Minor Courses offered by the Department of Zoology

"Student can choose any one course from each stream"

Year	Type of Course	Course Code	Title of the Course	Credits	Teaching Hours
1st Year (Semester-I & II)	MID -1(A)		Wildlife Conservation	4	5
	MID -1(B)		Fundamentals of Zoology		
	MID -1(C)		Zoonotic Diseases of Humans and Animals		
	MID -2(A)		Public Health and Hygiene	4	4
	MID -2(B)		Basic Immunology		
	MID -2(C)		Value Added Products of Animals		
2nd Year (Semester-III & IV)	MID -3(A)		Economic Zoology	4	4
	MID -3(B)		Agricultural Entomology		
	MID -3(C)		Food, Nutrition and Health		
	MID -4(A)		Genetic Engineering	4	4
	MID -4(B)		Microbiology		
	MID -4(C)		Environmental Biotechnology		
3rd Year (Semester-V & VI)	MID -5(A)		Toxicology	4	4
	MID -5(B)		Forensic Entomology		
	MID -5(C)		Tools and Techniques		
	MID -6(A)		Vectors and Diseases	4	4
	MID -6(B)		Reproductive Biology		
	MID -6(C)		Medical Microbiology		
4th Year (Semester-VII)	MID -7(A)		Environmental Pollution and Human Health	4	5
	MID -7(B)		Life Style Diseases and Management		
	MID -7(C)		Nanobiology		
	MID -8(A)		Animals and Human Welfare	4	4
	MID -8(B)		Neurobiology		
	MID -8(C)		IPR, Biosafety and Bioethics		

MID-1: WILDLIFE CONSERVATION

UNIT-1: CONCEPT OF BIODIVERSITY, HUMAN-WILD LIFE INTRACTION

[5 HRS]

Definition, Levels, Values, Measurement of Biodiversity; Concept of Wildlife. Man-animal conflict in India; Human-wildlife Coexistence; Eco-tourism; Wildlife Crimes, Sustainable Utilization of Biodiversity Resources.

UNIT-2: CONSERVATION OF BIODIVERSITY [12 HRS]

Factors causing biodiversity degradation, Concept of species extinction. In situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries, Conservation Reserves, Community reserves, Sacred Habitats), Ex-situ conservation (Botanical & Zoological Gardens, Gene Banks, Seed And Seedling Banks, Pollen Culture, Tissue Culture and DNA banks, Butterfly Gardening); Concept of Biodiversity Hotspots and Mega-diversity Country. Traditional Ecological Knowledge and documentation of local biodiversity.

UNIT-3: BIODIVERSITY AND WILDLIFE RESOURCES IN INDIA [8 HRS]

Biodiversity of Indian subcontinent, Bio-geographical region in India, India as a mega diversity nation; India's National Biodiversity Action Plan, Biodiversity hotspot in India; Species conservation projects in India (Tiger, Rhino, Lion, Turtles, Crocodiles, Birds, Coral reefs).

UNIT-4: ESTIMATION OF WILDLIFE AND ITS HABITAT [8 HRS]

Species Census methods; Species sampling method (Quadrat, Line Transect, Belt Transect, Pit fall, Mark-Recapture technique, Radio-telemetry etc.); Ethics in Field Studies. Methods of recording field observations; Essential Field kit and its usage; Data analysis.

UNIT-5: NATIONAL AND INTERNATIONAL PROTECTION MEASURES; WILDLIFE PHOTOGRAPHY

[12 HRS]

Wild Life Protection - Indian Wildlife (Protection) Act, 1972, Concept of Schedule in Wildlife Protection; Indian Biodiversity Act 2002; IUCN Red list of Threatened Species; The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Wildlife Photography - Basic Principles; Fundamentals of camera lenses and accessories; Learning to see, Finding the best subject, Positioning the subject, Utilizing colour, lines, shapes, patterns and texture; Techniques for photographing mammals, birds, fish, insects, reptiles, and amphibians; Composition on landscape photography; Ethics; Legalities.

Suggested Reading

1. Krishnamurthy, K. V. 2003. Textbook of Biodiversity. Science Publication.
2. Groom, M. J., Meffe, G. R. and Carroll, C. R. 2006. Principles of Conservation Biology, Sinauer Associates, Inc., USA.
3. Rangarajan M. (2001) India's Wildlife History. Permanent Black, New Delhi, India.
4. M.Kato. The Biology of Biodiversity, Springer.
5. J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall,New York.
6. E.O. Wilson. Biodiversity, Academic Press, Washington.
7. G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company.
8. E. Mayer. Elements of Taxonomy.
9. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northem& Co. o
10. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.

MID-1: WILD LIFE CONSERVATION PRACTICAL

Field work and educational excursion in an ecosystem:

1. Practical aspects of wildlife biology will be covered viz., identification & characterization of floral and faunal diversity in any wildlife habitats (Mountain, Hill, Forest etc.) of India.
2. Participants will be required to undertake exercises in habitat description, mapping and evaluation, estimation of wildlife populations.
3. The participants will be given hands-on training to analyse the data collected in the field using software with field report.
4. Basic techniques on Wildlife Photography

.

MID-1: FUNDAMENTALS OF ZOOLOGY

(For other Majors as Allied)

Objectives: Students will be able to identify the major group of organisms with an emphasis on animals and be able to classify them with in a phylogenetic frame work.

Students will be able to compare and contrast the characteristics of animals that differentiate them from other forms of life.

Programmes Outcomes:

Students gain knowledge and skills in the fundamental of Animal Sciences, understands the complex interaction among various living organisms.

UNIT I: (8 Hrs)

General classification of Animal kingdom- general characteristics of Invertebrate, Chordates and Vertebrata.

UNIT II: (9 Hrs)

Protozan parasites of human (Entamoeba, Trypanasoma), Canal system in sponges, Polymorphism in coelenterates, Helminth parasites of human (Tapeworm, Ascaris), Coelom and its significance.

UNIT III: (8 Hrs)

Respiration in Arthropods. Metamorphosis in Insects. Economic importance of mollusca. water vascular system in Echionodermata, Larval forms in Echinodermata.

UNIT IV: (10 Hrs)

Life cycle and retrogressive metamorphosis in Ascidia. Life cycle of Amphioxus. Life cycle of Balanoglossus and affinities.

UNIT V: (10 Hrs)

Accessory respiratory organ in Fishes, Migration of Fishes. Parental care of Amphibia. Poisonous snakes of India. Flight adaptation in birds. Placenta in Mammals.

Suggested Readings:

1. Ekambaranatha Ayyar, M and Ananthakrishnan, T.N. 1993, Outlines of Zoology, Vol.I and II, Viswanathan and Co. Madras.

2. Jordan, E.K. and P.S. Verma, 1993. Chordate Zoology, 12th edition, S. Chand & Co. Ltd., Ram Nagar, New Delhi.

3. Text book of Invertebrata – N.Arumugam et al., (2008) Saras Publications Nagerkovil 4. P.S. Dhami and J.K. Dhami – Invertebrate Zology – S.Chand and Co. New Delhi.

5. Invertebrate Zoology – R.L.Kotpal, (2005) Rastogi Publications, Meerat.

MID-1: FUNDAMENTALS OF ZOOLOGY PRACTICAL

1. Prawn Digestive -Nervous system
2. Cockroach Digestive - Nervous system
3. Earth worm - Body setae
4. Mosquito - Mouth parts
5. Prawn – Appendages
6. Spotters: Amoeba, Paramecium, Entamoeba, Sycon, *Obelia*, Aurelia, *Fasciola*, *Taenia*, Ascaris – Male & Female, Leech, Fresh water mussel, star fish, Amphioxus, Ichthyophis, Cobra, Pigeon (feathers) and Rabbit.

MID-1: ZOONOTIC DISEASES OF HUMANS AND ANIMALS

Course Objectives:

Students should be able to:

- Recognize and comprehend the zoonotic potential of diseases presented after successfully completing the course.
- Recognize the epidemiology of zoonotic illnesses that pose a serious threat to public health.
- Explain the role zoonotic illnesses play in public health.
- Specify the path(s) by which the main zoonotic illnesses are transmitted.
- Enumerate notable achievements in zoonotic disease public health (and provide justification for each success).
- List the main zoonotic disease prevention and control strategies for both individuals and populations.
- Enumerate the groups that are most susceptible to the particular zoonotic illnesses that will be covered in the course.
- Recap the variations between industrialized and developing nations with respect to zoonotic disease prevalence and risk (and the reasons for these disparities)

Course outcome

The following competencies are reinforced or gained primarily via this course: Providing an account of the genetic, physiological, and psychological elements that influence an individual's vulnerability to negative health consequences after being exposed to environmental risks. The ability to analyse and interpret epidemiologic data; a description of methods for identifying, preventing, and controlling environmental hazards that endanger human health and the environment; and the application of epidemiologic knowledge and technique in a relevant field or applied setting.

Unit: I **[08 hrs]**

Principles of Zoonoses, Human Viral Diseases: Rabies, AIDS and Covid-19.
Zoonotic Viral Diseases of Human: Encephalitis Influenza, Lymphocitic, Choriomeningitis, Monkey pox.

Unit: II **[10 hrs]**

Zoonotic Bacterial Diseases of Human: Rat-bite fever, Staphylococcosis, Vibriosis, Yersiniosis Anthrax, Cat Scratch Disease, Leptospirosis, Tuberculosis, Brucellosis, Salmonellosis, Botulism. Bacterial Diseases Animals: Pasteurellosis, Psittacosis, Listeriosis, Q fever.

Unit: III **[10 hrs]**

Vector Borne Bacterial Diseases: Lyme disease, Rocky Mountain spotted fever, Ehrilichiosis Leishmaniasis, Plague, and Tularemia. Vector borne parasitic diseases: Chikungunya, Dengue and severe dengue, Yellow fever, Zika virus, Malaria, Japanese encephalitis, Lymphatic filariasis, Leishmaniasis.

Unit: IV **[09 hrs]**

Protozoans Parasitic diseases of Human: Babesiosis, Cryptosporidiosis, Giardiasis, Toxoplasmosis, Round Worm Infections, Tapeworm Infections, Trichinosis, TSEs: BSE, Chronic Wasting Disease, Scrapie.

Unit: V **[08 hrs]**

WHO, CDC, NCDC, NCVBDC, ICMR, VCRC, NIRT, NIP, NIP, NIMR, NARFBR, VIDRL, NIV, NLEP, NTEP, NARI.

References:

- Handbook of Zoonoses: Identification and Prevention by J. L. Colville and D. L. Berryhill. 2007 ISBN: 978-0-323-04478-3.
- Human-Animal Medicine: Clinical Approaches to Zoonoses, Toxicants and Other. Shared Health Risks by Rabinowitz and Conti. 2009 ISBN: 978-1416068372.

MID-1: ZOONOTIC DISEASES OF HUMANS AND ANIMALS -PRACTICAL

1. Identification of vectors.
2. Identification Bacterial diseases.
3. Identification of Viral diseases
4. Identification of Protozoan parasites
5. Institute Models: CDC

MID-2 PUBLIC HEALTH AND HYGIENE

UNIT – I Concepts of Public Health and Hygiene: [**9 Hrs]**

Nutrition and health- Malnutrition and Over nutrition, Nutritional Deficiencies, Vitamin deficiencies.

UNIT – II Environment and Health Hazards: [8 Hrs]

Need of Water Purification, Adulteration of Food, Undesirable Changes in Air, Radiation effects, e- waste, Solid waste and Excreta disposal.

UNIT-III Communicable diseases and their control measures: [10 Hrs]

Air Borne Disease : Tuberculosis, Influenza Food and water Borne Disease : Amoebiasis, Jaundice Vector Borne Disease : Malaria, Dengue Contact Disease : Venerial disease and AIDS.

UNIT – IV Non – communicable diseases and their preventive measures: [9 Hrs]

Hypertension, Coronary Heart Diseases, , Diabetes, Obesity and Tumour Haemophilia and Sickle Cell Anaemia, Occupational health Hazards

UNIT – V Health Education in India: [9 Hrs]

Ill Effects of Smoking, Alcoholism and drug abuse WHO programmes, Government and voluntary Organizations – vaccination and awareness programme. First Aid- Precautions and awareness on Personal hygiene.

Suggested Readings:

1. Park and Park, 1995: Text book of preventive and social medicine – Banarsidas Bhanot Publ. jodhpur- India.

2. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India

3. Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation –Part I- IV

4. Murray, C. J. L. and A.D. Lopez. (1996). The Global Burden Of Disease. World Health Organization.

5. Park, J.E. and Park, K. Textbook of Community Health for Nurses.

MID-2 PUBLIC HEALTH AND HYGIENE PRACTICAL

1. Identification of Parasites
2. Identification of disease causing vectors
3. Occupational Health Hazards
4. Estimation of Haemoglobin
5. Demonstration of ECG
6. Estimation of BMI
7. Vitamins and Deficiency diseases
8. Visit to a hospital to study solid waste management and report submission

BIOLOGY OF NON-CHORDATES - II

BIOLOGY OF NON-CHORDATES – II PRACTICAL

MID-2 BASIC IMMUNOLOGY

Objectives: To study the process which help to maintain the organisms internal environment, when challenged with foreign substances.
To understand the basics in Immunology

Unit: I
Introduction-Scope of immunology- Historical perspectives - Immunohaematology- blood groups, blood transfusion, Rh-incompatibilities; Types of immunity- innate and acquired immunity.

Unit: II
Anatomy of lympho-reticular system- primary and secondary lymphoid organs; Cells of the immune system.

Unit: III
Antigens- Types, properties, antigenic determinants, haptens, adjuvants. Immunoglobins- types, structure and properties, Monoclonal and polyclonal antibodies; Antigen-antibody interactions. Vaccines- types, toxoids,antitoxins.

Unit: IV
Immune responses- Primary and secondary immune response- Cell mediated and humoral immune responses, Immune responses against tumors, Immunologic tolerance and disorders, autoimmune diseases.

Unit: V
Complement system- Classical and alternate pathway, MHC-classes, Hypersensitivity reactions – types and diseases. Types of grafts, graft Vs host reactions.

References

1. Ivan M.Roit 1994. Essential Immunology-Blackwell scientific publications, oxford.

2. Janis kuby 1993. Immunology II edition. W.H.Frumen and company, New york.

3. William E.Paul 1993. Fundamental immunology. II edition Raven press, New york.

4. Ian R. Tizard, 1995, Immunology: An Intoduction, 4th edition, Saunders College Publishing,

5. Chakravarthy, A.K. (1996) – Immunology, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

MID-2 BASIC IMMUNOLOGY PRACTICAL

1. Human Blood grouping [ABO and Rh]
2. Study of prepared slides of primary and secondary lymphoid organs.
3. Thymus
4. Spleen
5. Bone marrow
6. Lymph node.
7. Peyers patches
8. Bursa fabricus
9. T – cell
10. **B-** cell
11. MALT
12. GALT

MID-2: VALUE ADDED PRODUCTS OF ANIMALS

Unit-I: 9 Hrs

Value added products of honey – Bee Wax, Bee propolis, Bee Venom, Bee Pollen, etc. Fermented honey (mead), honey paste for dressing wounds, honey jelly, honey caramels, creamed honey, comb honey, honey beer, honey fruit syrup, honey with fruits and nuts and honey gums their manufacture.

Unit –II: 9 Hrs

Value added products of fishes – Fish protein concentrate, fish oils- fish liver oil and body oil, squalene from shark liver oil, fish gelatin, fish glue, fish maws and isinglass, fish wafers, fish silage, fish skin leather, shark cartilage, fertilizer from fish waste, chitin and chitosan, surumi, roe, ambergris-ready to cook and ready to eat products.

Unit –III: 9 Hrs

Different kinds of goat meat products-Curried goat, Goat Sausage, Goat Hamburger - Curried goat burrito; Organ products for food and pharmaceuticals. Meat Products: Canned meat, Frozen meat, Cooked and Refrigerated meat, Dried and preserved meat, Cured meat, Prepared meat products, Production methods for Intermediate moisture and dried meat products,

Unit –IV: 9 Hrs

Poultry Products: Poultry meat processing operations in detail along with equipment used – Packaging of poultry products, refrigerated storage of poultry meat, by products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

Unit –V: 9 Hrs

Milk Products: Testing and grading of raw milk. Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and flavoured milks. Preparation of cultured milks, cultures and their management, yoghurt, Dahi, Lassi and Srikhand. Milk products such as Cream, Butter, Ghee, Khoa, Cheese, condensed, evaporated,dried milk and baby food, Ice cream and Kulfi, butter milk, lactose and casein.

Suggested Readings:

1. Krell,1996. Value-added products from beekeeping.FAO agricultural services bulletin no.124, FAO, United Nations,Rome.http:/www.fao.org/docrep/woo76Eoo.htm.

2. La Bell, F. 1988. Honey :Traditional food finds new uses.Food Process.11:111-114.

3.Spottel,W.1950. (Honey and dried milk). J.A. Barth,Leipzig, Germany,p.323.

4. Gopakumar, K.1997. Tropical Fishery Products. Oxford & IBH Publications.

5. Chandran, K.K., 2000. Post Harvest Technology of Fish and Fish Products. Daya publishing House, New Delhi.

MID-2: VALUE ADDED PRODUCTS OF ANIMALS PRACTICAL

1. Different Types of Honey bees
2. Beehive architecture
3. Economically important freshwater and marine water fishes.
4. Identification of Breeds of Goat.
5. Identification of Poultry Breeds.
6. Breeds of Cattle
7. Value added Products related to syllabus-Samples

MID-3: ECONOMIC ZOOLOGY

UNIT – I Aquaculture

Definition, scope, and significance of Aquaculture, Prawn culture, Pearl culture, Edible Oyster culture.

UNIT – II Pisciculture

Basic concept on mono and composite fish culture (Carp culture); Fish diseases caused by Ichthyophthirius multifilis, Trichodinia sp. and Ichthyobodo sp., symptoms and control; Maintenance of aquarium.

UNIT – III Sericulture

Different species and economic importance of silkworm, Mulberry and Non-mulberry Sericulture (Eri, Muga, Tussar), Sericulture techniques.

UNIT – IV Apiculture

Different species of Honeybee, types of beehives - Newton and Lang troth, Bee Keeping equipment, Methods of extraction of honey (Indigenous and Modern) and its processing, Products of apiculture industry (Honey, Bees Wax, Propolis, Royal jelly, Pollen etc.) and their uses.

UNIT – V Agricultural Crop Pest and Management

Bionomics of crop pests of rice (Leptocorisa acuta); sugarcane (Pyrilla perpusilla); vegetable (Raphidopalpa foveicollis); and stored grain (Corcyra cephalonica); Pest Management Strategies (Physical, Chemical & Biological)

Reference Books

1. Atwal, A.S. (1993) Agricultural Pests of India and Southeast Asia. Kalyani Publishers, New Delhi.
2. Shukla, G.S. and Upadhyay, V.B.: Economic Zoology, 4e, 2002, Rastogi.
3. D. B. Tembhare. (2017) Modern Entomology. Published by Himalaya Publishing House (ISO 9001: 2008 Certified).
4. Dawes, J. A. (1984). The Freshwater Aquarium, Roberts Royee Ltd. London.
5. S.S. Khanna and H.R. Singh. A Textbook of Fish Biology & Fisheries Published by Narendra Publishing House.3rdEdition. (ISBN13: 9789384337124).
6. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH Publishing Co., Pvt. Ltd. Calcutta.

MID-3: ECONOMIC ZOOLOGY PRACTICAL

1. Study of aquatic organisms - prawns, oysters and fishes (any three) through museum specimens in the laboratory with details on their classification, distribution and specialized features.
2. Study of different species of aquarium fishes (Goldfish, Guppy, Swordtail fish) and maintenance of aquarium in lab/indoor.
3. Study of major crop pests of rice (Leptocorisa acuta), sugarcane (Pyrilla perpusilla), vegetable (Raphidopalpa foveicollis) and stored grain (Corcyra cephalonica) belonging to different orders.
4. Study of Bombyx mori, its life cycle and economic importance.
5. Study of the life history of honeybee, Apis cerana indica and Apis mellifera from specimen/ photographs - egg, larva, pupa, adult (queen, drone, worker).
6. Study of artificial hive (Langstroth/Newton), its various parts and beekeeping equipment.
7. Project report on life cycle of any one crop pest or on a product obtained from apiculture industry.
8. Field study/lab visit to an apiary/honey processing unit/sericulture institute/aquarium shop/fish farm/pisciculture unit.

MID-3: AGRICULTURAL ENTOMOLOGY

UNIT-I: Introduction [9 hours]

History of entomology in India, evolution of insects as a most successful group in the animal kingdom, classification of insects up to the orders mention important families, morphology of insects-Head, thorax, abdomen, wings, genitalia, appendages, types of mouth parts and its structures, sampling methods for insect population

UNIT-II: Insect pest and pest out break [7hours]

Definition of pest, categories of pests, parameters of insect population levels, causes of insect outbreak, accidental introduction of pests from foreign countries, resurgence, and pest resurgence, methods of collection and sampling of insect populations.

UNIT-III: Major crops pests in India [11 hours]

Distribution, damage, bionomics and management of various insect pests-Paddy Pests-Thrips, brown plant hopper, gall midges, yellow stem borer, leaf roller; Wheat Pests-Aphids, Armyworm, Ghujhia weevil, gram pod borer, termites; finger millet- pink stem borer, white stem borer, root aphid, cut worm, white grub; Coconut pests- Rhinoceros beetle, red palm weevil, black headed caterpillar, eriophyid mite, slug caterpillar; Cotton pests-leaf hopper, cotton aphids; thrips, whitefly, mealy bug; Mango pests- stemborer, nut weevil, fruitfly, flower gall midges, leaf webber, flower webber and leaf caterpillar; Pest of sugar cane-Pyrilla perpusiella

UNIT-IV: Biological and Chemical control of pests [9 hours]

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation.Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation.Successful biological control projects, analysis, trends and future possibilities of biological control.

UNIT-V: Integrated pest management (IPM) [9 hours]

Definition and concept, Principles of pest management and history, Ecological methods of pest management-physical, mechanical and cultural,Pest management through botanicals, behavioural modification and radiation technology,Host plant resistance and biological components of IPM.Biotech approaches, AESA and IPM case studies in field crops.IPM in paddy, cotton and Mango.

References

1. Ananthakrishnan, T. N. (Ed.). (1992). Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
2. Ananthakrishnan, T. N. (1984). Biology of Gall Insects. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 3. Apple, J. L. and Smith, R. R. (1976). Integrated Pest Management. Plenum Press, New York.
3. Atwal, A. S. (1986). Agricultural Pests of India and South East Asia. Kalyani Publishers, Ludhiana.
4. Banerjee, B. (1988). An introduction to Agricultural Acarology - Biology and control of mite pests in the tropics. S.K. Dutta Associated Publishing Co., 8798/7, Shidipura, Karolbagh, New Delhi.
5. Bucherl, W. and Buckley, E. (Eds). (1971).Venomous Animals and Their Venoms. Academic Press New York, London.
6. Claussen, C. P. (1962). Entomophagous Insects. Haner Publishing Co.,
7. David, B. V. and Ananthakrishnan, T. N. (2004). General and Applied Entomology Second Edition. Tata McGraw Hill Publishing Company Limited, New Delhi.
8. Debach, Paul (1964). Biological Control of Insect Pests and Weeds. Chapman & Hall.
9. Dent, D. (1991). Insect Pest Management, CAB International, UK.
10. Evans, G. O. (1992). Principles of Acarology, CAB International, U.K.
11. Kilgore. W. W. and Doutt, R. L. (1967). Pest Control. Academic Press, London
12. Krantz, G. W. (1978). A manual of Acarology, D.S.U. Book Stores, Corvallis, Oregon.
13. Nair. M. R. G. K. (1975, 1996). Insect & Mites of Crops in India. ICAR, New Delhi
14. Pedigo, L. P. (1996). Entomology & Pest Management Practice. Hall India Pvt. Ltd., New Delhi.
15. Ramakrishna Ayyer, R. V. (1963). A Handbook of Economic Entomology of South India. Govt. of Madras publication.

MID-3: AGRICULTURAL ENTOMOLOGY PRACTICAL

I. Spotters

1. Spodoptera
2. Rhinoceros beetle
3. Eriophyid mite
4. Batocera
5. Pyrilla
6. Earias vittella
7. Helicoverpa
8. Mealy bug
9. Lady bird beetle
10. Zambi flies

II. Different methods of insect sampling

1. Sweep net
2. Sticky traps
3. Light traps
4. Pit fall traps
5. Malaise trap
6. Pan trap

III. Collect any five crop pests available in your locality, make an insect box and submit it individually.

IV. Study the life cycle of any two insect pests.

V. Visits the paddy fields and collect and identify pests and their natural enemies; Make a record.

MID-3: FOOD, NUTRITION AND HEALTH

Course Objective: The prime focus is to provide the students with a basic understanding of the relationship between food, nutrition and health. It is important to understand this link and change eating habits in accordance to one`s age, pregnancy, lactation and physical activity. Mental health is also affected largely by our lifestyle. Apart from physical activity, the intake of the required vitamins, minerals and antioxidants also nourish the brain. Malnutrition is the main cause of impairment of growth in young children and infants and leads to diseases like Marasmus. Moreover, food hygiene including food and water-borne infections along with food spoilage has also been covered in this course.

Course Learning Outcome: Upon the completion of the course, students will be able to:

• Have a better understanding of the association of food and nutrition in promoting healthy living.

• Think more holistically about the relationship between nutrition science, and social and health issues.

• Move on to do post-graduation studies and apply for jobs as food safety officers, food analysts, food inspectors, food safety commissioners or controllers for jobs in organizations like FSSAI.

• Specialize in various fields of nutrition.

Unit I: Basic concept of food and nutrition [10 hrs]

Food Components and food nutrients, Concept of a balanced diet, nutrient needs and dietary patternsfor various groups- adults, pregnant and nursing mothers, infants, school children, adolescents andelderly. Food Pyramid, Nutritional anthropometry- BMI, waist-to-hip ratio, skin-fold test andbioelectrical impedance; interpretation of these measurements.

Unit II: Nutritional Biochemistry [8 hrs]

Carbohydrates, Lipids, Proteins, their dietary source and role Vitamins- their dietary source and importance Minerals- their biological functions. Dietary Fibres - Definition, their dietary source andnutritional importance. Elementary idea of Probiotics, Prebiotics, and Organic Food.

Unit III: Health and deficiency [7 hrs]

Definition and concept of health, Major nutritional Deficiency diseases- (kwashiorkor and marasmus),Deficiency disorders, their causes, symptoms, treatment, prevention and government programmes, if any.

Unit IV: Life style disease and social health problems [8 hrs]

Life style related diseases- hypertension, diabetes mellitus, Atherosclerosis and obesity-theircauses and prevention through dietary and lifestyle modifications, Social health problems-smoking, alcoholism, drug dependence and Common ailments- cold, cough, and fevers, their causes and treatment.

Unit V: Food hygiene **[12 hrs]**

Food and Waterborne infections; Bacterial infection: Cholera, typhoid fever, dysentery; Viral Infection: Hepatitis, Poliomyelitis; Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention; Brief account of food spoilage: Causes of food spoilage and their preventive measures.

Recommended Books:

• Shashi Goyal& Pooja Gupta. Food, Nutrition and Health (ISBN: 9788121940924)
• Linda Tapsell. Food, Nutrition and Health. I Edition , Oxford(ISBN: 978- 0195518344)
• Avantina Sharma. Principles of Therapeutic Nutrition and Dietetics.. CBS Publishers and Distributors Pvt. Ltd.
• Elia M et al. (eds) Clinical Nutrition. Wiley-Blackwell, A John Wiley & Sons Ltd.
• Gibney MJ et al. (eds) (2009) Introduction to Human Nutrition. Wiley-Blackwell A John.

MID -3: FOOD, NUTRITION AND HEALTH-PRACTICAL

1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
2. Estimation of Lactose in milk and diagnosis of lactose intolerance by measuring hydrogen gas during expiration.
3. Ascorbic acid estimation in food by titrimetric
4. Estimation of Calcium in foods by titrimetric
5. Study of the stored grain pests from slides/photographs (Sitophilus oryzae, Trogodermagranarium, Callosobruchuschinensis and Triboliumcastaneum): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
6. Visit to food testing lab /or any agency of food standards
7. Project work
8. Undertake computer aided diet analysis and nutrition counseling for different age groups.
9. Identify nutrient rich sources of foods (fruits and vegetables), their seasonal availability and price.
10. Study of nutrition labeling on selected foods

MID-4 : GENETIC ENGINEERING

Course Objectives:

1. To impart knowledge about major events in the development of rDNA technology and to acquire skills on techniques of construction of recombinant DNA - Cloning vectors and isolation of gene of interest.
2. To familiarize with the concepts of different operons and regulation of gene expressions in prokaryotes and eukaryotes.
3. To acquaint them with the different gene transfer methods and mappings.
4. To explain the applications of genetic engineering in biotechnology.

Course Outcomes: The student will be able to

1. Familiar with the tools and techniques for isolation and purification of genes, vector construction.
2. Understand the mechanisms of regulation of gene expression in different operons.
3. Know the techniques for transfer and expression of cloned gene and
4. Apply the knowledge of genetic engineering in biological research.

Course Contents:

Unit I Cloning and amplification of DNA: Introduction, choice of the organism, use of restriction endonucleases for the production of DNA fragments. Vehicles for cloning - plasmids, phage vectors and cosmids. RNA isolation, preparation and use of cDNAs. Screening and determination of nucleotide sequences. Application of recombinant DNA technology. Oncogenes and their mode of action.

Unit II Isolation, sequencing and synthesis of genes: Isolation of genes, sequencing of genes, synthesis of genes, Cloning of specific eukaryotic genes and their expression in bacteria. Operon model: Isolation and chemical nature of repressor. Catabolite repression and role of cAMP and cAMP receptor protein (CRP) in the expression of glucose – sensitive operons. Lac operon, His operon, Trp operon of E. coli. Stringent and relaxed control. Regulation of gene expression in prokaryotes and eukaryotes: Transcriptional control, enzyme induction and repression. Constitutive synthesis of enzymes. Genes involved in regulation, regulatory gene, promoter gene, operator gene and structural genes. Genome imprint.

Unit III Gene transfer methods and transgenic organisms: Gene transfer methods for animals and plants, Agro bacterium mediated gene transfer, electroporation and particle gun. Trasgenic animals, and transgenic plants. Restriction maps and molecular genetic maps: Restriction mapping, restriction fragment length polymorphisms (RFLP) Linkage and recombination between molecular and phenotypic markers, Random amplified polymorphic DNA (RAPDs) using PCR, Chromosome walking. Organic genome engineering and cell molecular memory/ Biosensors

Unit IV Applications of genetic engineering in biotechnology: Genome imprint, Dynamic genome engineering and cell molecular memory. Plant, animal cell and Tissue culture methods.

Biosensors: Genetically Modified Organism - Market potential, Diet, Leash, Potato, Rice BT.

Recommended Books

1. Genes and Probes, A Practical Approach Series (1995) by Hames and SJ Higgins; Oxford Univ. Press.
2. Gel Electrophoresis of Nucleic Acids, A practical Approach (1990) by D Rickwood and BD Hames. 3. Oxford Univ. Press.

MID-4 : MICROBIOLOGY

Objectives: To emphasize the importance of integrating new knowledge on Microorganisms.

UNIT-I Scope of Microbiology

Diversity of Microbes, Broad classification of bacteria, fungi, yeast and virus. Structure and functions of bacteria and virus , Bacterial Culture – Media & types.

UNIT-II Microbes of the Environment

Air, Water and Soil and its role in ecosystem, Role of Microbes in Ecosystem Bioremediation of industrial wastes, sewage treatment plants,

UNIT-III Agricultural Microbiology

Microorganisms as Biofertilizers, production and application of. Microbial biopesticides; Mechanism of N2 fixation.

UNIT –IV Food Microbiology:

Microbes of milk and food, Pasteurization and food spoilage. Fermentation techniques and Production of alcohol. Uses of microbes in food Industry - Bread, Vinegar,

UNIT- V Microbial Control

Concept of Sterilization pasteurization, tantalization; fumigation, ultrasonication, and filtration.

Suggested Readings:

1. Burden, K.L. and R.P. Williams (6th Ed.) 1968. Microbiology. The Macmillan Co., London

2. Roberts, T.A. and F.A. Skinner (Eds.) 1983. Food Microbiology: Advances and Prospects, Academic Press, Inc. London,

3. Pelczer, M.J., Reid, R.D. And Chan, E.C.S. (1996), Microbiology, V Ed., Tata McGraw Hill Publishing Company Ltd., New Delhi.

4. Ananthanarayanan, T And Jayaram Paniker, C.K. (2000), Text Book of Microbiology,VI Ed., Orient Longman Ltd., Madras.

5. C.B.Powar, H.F.Daginawala, (1965) General Microbiology Himalayan Publishing House

MICROBIOLOGY PRACTICAL

1. Identification of microorganisms from the habitats [simple staining, differential staining,]

2. Morphological Observation of bacterial cell.

3. Methods of inoculation of microbes – Spore plate, Streak and Swab.

4. Motility study of Lactobacillus – Hanging drop method

Spotters:- (Any Ten)

1. Mycoplasmas,
2. Rickettsiae,
3. Chlamydiae,
4. Staphylococcus aureus,
5. Streptococcus pneumoniae,
6. Salmonella,
7. HIV,
8. Hepatitis virus
9. Rabies virus.
10. Fermentor,
11. Bioreactors,
12. Biofilters

MID-4: ENVIRONMENTAL BIOTECHNOLOGY

Course Objectives:

- Make them understand the concept, organization, and energy flow in an ecosystem
- Impart knowledge of the process of biodegradation and bioremediation
- Equip with the knowledge on biological control and scope of biofertilizers in agriculture
- Educate about different types of waste and their eco-friendly management

UNIT-I **[10 Hrs]**

Structure of model ecosystem - terrestrial, aquatic ecosystems - Energy flow - Degradation ofecosystem. Consequences - Ecosystem management - Energy conservation – Alternativeenergy sources - Biofuels: Production of bioethanol, biobutanol from agriculture waste -Problems and perspectives - Biodiesels: mass cultivation of Jatropa and use of Jatropa,marine algae for the production of biodiesel.

UNIT-II **[12 Hrs]**

Nature of recalcitrant compounds - Anthropogenic activities generating recalcitrant chemicalwaste - BHC, DDT, nitro phenols, polycyclic aromatic carbons. Biodegradation – microbialconversion of recalcitrant toxic compounds into TCA cycle intermediates eg: Pseudomonasputida. Bioremediation, Degradation pathways - naphthalene, BHC, and nitro phenols. Use ofmicrobes for reconstruction of ecosystems - Genetics of biodegradation. Microbes asbiosensors for detecting pollution. Superbug – cleaning of oil spills.

UNIT-III **[8 Hrs]**

Biological methods of pest management - Role of Juvenile hormones, pheromones and their analogs for pest management, Chromosomal manipulation and androgenesis of pest,sterile male technology, Biological control of weeds. Bacterial (BT), viral, fungal insecticides- Technology for mass production and formulation of biopesticides - Problems and prospects.

UNIT-IV **[8 Hrs]**

Biofertilizers - Important diazotrophic, microbes - mechanism of symbiotic and asymbiotic biological nitrogen fixation - Regulation of nitrogen-fixing genes (Nif genes). Manipulationof Nif genes for constitutive expression of nitrogenase - Ammonia transport and itssignificance. Mass production of biofertilizers - Rhizobium, Azolla.

UNIT-V **[7 Hrs]**

Waste management - Nature and classification of agriculture, domestic and industrial waste - Recycling methods. Solid waste treatment. Biological and non-biological methods of waste water treatment. Reclamation of treated waste water.

Reference Books

- Environmental Biotechnology: Concepts and Application by Jordening H J and Winter J.
- Environmental Biotechnology: Theory and Application by Evans G M and Furlong J C.
- Environmental Biotechnology by Bhattacharya B C and Banerjee R.
- Environmental Biotechnology: Basic Concepts and Applications by InduShekhar Thakur.
- Environmental Biotechnology by V Kumaresan and N Arumugam.
- Environmental Biotechnology by Perry L McCarty and Bruce E Rittmann.
- Textbook of Environmental Biotechnology by P K Mohapatra.
- Environmental Biotechnology by T Srinivas.

MID-5: TOXICOLOGY

Course objectives:

While studying the **Toxicology** course, the student shall be able to:

- Provides broad theoretical knowledge within toxicology and development of a general working knowledge of the principles and practice of clinical toxicology.
- Basic toxicology concepts including: mechanisms of toxicology, absorption, distribution and excretion of toxicants, xenobiotic metabolism, toxicokinetics, chemical carcinogenesis, hepatotoxicology.
- Based on student interest some of the following areas may be included: genetic toxicology, developmental toxicology, renal toxicology, toxic effects of pesticides, toxic effects of metals, toxic effects of radiation, venoms and animal poisons, air pollution, ecotoxicology, food toxicology, forensic toxicology, occupational toxicology, regulatory toxicology, other.
- This course includes the study of Pesticides that are agrochemicals and used for preventing, repelling, mitigating or destroying any pests. It includes insecticides, fungicides, rodenticides and herbicides etc. These insecticides are of chemical or biological origin that controls the insect.
- The course indicates the mechanism of Pest control that may result in the form of killing the insects or otherwise preventing it from its destructive behaviors. Insecticides are either natural or man-made synthesized and are applied to target pests in a myriad of formulations (EC, WP, SP, FP, G etc.) and delivery systems (sprays, baits, slow-release diffusion, dust, etc.). In recent years, the bacterial genes coding for insecticidal proteins have been incorporated into various crops that deal with the mortality of the pests feeding on them.
- The course highlights various categories of insecticides and their relative efficacy in relation to other control methods in a particular ecosystem. Use of bio-pesticides and other plant derived pesticides form an important part of IPM (Integrated Pest Management).
- The course indicates the biodiversity of insects in different ecosystems and the impact of global climatic changes on insects diversity and their behaviour. Insects are important for the survival of different biota on the earth. Effect of various anthropogenic activities and pollutants on insects is correlated with maintenance of different ecosystems.
- To apprise the students about the toxicants along with their application and their effects on biosphere as well as human health.

Unit- I:

Introduction and scope of toxicology and classification of xenobiotics. Principles of toxicology- Dose response relationship- Toxicity tests {acute (LD50, LC50, ED50) and chronic toxicity tests on aquatic and terrestrial animals}, Variations in toxic response. Mechanism of toxic action of pesticides (Receptor concept, nature of receptors, Theory of toxicants- receptors interactions and mechanism of action of some pesticides) Toxicokinetics- i) Classic toxicokinetics ii) Physiologic toxicokinetics

Unit- II:

Translocation of toxicants; Absorption of Toxicants, Distribution of Toxicants, Excretion of Toxicants Biotransformation of Xenobiotics; Biotransformation sites, Biotransformation enzymes, Biotransformation reaction and bioactivation Bioaccumulation of Xenobiotics; Bioconcentration, Bioaccumulation and Biomagnification; Biomagnification of lipophilic and recalcitrant substances Toxic effect of metals - Mercury, Lead, Cadmium and Arsenic

Unit- III:

Toxic Response of Blood: Toxicology of erythron, leukon, platelets and homeostasis Toxic Response of Liver; Mechanism and types of toxin – induced liver injury; critical factors in toxicant induced liver injury; detoxification mechanisms by liver. Toxic Response of Kidney; Susceptibility of the kidney to toxic injury; Biochemical mechanisms / mediators of renal cell injury.

Unit-IV

Toxic Response of Reproductive system; Endocrine disruption: endocrine disruptors (including screening and puberty) in humans and mammals. Testicular and ovarian dysfunction. Deterioration in fertility by toxicants.

Unit- V:

Xenobiotic effect on basic metabolism (Carbohydrates, Proteins, Lipids) Teratogens and Teratology (Relationships between maternal and developmental toxicity) Antidotal therapy; Types of antidotes and antidotal procedures. Risk assessment – Hazard identification; Risk characterization and Safety evaluation of Chemicals.

SUGGESTED READING MATERIAL

1. Casarett & Doul's- Toxicology- The basic science of poisons- C.D. Klassen, Mary, O.D & John Doull.
2. Concepts of Toxicology Dr. Omkar, Vishal Publishing C.2003.
3. Environmental toxicology of pesticides- F. Mastimura, G.M.Boush and T.Misato.
4. Introduction of Biochemical Toxicology- E.Hodgson & F.E.Gutherie.
5. Pesticides action and metabolism- O'Brrien.
6. Pesticides and Human Welfare- D.L. Gunn and J.G.R.Stevens. Oxford University Press- 1978.
7. The Encyclopedia of Americana- Vol.15.

MID-5: FORENSIC ENTOMOLOGY

Course Objectives: After studying this paper the students will know-

- The overview of forensic entomology and its applications.
- The stages of death.
- The role insects play in the decomposition of carrion.
- The life cycle of insects.
- The forensic importance of insects.

Course Outcome: This course will enable the students to:

- Identify the relationship between insect type and the stages of death.
- Distinguish among major insect types associated with carrion.
- Estimate time of death.
- Types and identification of microbes of forensic significance.

UNIT-I **(10 Hrs)**

Forensic Entomology: Introduction and history of entomology, general entomology and arthropod biology and taxonomy of arthropod, forensically important insects.

UNIT-II **(10 Hrs)**

Insects of forensic importance; collection of entomological evidence during death investigations; the role of aquatic insects in forensic investigations; life cycles of insects.

UNIT-III **(15 Hrs)**

Stages of decomposition: insect succession on carrion and its relationship to determine time since death; factors influencing insect succession on carrion, its application to forensic entomology.

UNIT –IV **(10 Hrs)**

Forensic Enotomotoxicology: Current concepts, trends, challenges and techniques. Implication of morphmetric and growth rate

Reference Book:

1. J.H.Byrd and J.K. Tomberlin, 3rd Edition Forensic Entomology (2009).
2. D.B.Rivers And G.A. Dahlem, 1st Edition, the Science of Forensic Entomology(2022).
3. J.Amendt, M.Lee Goff and C.P.Campobasso, Current Concept of Forensic Entomology (2010)

MID-5: TOOLS AND TECHNIQUES

Course Objectives:

While studying the **Tools & Techniques**, the student shall be able to:

- To study the different tools used in biology and research.
- To learn about the operational handling and maintenance of laboratory instruments and glassware.
- To study different types of microscopy used in biology.
- To learn about different molecular and cellular separation techniques and their application in biological research.
- To study principles and methods of microtechnique.

UNIT-I.

Chromatography: Molecular sieve chromatography: Principle, Determination of void volume and molecular mass of native molecules.
Ion exchange chromatography: Ion exchange materials – Cation and anion exchange materials. Principle and separation of charged molecules. Principle and application of TLC and HPLC.
Centrifugation: Techniques-Density gradient., ultra centrifugation.

UNIT-II

Electrophoresis: principle, Matrices used in electrophoresis – PAGE for separation of proteins, molecular mass determination. Separation of nucleic acids using agarose gel- electrophoresis. Pulse field electrophoresis and isoelectric focusing. Blotting techniques: western, southern and northern blotting techniques.

UNIT-III.

Introduction to cell and tissue culture: Preparatory techniques – cleaning, sterilization, sterile handling tissue culture laboratory requirements, Design of tissue culture laboratory: Equipments and purpose.
Cell types (Primary and secondary) and cell lines, Cell proliferation measurements, Cell viability testing: Dye inclusion and dye exclusion tests.
Culture media: composition, preparation and sterilization, macro and micro nutrients, Importance of serum and limitation with serum media, cell harvesting methods.
The biology of stem cell: overview; different types of stem cells – embryonic stem cells, fetal tissue stem cells, adult stem cells, stem cell nuclear transfer; somatic cell nuclear transfer, Animal cloning.

UNIT-IV.

Electromagnetic spectrum of light- Simple theories of absorption of light by molecules. Beer-Lambert law. Types of detectors: UV-Visible spectrophotometry, Infra red spectrophotometry, Fluorescent spectroscopy. Flame photometry, AAS, IC-OES, ICP-MP.
Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, CAT.

UNIT-V:

Microscopic techniques: Principles of microscopy Scanning and transmission microscopes. Image processing methods in microscopy. Different fixation and staining techniques for Light microscope and Electron microscope. Microtomy and processing of tissues for Light microscope and Electron microscope. Cryopreservation and cryotechniques for microscopy Freeze-etch and freeze-fracture methods for EM.

Course Outcomes:

- Students would be trained in various tools and techniques used to gain insight into
- biological processes.
- Students would be expertise techniques used for imaging, isolation, purification and characterization of various biological substances.
- Students would gain basic knowledge of the underlying principles and practical strategy of the analytical and preparative techniques that are fundamental to study and understanding of life processes.
- Identify and describe the different equipment and tools used in a biology laboratory.
- Correctly operate different laboratory instruments.
- Correctly operate different types of microscopes.
- Prepare tissue for section cutting and correctly operate a microtome.
- Choose and perform correct staining technique for any given tissue sections.
- Describe cellular separation techniques.
- Properly handle and maintain glassware.
- Properly operate laboratory equipment.

SUGGESTED READING MATERIAL:

1. A Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.W. Goulding, ELBS Edn.
2. Animal Cell Culture – A practical approach, Ed.John. R. W.Masters IRL Press.
3. General Zoological Microtechniques - P.M. Weesner.
4. Principles and techniques of Biochemistry and molecular biology by Kein Wilson and John Walker, VII volume, Cambridge press Edition.
5. Neuro anatomical Techniques, N.J. Stransfed and T.A. Miller Springer Verlag, New York Heidelberg, Berlin.
6. Principles of Neuro Phychopharmacology- Robert S. Feldman, Jerrold S. Meyer and Lind F. Quenzer. Sinauer Associates, Inc. Publishers. Sunderland. Massachusetts.
7. Biophysical chemisty by Upadhyay – Upadhyay - Nath. Analytical Biochemistry (Biochemical techniques) by Dr P. Asokan. Chinnaa publications.
8. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International Edition.
9. Vogel's Qantitative Chemical Analysis by Vogel, ArthurI.

SEMESTER – VI

MJD-12: ENDOCRINOLOGY

Objectives :
Explaining the role of hormones on physiological activities of animals with special reference to humans.

UNIT – I
Scope of Endocrinology, Endocrine glands, hormones and hormone action, Structure, hormone secretion and functions of hypothalamus and pituitary gland, Pineal gland: Melatonin and serotonin – circadian rhythm.

UNIT – II
Structure of thyroid gland – Biosynthesis of thyroid hormones, Biological functions of Thyroid hormones, Regulation of Thyroid secretion, Hormones of parathyroid Glands and their biological action. Role of calcitonin in calcium and phosphate homeostasis in blood. Disorders of thyroid and parathyroid.

UNIT – III
Adrenal Cortex – Glucocorticoids, Mineralocorticoids and their biological function. Renin Angiotensin System. Adrenal Medulla – Catecholamines – Synthesis and Biological action. Corticosteroids: Biosynthesis, secretion, actions, metabolism and excretion of cortisone Cortisol, corticosterone, deoxycorticosterone and aldosterone. Disorders of adrenal gland.

UNIT – IV
Pancreatic (Islets of Langerhans) hormones – Insulin, Glucagon – Biosynthesis, Regulation, Biological action, Gastrointestinal Hormones: Gastrin, secretin, pancreozymin Cholecystokinin etc. Disorders of pancreas gland.

UNIT – V
Male reproductive system: Structure of Testes, Biosynthesis of testosterone and inhibin, Regulation and functions. Female reproduction system: Structure of Ovary, Biosynthesis of estrogen, Feedback regulation and functions Female Reproductive Cycle – Estrous, Menstrual, contraceptions. Placental hormones – parturition – Lactation. Disorders associated with gonadal hormones.

Suggested Readings

1. Mac E Hadley, 1992 Endocrinology, Third edition, prentice Hall, New Delhi Jersy
2. Wilson J.D and Foster D.W 1992, William's textbook of endocrinology, 8th edition, WB saunders company, Philadelphia.
3. Turner C.D and Bagnarr, J.T., 1994, General Endocrinology, 6th edition, WB saunder's company, Philadelphia [saunder's international students edition]
4. Prakash S Lohar Endocrinology, Hormones and Human Health.
5. Hormones" by A.W. Norman and G. Litwack, Academic Press 2nd Edition

MJD-12: ENDOCRINOLOGY PRACTICAL

1. Observation of permanent slides – Pancrease, Testes,Ovary, Adrenal Pituitary

2. Test for Pregnancy

3. Fertility test

MJD-13: BIOTECHNOLOGY

UNIT I

General Introduction and Achievements of Biotechnology. Genetic Engineering and r-DNA technology (Restriction endonucleases, DNA ligases, Topoisomerases, Methylases, Nucleases, Polymerases, Reverse transciptase and their Properties and functions). Cloning vectors (plasmids, Bacteriophages, Cosmids, Yeasts Shuttle vectors, Viruses, PBR-322 and its derivatives, S.V 40 and other vectors) used in Gene cloning. Cloning Strategies and Screening Analysis of recombinants (Single colony hybridization Technique), immunologic test, Southern blotting.

UNIT II

Animal cell culture techniques: Types of cell culture - primary and established culture; organ culture; tissue culture; three dimensional culture and tissue engineering; feeder layers; disaggregation of tissue and primary cell culture; cell separation; cell synchronization; cryopreservation.

UNIT III

Animal cell culture techniques: Culture media - Balanced salt solutions and simple growth medium, Physical, chemical and metabolic functions of different constituents of culture medium; Role of carbon dioxide, serum, growth factors, glutamine in cell culture; Serum and protein free defined media and their applications.

UNIT IV

Transgenesis in animals: cell transformation; vector-less gene transfer – calcium mediated, electroporation, electrofusion, liposome mediated gene transfer, microinjection. Gene transfer through vectors - Adenoviruses, ALVs, Bacculoviruses, SV40.

UNIT V

Application of transgenic animals: Animals as models for human diseases, live-stock improvement, bovine growth hormone, silk worm as bioreactors. Techniques, significance and applications of sericulture, apiculture, aquaculture (fish, prawn and pearl), poultry, diary and rabbit farming.

Suggested readings:

1. Animal cell culture; A practical approach, 4th Edition, by Freshney. R.I. John Wiley publication.
2. Methods in cell biology; Volume 57, Animal cell culture methods, Ed. Jennie P. Mather, David Barnes, Academic press.
3. Mammalian cell biotechnology; A practical approach, Ed. M. Butler, Oxford University press.
4. Exploring genetic mechanism; Ed. Maxine Singer and Paul Berg.
5. Principles of genetic manipulation; Ed. Old and Primrose, 6th Edition. Blackwell science publication.
6. Biotechnoloical innovations in Animal productivity, BIOTOL Series, Butterworth - Heineman Ltd. Oxford, 1992
7. An introduction to embryology. WB Sounders company, Philadelphia, Balinsky. BI, 1970
8. P.K.Gupta – Elements of Biotechnology [2001] Rastogi publication, Meerut.
9. 5. Lohar.P.S – Biotechnology (2005) – MJP Publishers, Chennai – 5.

MJD-13: BIOTECHNOLOGY PRACTICAL

1. Identification techniques – Morphological, Biochemical and molecular techniques
2. 16S RNA typing: Phylogenetic tree construction
3. Preservation of pure culture – Lyophilisation
4. Isolation of DNA from Bacteria
5. Isolation of plasmids
6. Restriction and ligation
7. Preparation of competent cell
8. Gene transfer in microbes – calcium mediated, electroporation, vector mediated
9. Identification of recombinants – antibiotic markers, Blue-white colony
10. PCR
11. Blotting techniques –Western and Southern blot, Electrophoresis

MJD-14: EVOLUTION AND ETHOLOGY

Objectives :
To explain the scientific concepts of animal evolution through theories and evidences and understanding of Animal Behaviors.

UNIT –I
Origin of Life on Earth, Evidences of Evolution – Morphological, Embryological, and palaentological. Geological time scale – Fossils & Fossilization, Dating of Fossil Living,connecting and Extinct Fossils.

UNIT –II
Theories of Evolution : Lamarckism, Neo-lamarckism, Darwinism, Neo-Darwinism, Devries concept of Mutation, Modern version of Mutation theory.

UNIT –III
Origin of Species, Phylogentic and biological concept of species: Mechanisms of reproductive isolation; Models of speciation, Hardy –Weinberg law of genetic equilibrium. natural selection, mutation, genetic drift and migration.

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

UNIT V
Description and types of animal behaviour. Types of communications in insects. Pheromones and their role. Parental care in fishes. Courtship behaviour in fishes and birds. Biological Rhythm: Circadian rhythm. Migration in insects, fishes and birds.

Suggested Readings:

1. Dobzhansky, T., F.J.ayala, G.L.Stebbins and J.M.Valentine 1998. Evolution, Surjeet Publications, New Delhi.
2. Dobzhansky T 1984 Genetics and Origin of species. Columbia Univ. Press.
3. Alcock, 1. Animal behaviour- an evolutionary approach. Sinauer Assoociates Inc., Massacheussets
4. Chandrasekharan, M.K. Biological Rhythm. Vishwanathan Printers, Chennai.
5. Lull, R.S. 1976. Organic Evolution. Light & Life Publisher.

MJD-14: EVOLUTION AND ETHOLOGY PRACTICAL

Evolution

1. Study of Fossils
2. Homologous organs
3. Analogous organs
4. Industrial melanism
5. Adaptive radiation (Darwin finches)
6. Living fossils
7. Connecting link
8. Hardy Weinberg law calculation

Ethology

1. Tagging (paper/aluminium) of animals and recapture to study patterns of migration.
2. Study of different types of nests of animals.
3. Study of Parental Care

MJD-15: PUBLIC HEALTH ENTOMOLOGY

Objectives:

The course provides an opportunity for students to gain in-depth knowledge of Public Health Entomology and intense training on the modern approaches for epidemiology, prevention and control of vectors and vector-borne diseases.

Course Outcome:

Upon completion of the course, students will have

1. A foundational understanding of public health entomology, encompassing vector biology, ecology, environment, epidemiology, and vector-borne disease control.
2. Investigating outbreaks and epidemics of vector-borne illnesses.
3. Using contemporary instruments for vector-borne disease detection and diagnosis.
4. The ability to make sound decisions when organizing and carrying out suitable preventative and control actions, such as monitoring and assessment, within the framework of integrated vector management

Unit I: [08 hrs]

Principles and practices of public health: Public Health- what it is; causation, prevention, social determinants of health, health systems, health policy and Public Health action. Disease control institutions: WHO, CDC, NCDC, NCVBDC, VCRC, NIRT, NIE, NIMR. Introduction to medically important Arthropods: Characteristics of different Classes of Arthropoda. Classification of Insecta. Characteristics of Orders: Diptera – Siphonaptera – Anoplura – Hemiptera – Dictyoptera

Unit II: [08 hrs]

Characteristics of Families Culicidae – Phlebotomidae – Muscidae – Tabanidae – Calliphoridae. Characteristics of mosquitoes – Anopheles – Culex – Aedes – Mansonia.
Characteristics of sand flies: Phlebotomus – Sergentomyia. Characteristics of flies: Musca – Calliphora. Characteristics of fleas: Xenopsylla – Pulex – Ctenocephalides. Characteristics of Pediculus – Pthirus. Characteristics of families Ixodidae – Argasidae – Trombiculidae – Sarcoptidae, Characteristics of Ticks: Boophilus – Ripichephalus – Haemaphysalis – Ornithodoros, Characteristics of mites: Leptotrombidium – Sarcoptes.

Unit: III [10 hrs]

Biology of blood feeding arthropods of public health importance- Life history of importance vector mosquitoes *Anopheles* (*An. stephensi, An. culicifacies, An. fluviatilis), Aedes (Ae. aegypti, Ae. albopictus), Culex (Cx. quinquefasciatus, Cx. tritaeniorhynchus), Mansonia (Ma. annulifera, Ma. uniformis)* – Sandflies *(Phlebotomus argentipes*) – black flies *(Simulium damnosum)*

Biology of blood feeding and filth breeding arthropods of public health importance - Life history of horse flies, tsetse flies, house flies, myiasis causing flies, fleas (species of *Xenopsylla and Ctenocephalides)*, Triatomine bug, bed bug, head and body louse.

Biology of blood feeding acarina of public health importance- Life history of Ixodids (*Haemaphysalis, Ixodes, Dermacentor, Rhipicephalus, Amblyomma*), Argasid (*Argas, Ornithodorous*) and Mites (*Sarcoptes, Leptotrombidium, Dermatophagoides).*

Unit IV: [09 hrs]

Pesticides in public health: Pesticides origin - Use of pesticides – History of pesticides/Insecticides– Definition of various terms– Classification of pesticides: According to hazardous category, chemical type, physical state, main use etc. – Chemical Pesticides – Bio-larvicides – Insect growth regulators – Mode of action – Advantages of chemical control and its

utility in vector control – Pesticide formulations: Types of formulations – conventional and newer formulations (nano based).

Unit V **[10 hrs]**

Control of mosquitoes and flies (Black flies, Sand flies, Biting midges, Tabanids, Stable flies): Selection of suitable site-specific control measures-Personal protection measures – zooprophylaxis – Insecticide treated fabrics – Long lasting insecticide treated mosquito nets (LLINs) – Insecticide spraying (larviciding – indoor residual spraying – space spraying) – Alternatives – biological control – environmental management including source reduction.

Control of Tsetse flies and Triatomine bugs: Tsetse fly: Prevention and control – Traps and insecticide impregnated screens – Insecticide spraying (ground and aerial). Triatomine bugs: Introduction to control measures – Application of insecticides – insecticides and formulations – House modification/ improvement – improvement of Peri-domestic environment – insecticide treated bed nets –fumigant canisters.

Control of bedbugs, fleas, lice, ticks, mites and others: Bedbugs: Detection – repellents – household measures – insecticide treated bed nets – smoke generators – smoke density – residual insecticide spraying; prevention and control of rodents (physical, trapping, application of baits) – control of rodent ectoparasites - control of fleas in human, rat, cat, dog control of lice (head, crab or pubic and body lice) – control of ticks: hard and soft ticks, - control of mites: trombiculid, scabies, dust and domestic mites – control of cyclops – fresh water snails – venomous arthropods.

References:

1. Bonita R., Beaglehole, R. and Kjellstrom, T. (2006). Basic Epidemiology (Second edition). WHO, Geneva.
2. Gordis, L. (2018). Epidemiology (Sixth edition.). Philadelphia: Elsevier Saunders
3. John W Creswell (2007). Qualitative inquiry & research design, New Delhi: Sage publications
4. National ethical guidelines for biomedical and health research involving human participants. New Delhi: Indian Council of Medical Research; 2017.
5. Park K. Park's textbook of Preventive and Social Medicine. 27th ed. Jabalpur: M/s Banarsidas Bhanot Publishers; 2023.
6. Raju K. H, Sabesan S, Subramanian S, and Jambulingam P. Validating the Association of Japanese Encephalitis Vector Abundance with Paddy Growth, Using MODIS Data. Vector-Borne and Zoonotic Diseases. 2018; 18(10).
7. Rothman K, Greenland S, and Lash TL. Modern epidemiology, 4th Edition. Philadelphia, PA: Lippincott Williams & Wilkins.
8. Roy D.N. and Brown A.W.A. (1970). Entomology (Medical and Veterinary) including insecticides & insects & Rat control; The Bangalore Printing & Publishing Co. Ltd., Bangalore.
9. Sabesan S, Raju KH, Subramanian S, Srivastava PK, Jambulingam P. Lymphatic filariasis transmission risk map of India, based on a geo-environmental risk model. Vector-Borne and Zoonotic Diseases. 2013; 13(9): 657-65.
10. WHO (2016). Handbook: Vector surveillance and control at ports, airports and ground crossings. International Health Regulations. Available from: WHO.int/ihr/publications/9789241549592/en/

MJD-15: PUBLIC HEALTH ENTOMOLOGY PRACTICAL

1. Demonstration of mouth parts and wings of medically important insects.
2. Identification of *Culex quinquefasciatus, Cx. tritaeniorhynchus, Anopheles stephensi, Aedes aegypti, Ae. albopictus, Mansonia annulifera, Ma. uniformis*.
3. Identification of *Phlebotomus papatasi, Ph. argentipes, Chrysomya bezziana.*
4. Identification of *Xenopsylla astia, Xe. brasiliensis, Xe. cheopis, Pthirus pubis, Pediculus capitis.*
5. Identification of *Boophilus, Rhipichephalus, Haemaphysalis, Ornithodoros.*
6. Demonstration of life cycle stages of mosquitoes.
7. Dissection and mounting of mouth parts: Sandfly, mosquito.
8. Environmental and entomological risk assessment of dengue transmission in an endemic area.
9. Visit to Department of Vector borne disease control centres.
10. Preparation of stains - JSB I and II, Leishman and Giemsa.
11. Preparation of blood smears (thick and thin) and staining with JSB. Leishman and Giemsa For detection of malarial parasites.
12. Identification of human malaria parasite species through examination of blood smears: *(I)Plasmodium vivax* (II) *P. falciparum* (III) *P. malariae* (IV) *P. ovale*
13. Staining and examination of blood smears for detection of microfilariae.
14. Dissection and examination of mosquitoes for filarial parasite (*Wuchereria bancrofti* and *Brugia malayi*)
15. Demonstration of various stages of filarial parasites and differentiation of species.

MID-6: VECTORS AND DISEASES

Course outcome

- After completion of the course the student is able to:
- Learn in detail of insect, vector diseases
- Identify in detail with examples insect, vector diseases
- Deliberate the detail of insect ,vector diseases
- Learn in depth Insect, vectors and diseases

UNIT I

Introduction to Insects General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits. Concept of Vectors : Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity. Insects as Vectors: Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

UNIT II

Dipteran as Disease Vectors: Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes.

UNIT III

Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

UNIT IV Siphonaptera as Disease Vectors: Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas.
Siphunculata as Disease Vectors: Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

UNIT V Hempitera as Disease Vectors: Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.

PRACTICAL VECTORS AND DISEASES

1. Study of different kinds of mouth parts of insects.
2. Study of following insect vectors through permanent slides/ photographs: Aedes, Culex, Anopheles, Pediculus humanus capitis,
3. Pediculus humanuscorporis, Phithirus pubis, Xenopsylla cheopis, Cimex lectularius'.
4. Phlebotomus argentipes, Musca domestica, through permanent slides/ Photographs.
6. Study of different diseases transmitted by above insect vectors.

Reference:

1. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
2. Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
4. Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell

MID-6: REPRODUCTIVE BIOLOGY

COURSE OBJECTIVES

- This course will take a comprehensive look at the exciting process of reproduction by examining the role of hormones, the process of puberty, and the production of offspring.
- While a variety of species will be used to explain basic principles of the reproductive process, this course will focus on sexual reproduction by emphasizing mammalian, especially human, reproduction.

COURSE OUTCOME

Upon successful completion of this course, students should be able to:

- Demonstrate knowledge of the key steps in sexual determination and differentiation at chromosomal, gonadal, internal and external genitalia, and hypothalamic levels.
- Describe the key gross and microscopic components of the human reproductive system.
- Describe gametogenesis and structure of gametes and relate it to their function.
- Demonstrate knowledge of key principles of reproductive endocrinology including: a) biosynthesis and chemistry of the different classes of hormones, b) mechanisms of action of hormones.
- Demonstrate a detailed and comparative knowledge of the control of human reproduction. Demonstrate a detailed and comparative knowledge of the physiology of pregnancy, parturition and lactation in humans.
- Evaluate the principles, merits and limitations of various forms of reproductive technology in use.
- Describe the process of in vitro fertilization and evaluate advantages and disadvantages of the methodology used Define different types of stem cells; comparison and applications

COURSE CONTENT

UNIT I

Sexual Differentiation and Development. Male Gross Anatomy and spermatogenesis; Testicular Descent; Testicular Thermoregulation; Erection; Ejaculation. Male Reproductive Endocrinology-Semen Physiology.

UNIT II

Overview of Female Reproductive Anatomy; Folliculogenesis. Oogenesis; Atresia, Endocrine Control of Ovarian Function.

UNIT III

Female: Ovulation; Corpus Luteum Formation. Prostaglandins and Role in Reproduction. Puberty and the Menstrual Cycle. Hypothalamus and pituitary; Neuroendocrine Control of Reproduction.

UNIT IV

Sperm and Ova Transport; Sperm Capacitation and Acrosome Reaction; Fertilization Early Embryonic Development and Maternal Recognition of Pregnancy Gestation; Prenatal Development and Placentation.

UNIT V

Human Contraception and Human reproductive Technologies. In vitro fertilization techniques. Stem cells; types, comparison and applications (embryonic, adult, induced pluripotent stem cells).

Suggested readings

1. Human reproductive biology 4th edition, 2013, Jones And Lopez, Academic Press: New York
2. Pathways to pregnancy and parturition. 2003. P.L. Senger. Current Conceptions, Inc.
3. Biology of Human Reproduction. 2002. Ramon Pinon, Jr. University Science Books.
4. Human Sexuality. 2003. Simon LeVay and Sharon M. Valente. Sinauer Associates, Inc.

MID: 6-MEDICAL MICROBIOLOGY (THEORY)

Unit I: **Hours: 13**

Normal microflora of the human body and host pathogen interaction:

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract. Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS.

Sample collection, transport and diagnosis

Collection, transport and culturing of clinical samples, principles of different diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests,Complement fixation, PCR, DNA probes).

Unit 3: Bacterial diseases **Hours: 10**

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control: Respiratory Diseases: Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis. Gastrointestinal Diseases: Escherichia coli, Salmonella typhi, Vibrio cholerae, Helicobacter pylori. Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani, Treponema pallidum, Clostridium difficile.

Unit 4: Viral and fungal diseases **Hours: 10**

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control: Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis.

Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention: Cutaneous mycoses: Tinea pedis (Athlete's foot). Systemic mycoses: Histoplasmosis. Opportunistic mycoses: Candidiasis.

Unit 5: Protozoan diseases and Antimicrobial agents **Hours: 12**

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control: Malaria, Kala-azar.

Antimicrobial agents: General characteristics and mode of action: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism. Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin. Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA, NDM-1.

MID-6: MEDICAL MICROBIOLOGY (PRACTICAL)

1. Identify bacteria, E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus (any three)on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.

2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS.

3. Study of bacterial flora of skin by swab method. 4. Perform antibacterial sensitivity by Kirby-Bauer method.

5. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms).

6. Study of various stages of Malarial parasite in RBCs using permanent mounts/Photomicrographs.

SUGGESTED READING

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier

4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

MID-7: ENVIRONMENTAL POLLUTION AND HUMAN HEALTH

Program Outcomes:

- This paper deals with different aspects of environmental contamination, which have adverse effects on human health.
- It will lay emphasis on understanding mechanisms of pollutants impacting human health by developing an understanding of different types of pollutants, their sources and mitigation measures.
- The students will also be introduced to the concept of permissible limits.

UNIT 1: (10 Hrs)

Definition of pollution; pollutants; classification of pollutants; concept of biotransformation and bioaccumulation. Air pollution- Introduction- Ambient air quality: monitoring and standards (National Ambient Air Quality Standards of India); air quality index; Primary and Secondary Pollutants- Causes- Effect of Air Pollution on human health- Control measures.

UNIT 2: (8 Hrs)

Water pollution- Introduction- Drinking water quality- Water Pollutants- Causes- Effects of water pollution on human Health- Control measures.

UNIT 3: (8 Hrs)

Soil pollution- Introduction- Soil pollutant and its sources- Causes- Effects of Soil pollution on human Health- Control measures.

UNIT 4: (10 Hrs)

Thermal pollution- Introduction- sources of thermal pollution- Causes- Effects on human Health- Control measures- Radioactive pollutants-Effects on human health- Control measures.

Unit 5: (9 Hrs)

Solid waste- causes, impacts and management. Effect of Biomedical pollutants - Control Measures. Noise pollution- Sources- permissible ambient noise levels- Effects on human health- Control measures.

Text Books:

1. Pepper, I.L., Gerba, C.P.& Brusseau, M.L. 2006. Environmental and Pollution Science. Elsevier Academic Press.
2. 2.Purohit, S.S.& Ranjan, R. 2007. Ecology, Environment & Pollution. Agrobios Publications.

Reference Books:

1. Gurjar, B.R., Molina, L.T. & Ojha C.S.P. 2010. Air Pollution: Health and Environmental Impacts. CRC Press, Taylor & Francis.
2. Hester, R.E. & Harrison, R.M. 1998. Air Pollution and Health. The Royal Society of Chemistry, UK.
3. Park, K. 2015. Park's Textbook of Preventive and Social Medicine (23rd edition). Banarsidas Bhanot Publishers.
4. Vesilind, P.J., Peirce, J.J. & Weiner R.F. 1990. Environmental Pollution and Control.Butterworth-Heinemann, USA.

MID-7: ENVIRONMENTAL POLLUTION AND HUMAN HEALTH PRACTICAL

1. **Water Analysis**: Parameters analysis: Oxygen, Carbon dioxide and pH.

MID-7: LIFE STYLE DISEASES AND MANAGEMENT

Scope:

1. To give a general awareness of health and well being.
2. To have a basic awareness of modern lifestyle and the diseases associated with it.

Course Outcomes:

1. Obtain knowledge and understanding of health, nutrition and other modern lifestyle and associated diseases.
2. Develop own thinking, opinions and attitudes over the global lifestyle changes on health issues.

UNIT I: (10 hours)

General awareness of Basic biochemistry (lipids, proteins, vitamins and minerals), Life style habits, healthy and unhealthy food & habits. Arteriosclerosis : Characteristics, causes – Diagnosis- Prevention and management

UNIT II: (10 hours)

Hypertension: Characteristics, Causes, Diagnosis, Prevention and Management, Stroke, Causes, Diagnosis and Management. Anxiety, Depression, Migraine, Insomnia- Causes, Diagnosis, Preventionand Management.

UNIT III: (8 hours)

Diabetes mellitus: Classification – type I, type II and gestational, Causes, Diagnosis, and Management. Obesity- classification according to BMI (brief description), symptoms, causes, diagnosis, treatment and management.

UNIT IV: (8 hours)

Cancer: Introduction, Types- Causes, Diagnosis, Prevention-Management.

UNIT V: (9 hours)

Nephritis- Types, Causes, Symptoms, Diagnosis, Treatment and management. Liver diseases- symptoms, causes, diagnosis, treatment and management.

References:

1. Biochemistry – U. Satyanarayana, U. Chakrapani , third edition, ISBN 81-87134-80-1
2. Textbook of Medical Physiology, by Arthur C Guyton, John E Hall Prism Saunders 9th EditionISBN: 81-7286-034-X.
3. Cell and Molecular Biology by Gerald Karp, John Wiley & Son, Inc. New York ISBN 9780470-16961-2, 5th Edition.

MID-7: LIFE STYLE DISEASES AND MANAGEMENT PRACTICAL

1. Measurement of blood pressure.
2. Measurement of blood glucose level.
3. Measurement of height and weight of class students.

MID-7: NANOBIOLOGY

UNIT I

Overview of cell structures, bio-macromolecules, chemical building block of cells.

UNIT II

Introduction and scope of Nano biotechnology - DNA nanotechnology, DNA nanotubes, and its applications.

UNIT III

Nanotechnology, Nanoparticles-different types, structures and its applications in biology – Nanoparticles for biological assays, nanoparticles for targeted drug delivery system. Ligands used for intracellular delivery.

UNIT IV

Nanoprticles toxicity to various organisms- in-vitro and in-vivo in different organs and their related systems. Engineered nanoparticles for biomedical applications, merits and demerits.

UNIT V

Engineered nanoparticles in therapeutics – cell targeting – gene delivery – bio-imaging – drug encapsulation and release – immune response.

Suggested Readings

1. B.K. Parthasarathy. Introduction to Nanotechnology. 2007
2. Challa Kumar (Ed) – Biological and Pharmaceutical Nanomaterials, Wiley – VCH Verlag, Weinheim, 2006.
3. Challa Kumar (Ed) – Nano materilas for Medical Diagnosis and Therapy, Wiley – VCH, 2006.
4. Veenitha Singh. Nanobiology. 2012.

MID-8: ANIMALS AND HUMAN WELFARE

Unit – I: Biodiversity and Human Welfare

Threats to Biodiversity - Habitat loss and Man-Wildlife conflict. National parks, Sanctuaries and Biosphere reserves

Unit – II:

Animal husbandry:

Breeds of cattle- milk breeds- draft breeds- Dairy and Dairy products

Unit – III: Culture:

Vermiculture, Apiculture, Pisciculture and Poultry

Unit – IV

Communicable and non-communicable diseases

Tuberculosis and Typhoid; Hepatitis (A and B), AIDS, Gonorrhea and Syphilis Diseases of respiratory system- Asthma, Bronchitis.

Oral Cancer - cause/causative agents, symptoms, diagnostics, precaution /prevention and remedy.

Unit – V

Non – Communicable Diseases

Stress related disorders

Hypertension, Diabetes type II, anxiety, insomnia, migraine, depression (cause, symptoms, precaution and remedy).

MID – 8 ANIMAL AND HUMAN WELFARE PRACTICAL

1. 1.Study of animals in Nature/National park
2. Study of various breeds of cattle.
3. Visit to a Fish culture pond.
4. Study of Apiculture.
5. Identification of parasites related to syllabus

MID-8: NEUROBIOLOGY

Course Objectives :

While studying the **Neurobiology** course, the student shall be able to:

1. To study the microanatomical structure of neuron
2. To describe the different types of Neurons and their organization
3. To understand the Molecular mechanism of transmission
4. To study the chemical composition of Nervous system
5. To understand the principles of different types of neurotransmitters

UNIT-I

Anatomical techniques: Golgi Silver stain; Cobalt chloride Back-filling; HRP method; Procion yellow staining. Neurons and associated structures; Micro anatomy of neurons; Types of neurons and Glial cells. Organization of the Central Nervous System (Spinal cord; Brain stem; Cerebral cortex). Organization of the Peripheral nervous System (Sympathetic and Parasympathetic nervous system).

UNIT-II.

Electrophysiological techniques (Voltage-clamp and Patch-clamp); Bioelectrical properties of Neurons-Neuronal excitability; The resting potential membrane potential; Nearnst equation; Sodium and Potassium pump; Generation of the action potential; Propagation of nerve Impulse.

UNIT III

Molecular mechanism of Excitation Carrier protein; Ion channels; Gating mechanisms. Synapses: Structure and Integration; Morphology and Ultra structure of synapse; Types of Synapses; Chemical transmission; Electrical transmission. Second messenger systems: Cyclic AMP and GMP; G-protein; IP3; Calcium and Calmodulin.

UNIT-IV.

Chemical composition of the nervous system-Cerebro Spinal Fluid-CNS Barriers-Nerve Growth Factor. Synthesis-storage-release and inactivation mechanisms and functions of the neurotransmitters. Viz. Acetylcholine & Catecholamines (Norepinephrine, Eponephrine, Dopamine and Serotonin). Amino acid Neurotransmitters- Excitatory amino acids (Glutamate and Aspartate); Inhibitory Amino acids (GABA and Glycine). Peptide Neurotransmitters: Oxytocin, Vasopression, Substance-P and Cholecystokinin.

UNIT-V.

Major drug classes-brief history-absorption-binding-tolerance-excretion physiological and Behavioral Effects of the following drugs; Opium; Stimulants (Amphetamine, Cocaine, Nicitine and Caffeine) Hypnotic and Anxyolytic drugs. (Barbiturates & Benzodiazepines); Mind altering drugs (Marijuana, LSD) Drug abuse and treatment programs Etiology,

Pathology, Symptoms, Diagnosis and treatment strategies for the Neurological Disorders Viz.Schizophernia, Depression; Epilepsy, Alzheimer's and Parkinson 's disease.

Course Outcomes:

- Learnt about structure, function and organization of Neurons in the Central nervous system
- Understanding Electrophysiological techniques and Molecular mechanisms associated with action potentials
- Students leant and gain knowledge on structure and function of different types of Synapses
- Gained information on different types of Neurotransmitters i.e. Amino acids and Peptides

SUGGESTED READING MATERIAL:

1. Basic Neurochemistry-G.J. Siegal, RW. Albers, B.W. Agranoff, R Katzman (1981) Little, Brown and company. Boston.
2. Introduction to Nervous system- T.H. Bullock, R Cork, A. Granner (1977); W.H Free man & Co.
3. Mechanism of Drug Action on the Nervous SystemM.A.B. Brazil, RW. Ryall. (1979), Cambridge University Press. Cambridge, London and New York.
4. Neuro anatomical Techniques, N.J. Stransfed and T.A. Miller Springer Verlag, New
5. Neurobiology. Shepherd, G.M. Oxford University press, London.
6. Principles of Neural Science -E.R Kandel and J.H. Schwertz. (1981); Elsevierl North Holland. NY. Oxford.
7. Principles of Neuro Phychopharmacology- Robert S. Feldman, Jerrold S. Meyer and Lind F. Quenzer. Sinauer Associates, Inc. Publishers. Sunderland. Massachusetts.
8. The Bio Chemical basis ofNeuropharmacology-J.R Cooper, F.E. Bloom, &RH. Roth. (1982); Oxford University Press, NY and London. York Heidelberg, Berlin, 1980.

MID-8: IPR, BIOSAFTY AND BIOETHICS

Objective

- This paper provides information on ethical issues involved in biotechnology experiments. This also addresses on Biosafety aspects in Biotechnology and intellectual property rights.
- To enable the students to know about the legal issues affecting the biotechnology research and how to establish ownership of a novel finding.
- The students will be able to understand the legal aspects involved in the biotechnology research

CONTENTS

UNIT I:

Introduction to ethics and bioethics: Personal ethics: profession and professionalism – Moral Reasoning – Ethical theories – person as an experimenter – Moral leadership (integrity and ingenuinity) - framework for ethical decision making;

UNIT II

Biotechnology and ethics: Biotechnology in agriculture and environment: benefits and risks – benefits and risks of genetic engineering – ethical aspects of genetic testing – ethical aspects relating to use of genetic information – genetic engineering and biowarfare.

UNIT III

Ethical implications of cloning: Reproductive cloning , therapeutic cloning ; Ethical, legal and socio-economic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research- GM crops and GMO's – biotechnology and biopiracy – ELSI of human genome project.

UNIT IV

Introduction to biosafety: Biosafety issues in biotechnology – risk assessment and risk management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment

UNIT V Introduction to intellectual property and intellectual property rights rights: Types, patents, copy rights, trade marks, design rights, geographical indications – importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO)

REFERENCES:

1. Principles of cloning, Jose Cibelli, Robert P. lanza, Keith H. S . Campbell, Michael
2. D.West, Academic Press,2002Glimpses of Biodiversity – B.Bltosetti
3. Ethics in engineering, Martin. M.W. and Schinzinger.R. III Edition, Tata McGraw-
4. Hill, New Delhi. 2003.
5. http://books.cambridge.org/0521384737.htm
6. http://online.sfsu.edu/%7Erone/GEessays/gedanger.htm
7. http://www.actahort.org/members/showpdf?booknrarnr=447_125
8. http://www.cordis.lu/elsa/src/about.htm
9. http://www.csmt.ewu.edu/csmt/chem/jcorkill/bioch480/bioLN98.html
10. http://www.accessexcellence.org/AE/AEPC/BE02/ethics/ethintro.html