Medical Entomology and Elementary Parasitology. S.Viswanathan (Printers & Publishers) Pvt. Ltd.
6. Service. M.W. 2000 Medical Entomology for students. Cambridge University Press.
7. Becker, N., D. Petric, Zgomba, M. Boase, C. Madon, M.B. Dahl Kaiser, A. 2010. Mosquitoes and their control. Springer.

COURSE – IV: PAPER – IV: AREA OF SPECIALIZATION

5.SERICULTURE

UNIT - I: MORICULTURE

Mulberry plant-description-varieties-cultivation -propagation-Irrigation -manuring-pruning-harvesting of leaves- Diseases and pest and their managements.

UNIT - II: MULBERRY SILKWORM AND NON MULBERRY SILK WORM

Morphology-Life cycle - geo-graphical distribution-Moultinism,Voltinism.

UNIT - III: REARING OF MULBERRY & NON MULBERRY SILKWORM

Rearing programme- Hatching-feeding, Cleaning and Spacing-care at moulting-Leaf quality-Rearing of Early and late age silkworm-Rearing of wildworms.

UNIT - IV: REELING OF SILK : (Cocoon as raw material)

Reeling systems-conditions of cocoon for reeling processing of cocoons before reeling-Reeling techniques-Reeling

UNIT - V: SILKWORM DISEASES AND PEST

Protozoan diseases-Bacterial disease-Viral disease-Fungal diseases- Insect pests on silk worm.

Reference book:

1. Manuals on Sericulture, Central silk Board , Bangalore.
2. Vasantharaj David.B and Ramamurthy V.V.(2011). Elements of Economic Entomology, Namurutha Publications Chennai.
3. Srivastava.K.P (2013).A Text Book of Applied Entomology. Vol. I & II, Kalyani publishers.Delhi
4. Temphare.D.B (2019). Morden entomology. Himalaya Publishing House, Mumbai.
5. K.Jaiswal, A Text book of Moriculture, APH Publishing corporation.

COURSE – IV: PAPER – IV: AREA OF SPECIALIZATION

6. 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 endogeic; Exotic and Indigenous earthworms.

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.

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.

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 and chemical aspects.

UNIT - V: Vermicomposting in India

Prospects and problems of waste management and vermicomposting, prospects and problems of waste land management and vermiconservaion, vermitechnology development at national and international level, economic importance.

References:

1. Lee, K.E.(1985). Earthworm: Their Ecology and Relationship with Soil and Land Use. Academic press, Synday.
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.
7. Mary violet chir4sty (2014) Vermitechnology. MJP Publications Chennai

COURSE – IV: PAPER –IV: AREA OF SPECIALIZATION

7. 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.

COURSE –IV: PAPER – IV: AREA OF SPECIALIZATION

8. BIOREMEDIATION AND WASTE WATER MANAGEMENT

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

UNIT - I: Bioremediation principles

Bioremediation-Definition, 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, -plants exudates in organic phytoremediation, phytoremediation of metals - 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 - Anaerobic bioremediation of hydrocarbons, phenols, chlorophenolic compounds, Polycyclic Aromatic Hydrocarbons(PAH), radioactive waste.

UNIT - IV: Waste water treatment technologies

Sewage and waste water treatment systems-primary, secondary and tertiary treatments, Bioreactors for waste water treatments- 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 and future applications in bioremediation-Genetically modified organisms and biosafety.

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. Rastogi 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

9.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 and its functions.

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 and parturition. Lactogenesis and lactation. Factors controlling spermatogenesis and oogenesis. Infertility and 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

10. ADVANCES IN BIOMEDICAL SCIENCE

UNIT – I: 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.

UNIT – II: 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.

UNIT – III: 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.

UNIT – IV: Diabetology:

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

UNIT – V: 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. Moeccular and Biochemical toxicology by Robert C Smart and Ernest Hodgson, 2013. Jhon willy and sons publisher

COURSE – IV: PAPER - IV: AREA OF SPECIALIZATION

11. RECENT TRENDS IN BIOTECHNOLOGY

UNIT - I: Molecular Cloning:

Vectors in Molecular Biology - Modifying Enzymes - Polymerase chain reaction - DNA/Protein sequencing Mutagenesis - Genomic, cDNA Library construction.

UNIT - II: Cloning in Microorganisms:

Cloning Techniques; Cloning in *E-coli*- Cloning in *Bacillus subtilis* - Cloning in Yeast
Specialized vectors: Operons - Expression of cloned genes, site directed mutagenesis, fusion proteins
– cloning vectors PBR 322 cosmids.

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 - Production of interferons - DNA vaccines, Interleukins, monoclonal antibodies. Transgenic animal, protoplast isolation and culture: Somatic hybridization, 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.
8. Dubey. R.C. (2015): A text Book of Biotechnology. S. Chand and Company, New Delhi.