

**Credit : 4**

**Hours/Week : 3 Code: RR1MZ01**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC1–RESEARCH METHODOLOGY**

### **Unit- I**

Research: selection of problem-stages in execution of research- report writing-thesis format. Proof reading. MS preparation- Journals-types of journal-peer reviewed and nonpeer reviewed, online open access journals- format of journals-types of journal articles-short communication-review articles-research papers-monographs

### **Unit- II**

Bibliometrics and Scientometrics-impact factor-citation index-h index- Information retrieval: access to archives and databases (literature databases), search engines: google scholar, pubmed, online database library, digital library and virtual labs

### **Unit- III**

Measures of dispersion: universe and population-delimiting population-sampling methods—variables-types of variables. Measures of central values Mean, mode, median. Measures of dispersion-standard deviation, Measures of dispersion -standard error, coefficient of variations

### **Unit - IV**

Comparison of means- Students t-test, One-Way ANOVA-with simple model sums. Statistical tables and their uses-levels of significance

### **Unit -V**

Bivariate relationships-correlation, types, methods, spearman and Rank correlation and regression analysis.Types and applications with model sums, Chi square test. Introduction to uses of statistical software, SPSS, Excel

## **REFERENCE BOOKS**

**1. ZAR, J.H.** 2010. Biostatistical Analysis.Prentice Hall, Upper Saddle River, NJ.

**2. SOKAL, R.R., AND F.J. ROHLF.** 1995. Biometry: The principles and practice of statistics in biological research. 3rd edition.W.H. Freeman, New York.

**3. MCDONALD, J.H.** 2009. Handbook of Biological Statistics (2nd ed.). Sparky House Publishing, Baltimore, Maryland.

### **Question pattern**

**(Marks: 60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)

**Credit :4**

**Hours/Week :3 Code: RR1MZO2**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC2-BIOINSTRUMENTATION AND BIOLOGICAL TECHNIQUES**

### **Unit – I**

Principle and working process of  $p^H$  meter - Laminar air flow - Centrifugation – types of centrifugation, preparative and analytical centrifuges, differential centrifugation, Sedimentation velocity, sedimentation equilibrium, density gradient methods and their application. DNA finger printing, Polymerase Chain Reaction (PCR), Southern blotting, Northern blotting and DNA sequencing techniques.

### **Unit – II**

Principles of chromatography, theory and applications of paper, Thin layer, Gel filtration, Ion exchange, affinity, Gas chromatography (GC), High-pressure Liquid chromatography (HPLC). Principle and applications of GC-MS, LC-MS and its working process

### **Unit – III**

Basic principles of electrophoresis, types of electrophoresis, Theory and applications of Gel electrophoresis (AGE and PAGE), Pulse Field Gel Electrophoresis (PEGE) and Immuno electrophoresis - factors affecting electrophoresis,

### **Unit – IV**

Principles and application of spectroscopy, Fluoroscopy, angiography, Mammography, Xero radiography, Digital radiography. Basic law of light absorption, X- ray diffraction- Colorimeter, UV, Visible, IR, NMR, Mass, Raman spectroscopy.

### **Unit – V**

Principles and working process of microscopes - light microscope, fluorescence and digital imaging, confocal microscopy, total internal reflection fluorescence (TIRF) microscopy, FRET, FRAP, STORM and STED microscopy, more advanced, specialized techniques such as CARS and two-photon fluorescence microscopy, scanning probe microscopy (SPM) techniques such as atomic force microscopy (AFM), electron microscopy (SEM and TEM), and finally X-ray microscopy and microCT, probes and live cell imaging – image capturing, processing and analysis

## **REFERENCE BOOKS**

- 1. VEERAKUMAR, L.** (2006). Bioinstrumentation. MJ.P. Publisher, Chennai.
- 2. KOTHARI, C.R.** (2008). QUANTITATIVE TECHNIQUES, S. Chand & Co. New Delhi.
- 3. CASEY, E.J.** (1992). Biophysiccs. Affiliated East – West Press Pvt. Ltd. New Delhi.
- 4. JAIN, J.L.** (2002). Text book of Biochemistry. Tata McGraw Hill. New Delhi.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)

**Credit :4**

**Hours/Week :3Code: RR1MZ03**

**Medium of instruction: English (For students admitted from 2015 onwards)**

### **CC3-MOLECULAR ZOOLOGY**

#### **Unit - I**

Prokaryotic and eukaryotic gene expression. Organization of genome; definition and description of promoters, enhancers, silencers, transcription factors, RNA transcription - Translation - Post - translational processing and protein structure - splicing - Alternative splicing.

#### **Unit – II**

Introduction to transgenic animals - Microinjection - Embryonic stem cells - reporter transgene- Different approaches in transgenesis - Application of transgenesis in disease diagnosis and gene therapy - Transgenesis and growth performance in livestock.

#### **Unit - III**

Structure and functions of different types of RNA and Ribosome. The role of maternal stored mRNA in the development process - Role of the cytoplasmic determinants and morphogenesis.

#### **Unit - IV**

Cell cycle (review) - cell culture lab and requirements - primary cell culture - Nutritional requirements for animal cell culture - techniques for mass culture of animal cell lines – Application of animal cell culture for production of vaccines, growth hormones - interferon - cytokines and therapeutic proteins - stem cells and their application - cell culture as expression system.

#### **Unit - V**

Electrophoresis (PAGE and Agarose) - Methods of DNA profiling - RAPD - RFLP - Satellite DNA - VNTR SNP, Principles and Techniques involved in Southern hybridization - Western blot - Northern blot - PCR - DNA sequencing - Proteomics.

#### **REFERENCE BOOKS**

- 1. MALAACHIN, C.** 2007. Essential of Molecular Biology, Books & Allied Private Ltd.
- 2. TAMARIN, R.H.** 2005. Principles of Genetics. Tata McGraw Hill Edition, New Delhi.
- 3. FREIFELDER, D.** 1997. Molecular biology, Narosa publishing House, New Delhi.
- 4. KUKAR, H.D.** 2000 Molecular Biology, Vikas Publishing House Pvt. Ltd. New Delhi.

#### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)

**Credit : 4**

**Hours/Week :3 Code: RR1MZO4A**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - STORAGE PEST MANAGEMENT**

### **Unit -I**

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses with regard to total production of food grains in India. Scientific and socio-economic factors responsible for grain losses.

### **Unit -II**

Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites. Type of losses in stored grains and their effect on quality including biochemical changes.

### **Unit -III**

Ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage-types of storage structures.

### **Unit -IV**

Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms.

### **Unit -V**

Preventive measures - Hygiene/sanitation, disinfestations of stores/receptacles, legal methods. Curative measures-Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Integrated approaches to stored grain pest management.

## **REFERENCE BOOKS**

1. **HALL DW.** 1970. Handling and Storage of Food Grains in Tropical and Subtropical Areas. FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome.
2. **JAYAS DV, WHITE NDG & MUIR WE.** 1995. Stored Grain Ecosystem. Marcel Dekker, New York.
3. **KHADER V.** 2004. Textbook on Food Storage and Preservation. Kalyani Publ., New Delhi.
4. **KHARE BP.** 1994. Stored Grain Pests and Their Management. Kalyani Publ., New Delhi.
5. **SUBRAMANYAM B & HAGSTRUM DW.** 1995. Interrelated Management of Insects in Stored Products. Marcel Dekker, New York.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type—Two questions from each Unit)  
Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)

**Credit : 4**

**Hours/Week :3 Code: RR1MZO4B**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - MEDICAL ENTOMOLOGY**

### **Unit- I**

Scope of Vector Entomology-Vector borne diseases-mechanisms of transmission in human beings -types of vectors and their identification.

### **Unit- II**

Vectors of medical importance - their life cycle - epidemiology, and management-mosquitoes – houseflies- sand flies - Human lice - Tsetse flies - Human lice of different types - fleas and reduviid bugs,

### **Unit - III**

Vectorborne diseases spread through mosquitoes - Malaria –filarial -viral encephalitis, viral fever,dengue, yellow fever.Vectorborne diseases spread through houseflies - typhoid, paratyphoid, dysentery, diarrhoea, cholera gastroenteritis, amoebiasis, diseases spread through sandfly - kala-azar, oriental sore; tsetse fly -sleeping sickness.

### **Unit- IV**

Vector control - Insecticides - Insecticide toxicology - Classification of insecticides of public health importance Mode of action – medical problems associated with insecticidal use - Use of bio-control agents and biopesticides– Use of Bacillus, Predatory fish and other bio-control agents.

### **Unit -V**

National programmes related to vector borne diseases - Malaria - N.M.E.P - N.M.C.P. - Filaria N.F.C.P. -N.F.E.P. International days on vector diseases-importance.

## **REFERENCE BOOKS**

1. **ELDRIDGE, B.F. and EDMAN, J.D.** 2004. Medical Entomology: A textbook on public health and veterinary problems. Kluwer Academic Publishers, Cornwall.
2. **SERVICE, M.W.** 2008. Medical Entomology for students. Cambridge University Press, Cambridge, UK.
3. **GODDARD, J.** 2008. Infectious diseases and arthropods. Humana Press, US.
4. **HOWELL V. DALY, JOHN T. DOYEN, ALEXANDER H. PURCELL.** 1998. Introduction to insect biology and diversity. Oxford University Press

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)

**Credit : 4**

**Hours/Week :3Code: RR1MZO4C**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - PHEROMONE TECHNOLOGY**

### **Unit- I**

**Semiochemicals:** Classification – pheromones, definition, types - primer, releaser, signalling and imprinting; allelochemicals, definition, types – kairomone allomones, synomones and apneumones: sources, chemistry and nature of pheromones.

### **Unit-II**

**Microbial and aquatic pheromones:** Pheromones in yeast, bacteria and protozoa. Peptide pheromones in crustacean and mollusca; - primer and releaser pheromones effects in gold fish; Migratory pheromones in lamprey; sex pheromones in urodeles.

### **Unit-III**

**Pheromones in integrated pest management:** Trail, alarm, aggregation and sex pheromones in insects and their role in pest management, pheromones in masking the poison based shyness in rodents ; Methods of pheromone application in insects and rodents- role in IPM. Merits and demerits in using pheromones for pest management.

### **Unit-IV**

**Pheromones in animal production:** Reproductive behavior in farm (sheep, goat, pig, cow and buffalo) and wild animals (antelope, elephant and tiger); Bio- stimulation in farm animals; Conservation in wild animals with help of pheromones. Human pheromones menstrual synchronization, necklace experiment, armpit and sweat odors.

### **Unit-V**

**Pheromone carrier/binding proteins and techniques:**General characters of Lipocalin. Pheromones binding proteins-major urinary protein (mice), alpha 2µglobulin (rat) albumin (elephant), aphrodisin (hamster) and apolipoprotein D (human); Odorant – binding protein – main olfactory system (MOS) and accessory olfactory system (AOS); in pheromones perception. Techniques- SDS-PAGE, Western blot, MALDI – TOF, MS – Edman’s degradation Tandem MS; Gel and ion exchange chromatography; GC-MS Y maze apparatus and olfactometry.

## **REFERENCE BOOKS**

- 1. G. VANDENBERGH**, 1984. Mammalian Reproductive Pheromones. Academic Press.
- 2. D.L. MOULTON and J.W. JOHNSON**. 1976. Methods in Olfactory Research. Academic Press.
- 3. A. MARCHLEWSKA and A. MULLER- SCHWARZE**. 2001. Chemical Signal in Vertebrate Plenum Press.
- 4. R.VAN DEN HURK**. 2007. Intra-Specific Chemical communication in Vertebrates with special attention to its role in reproductive. Pheromone Information Centre, the Netherland.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A : 5 × 6 = 30 Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B: 3×10=30 Marks Answer any Three Questions (One Question form each Unit)

**Credit :4**

**Hours/Week :3 Code: RR1MZO4D**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - ECOTOXICOLOGY**

### **Unit- I**

**Safety evaluation of toxicants:** Environmental Evaluation of Combined Toxicity of Toxicant Mixtures, Role of LC<sub>50</sub> or LD<sub>50</sub> values in Safety Evaluation of Toxicants. Dose – response relationship: Selected toxicological methods: Evaluation of Toxicity of Pollutant, in Aquatic Organisms and Terrestrial Organisms.

### **Unit - II**

**Metabolism of toxic Substances:** Uptake, Excretion, Chemical localization and its consequences of toxic substances in animals. Hepatic metabolism, Synergistic and Antagonistic effects, Variations in metabolism between Animals and Comparative toxicology.

### **Unit - III**

**Toxic Substances:** Heavy metal pollutants: Mercury, Cadmium, Copper, Lead, Manganese, Nickel, Vanadium, Zinc, Arsenic, Iron and Chromium. Pesticide pollutants: Organochlorines, Organophosphorus and Carbamates.

### **Unit- IV**

**Water Pollutions:** Petroleum and related compounds, oil pollutants, radionuclides and thermal pollutions.

### **Unit - V**

**Sublethal Toxicity:** Evaluation of sublethal toxicity of on histopathological alterations, haemopoietic activity, oxygen consumption, physiological activities and biochemical constituents.

## **REFERENCE BOOKS**

- 1. CASARETT, L. J. and DOULL, J.,** 1975. Toxicology: The basic science of poisons, Mac Millan, New York.
- 2. De Bruin, A.,** 1977. Biochemical Toxicology of Environmental Agents. Elsevier, Amsterdam.
- 3. JOHN H. DUFFUS,** 1980. Environmental Toxicology, Edward Arnold, London.
- 4. PAGET, G. E** (ed.) 1970. Methods in Toxicology, Blackwell, Oxford. London
- 5. VALKOVIC, V.,** 1975. Trace Element Analysis. Taylor and Francis. London.
- 6. SUBRAMANIAN, M. A.,** 2004. Toxicology. Principles and methods. MJP Publishers, Chennai.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A : 5 × 6 = 30 Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B: 3×10=30 Marks Answer any Three Questions (One Question form each Unit)

**Credit : 4**

**Hours/Week :3Code: RR1MZO4E**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - BIOREMEDIATION**

### **Unit- I**

Introduction; advantages of bioremediation; levels of bioremediation – biostimulation, bioaugmentation; biosorption; bioaccumulation; environmental clean up by microbes; phytoremediation for soil decontamination; factors affecting bioremediation.

### **Unit- II**

Biodegrading agents; metabolic pathways for degradation of hydrocarbons, pesticides, polychlorinated biphenyls; Construction of Superbug; Molecular techniques involved in bioremediation.

### **Unit- III**

Biotechnology in Pollution control: Role of biotechnology in Pollution control, Environmental monitoring, Environmental Impact Assessment, Biosensors, DNA probes. Air Pollution treatment – Bio-filtration, bio-trickling filtration, bio-scrubbers. Carbon dioxide sequestering.

### **Unit- IV**

Liquid and Solid Waste Treatments: Sewage treatment – Primary treatment, Secondary treatment, Tertiary treatment; Compost making – Indor method, Bangalore method, Vermicomposting – Pit method, Bed method; Limitations to bioremediation – bioavailability, toxicity and molecular size.

### **Unit- V**

Treatment of industrial and mining wastes: Bioremediation of hydrocarbons, pesticides, industrial solvents; Biomining - bioleaching, biobenification, metals removal from water, microbial enhancement of oil recovery.

## **REFERENCE BOOKS**

1. **EC. ELDOCONEY, S., D. HARDMAN and S. JAND WAITE**,1993. Pollution: Ecology andbiotreatment. Longman scientific technical.
2. **BAKER, K.H and D.S. HERSON**,1994. Bioremediation, Mc.GrawHillInc, NewYork.
3. **BALASUBRAMANIAN, D., C.F.A. BRYCE, K. DHARMALINGAM, J. GREEN, K. JAYARAMAN**, 1996.Concepts in Biotechnology. Universities Press Ltd., Hyderabad.
4. **DUBEY, R.C.** 1995. Text Book of Biotechnology. S. Chand & Co.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A :  $5 \times 6 = 30$  Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B:  $3 \times 10 = 30$  Marks Answer any Three Questions (One Question form each Unit)



**Credit : 4**

**Hours/Week :3Code: RR1MZO4F**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - PROBIOTIC AND ITS APPLICATION**

### **Unit-I**

Definition of probiotic - Probiotic health benefits-Food application of probiotic –Its application challenges.

### **Unit -II**

Nutritional program of probiotics – Prebiotic gut flora management tools-Efficacy of prebiotics across the life span – Prebiotic as therapeutics-Its efficacy in human disease.

### **Unit -III**

Probiotic food products- Safety of probiotic bacteria – FAO / WHO approach – Non-dairy probiotic products.Application of probiotic bacteria in dairy foods.

### **Unit -IV**

Schematic representation of gastro intestinal tract in human - Selection of probiotic microorganisms – Beneficial effect of probiotics and its role.

### **Unit -V**

Techniques for the addition and production of probiotic in dairy products – Production flow chart of for ice cream and cheese with probiotic.*In vitro* tests to evaluate probiotic capacity.

### **REFERENCE BOOKS**

1. **FAO/WHO** (2001) Health and Nutritional Properties of Probiotics in Food including Powder Milk with Live Lactic Acid Bacteria. Cordoba, Argentina: Food and Agriculture Organization of the United Nations and World Health Organization Expert Consultation Report.
2. **BARRANGOU R, LAHTINEN SJ, IBRAHIM F, OUWEHANDAC** (2011) Genus *Lactobacillus*. In: Lactic Acid Bacteria: Microbiological and Functional Aspects. London: CRC Press. pp. 77-91.
3. **O'HARA AM AND SHANAHAN F**(2006) The Gut Flora as a Forgotten Organ. *EMBO Rep.* 7 (7): p. 688-693.
4. **KOPP-HOOLIHAN L**(2001) Prophylactic and Therapeutic Uses of Probiotics: A Review. *Journal of American Dietary Association*; 101(2) 229-241.

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A : 5 × 6 = 30 Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B: 3×10=30 Marks Answer any Three Questions (One Question form each Unit)

**Credit : 4**

**Hours/Week :3 Code: RR1MZO4G**

**Medium of instruction: English (For students admitted from 2015 onwards)**

## **CC4 - AQUATIC BIOLOGY**

### **Unit - I**

Introduction to aquaculture – Scope of aquaculture – Types of aquaculture – Research in aquaculture and Fisheries – Area available for aquaculture and fisheries – Cultivable organisms

### **Unit - II**

Types of fish Ponds – Preparation of fish Ponds – Fin Fish culture – Shell fish culture - Edible oyster culture – Integrated fish farming

### **Unit – III**

Fish Feed – Life feeds and their culture – Diseases of aquaculture organisms

### **Unit – IV**

Aquatic Pollution – Water quality management – Management of fish Farms –Weed Control

### **Unit – V**

Ornamental fish culture – Crafts and Gears Preservation of fishes – Fish marketing – Economic importance of aquaculture.

## **REFERENCE BOOKS**

- 1. G.SANTHANAKUMAR and AM SELVARAJ.** 2002. Concept of aquaculture, Meenam Publication Nagercoil.
- 2. K.C.JAYAMAN.**1999. The freshwater fishes of Indian region.Narendra Publishing House, Delhi.
- 3.V.G.JHINGRAN.**1988. Fish and fisheries of India. Hindustan Publishing Co (India), Newdelhi.
- 4.EDWARDS, C.A. and LOFT, J.R.,** 1977. Biology of Earthworms, 3<sup>rd</sup> Edition, Chapman Publications

### **Question pattern**

**(Marks :60)**

**Time: 3Hours**

Part A : 5 × 6 = 30 Marks Answer All Questions (Either or type–Two questions from each Unit)

Part B: 3×10=30 Marks Answer any Three Questions (One Question form each Unit)