

SRI VENKATESWARA UNIVERSITY :: TIRUPATI
PROGRAMME: B.Sc. (Honours) in Biotechnology (Major)
w. e. f. AY 2023-2024
Semester V

Course: V-1: Biostatistics & Bioinformatics

Maximum Marks Theory: 100 + Practical: 50

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Learn about concept and branches of bioinformatics
2. Learn about searching sequences using databases
3. Learn about computer phylogenetics
4. Learn about the measurement of central tendency
5. Learn about test hypothesis

II. Syllabus:

UNIT -1:

1. Scope of computers in biological research, Introduction to Bioinformatics: Definition, nature and scope of bioinformatics.
2. Bioinformatics versus computational biology.
3. Branches of bioinformatics. Basic concepts in bioinformatics.

UNIT-2:

1. Basic concepts of system biology. Protein Data Bases -visualization of proteins using database
2. Overview of computer-aided drug design.
3. Searching sequence database using BLAST. Concept of genomics and proteomics

UNIT-3:

1. Computational phylogenetics – various applications.
2. Phy lip software. Microarray,
3. Bio informatics – Experimental design & Over view of data analysis.

UNIT-4:

1. Measurement of central tendency (mean, mode and range)
2. Dispersion (standard error and standard deviation).
3. Probability and distribution. Poisson and binomial distributions. Normal distribution

UNIT-5:

1. Population and sampling test of significance. Test hypothesis.
2. Student t-test for small samples. ANOVA, Chi² test for analysis, correlation and regression.
3. Computer applications in Biotechnology

Practical syllabus: V-1: Biostatistics & Bioinformatics

III. Skill outcomes:

On successful completion of the practical course, student shall be able to

1. Learn about problems of mean median mode
2. Learn about test hypothesis
3. Learn about sequence Retrieval from NCBI

IV. Practical syllabus:

1. Mean, Median, Mode
2. Standard deviation, variance and coefficient of variation
3. Testing of hypotheses regarding population mean
4. Testing of hypotheses about the difference between population means
5. Chi-square test
6. Testing of Correlation Coefficient
7. Fitting of simple linear regression
8. Sequence retrieval (protein and gene) from NCBI, Structure download (protein and DNA) from PDB

V. References:

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley and Sons, 2nd ed. .
2. Bland, M. (2006). An Introduction to Medical Statistics. Oxford University Press, 3rd ed.
3. Finney, D.J. (1980). Statistics for Biologists. Chapman and Hall Ltd.
4. Wayne, W, Daniel (1999). Biostatistics: A Foundation for Analysis in Health Sciences. John Wiley and Sons, 7th ed.

VI. CO-Curricular Activities

a) Suggested CO-Curricular Activities

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on data bases

Semester V
Course: V-2: Marine Biotechnology
Maximum Marks Theory: 100 + Practical: 50

I. Learning outcomes:

Students will be able to

1. Explain the fundamentals of marine ecosystem
2. Identify commercially important marine organism and their feed
3. Have insight into the techniques of disease identification in marine organisms
4. Understand the concept of biofouling and antifouling and its effects

UNIT – I - The marine ecosystem and its functioning

Intertidal, estuarine, salt marsh, mangrove, coral reef, coastal & deep sea ecosystems. Hydrothermal vents - biodiversity of organisms. Marine microbes - unculturable bacteria, occurrence, characteristics and exploitation

UNIT – II - Bioactive compounds from marine organisms

GFP, RFP characteristics and their applications, Green mussel adhesive protein, Marine hydrocolloids - Agar, Agarose, Chitosan, Chitin, Alginate, Carrageen and its applications, Marine enzymes and their applications in food processing, Marine Pharmaceuticals – Zinconotide, Dolostain, Bryostain.

UNIT – III - Aquaculture

Culturing of shrimp, edible mollusks, oysters, pearl oysters. Culture of live feed organisms - brine shrimp, marine algae. Techniques for identification of bacterial & viral pathogens in aquaculture Methods of diagnosis of SEMBV, MBV and Vibrio diagnosis, Probiotic and Prebiotic bacteria and their importance in aquaculture; Vaccines in aquaculture: Fish, shrimps & prawns

UNIT – IV - Chromosome manipulation in aquaculture

Hybridization; Ploidy induction; Gynogenesis, Androgenesis and sex reversal in commercially important fishes; Cryopreservation of fish gametes and embryo; Transgenic fishes - Antifreeze and metallothioneine gene.

UNIT – V- Bioremediation

Biofouling, biofilms, corrosion and antifouling treatment. Ballast water, consequences &

management. Red tides: causative organisms and control. Control of oil spills and bioremediation.

Practical syllabus: V-2: Marine Biotechnology

III. Skill outcomes:

On successful completion of the practical course, student shall be able to

1. Learn to apply Biochemical tests for identification of Marine bacteria
2. Discuss the various steps involved in conducting research
3. Acquire hands on training on Plankton analysis
4. Learn to know disease identification in shrimps and fishes

IV. Practical syllabus:

1. Biochemical tests for identification of Marine bacteria.
2. Measurement of growth of microorganisms.
3. Plankton analysis.
4. Isolation, characterization and antagonistic effects of probiotic bacteria against fish pathogens.
5. Identification of Shrimp/Oysters/Fishes (Spotters)
6. Estimation of Ammonia from shrimp pond
7. Disease identification in shrimps and fishes.
8. Isolation of chitin and chitosan from shrimp waste.

V. References:

1. Milton Fingerman, Nagabhushanam. R, Recent Advances in Marine Biotechnology, Vol. 8: January 1, Science Publisher, (2003).
2. Kim, Se-Kwon, Springer Handbook of Marine Biotechnology, Springer Handbooks,

(2014) Pillay T V R; Kutty M N, Aquaculture: Principles and practices, 2nd edition,

Blackwell Pub.,(2005).

3. Ronald M. Atlas , Richard Bartha, Microbial Ecology: Fundamentals and
4. Applications (4th edition), Benjamin Cummings, (1997).
5. Marco Saroglia, Zhanjiang Liu, Functional Genomics in Aquaculture, Wiley Blackwell (2012).
6. Laboratory manual on methodologies for assessing Biodiversity in estuaries,
7. Mangroves and coastal waters – Annamalai University.

Semester V

Course: V-3: Legal, Ethical & Moral Implications of Biotechnology

Maximum Marks Theory: 100 + Practical: 50

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Develop awareness on types IPR and patenting process
2. Understand legal and ethical controversies in biotechnological innovations
3. Apply knowledge in providing safety of food, water and environment
4. Gain overview of GM crops and microbes and their impact on environment

II. Syllabus:

UNIT -1: Intellectual property rights

Definition, Types: Patents, Copy rights, Trade marks etc. Essential requirements for IPR, Procedures of filing patents, Pan-Co-operation treaty (PCT) application: GATT and IPR: WTO Act - Global and Indian Biodiversity Act- Indian Patent Act and their revised versions.

UNIT-2: Legal aspects of Biotechnology

Prenatal diagnosis, Genetic screening, Surrogate mothers and exploitation of women, Stem Cell Usage and Research associated legal aspects

UNIT-3: Ethical Aspects of Biotechnology

Designing of plants and animals, Gene therapy, Cloning and Manipulation of human genome, Technology transfer, Designer babies, Crisper Technology and associated ethical issues

UNIT-4: Social and Moral aspects of Biotechnology

Biotechnology and International trade, Privatization and patenting of Biotechnology products, Role of Government, Industries and society in promoting, accepting and regulating the rDNA research.

UNIT-5: Environmental and Health aspects of Biotechnology

Generally engineered organisms: Introduction of novel species and natural equilibrium, Environmental security and safety, Precautionary measures. Genetically modified foods & health safety.

Practical syllabus: V-3: Legal, Ethical & Moral Implications of Biotechnology**III. Skill outcomes:**

On successful completion of the practical course, student shall be able to

1. files a patent and other IPRs
2. knows various ethical and legal aspects of Biotechnology
3. social aspects of Biotechnology
4. health and environmental aspects of Biotechnology

Practical syllabus

1. IPR and Types
2. Patent & Its filing

3. Patentable and Non-patentable Inventions
4. Patent infringement
5. Case studies of various types of IPRs
6. Neem (Azadiructa) Issue
7. Haldi (Curcumin) issue

V. References:

1. Gene cloning - Brown
2. Concepts in Biotechnology- Balasubramanyam. D
3. Basic Biotechnology - Colin Rotledge and Kristainsen
4. Gene Biotechnology - Jogdand
5. From Genes to Clones, Introduction to Gene Technology-Winnacker, Ernst. L
6. Safety, Moral, Social and Ethical issues related to genetically modified foods - Smith J.E.
7. Molecular Biology and Biotechnology - Meyer R A
8. Environmental Biotechnology- Forster and wase
9. Biotechnological Innovations in Environmental Management - Leach and Van Dam-mieras
10. Industrial Microbiology and Biotechnology- Demain and Solomon

Course: V-4: Organic farming & Biofertilizers

Maximum Marks Theory: 100 + Practical: 50

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Understand the soil profile and nutrients in soil

2. Appreciate the importance of organic manure and bio fertilizers
3. Produce vermi compost, farmyard manure from bio waste
4. Acquire skill on isolation and maintenance of bio fertilizers

II. Syllabus:

UNIT -1: Soil

Definition, soil formation, composition and characteristics. Types of soils. Distribution of soil groups in India. Acidic, Alkaline and heavy metal contaminated soil. Methods of reclamation. Effects of chemical dependant farming on yield and soil health.

UNIT-2: Plant Nutrition

Macro and micro nutrients, functions of nutrients in plant growth and development. Nutrient uptake and utilization by plant. Types of fertilizers. Organic, inorganic and bio fertilizers. Chemical fertilizer. Advantages & disadvantages of their use. Importance of organic and bio fertilizers.

UNIT-3: Organic Farming

Definition, concept, benefits. Integrated farming system (combination of organic and inorganic). Mixed farming system. Concept of different cropping systems in relation to organic farming, Inter cropping, crop rotation. Organic farming process. Organic fertilizers, crop nutrients and effective microorganisms in Organic farming.

UNIT-4: Organic Compost

Definition, types of compost, farm yard compost, green leaf compost, animal husbandry, animal housing, animal feeding, animal health, breeding goals. Vermicompost: Introduction, vermi composting material, species of earthworms, small scale, large scale composting process. Vermicastings, harvesting, processing and drying. Nutrient content of Vermicompost. Field application methods.

UNIT-5: Biofertilizers

Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers: *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*. Cyanobacterial Biofertilizers: *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal Biofertilizers: AM mycorrhiza and ectomycorrhiza. Mechanism of nitrogen fixation and phosphorus solubilization.

Practical syllabus: V-4: Organic farming & Biofertilizers

III. Skill outcomes:

On successful completion of the practical course, student shall be able to

1. Estimate NPK levels in the soil
2. Demonstrate the collection and processing of raw material
3. Develop skill of vermicompost production
4. Learn the technique of establishing organic farms
5. Equip with the skill of preparation of microbial media

IV. Practical syllabus:

1. Collection of different soil samples
2. Qualitative estimation of nitrogen, phosphorus and potassium in soil samples
3. Collection of fruit, vegetable and other domestic waste
4. Preparation of compost beds and introducing earthworms
5. Collection of vermi castings
6. Sieving, drying and packing of vermi compost
7. Visit to animal shed and observing farm yard manure production
8. Preparation of media and isolation of bio fertilizers

V. References:

1. *Principles of Organic Farming*:: by E Somasundaram,D Udhaya Nandhini,M Meyyappan ;**2021**
2. *Organic farming in India*: by Arpita Mukherjee; 2017
3. *Biofertilizer and biocontrol agents for agriculture*; by AM Pirttilä · 2021
4. *Trends in Organic Farming in India*; by S. S. Purohit, 2006
5. *Biofertilizers for Sustainable Agriculture and Environment*; by Bhoopander Giri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019