DEPARTMENT OF ZOOLOGY

SCHOOL OF LIFE SCIENCES

M. Phil. Programme in Zoology

SYLLABUS

(Under Credit and Semester w.e.f 2017 admission)

UNIVERSITY OF KERALA

DEPARTMENT OF ZOOLOGY
SCHOOL OF LIFE SCIENCES
UNIVERSITY OF KERALA

M.Phil Programme in Zoology

Programme Objectives

- Generating interest to learn about animals in their natural habitats, creating the desire to further extend their understanding.
- To make the students conquer new avenues in biological research by learning in a supportive and challenging environment.
- To mould a generation aware of their eco-system and committed to conserve.
- Make the student capable of taking up duties as educators, conservators and volunteers in the field of biology.

DEPARTMENT OF ZOOLOGY
UNIVERSITY OF KERALA
KARIAVATTOM

Syllabus for M. Phil. Program in Zoology

Semester No	Course code	Name of the Course	Number of credits
Semester 1	ZOO711	Research Methodology	4 Credit
	ZOO712	Instrumentation	4 Credit
	ZOO713(i)	Comparative Endocrinology	4 Credit
	ZOO 713(ii)	Stress and Ease Physiology	
	ZOO 713(iii)	Biodiversity & Conservation Biology	
	ZOO 713(iv)	Entomology	
	ZOO 713(v)	Ethology	
	ZOO 713(vi)	Aquaculture	
	ZOO 713(vii)	Freshwater Ecology	
	ZOO 713(viii)	Biology of Cutaneous system & Disorders	
	ZOO 713(ix)	Cancer Biology	
Semester 2	ZOO721	Dissertation – Based on Original Research Work	20 credit
		TOTAL CREDITS	32

Detailed Syllabus

Semester : 1
Course Code : ZOO 711
Course Title : Research Methodology

Credit : 4

AIM- To expose students to area of creative thinking and critical reasoning and introduce them to current research issues and processes , after completing their course the students are expected to be competent in literature and data collection, critical analysis of problems and communication of hid/her observations and findings in a report

OBJECTIVES-This course consist of lectures and relative activities that will help in developing good methodology. Types of research process and management. This should help in critical thinking formulation of hypothesis, design of experiments and better scientific communication

MODULE-I : An Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research

MODULE-II : Defining and Design a Research Problem: What is a Research Problem?, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs

MODULE-III : Data Analysis and Presentation: Methods of Data Collection, Role of statistics in data analysis; Mean, mode, median, probability, frequency distribution, Standard Deviation and Standard Error, ANOVA, Correlation, T test, Software's for Data Analysis, Bioinformatics Tools, Techniques and tools for Presentation of data and results

MODULE-IV : Interpretation and Scientific Report Writing: Meaning of Interpretation, Technique of Interpretation, Significance of Report Writing , Different Steps and Layout in Writing Papers, Review, Books, Popular articles, Mechanics and Precautions of Writing Papers, Review, Books, Popular articles, Guidelines for effective Multi-Media and Poster Presentations, Open Access Publications, Research Ethics. Copy Write and IPR Awareness.

MODULE-V: Research communication and management: Bibliographic databases, Impact Factors, Citation Index, H Indices, Reference Management Tools, Familiarizing Popular Life Science Journals, Review of Component of a research Proposal, Funding agencies and Fellowship Opportunities in India and Abroad

REFERENCES

1. Petter Laake ,Haakon Benestad, Bjorn Olse: Research Methodology in the Medical and Biological Sciences 1st Edition
2. N Guruamni: Research Methodology for Biological Sciences – 2006
3. Thomas D. Pollard MD ;Cell Biology, 3e Hardcover – 5 Jan 2017
4. N Arumugam :Research Methodology for Life Sciences

5. Bright Wilson: An Introduction to Scientific Research .1990
6. Dharmapalan, Biju: Scientific Research Methodology .2012
7. KothariC.R: Research Methodology: Methods and Techniques 2nd edition.2009

Semester : 1
Course Code : ZOO 712
Course Title : Instrumentation
Credit : 4

AIM- To introduce the students to the major tools and techniques used for studying biochemical and biophysical nature of life and the application of various instrument in the research laboratory

OBJECTIVES-This course familiarizes the essential and basic tools used for understanding the concepts in biological science. Applications and principles of all major techniques including the up to date information used in the field of biological science are dealt with this chapter.

MODULE-I: Microscopy : Principle, Structural parts and applications of Light microscopy, Compound microscopy, Bright Field Microscopy, Phase-contrast microscopy, Fluorescent microscopy, Confocal Laser Scanning Microcopy, Transmission Electron Microscopy, Scanning Electron Microscope, Sample Preparations' and Staining Procedures

MODULE-II: Microtome: Sectioning, Traditional Histology (Fixation, Dehydration, Embedding and Staining), Ultra microtome, Cryostat (Mounting and Sectioning), Incubation

MODULE-III: Molecular Biology Techniques & Omics Tools: Equipment- hoods, CO2 incubator. Safety considerations, Aseptic techniques, Eradication of infections. Animal cell cultures- Primary cell cultures, Cell lines, Media and Growth requirement, Subcultures, Cell quantification, Cryopreservation, Cell viability, Principles and Applications of Flow Cytometry, MTT assay, Angiogenic Assay, Wound Healing Assay, Sphenoid Invasion Assay, Matrigel Invasion assay. PCR-principle and applications, Real-time quantitative PCR, DNA and protein microarrays applications, Metabolomics, DNA fingerprinting, Next-generation Sequencing, Genome wide analysis

MODULE-IV: Cell Fractionation & Separation Methods: Centrifugation, Ultracentrifugation Methods and Applications; Principles of Chromatography, Paper Chromatography, Thin Layer Chromatography, Column Chromatography, Adsorption Chromatography, Gas chromatography, Ion Exchange Chromatography, High-Pressure Liquid Chromatography & Affinity Chromatography

MODULE-V: Seperation and quantification techniques: Principle of electrophoresis, paper electrophoresis, polyacrylamide gel electrophoresis, 2D gel electrophoresis, Southern transfer, Northern transfer, Western transfer, ELISA, Immunocytochemistry, Immunohistochemistry and RIA, Spectrophotomey, Colorimetry and its applications, Fluorescence Spectroscopy, NMR and ESR spectroscopy, Mass spectrometry ,Types of Ion Sources (EI, CI, ESI, APCI, APPI, MALDI) and Types of MS (Ion Traps, Quads, FT-ICR, TOF, MS/MS), ICP-MS.

REFERENCES:

1. Prakash S. Bisen , Mathur : Life Science in Tools & Techniques Paperback Walter Gilbert Hartley: The light microscope: its use and development
2. Bruce Alberts: Molecular Biology of the Cell
3. Baker,EJ and Silverton R.E : Introduction to Medical laboratory Technology .1978
4. Alonso A: Advanced Techniques in Biophysics .2006
5. Ackerman.E: Biophysical Science .1962
6. Huimin Zhao: Synthetic Biology: Tools and Applications
7. Joel gamon Bioinformatics: Concepts, Methodologies, Tools, and Applications

Semester : 2
Course Code : ZOO 713(i)
Course Title : Comparative Endocrinology
Credit : 4

AIM- This course provides a comprehensive knowledge to the students in endocrinology, which will help to understand the hormones and its functions in human body as well as gives an idea about the new developments in the field of endocrinology

OBJECTIVES – comparative endocrinology deals with the essential role of endocrine system in maintaining homeostasis, integrating growth, development and reproduction and how it is regulated

MODULE-I: Endocrines: An outline of their structure-Pituitary, Thyroid, Adrenal, Pancreas..etc. Chemistry of Hormones produced by Endocrine glands, Steroid hormones, Peptide hormones, Thyroid hormones-Gastrointestinal hormones, Tissue Hormones.

MODULE-II: Hormones and metabolism: Hormones in intermediary metabolism, Hormones in ionic and water balance, Hormones in development, Growth and Metamorphosis.

MODULE-III: Hormones and Behavior, Role of sex hormones in reproductive behavior, Hormones and colour change.

MODULE-IV: Mechanism of hormone action, Steroid hormones, peptide hormones, Thyroid hormones, Hormones and reproduction

MODULE-V: Role of sex hormones in reproduction, Hormones in population control Human and pests, Neuroendocrine integration, Hormonal heterophylly

REFERENCES:

1. A. Text book of comparative Endocrinology, Gorbman & Bern, John Wiley
2. Comparative Endocrinology of Invertebrates, Highnam & Hill, Arnold
3. An Introduction to Invertebrate Endocrinology, Tombes, Academic

4. Comparative Vertebrate Endocrinology, Bentley Cambridge University press
5. Metabolic and Endocrine physiology, Tepperman, year Book, Med. Publication
6. Insect Endocrine-----K.K. Nayar
7. Insect Hormones ------Wigglesworth
8. William Endocrinology (1995)
9. Endocrinology Dc G root Vol. 1-3 (1996)
10. Endocrinology –Norris (1998)
11. An Introduction to Endocrinology of Invertebrates- Tombes, Academic
12. Reproduction in Mammals, Serial Books, Cambridge University Press
13. Advances in Reproduction Physiology (Series), Mc Laren, Logos & Acad
14. Fertilization, Rothchild, Methuen
15. Fertilization, Austin, Prentice Hall India
16. Chemistry & Physiology of Fertilization, Monroy, Holt etc. 1965.
17. Vertebrate Reproductive cycles, Bullough, Mthuen 1961
18. Biology of sex, C.J. Avers, John Willey
19. Sex and Fertility, Clive wood, Thomas & Hudson 1969
20. Physiology and Genetics and Reproduction (Basic Sciences.Vol. 48)
21. Control of growth and Metamorphosis, Jenkin pergamon Press 1970
22. Biology of gestation (ED. BY) Assali, Academic Press
23. Insect Behavior, Haskel, Symp. Roy. Ent. Soc. Lond. 3 1966
24. Animal communication by Pheromones, Shorey, Academic press, 1976

Semester : 2
Course Code : ZOO 713(ii)
Course Title : Stress and Ease Physiology
Credit : 4

AIM- To introduce the various scope and aspect of stress and ease physiology

OBJECTIVES- the students will be introduced on the various aspects of stress physiology in lower and higher organisms and the physiology of stress adaptation and management

MODULE-I: Definition and Scope: Concept of stress physiology, implementation on physiological process, the phenomenon of stress, stressor and stress response

MODULE-II: Neuroendocrine control of stress response, Stress hormone, eustress, distress chronic and acute stress, BSC and HPA axes

MODULE-III: Ease response, ease hormone, physiological process that promote ease response

MODULE-IV: Endocrinology of stresss and ease, endocrine disruptors, stress adaptation and tolerance, stress proteins, Morphological and Physiological basis of stress adaptation, hormonal control of stress tolerance, molecular mechanism of stress adaptation in aquatic and terrestrial animals, stress resistance, stress avoidance.

MODULE-V: Stress and Ease Physiology - water and mineral balance, acid/base balance, energy metabolism .

REFERENCES:

1. Comparative animal physiology. Hoar and Randall .1998
2. Fish physiology – Chapman & Hall , London, J.C. Rankin & F.B. Jensen, 1993. Fish Physiology, Vol, XI , Randall D. J , Academic Press 1997 Introduction to cellular signal transduction. Ari. Sitaramaya Birkhauser, Boston (1999). Animal Physiology – Knut – Schimidt – Nielsen. Vth Edition, Cambridge University Press,1997.
3. R. Rajagopalan: Environmental Studies: From Crisis to Cure : 2015
4. Sushil K. Khetan: Endocrine Disruptors in the Environment 1st Edition
5. Robert N. Brandon Adaptation and Environment 1990

Semester : 2
Course Code : ZOO 713(iii)
Course Title : Biodiversity, Conservation Biology
Credit : 4

AIM– This course introduce the concept and fundamentals in biodiversity and conservation biology. It will give the students a better understanding about biodiversity, the problems faced and how it can be managed

OBJECTIVES– It helps students to get an insight on how to conserve and sustain the nature and environment and different techniques used and also awareness of the environment and its current problems.

MODULE- I: Biodiversity, deforestation, scope of the subject, methodology, biodiversity, indices, systematic, IUCN, threatened categories of animals. The Earth summit, Convention on biodiversity. Biodiversity hot spots, Economic evaluation of biodiversity

MODULE-II: Wildlife Habitat: Wildlife of Kerala, Wildlife of India

MODULE –III: Endangered wildlife of Kerala, Natural Habitat, Animal Habitat interactions, Habitat requirements

MODULE-IV: **Conservation Biology:** Definition and scope, conservation initiative, conservation of threatened species conservation of common species Ex situ and in situ conservation.

MODULE-V: Conservation convention and co-operations: International agencies (UNEP, IUCN, WWF etc) National conventions, .International Conventions, Indian Wildlife Act-Status and Prospects

REFERENCES:

1 .The Book of Indian Animals- prater S.H. Bombay Natural History Society, Bombay (1980)
2. A revised Survey of the Forest types of India- Champian & Seth (1938), Manager of publications, Government of India
3. Wildlife management Techniques- (Nataraj Publishers, Dehra Dun 1984
4. The Book of Indian Bids- Salim Ali, Bombay Natural History Society, Bombay (1971)
5. Biodiversity Implications for Global food security M.S. Swaminathan and S. Jara Mae Milton, Pub. 1992

6. Manual of Wildlife Conservation-Teague, R.D. Nataraj Publishers Dehra Dun (1987)
7. Wildlife of India- Saharia V.B. Nataraj publishers, Dehra Dun (1985)
8. Conservation in Developing countries- (Eds) Daniel J.C. and Serrao J.S. Oxford University press (1990) Bombay
9. Environmental problems and prospects in India- M. Balakrishnan (Eds) 1993 Oxford & IBH, New Delhi
10.Tropical Ecosystems – A synthesis of Tropical Ecology and Conservation Biology- M. Balakrishnan et al (Eds) 1994 Oxford & IBH New Delhi
11. Conservation & economic evaluation of biodiversity vol. 1 & 11(1997) (eds) P. Pushpangadan, K. Ravi & V. Santhosh) Oxford IBH Publishing Co. NewDelhi
12. Hot spots of endemic plants of India, Nepal Bhutan M.P. Nagar (1996) TBG & RI, Palode, Trivandrum.
13. Global Biodiversity R.K. Sinha (1997) INA Shree Pub, New Delhi
14. Ecological diversity and its measurement Magurran A.E (1988) roon Heln, London
15. The diversity of Life E.O. Wilson 19923. The Belknap press of Harvard University, Cambridge.
16. Biological Diversity M.A. Huaton 1994Cambridge University press
17. Economics and Biological Diversity J.A. McNeely (1988) IUCN, Switzerland

Semester : 2
Course Code : ZOO 713(iv)
Course Title : Entomology
Credit : 4

AIM- This course focuses on the study of insects as they have developed into a very large division of the animal science owing to their huge portion in the animal kingdom and the importance in the applied fields

OBJECTIVES – To provide a broad and balanced study on entomology and the intimacy between insects and environment is also emphasized in this course

MODULE -I: Introduction to Entomology: Origin of Insects, classification, Phylogeny, Morphology and Anatomy.

MODULE-II : Insects Anatomy and Physiology: Structure and Function of Insects, integument, nervous system, muscular system, alimentary canal and nutrition, reproduction & development, sensory mechanisms, locomotion, behavior and ecology, circulatory system, inset populations and their physical-chemical and biotic environment, insect –host plant reaction ,Growth and metamorphosis, Insets Adptations.

MODULE-III : Applied Entomology: Beneficial and harmful insects, Insect products, Use of insects in medicine, Insects in biological research, Pollination by insects, Forensic entomology, Agricultural entomology, Aquatic entomology, Harmful insects.

MODULE-IV: Insect Control and Collection: Insecticides, Biological control, Genetic control, Ecological control, Physical control, Regulatory control, integrated pest management, Collection, Preservation, Curation and Identification of insects.

REFERENCES:

1. By Cedric Gillott: Entomology
2. K. D. Upadhyay : A Text Book of Entomology
3. P. J. Gullan, P. S. Cranston: The Insects: An Outline of Entomology
4. Lawrence I. Gilbert, Sarjeet S. Gill: Insect Control: Biological and Synthetic Agents

Semester : 2
Course Code : ZOO 713(v)
Course Title : Ethology
Credit : 4

AIM –This course outlines the fundamental principles of animal behavior .it helps in understanding the role of organism and hoe they interact with each other in the environment it will also proves knowledge on the complexities animal behavior which they have to maintain in order to confront various challenges in the nature

OBJECTIVES-This course deals with socio-biology of animals, it gives an outline on how animals are able to communicate effectively with other individuals and about the type of communications signals used by them for the variety of functions they serve

MODULE-I: Origin and Development: Introduction, history of Ethology, Aims and methods, Application, Ehology in India, Current status**,** Nervous system, Neurones, Central Nervous System, Brain and Behaviour, Neurotransmission Environmental Neuroendocrine transducer organs, Hormones and Behavior

MODULE-II: Motivation: Features, Models, Types, Physiological basis, Types of Learning, Neural Mechanism, Biochemical and Biophysical aspects, instinct, imprinting

MODULE - III: Mammalian social organization: Social organization among Primates, Dominance Hierarchy, Territorial Behavior

MODULE- IV: Animal Communication: Communication Modalities, Social Signals Olfaction, Scent Marking, pheromones. Social organization of termites or Honey bee Dance(Waggle dance)

MODULE –V: **Reproductive Behavior:** Determination of sex and sexual Behavior courtship and mating, sexual Dimorphism, Parental Care, Hormones and Behavior

REFERENCES:

1. Animal Conflict --F.A. Huntingfod A.K. Tumer
2. Animal Behavior -- causes and effects –ED . T.R. Halliday & P.J.B. Slater
3. Animal Behavior -- Communications -- ED. T.R.Halliday & P .J. B Slater
4. Hormones and Behavior -- ed. S. Eleftherion & R.L Sprott

Semester : 2
Course Code : ZOO 713(vi)
Course Title : Aquaculture
Credit : 4

AIM –This course focuses on the study of aquatic animals and plants, their growth and breeding, especially fishes and the different types of problems faced by them

OBJECTIVES- To introduce the various nature and scope of aquaculture and its management

MODULE-I: Criteria for the selection of cultivable species of edible fishes: Major Cultivable species of edible fishes in India. Culture of Carps, Tilapias, Mullets, Pearl spot and air breathing fishes. Broodstock selection, management, induced breeding and larval rearing of carp Hormonesused and different hatchery systems. Layout of ponds- Nursery, rearing and stocking ponds. Pond preparation – manuring, liming, fertilizing, eradication of weeds, pests and predators. Water quality parameters affecting pond fish culture, Harvesting.

MODULE-II: Nutritional requirement of fishes: Different types of feed – Natural and Artificial. Feeding methods. Preparation of artificial feeds. Live feeds and their culture - Microalgae, Daphnia, Moina, Earthworm, Mosquito larvae, Chironomous larvae, Artemia, Infusoria, Tubifex. Nutritional diseases. Fish diseases and their management. Bacterial, Viral, Fungal, protozoan and other parasitic diseases of aquarium fishes. Preventive measures, disease symptoms and treatment of fish diseases.

MODULE-III: Brackish water Aquaculture and Mari culture: Major brackish water aquaculture species, Major species of mariculture, Different types of cages and cage culture, fabrication and maintenance of cage.

MODULE -IV: Integrated farming: Rice cum fish culture, Duck cum fish culture, Poultry cum fish culture, pig cum fish culture. Principles functioning of Aquaponics, Recirculatory aquaculture systems. Different culture systems like tanks, canals, silo, running water culture, pen culture.

MODULE –V: Seed banking: Seed resources and seed collection methods. Ecological problems of mariculture.Major species of Shrimps, crabs and lobsters cultures, Cryopreservation and techniques,Important species of marine algae cultured and algal products.

REFERENCES

1. Aquaculture: Principles and Practices, T. V. R. Pillay, M. N. Kutty, July 2005, Wiley-Blackwell.Milne.P.H (1972) Fish and shell fish farming in China. Fishing News
2. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and marine organisms
3. Galtsoff, P.S., Culture methods for invertebrate animals
4. Thomas P.C (Ed) Current and emerging trends in aquaculture
5. Coche, A.G., Muir, J.F. Simple methods for aquaculture: Pond construction for freshwater
6. Introduction to aquaculture Pillai, T.V.R., Aquaculture principles and practices
7. Jonathan Shepherd, C. (Ed) Intensive Fish Farming.

8. William Royce, F., An introduction to the practice of fishery science.
9. Planning of Aquaculture Development. FAO, Fishing News Books
10. Advances in Aquaculture. FAO, Fishing News Books.

Semester : 2
Course Code : ZOO 713(vii)
Course Title : Fresh Water Ecology
Credit : 4

AIM – To study the nature and scope and aspect of fresh water ecology its management and conservation

OBJECTIVES – To make students aware of the existing wetlands and to provide fundamental knowledge on nature, its energy flow, climatic change, pollutants and its managements

MODULE-I: Introduction: Stream, ponds, lakes and rivers. General characteristic and types of freshwater ecosystems. Classification and types of streams, pond and lakes.

MODULE-II: Abiotic components: Light, Currents, Substrate, Temperature, Dissolved gases O2, CO2 etc, Dissolved solids in freshwater ecosystems and the factors affecting ecological properties.Biotic components: Major flora: Algae, Macrophytes, Attached plants, submerged plants, Floating plants. Major fauna: Insects, Molluscs, Fishes etc.

MODULE-III: Food web and Energy flow: Energy sources in freshwater ecosystems (Autochthonous), Terrestrial energy sources (Allochthonous), Dissolved Organic Matter (DOM), Energy flow and Nutrient cycle, Food web and feeding roles of vertebrates and invertebrates.Producers and Consumers in freshwater ecosystems and food chains and food web.

MODULE-IV: Threat to freshwater ecosystems such as pollution and other anthropogenic activities. Effects of acidification, increase of temperature and climate change in freshwater ecosystems with special reference to ecosystems of Western Ghats.

REFERENCES:

1. Laurence P. Pringle; chains, webs, & pyramids: the flow of energy in nature
2. Walter Dodds Matt Whiles: Freshwater Ecology 2nd Edition
3. Walter Kennedy Dodds: Freshwater Ecology: Concepts and Environmental Applications/Author
4. Gene E. Likens: Lake Ecosystem Ecology: A Global Perspective
5. Stephen Alfred Forbes: Fresh Water Fishes and Their Ecology Paperback .2013
6. Gerry Closs: Freshwater Ecology A Scientific Introduction New Ed Edition

Semester : 2
Course Code : ZOO 713(viii)
Course Title : Biology of Cutaneous system & Disorders
Credit : 4

AIM- the course focuses on the study of integumentary system

OBJECTIVES – This course focuses and help the student to understand the normal integumentary anatomy, functions and the related disorders

MODULE-I :Skin: Epidermis (Sratumcorneum, stratum lucidum, stratum granulosum, stratum spinosum, stratum basale), Dermis (Papillary layer, reticular layer), Dermal papillae, collagenous fibers, Dermal structures, Keratinocytes, Hypodermis, Skin and appendages embryological development in human, Differentially regulated pathways associated with integementary system, factors influencing integementary system

MODULE-II: Structure and Functions of Skin: Protection, Temperature regulation, Excretion, Synthesis, Sensory reception, Color of Skin, Blood Supply to the Skin, Wound and healing, burns, skin and hair transplant and grafting, Sweat glands, Sebaceous Glands, Gland disorders and inflammations, Primary and secondary cell line models in skin

MODULE-III: Hair: Functions of hair, structure of hair, hair growth, loss and replacement, Nails functions, diseases, Fishes, amphibians, reptiles, birds and mammals (Structure of integumentary system, function, development and cycle, glands and skin organs, skin color patterns and pigmentation, Role of animal models in skin research, Skin and appendages embryological development in amphibians, reptiles, birds and mammals

MODULE -IV: Integumentary Disorders: Skin, Hair, Glands and Nail Disorders, Inflammatory diseases, major pathways associated with pathobiology of Cutaneous system

MODULE-V: Modern Approaches in Integementary System: Genomics, Proteomics and Metabolomics using biomarker analysis, Integumentary cell culture and isolation, stem cell (isolation, culture, markers), 3D cell culture, media, chemicals and instruments used for cell culture, stem cell therapy

REFERENCES:

1. S. Sacchidanand, Savitha A. S., Lakshmi D. V. (2015). Hair and hair disorders: Diagnosis and management.
2. K. Lahiri, Chatterjee M., Sarkar R. (2014). Pigmentary disorders: A comprehensive compendium.
3. M. Darmon, Blumenberg M. (2012). Molecular biology of the skin: The keratinocyte.
4. L. J. Bolognia, Jorizzo L. J. (2012). Dermatology.
5. Z. Y. N. Chiang, Verbov J. (2014). Dermatology: Handbook for medical students and junior doctors.
6. D.T. Woodley (2001). The biology of the skin.
7. S. M. Chapman (2001). Skin Disease: Diagnosis and treatment.

8. E. Epstein (1979). Common skin disorders

Semester : 2
Course Code : ZOO 713(ix)
Course Title : Cancer Biology
Credit : 4

AIM–To expose students to area of cancer and its management

OBJECTIVES – This course helps in understanding, and imparts knowledge about cancer, its different types and modern techniques which helps in cancer management

MODULE-I: Cancer- Causes of Cancer, Identification and histopathology of cancer, Characteristics of cancer: Immortality, Oncogenes, Tumor Suppressor Genes, Apotopsis, Angiogenesis and Metastasis, Role Biomarkers in Cancer

MODULE-II: Different Types of Cancers- Brain, Prostate, Breast, Pancreas, Thyroid, Oral, Cervical, Carcinoma, Sarcoma, Melanoma, lymphoma and Leukaemia etc.

MODULE- III: Hormones & Cancer- Hormonal Carcinogenesis (Sex hormones and Cancer, Risk of Hormone Replacement Therapy).

MODULE -IV: Management of Cancer- Chemotherapy, Radiation therapy, Immunotherapy and Hormonal therapy, Gene Therapy, Stem Cell Therapy etc. , Cancer Specific Assays

MODULE -V: Cancer Stem Cells- Origin of cancer stem cells, Implications for cancer treatment (Stem Cell Transplantation etc.,), Cancer Stem Cell Markers (markers for colon cancer, breast cancer, liver cancer, melanoma, pancreatic cancer and prostate cancer).

REFERENCES

1. Robin Hesketh, 2013. Introduction to Cancer Biology.
2. Memna Hejmadi, 2010. Introduction to Cancer Biology.
3. Hippocratis kiaris, 2006. Understanding Carcinogenesis: An Introduction to the Molecular Basis of Cancer.
4. Robert Weinberg, 2013. Biology of Cancer.