THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE
B.Sc. BIOTECHNOLOGY
UNDER CBCS

(With effect from 2022 - 2023)

Programme Objectives:

The objectives of B.Sc. Biotechnology programme are

1.To introduce basics and advanced concepts of biotechnology

2. To prepare students with good laboratory skills

3. To produce manpower to fill the existing gaps of academia and industry

4.To enable the students for industry setting

5. To produce competent entrepreneurs in biotech sector

Programme Educational Objectives:

The PEOs of B.Sc. Biotechnology define achievements of graduates that are viable within a five year duration

1.Facilitate the students to pursue higher education (Masters and/ or Doctoral degree) in national and international institutions

2.Enable the students to become Biotech entrepreneurs

3.Empower the students to better employment opportunities in Biotech and related firms

4. Students can be absorbed in hospitals and clinical sectors

5. They can be placed in agriculture-based and food production industries

Programme Specific Outcomes:

The PSOs of students completing the B.Sc. Biotechnology programme anticipated to possess include

1.To develop strong subject knowledge in different areas of Biotechnology

2. To understand the scientific concepts to clear national entrance exams for pursuing Masters degree

3. To gain increased creative and innovative thinking for pursuing research career

4.To procure contextual knowledge on ethical issues and biosafety protocols

5. To identify research problems and produce solutions

6. To create efficient and able employees who suffice the needs of Biotech industries

7. To direct the students towards research and entrepreneurship

8. To create multifaceted students possessing skills for Academia, Service, Health, Life Sciences, Food and Agriculture Sectors

9. To work in teams and as an individual when the scenario demands

10. To have basic ethics of biology and time management

Programme Outcomes

On successful completion of B.Sc. Biotechnology programme, the students will be able to

1. Understand the concepts of biotechnology

2. Gain knowledge principles of basic biologicaltechniques

3. Attain basic laboratory skill sets required for interdisciplinary industry setting

4. Utilize computational tools for biological data analysis

5. Gain knowledge on ethics and good laboratory practices (GLPs)

6.Fit into positions that require basic subject knowledge

7. Employ science and technology for the welfare of society

8.Establish mini and large scale entrepreneurial startups

9. Tackle the challenges arising in present and future of academia/industry

10.Apply responsibilities in the acquired position as a professional by demonstrating modern analytical skills

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(With effect from 2022 - 2023)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components / Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Cell Biology & Evolution	25	75	100
	III	Core Practical	Practical-1	4	0	Lab in Cell Biology & Evolution	0	0	0
4.	III	Allied -1	Paper-1	4	3	Biodiversity	25	75	100
	III	Allied- 1	Practical-1	2	0	Lab in Biodiversity	0	0	0
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II							
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	4	4	**Communicative English II**	25	75	100
9.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper-1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
10.	III	Core Theory	Paper-2	5	4	Biochemistry	25	75	100
11.	III	Core Practical	Practical-1	3	2	Lab in Cell Biology & Evolution and Biochemistry	25	75	100
12.	III	Allied-1	Paper-2	4	3	Food & Nutrition	25	75	100
13.	III	Allied Practical - 1	Practical-1	2	2	Lab in Biodiversity and Food & Nutrition	25	75	100
14.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15.	IV	Value Education		2	2	Value Education	25	75	100
16.	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		**36**	**27**		**225**	**675**	**900**
		SEMESTER III							
17.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
18.	II	English	Paper-3	6	4	English	25	75	100
19.	III	Core Theory	Paper-3	4	4	Microbiology	25	75	100
		Core practical	Practical - 2	3	0	Lab in Microbiology	0	0	0
20.	III	Allied-2	Paper-3	4	3	Biostatistics & Computer Applications	25	75	100
		AlliedPractical - 2	Practical-2	3	0	Lab in Biostatistics & Computer Applications	0	0	0
21.	IV	Skill Based Subject	Paper-1	2	2	Organic Farming	25	75	100
22.	IV	Non-Major Elective	Paper-1	2	2	Herbal Medicine	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**

		SEMESTER IV							
23.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
24.	II	English	Paper-4	6	4	English	25	75	100
25.	III	Core Theory	Paper-4	4	4	Immunology	25	75	100
26.	III	Core Practical	Practical-2	3	3	Lab in Microbiology and Immunology	25	75	100
27.	III	Allied-2	Paper-4	4	3	Molecular Genetics	25	75	100
28.	III	Allied Practical - 2	Practical-2	3	2	Lab in Biostatistics & Computer Applications and Molecular Genetics	25	75	100
29.	**IV**	**NMSDC II : Digital Skills For Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	25	75	100
30.	IV	Non-Major Elective	Paper-2	2	2	Applied Biotechnology	25	75	100
		Sem. Total		**30**	**24**		**200**	**600**	**800**
		SEMESTER V							
31.	III	Core Theory	Paper-5	6	6	Genetic Engineering	25	75	100
	III	Core Practical	Practical-3	3	0	Lab in genetic Engineering	0	0	0
32.	III	Core Theory	Paper-6	6	6	Industrial Biotechnology	25	75	100
		Core Practical	Practical-4	3	0	Lab in Industrial Biotechnology	0	0	0
33.	III	Core Theory	Paper-7	5	5	Bioinformatics	25	75	100
34.	III	Internal Elective	Paper-1	4	3	(to choose 1 out of 3) A. Biofertilizer Technology B. Public Health & Hygiene C. Enzyme technology	25	75	100
35.	IV	Skill Based Subject	Paper-2	3	2	Medical Lab Technology	25	75	100
		Sem. Total		**30**	**22**		**125**	**325**	**500**
		SEMESTER VI							
36.	III	Core Theory	Paper-8	6	5	Plant & Animal Biotechnology	25	75	100
37.	III	Core Theory	Paper-9	5	5	Environmental Biotechnology	25	75	100
38.	III	Core Practical	Practical-3	3	3	Lab in genetic Engineering and Plant & Animal Biotechnology	25	75	100
39.	III	Core Practical	Practical-4	3	3	Lab in Industrial Biotechnology and Environmental Biotechnology	25	75	100
40.	III	Compulsory Project	Paper-10	5	5	Individual / Group Project	25	75	100
41.	III	Internal Elective	Paper-2	3	3	(to choose 1 out of 3) A. Forensic Science B. Sericulture C. Entrepreneurship	25	75	100
42.	III	Internal Elective	Paper-3	3	3	(to choose 1 out of 3) A. Biosafety, Bioethics & IPR B. Pharmaceutical Biotechnology C. Horticulture and Landscaping	25	75	100
43.	III	**NMSDC III : Medical Coding for Employability**	Paper-3	2	2	Medical Coding	25	75	100
44.	V	Extension Activities		0	1		100	0	100
		Sem. Total		**30**	**30**		**300**		**900**
		Grand Total			**142**				

THIRUVALLUVAR UNIVERSITY
B.Sc. BIOTECHNOLOGY

SYLLABUS
UNDER CBCS
(With effect from 2020-2021)

SEMESTER I

CORE PAPER I

CELL AND EVOLUTION BIOLOGY

Course Objectives

1. To impart the basic knowledge of cell design and its components, tools and techniques.
2. To impart the theory of evolution
3. To understand the evolutionary process of animals and plants.

Unit-1

Cell and membrane structure – Historical review, Discovery of cell, Cell theory. Ultra structure of Prokaryotic cell and Eukaryotic cell.Structure and functions of Plasma membrane.Structure and functions of Cytoskeleton.Plant and animal cell.

Unit-2

Structure and function of intracellular organelles, nucleus, nucleolus, chromosome, golgicomplex, mitochondria, plastids, ribosome, endoplasmic reticulum.

Unit-3

Cell division and cell death and cell renewal. mitosis, meiosis, cell wall, plasma membrane.

Unit-4

Theories of evolution, Lamarkism, Darwinism, evidence of evolution, micro evolution, macro evolution. patterns of evolution species and speciation.

Unit-5

Natural selection, modes of natural selection. Molecular phylogeny, phylogenetic tree. Construction ofphylogenitic tree.

References / Text Books:

1. Cell and Molecular Biology: Concepts and Experiments by Gerald Karp
2. Essential Cell Biology by Bruce Alberts,
3. Cell Biology, Genetics, Molecular Biology: Evolution And Ecology by P.S. Verma
4. The underlying pathway structure of biochemical reaction networks. Christopher H. Schilling et. al. 1998. PNAS. 95:4193-8
5. Cluster Analysis and Display of Genome – wide expression patterns. Michael B.Eisenet. al. 1998, Proc. Natl. Acad. Sci. USA. 95: 14863 – 14868.
6. Molecular Classification of Cancer: Class Discovery and Class prediction by Gene Expression Monitoring. Golub TR. et. al. 1999. . Science, 286: 531 – 537.
7. The Escherichia coli MG. 1655 in silico metabolic genotype: its definition, characteristics and capabilities. Jeremy S. Edwards et. al. 2000. PNAS. 97:5528-33.
8. https://www.livescience.com/474-controversy-evolution-works.html
9. https://www.britannica.com/science/evolution-scientific-theory

Course Outcomes

1. The student will be able to learn cell structure and function
2. The student will be able to understand cell organelles
3. The student will be able to learn cell division
4. The student will be able to understand evolution
5. The student will be able to understand evolutionary process of plant and animal

ALLIED 1

PAPER 1
BIODIVERSITY

Course Objective:
To introduce the students to the essential basics of plants, animals, biodiversity hotspots and their conservation.

Unit 1
Introduction to Biodiversity -Biodiversity- components of biodiversity (Genetic, Species and Ecosystem diversity). History of biodiversity, Biodiversity Hotspots-Criteria for selection of hotspots, Indian hotspots. Keystone species and their significance-scope and application of biodiversity

Unit 2
Plant Diversity-Kingdom- Plantae, Structure and reproduction (No developmental studies) Algae (Ectocarpus), Fungi (Puccinia), Bryophytes (Funaria) ,Pteridophytes (Selaginella), Gymnosperms (Cycas). Economic importance of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

Unit 3
Animal Diversity-Kingdom – Animalia Structure, organization and life history of Entamoeba histolytica, Taeniasolium, Ascaris, Penaeus indicus, Pila globosa, Star fish and Calotes.
Unit 4

Biodiversity values and threats -Direct use value (Food, Medicine, Biological control, Industrial materials, Recreational harvesting, Ecotourism)-Indirect use values (Ecosystem services) –Non-use value (Option value, Bequest value, Existence value, Intrinsic value). Threats to biodiversity - Direct exploitation- Habitat loss, fragmentation and degradation- Introduced species- Extinction cascade- Red data Book.

Unit 5
Biodiversity Conservation-Biodiversity Conservation- in situ conservation- objectives - National Parks- Wildlifereserves and Sanctuaries-Biosphere reserves. Ex situ conservation principle-Botanical garden. Germplasm collection- Seed banks Cryopreservation.
References / Textbooks

1. Gangulee & Khar, 1980. College Botany, Vol. II Tata McGraw Hill, New Delhi.
2. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 2008. A manual of Zoology Vol.I& II (Part 1,2) S.Viswanathan, Chennai.
3. Barnes,R.D 2001. Invertebrate Zoology, W.B.Saunders.
4. Prabodh K. Maiti and Mait, P., 2011. Biodiversity: Perception, peril and preservation. Learning Private Limited, New Delhi.
5. Asthana, D. K. and Meera Asthana, 2006. Environment, Problems and solutions. S.Chand & Company Ltd. New Delhi.
6. Longman, K.A. and Jenik, J., 1987. Tropical forest and its Environment: ELBS, 2ndedn. London.
7. Odum E. P. 1983. Basic Ecology, Holt Saunders International Editions

Course Outcomes:

1. The students will gain knowledge on the diversity of plant, animal and their importance.
2. The students can comprehend the structure and function of various ecosystems and hotspots.
3. The students can understand and differentiate the various plant ecological adaptations.
4. The students will be able to distinguish plant distribution, vegetation pattern of world, continental, state level, forest biodiversity management and its conservation strategies.
5. The students will gain knowledge on the importance of bioresources in human welfare

SEMESTER II

CORE PAPER 2

BIOCHEMISTRY

Course Objectives

1. To understand the structure of various bio molecules, their interactions, synthesis and structural relationship
2. To understand the structure of various bio molecules and their interactions
3. To understand synthesis of biomolecules

Unit-1:

Carbohydrates - Classification, occurrence, structure and functions of monosaccharide, disaccharides, oligosaccharides & polysaccharides. Carbohydrate metabolism - Introduction, digestion, absorption, glycol sis, gluconeo genesis, glycogenolysis, Glycogenesis, Citric acid cycle, Bioenergetics.

Unit-2:

Proteins - Classification, structure and biological function. Amino acids –Classification based on structure and polarity. Essential and non- essential amino acids. Amino acid metabolism-Introduction, digestion and absorption, amino acid degradation reactions, urea cycle, linking to TCA cycle.

Unit-3:

Lipids-Classification, structure and biological function–essential and non-essential fatty acids. Lipid metabolism-Introduction, digestion and absorption. β–oxidation. Cholesterol biosynthesis -pathway, importance and regulation.

Unit-4:

Nucleic acids - Structure of purines and pyrimidine's. Structure of DNA-Types of DNA. Enzyme: Classification, Nomenclature, Mechanism of enzyme action.

Unit-5:

Vitamins & Hormones- Classification, physiological functions & deficiency disorders of vitamins- A,D,E,K,B complex and C.Hormones - thyroxin, insulin, growth hormones. Separation technique – Chromatography – paper and thin layer. Electrophoresis - AGE, SDS-PAGE.

References / Text Books

1. Text Book of Biochemistry – U. Sathyanarayana

2. Text Book of Biochemistry - Kumaresan
3. Text Book of Biochemistry- Ambika Shanmugam
4. Text Book of Biochemistry – J. L. Jain
1. Lehninger, Cox and Nelson: Biochemistry
2. Voet & Voet: Biochemistry.
3. Stryer K. Biochemistry1995.W.H.Freeman & Company, New York.
4. Mathews, H.R.Freedland R.Miesfeld,R.L.1997. Biochemistry a short course. Wiley - LissInc.
5. Neal, A.C., Chemistry & Biochemistry: A Comprehensive Introduction. McGraw Hill Book Company.
6. Donald Voet, Judith G.Voet, Biochemistry, Second edition.
7. David L. Nelson, Michael M.Cox, Lehninger. Principles of Biochemistry, third edition.
8. Plummer, D.T.1988. An Introduction to Practical Biochemistry, Tata McGraw Hill Co., New Delhi.

Course Outcomes

1. The student will be able to identify and interpret the structure, classification, of carbohydrates
2. The student will be able to identify and interpret the structure, classification, of proteins
3. The student will be able to identify and interpret the structure, classification, of lipids
4. The student will be able to identify and interpret the structure, classification, of nucleic acid
5. The student will be able to identify and interpret the structure, classification, of vitamins

ALLIED 1

PAPER 2

FOOD AND NUTRITION

Course Objectives

1. To know the importance of food and meaning of nutrition
2. To know about the role of nutrition in human life
3. Increase the ability to overcome deficiency
4. To enable the students, gain knowledge about basics in nutrition.
5. To develop knowledge of food and nutritional value.

Unit-1

Food and its Importance: Definition-food, nutrition, optimum nutrition. Functions of foods-physiological, psychological and social functions. Basic five food groups. Balanced diet-definition and objectives, food guide pyramid and its uses.

Unit-2

Nutrition: Nutrients, Nutritional Status, Health. Carbohydrates –Nutritional classification, Function, Digestion and Absorption, effects of deficiency, sources and requirements Fibre-Definition, Types, and Role of fibre in health.

Unit-3

Protein: Protein- Nutritional value, Functions, Digestion and Absorption, Sources and Requirements, Deficiency. Lipids value,Functions, Digestion and Absorption, Sources and Requirements, Deficiency. Essential fatty acids – Functions, Sources.

Unit-4

Energy: Energy - Units of energy - Calorie, Joule, Determination of energy content of foods: Basal Metabolic rate (BMR), Determination of BMR (Benedict's oxy calorimeter), Factors affecting BMR. Thermic effect of food, Factors affecting Thermic effects of food.

Unit-5

Vitamins and Minerals - Vitamins – Fat Soluble Vitamins (A, D, E, K): Functions, Sources, Requirements, Deficiency and Excess. Water Soluble Vitamins (B1, B2, B3, B4, B6, B12 & C)

References / Textbooks

1. B. Srilakshmi, Nutrition Science, Fifth Edition, New Age International (P) Ltd, New Delhi (2008).
2. Ambika Shanmugam, Fundamentals of Biochemistry for Medical Students, Seventh Edition, New Age Publishing Pvt.Ltd., New Delhi (1986).
3. Gopalan, C.et. al,Nutritive value of Indian Foods, ICMR(1991).
4. Swaminathan, M. ,Essentials of Food & Nutrition. Vols I & II Ganesh & Co., Madras(1985).
5. Robinson, C.H., et. al (1986) Normal & Therapeutic Nutrition, 17th ed. MacMillan Publishing Co., (1986)
6. Williams. S.R. Basic Nutrition & Diet Therapy, 11th ed., Mosby, Inc. St. Louis(2001).

Course Outcomes

1. The students will be able to understand different functions of food and learn about balanced diet.
2. The students will be able to understand the importance of carbohydrates and fibre
3. The students will understand the nutritional value of proteins, lipids and fatty acids
4. The students will be able to gain knowledge on food energy intake
5. The students will be able to learn how vitamins are vital to our body.

Core Practical 1

Lab in Cell and Evolution Biology

1. Mitosis in onion root tip
2. Meiosis in flower buds of Alliumcepa(onion) or grass hopper testis
3. Observation of buccal cells
4. Separation of cellular organelles by differential centrifuge
5. Separation of cell membrane components from leaves
6. Microscopy and calibration
7. Measurement size of various cells using micrometry (Optional)

Lab in Biodiversity

1. Study of the field collection, preservation and identification of plants
2. Study of the field collection, preservation and identification of animals
3. Identify biodiversity of pond ecosystem (using charts only)
4. Identify biodiversity of grassland ecosystem (using charts only)
5. Identify biodiversity of marine ecosystem (using charts only)
6. List out Plant diversity in the campus
7. List out Animal diversity in the campus
8. Preparation of Herbarium
9. Preparation of Insect Box
10. Field visit to any one Hotspot and submission of field report. Field based Viva–Voce.

Lab in Biochemistry

1. Qualitative test for carbohydrates (Glucose, Fructose & Starch)
2. Qualitative test for proteins
3. Qualitative test for lipids
4. Amino acid separation by paper chromatography
5. Amino acid separation by TLC

ALLIED PRACTICAL-1

Lab in Food and Nutrition

Practical for Food

1. Factor affecting the quality of pulses- Use of hard water, soft water, sodium bicarbonate, vinegar; pressure cooking and preparation of few pulse based recipes.
2. Effect of heat and pH on vegetable pigments like: chlorophyll, carotenoids, anthocyanin, anthoxanthin.
3. Smoking temperature of different fats and oils (safflower oil, groundnut oil & palm oil)

Practical for Nutrition

Qualitative tests for Carbohydrates, Proteins and Minerals.

1. Qualitative analysis for Carbohydrates in gives food samples. a) Monosaccharide – Glucose (commercial Glucose), Fructose (fruit juice) b) Disaccharide - Lactose (milk)
2. Qualitative analysis for protein in given food samples a) Albumin (egg) b) Casein (milk)
3. Qualitative analysis for minerals in given food samples. a) Calcium (Ragi) b) Iron (Red rice flakes) c) Phosphorus (Ragi) d) Magnesium (Agathi)

SEMESTER III

CORE PAPER - 3

MICROBIOLOGY

Course Objectives

1. To understand the classification of microorganisms.
2. To understand the structure of various microorganisms
3. To understand the growth of microorganisms
4. To understand the factors affecting the growth
5. to understand the disease caused by microorganism

UNIT- I

History of Microbiology. Classification of microorganisms - Kingdom protista, prokaryotic and eukaryotic microorganisms, the five kingdom concept of classification, archaeobacteria, eubacteria and eukaryotes.

UNIT- II

Microscope-light, electron and laser optic system; micrometry. Algae, bacteria, fungi, viruses and protozoa - morphology, ultra-structures, sub cellular structure and cell envelope - slime, capsule, cell wall, cell inclusion.Reproduction and life cycle pattern.

UNIT- III

Nutritional requirements and nutritional grouping of microorganisms, selective and differential media, enrichment media, microbial assay media. Growth curve; axenic culture, synchronous culture, continuous culture; Methods of enumeration of microorganisms and preservation of microbes

UNIT- IV

Factors controlling microbial growth-Physical agents and processes- pH, light, temperatures, desiccations, osmotic pressure, radiation, filtration; Chemical agents-Disinfectants, antiseptics and chemical sterilants; Antimicrobial chemotherapy evaluation-tube dilution, agar plate technique, phenol coefficient techniques.

UNIT- V

Microbes as a source of protein - Single Cell Protein. Role microbes in food spoilage and human diseases such as hepatitis, typhoid, TB, cholera, Malaria, fungal skin diseases.

References / Text Books

1. Text Book of Microbiology -N. Arumugam
2. Microbiolgoy-Concept and applications, Pelczer M.J.J, E.C.S. Chang & N.R. Krieg, 1993. McGraw Hill company, New York
3. Microbiology. Prescot L.M, J.D. Harley & D. A. Klein, 1999. McGraw Hill.
4. Microbiology, Fundamentals and Applications, Ronald M. Atlas, 1987. Prentice Hall.
5. General Microbiology, Stanier, 1986. McMillan Publishing Co.
6. Microbiology - An Introduction, 4th Edition, Gerard J. Tortora, Berdell R. Funke, Christine L. Care, 1992. The Benjamin/Cummings Publishing Company, Inc.

Course Outcomes

1. The student will be able to know classification of microorganisms
2. The student will be able to know the structure of various microorganisms
3. The student will be able to know the growth of microorganisms
4. The student will be able to know factors controlling microbial growth
5. The student will be able to know various disease caused by microbes

ALLIED II
PAPER 3

BIOSTATISTICS AND COMPUTER APPLICATIONS

Course Objectives

1. To know about collection of data and presentation of data
2. To study measures of central tendency
3. To know the types and methods of correlation analysis
4. To implant computer knowledge
5. To know how to work with Excel

UNIT- I

Biostatistics - Introduction, definition, functions, scopes. Collection of data-primary, secondary. Sampling, Classification, Tabulation of data. Presentation of data-graphical and diagram matic representation, Charting of data using MS-Excel.

UNIT- II

Measure of central tendency -individual, discrete and continuous series-mean, median, mode. Use of Excel in measures of central tendency, Measure of variation -range. Quartile deviation, Standard deviation, Standard error.

UNIT- III

Correlation analysis - types and methods. Calculation r-value, Correlation using MS-Excel. Regression analysis- regression line and regression equation, Linear regression using MS-Excel, student t-test; chi-square test.

UNIT- IV

Anatomy and computer peripherals - Anatomy of computer system, Parts of computer system- Hardware, Software, Input devices, Output devices, Memory, Binary numbers in computers, Unit of size, Computer language.

UNIT- V

MS-Excel-Introduction, Features-Opening of Spreadsheet, Components of an Excel work book, Entering data and saving a new work book, Mathematical calculations, Moving and copying data, Deleting and adding rows and columns, Aligning data, Changing the size of row and column, Creating a graph, Adding, renaming or deleting a sheet from the work book, Closing the work book, Quitting Microsoft Excel.

Text Books / References

1. Biostatistics, Daniel, W.W.1987. New York, John Wiley sons
2. An introduction to biostatistics, 3rd Edn, Sundarrao, P.S.S. and Richards, J Christian Medical College, Vellore.
3. Statistics for Biology, Boston, Bishop, O.N. Houshton, Mifflin.
4. Statistics for biologist, Campbell, T.C.1998. Cambridge University press
5. 1.Elements of biostatistics, Prasad, S. Rastogi Pub
6. Digital computer fundamentals, Bartee,6th Edn, Fundamental of computers, algorithms, Horowitz, Sahhni, Tajasekaran.
7. Textbook of Computer applications and biostatistics, RemethDiasand Kailas KMali, Trinity Publishing House, Satara-415001. India.2011.
8. MS office, Sexena,2001,Vikas pub, House Pvt Ltd, New Delhi

9. Computer programming and application, J. Fernandez and Venkatasamy, Suja Pubs.
10. Statistics for biologist, Campbell, T.C.1998. Cambridge University press.
11. Computer programming and application, J. Fernandez and Venkatasamy, Suja Pubs.
12. https://www.biotecharticles.com/Biotech-Research-Article/Biostatistics-Statistical-Analysis-in-Life-Processes-564.html
13. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3657982/

Course Outcomes

1. The student will be able to know about collection of data and presentation of data
2. The student will be able to study measures of central tendency
3. The student will be able to know the types and methods of correlation analysis
4. The student will be able to implant computer knowledge
5. The student will be able to know how to work with excel

SKILL BASED SUBJECT
PAPER - 1
ORGANIC FARMING

Course Objectives:

To expose students to principles of agriculture and agricultural practices. To have a basic understanding on agriculture in India with relation to soil types, climatic conditions etc.

UNIT - I

Introduction - Introduction to Organic Farming, history, Farming models - Natural Farming, Fukuoka - Japan, Parma Culture, Billmollyson, Australian Organic Farming, Ecological Farming, Palekar Model,

UNIT - II

Soil Factor - Physical, chemical and biological properties - Classification of Indian soils - Mineral and organic constituents of soils and their role in maintaining soil productivity.

UNIT - III

Composting Technique-Introduction- history of composting - compost - composting processes - microbiology of composting - fate of pathogens - ingredients in composting - various methods of composting: vermi- composting and home composting - steps in composting.

UNIT - IV

Agricultural practices-Implements, Seed bed preparation, ploughing, harrowing, sowing, irrigation, weeding, leveling, transplantation.- Inter-cultivation, Crop rotation, harvesting, Post- harvest methods - Cultivation of paddy, tomato and mango

UNIT - V

Biofertilizers and their Production-Introduction - Types: Microbes as biofertilizer, Green leaf manure. Mass cultivation and Application of the following biofertilizers: i) Rhizobium ii) Azospirillum iii) Cyanobacteria iv) Mycorrhizae

References / Textbooks

1. 1.Shovan Ray (Ed). 2007. Handbook of Agriculture in India. Oxford University Press. New Delhi.
2. Kumar Arvind, 2006. Concepts of Tropical Agriculture.Eastern Books Coprporation. India.
3. Sreenivas, Y.S. 2009. Advances in Agricultural Research in India, Oxford Book Company.Jaipur.
4. RamanandSagar 2009.Advances in Agricultural Biotechnology. Cyber Tech Pub. New Delhi.
5. HemantRawat. 2008. Agricultural Biotechnology. Oxford Book Company. Jaipur.
6. Panda, S.C. 2005. Agronomy. Agrobios. Jodhpur.
7. Rajendra Reddy and J.P. Abhay Shankar. 2007. Encyclopaedia of Agriculture. Commonwealth Pub., New Delhi.

Course Outcomes:

1. The students will be able to understand various models of organic farming
2. The students could explain the role of soil health in organic crop production.
3. The students will identify the fundamentals of cultural practices and biological processes for successful establishment of organic farming.
4. The students could provide consultation and make awareness to the society about needs of organic farming for their routine life.
5. The students will be able to set their own business, marketing and to compete with entrepreneurs.

NON - MAJOR ELECTIVE
PAPER -1

HERBAL MEDICINE

Course Objectives:

1. To understand the outcome of herbal plant medicinal uses
2. To identify and utilization of medicinal plants.

UNIT- I

Introduction: Herbal Medicine-History of Traditional Medicine - History of Islamic Medicine, Siddha, Ayurveda, Homeopathy, Allopathy and Unani medicine.

UNIT- II

Ethano botany: *Withaniasomnifera* (Amukkara) *Glycyrrhizaglabra* (Athimathuram), *Myristicafragrans* (Jathikkai), *Gymnemasylvestre* (Cakkaraikkolli), *Pongamiapinnata* (Punkam)-PropertiesandMedicinaluses.

UNIT- III

Common medicinal plants: Family, Local Name, Common name, Medicinal uses- *Ocimumsanctum, Solanumtrilobatum, Cardiospermumhalicacabum, Adhatodavasica, Catharanthusroseus, Ecliptaalba*.

UNIT- IV

Parts of Medicinal plants: Fruit -Amla, Bulb - Garlic, Rhizome - Ginger, Seed -Castor, Bark - Cinchona, Leaves -Neem and Flower - Clove.

UNIT- V

Cultivation methods- crop protection - Harvesting- Storage and Protection-Marketing utilization-Export of medicinally important plant (General aspects).

References / Text Books

1. Gokhale, S.S,C.K.Kokate and A.P.Purohit (1994). Pharmacognosy. Niraliprakashan, Pune.
2. Faroogi, A.A. and B.S.Sreeramu (2004), Cultivation of Medicinal and Aromatic crops. University Press (India) P. Ltd., Hyderabad.
3. Pal. D.C and S.K. Jain (1998), Tribal medicine, Naya Prakash, 206, Bidhan Sarani, Calcutta.
4. Thirugnanam, Akbarsha and Krishnamurthy (2010), Indian Medicinal plants and Home Remedies, SelviPathipagam, Trichy.
5. Rasheeduzzafar (2006), Medicinal plants of India, CBS publication.
6. International Journal of Herbal Medicine
7. Journal of Herbal medicine Elsevier
8. http://herbal - medicine.imedpub.com/
9. en.wikipedia.org/wiki/Herbal_medicine

Course Outcomes

1. The student will be able to gain knowledge on traditional medicine
2. The student will be able to study some important medicinal plants
3. The student will be able to know the common herbal plants
4. The student will be able to know the preservation of herbal medicine
5. The student will be able to learn cultivation methods of herbal plants

SEMESTER IV
CORE PAPER - 4
IMMUNOLOGY

Course Objectives

1. To understand the system and cells of the immune system.
2. To know about Immunoglobulins
3. To understand the role of MHC's
4. To learn about Immuno hematology

UNIT- I

Immunology-Introduction, Historical perspective to the immune system.Innate immunity and acquired immunity.Primary and secondary lymphoid organs-structure and functions.Cells of the immune system, Antigens, Immune responses.

UNIT- II

Immuno globulin -structure and functions, Immunoglobulin classes and biological activities.Epitopes - Properties of B-cell and T- cellepitopes. Monoclonal anti bodies - Production, Classical uses.

UNIT- III

Immune cells -T- cells-Receptors, Maturation, Activation and differentiation. Cell mediated immune response, Cytokines and cytokine receptors. B- cells- Activation of B- cells by T-cell independent antigen and T-cell dependent antigens. Antibody mediated immune responses, Differentiation of B-cells.

UNIT- IV

Major His to compatibility complex-MHC, HLA complex, HLA typing. Immunological tolerance, auto immunity and autoimmune diseases.

UNIT- V

Immuno hematology - ABO blood grouping, Rh Blood grouping, and medical applications of blood grouping, blood transfusion and hemolytic disease of the new born.Hyper sensitivity-Type I, II, III, IV and V.

References / Text Books

1. Immunology-Dulsy Fatima and N.Arumugam-Saras Publication.
2. Immunology (7th Edition)-David Male, Jonathan Brost off, David Roth, Ivan Roitt, Mosby. Elsevier
3. Immunology-A short course-Eli Benjamin, Geoffrey Suashine, Sidney Leskowitz. John wiley&sons.Inc. Publications.
4. Fundamental Immunology (6th Edition)- William E Paul, Walters Kluwer Hedth, Lippincott William Wilkins.
5. https://www.researchgate.net/publication/313343876_Immunology_Lecture_Notes_Immune_responses
6. https://www.easybiologyclass.com/tag/immunology-short-notes/

Course Outcomes

1. The student will be able to learn the basics of immunology.
2. The student will be able to learn about the structure of immunoglobulins.
3. The student will be able to know about the details of immune cells.
4. The student will be able to learn about the mhc&autoimmune disease.
5. The student will be able to learn the details of blood grouping and its applications.

ALLIED-II
PAPER - 4
MOLECULAR GENETICS

Course Objectives

1. To make the students familiar with the DNA as a Genetic Material.
2. To understand the genetics of bacteria.
3. To Understand the Students about the mutation at the molecular level and Gene Expression.

UNIT- I

Central dogma: Structure of DNA and RNA, DNA as the Genetic Material: Griffith's experiment, Hershey-Chase Experiment, Experimental Proof by Avery, McLeod and McCarty. RNA as genetic material.

UNIT- II

DNA Replication: Types. Mechanism of Replication. DNA Repair Mechanism and Recombination -Holliday Model.

UNIT- III

Mutation: Spontaneous, Induced mutation, Radiation Induced Mutation - (Ionizing and UV radiation), Chemically Induced mutation. Point Mutation. Chromosomal Abnormalities.

UNIT- IV

Genetics of Bacteria and Viruses: Transformation, Conjugation, F+, Hfr, Transduction-Generalized and Specialized.

UNIT- V

Regulation of Gene Expression: Operon Concept - Lac and Trp Operons. Transposable Genetic elements - IS elements.Ac and Ds Elements in Maize, Elements in Drosophila.

References / Text Books

1. Textbook of population genetics by tomar
2. Textbook of Genetics by R.P. Meyyan (Saras Publication)
3. Text book of Genetics from Genes to Genomes-A joy Paul
4. Genetics-P.S. Verma,V.K. Agarwal
5. Essential of human genetics (5th Edn)-Manu L Kothari, Opa A Metha and Sadhana S Roy chodhury, Universities Press, Hyderabad.
6. Molecular Biology of Genes. 4th edition by Watson, Hopkins, Roberts, Steitz, Weiner.
7. The Cell - A molecular approach. 3rd edition by Geoffrey M. Cooper, Robert E. Hausman.
8. iGenetics (A Molecular Approach)- 2nd edition by Peter J. Russell
9. Genetics- A Conceptual Approach (2nd Edition)-Benjamin A. Pierce.W.H. Freeman Company
10. https://www.khanacademy.org/science/biology/bacteria-archaea/prokaryote-structure/a/genetic-variation-in-prokaryotes

Course Outcomes

1. The student will be able to explain Central Dogma and DNA as a Genetic Material
2. The student will be able to understand Replication, Repair and Recombination.
3. The student will be able to know Mutation, Chromosomal Abnormalities
4. The student will be able to understand Genetics of Bacteria and Virus
5. The student will be able to know the Regulation of Gene Expression and Transposable Elements.

NON-MAJOR ELECTIVE
PAPER -2
APPLIED BIOTECHNOLOGY

Course Objectives

1. To understand and familiarize with some of the molecular biology tools
2. It is easy to handle this technique and to apply in the agriculture, medicine, animal husbandry.

UNIT- I

PCR Technology: Introduction, Principle, Components of standard PCR-PCR Buffers and enzymes. Variants of PCR-Multiplex, Nested, Quantitative, RT-PCR. Medical applications of PCR.

UNIT- II

Vaccine Technology-Introduction, Generation of vaccine-First generation vaccines, Second generation vaccine (Cell Culture vaccine),Third generation vaccine (Recombinant and sub-unit and synthetic vaccines), fourth Generation vaccine (DNA vaccine). Medical Applications - Edible vaccines.

UNIT- III

RNA Technology-Introduction-Biogenesis of micro RNA, miRNA, siRNA. Applications - Medical, Veterinary and Agriculture fields.

UNIT- IV

Biosensor Technology- Introduction, Types, Immunosensors-Application, Medical. Blood Glucose monitoring for diabetes. Agricultural application-Pathogen detection, Food, Toxicology test. Industrial applications - Drug delivery - Military application-DID stick test.

UNIT- V

DNA foot printing-Southern blotting, Western blotting. Hybridoma technology-Monoclonal anti body production, application, advantages and disadvantages-DNA finger printing.

References / Text Books

1. Biotechnology and medicine and agriculture principles and practices -Anilkumar,
2. Applied Animal Biotechnology, V Kumaresan, Saras Publications, 2008
3. Advances in Applied Biotechnology, Tong-Cun Zhang Motowo Nakajima, Springer Link
4. Ashwan'sPareak, Sanjay Mohan Gupta. International Publishing House Pvt. Ltd. New Delhi.
5. Applied Plant Biotechnology, V Kumaresan, Saras Publications, 2008

Course Outcomes

1. The student will be able to know the importance of PCR technique
2. The student will be able to study about vaccines
3. The student will be able to learn about applications of RNA technology
4. The student will be able to know about Biosensors and its uses
5. The student will be able to study about blotting techniques

LAB IN MICROBIOLOGY

Semester: III & IV

Core Practical -2

1. Microscope - calibration using ocular stage micrometers
2. Sterilization methods
3. Preparation of culture media for bacteria and fungi
4. Isolation and enumeration of bacteria and fungi
5. Culture technique - streak plate, pour plate and spread plate
6. Measurement of bacterial growth rate
7. Identification - staining techniques, biochemical tests.

LAB IN BIOSTATISTICS AND BASIC COMPUTER APPLICATIONS

Semester: III & IV

Allied Practical-2

1. Collection of data and tabulation
2. Graphical representation of data-line graph, histogram
3. Diagram matic representation of data-pie diagram, bar diagram
4. Calculation of Mean, median and mode (using Neem leaves or height and weight of the students)
5. Calculation of correlation co-coefficient (r-value) for length and breadth of Neem leaves or height and weight of the students
6. Measurement of central tendencies for the given data using MS Excel
7. Calculation of r-value using MS Excel / Regression line using MS Excel
8. Drawing of graph with complete label for a given data

LAB IN IMMUNOLOGY

Semester: IV

Core Practical-2

1. ABO Blood Grouping and Rh Factor typing
2. RBC and WBC Count by Hemo cytometers.
3. Blood cell Analysis
4. Measurement of pulse and blood pressure.
5. Precipitation reactions (Radial immuno or Double immuno diffusion test)

LAB IN MOLECULAR GENETICS

Semester: IV

Allied Practical-2

1. Development of Auxotrophic mutants employing EMS
2. Screening of multiple antibiotic resistant mutants of *E. coli*
3. Replica plating technique
4. Estimation of DNA / RNA
5. Isolation of genomic DNA from plant / Bacteria/ Animal

SEMESTER V

CORE PAPER - 5
GENETIC ENGINEERING

Course Objectives

1. To impart the basic knowledge of tools used in genetic engineering, cloning vectors, PCR and DNA finger printing.
2. To make aware on vectors
3. To make understand about molecular markers

UNIT- I

Tools of genetic engineering - DNA polymerase, poly nucleotidekinase, alkaline phosphates, DNA ligase, nick translation systems, deoxynucleotidyltranserase, reverse transcriptase, restriction endo nucleases.

UNIT- II

Cloning vectors - Plasmid vectors-pBR322, PUC, Tiplasmid.Phage vectors-lambda, M13, cosmids, phagemid. Yeast vector-expression vector, shuttle vector. Plant and animal vector-CaMV, SV40.Artificial chromosomes - BAC and YAC.

UNIT- III

Polymerase Chain Reaction-Introduction, principle, steps involved in PCR amplification. Types of PCR, applications of PCR. Primers.

UNIT- IV

Molecular markers -Nuclearmarkers -RFLP, RAPD, VNTR, SSRs, AFLP, Coxgene. Mitochondrialmarkers-CO1, Cox, ITS,16SRNA, 18SRNA. DNA bar coding -introduction, components of DNAbarcoding.DNA sequencing technology-Maxamand Gilbert method, Sanger chain termination method.

UNIT- V

DNA finger printing, Production of recombinant proteins-insulin and HGH.Genelibraries-Establishing a library, screening the gene library, cDNA library.

References / Text Books

1. Genes to clones -Ernst L Winnacker, Panima Publishing House, New Delhi. (2003)
2. A text book of Biotechnology, RC Dubey, S. Chand and Company Ltd (2006).
3. Molecular Biotechnology-Bernard R Glick and Jack J Pasternak, Panima Publishing House, New Delhi (2002).
4. Biotechnology by satyanarayana (2010).
5. Genes to clones -Ernst L Winnacker, Panima Publishing House, New Delhi.(2003)
6. Gene cloning-TA brown, Blackwell Science (2001).
7. Molecular Biotechnology-Bernard R Glick and Jack J Pasternak, Panima Publishing House, New Delhi (2002).
8. https://www.ncbi.nlm.nih.gov/probe/docs/techPCR/
9. https://www.sciencedirect.com/topics/neuroscience/polymerase-chain-reaction

Course Outcomes

1. The student will be able to learn about molecular marker
2. The student will be able to study about the important tools in genetic engineering.
3. The student will be able tolearn about different type of cloning vectors.
4. The student will be able to study about principle and different types of polymerase chain reaction
5. The student will be able to study about recombinant DNA technology.

CORE PAPER - 6

INDUSTRIAL BIOTECHNOLOGY

Course Objectives

1. To impart knowledge in microbial production of industrial products.
2. Industrial products and their separation techniques.
3. Media formulation.

UNIT- I

Introduction to biotechnology and products. Major classes of commercial products using microorganisms-enzymes, amino acids, vitamins, antibiotics, organic solvents, organic acids.

UNIT- II

Industrially important microorganisms: screening techniques - strain improvements - mutations, protoplast fusion and rDNA techniques for strain development.

UNIT- III

Bioreactors / Fermentor: Types, features, operation: sterilization (Batch and ContinuousMicrobial growth and media formulation. Microbial culture - batch, fed batch, semi-continuous, continuous. Growth kinetics of microorganisms.

UNIT- IV

Downstream processing: Solid-liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, evaporation, liquid-liquid extraction, membrane filtration, precipitation, adsorption. Product purification by chromatography.

UNIT- V

Fermented foods and Agricultural products-Production of Cheese, Yoghurt, Milk products, Bio-fertilizers -SCP, Mush room cultivation &Cyano bacteria.

References / Text Books

1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
2. Biotechnology, Satyanarayana, U., 2006. Books and Allied (P) Ltd.
3. Industrial Microbiology, Reed C., Prescott and Dann's, 1982. Macmillan publishers.
4. An introduction to Genetic Engineering, Desmond, S.T., Nicholl, 1994. Cambridge press.
5. Text book of biotechnology by V.Kumaresan
6. Industrial biotechnology by N.Arumugam
7. Principles of Gene Manipulation. 4th edition, Old R.W. and S.B. Primrose, 1994. Blackwell scientific publication London.
8. Fundamentals of Biotechnology, P.Prave, P.Faust, V. Sitting, word sukatasch D., 1987. VCH verlasgetellSchafor MBH, Weinhkeim.
9. http://www.biologydiscussion.com/biotechnology/biotechnology-introduction-scope-and-applications-of-biotechnology/11608
10. https://courses.lumenlearning.com/boundless-microbiology/chapter/industrial-microbiology/
11. http://www.biologydiscussion.com/biotechnology/downstream-processing/stages-in-downstream-processing-5-stages/10160

Course Outcomes

1. The student will be able to know about Introduction to biotechnology and products
2. The student will be able to understand Industrially important microorganisms.
3. The student will be able to know Bioreactors / Fermentor: Types
4. The student will be able to know Downstream processing
5. The student will be able to understand Fermented foods and Agricultural products

CORE PAPER - 7

BIOINFORMATICS

Course Objectives

The course aims to provide the students with an experimental and computational knowledge to embrace a systems biology approach and experience authentic systems genetics research by designing and conducting independent research projects.

UNIT- I

Introduction about bioinformatics and biological databases- BioInformatics: Introduction, definition, objectives and scope. Application of BioInformatics.General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL), Protein databases.

UNIT- II

Sequence analysis -Introduction to Sequences, alignments and Dynamic Programming; Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm) and phylogenetic analysis.

UNIT- III

Similarity search, gene identification and prediction -Similarity Search Introduction, Working with FASTA, Working With BLAST.Basis of gene prediction, Pattern Recognition, Gene prediction Methods, Other gene prediction tools.

UNIT- IV

Protein classification and structure visualisation-Overview of the Protein Structure, Protein Structure Visualization and prediction: Pymol, Rasmol, and Structure - based Protein Classification, Protein Structure databases, Protein Structure Visualization Databases and tools.

UNIT- V

Protein structure prediction-Protein Identification and Characterization, Primary structure analysis and Prediction, Secondary Structure Analysis and Prediction, Protein Function Prediction and Protein Prediction from a DNA Sequence., Homology modeling.

References / Textbooks

1. Attwood.T.K. Parry D.J. and Smith. Introduction to Bioinformatics. A joint Publications. 1999
2. Baldi, P. and Brunak, S. Bioinformatics: The Machine Learning Approach. MIT Press. 2001
3. A.D. Baxevanis and B.F.F. Ouellette (Eds). Bioinformatics: A practical guide to the analysis of genes and proteins. John Wiley and Sons. 2002
4. Gentleman, R. Bioinformatics and Computational Biology Solutions using R and Bioconductor. Springer Science and Business media Inc. 2005
5. http://www.biologydiscussion.com/biodiversity/bioinformatics/notes-on-bioinformatics-genetics/38224
6. http://www.biotechnologynotes.com/bioinformatics/notes-on-bioinformatics/693

Course Outcomes

1. The student will be able to learn the basics of bioinformatics.
2. The student will be able to learn about sequence analysis.
3. The student will be able to bioinformatics tools like Blast and Fasta.
4. The student will be able to learn about protein structure using protein visualizing tools.
5. The student will be able to protein and its prediction.

INTERNAL ELECTIVE
PAPER -1
(to choose one out of three)

A. BIOFERTILIZER TECHNOLOGY

Course Objectives

1. To make the students familiar with the Biofertilizers and its Uses .
2. To make the Students well known about Isolation and Identification methods of Biofertilizers

UNIT- I

An introduction to fertilizers, synthetic fertilizers, natural fertilizers, inorganic fertilizers, organic fertilizers, bio-fertilizers - importance, advantages and constraints.

UNIT- II

Isolation, culturing methods - Rhizobium, AzospirillumAzotobacters, blue green algae and phosphate solubilisers.

UNIT- III

Enumeration and identification of microbial species - Rhizobium, AzospirillumAzotobacters, blue green algae and phosphate solubilisers.Staining Techniques of Bacteria.

UNIT- IV

Preparation of microbial inoculants - large-scale production of microbes - their application as biofertilizers - crop responses to biofertilizers.

UNIT- V

Azolla - distribution, morphological and biochemical characteristics - cyanobacterial symbionts. Azolla applications and limitations.

References / Textbooks

1. A textbook of microbiology by R. C. Dubey
2. N.S.Subba Rao, (2000). Biofertilizers in Agriculture. Oxford & IBH publishing Co., New Delhi.
3. Daniel Sundararaj, D. and G. Thulasidas. (1993). Botany of Field Crops. (2nd Ed.) Macmilan India Ltd.
4. Jeswani, L.M. and Balddev, B. (1990). Advances in Pulse Production Technology. ICAR, New Delhi
5. Malsen, L.J.G.V. and S. Somaatmadja, (1993). PROSEA - Plant Resources of South East Asia. No.1. Pulses. International Book Distributors, Dehradun.
6. https://www.bio-fit.eu/q8/lo1-why-biofertilizers?start=4

Course Outcomes

1. The student will be able to understand the Biofertilizers
2. The student will be able to know the Isolation Methods of Biofertilizers .
3. The student will be able to know the Identification Methods of Biofertilizers.
4. The student will be able to know the Large Scale Production Process of Biofertilizers.
5. The student will be able to know the Large Scale Production Process of Biofertilizers.

INTERNAL ELECTIVE
PAPER -1

B. PUBLIC HEALTH AND HYGIENE

Course Objectives

1. To understand the communicable and infectious diseases
2. To learn other aspects of health care.

UNIT- I

Introduction to Public Health-Introduction, Definition, Significance. Evolution of Public & community health. Determinants of Health - Biological, Behavioral, Socio-economic, Cultural, Environmental, Geographical etc.

UNIT- II

Concept of Primary Health Care - Public Health delivery system in India-Introduction to National Health Policy - 1983&2002, National Population Policy -2005, National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM), National Public Health Programs.

UNIT- III

Medical Terminology - Introduction to bacteriology /virology/ Mycology/ Parasitology/ Genetic diseases /Genetics /Pediatric diseases/ Problems/ Neoplasia/ Inflammation & healing.

UNIT- IV

Communicable & Infectious Diseases -General overview of communicable diseases, impact of communicable diseases on developing. Non - Communicable Diseases-Overview and introduction to NCDs-risk factors, prevention and management. General strategies, new approaches and policies of NCDs. NCDs programs of WHO, PAHO and Government of India.

UNIT- V

Occupational, Industrial and Urban Health-Occupational Safety & Health-Chemical and physical exposures, control of occupational exposures, injury control occupational health disorders and diseases. Occupational health of working population of organized and unorganized sectors -Farmers, Industrial workers, health workers, etc

References / Textbooks

1. World Health Organization: Report on infectious diseases and Report on Multi drug resistance, World Health Organization, Geneva
2. Principles and Practice of Medicine: Davidson, Edward, Bouchieret. Al., Pearson Professional Ltd. London, 1995
3. Global Hand book On Non-Communicable Diseases and Health Promotion By David V.Mcqueen, Springer Publication.
4. Occupational Health: Management and Practice for Health Practitioners By S.P.Hattingh, 3rd edition.
5. Urban Health: Global Perspectives edited by David Vlahov, JoIveyBoufford, Clarence E.Pearson, Laurie Norris, published by Jossey bass
6. International Journal of Hygiene and Environmental Health.

7. Journal of Public Health Hygiene and Safety.
8. https://en.wikipedia.org/wiki/Hygiene.https://www.open.edu/openlearncreate/mod/ou content/view.php?id=187&printable=1
9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4718376/

Course Outcomes

1. The student will be able to learn public health
2. The student will be able to understand health policy
3. The student will be able to know about medical terminology
4. The student will be able to learn communicable diseases
5. The student will be able to identify safety of working populations

INTERNAL ELECTIVE
PAPER -1

C. ENZYME TECHNOLOGY

Course Objectives

1. To learn Historic background-General Terminology of enzymes
2. To understand mechanism of enzymes, enzyme kinetics

UNIT- I

Introduction: Historic background-General Terminology, Nomenclature and Classification of Enzymes. Enzyme activity- chemical nature of enzymes. Protein nature of enzymes and Non protein enzymes.

UNIT- II

Enzyme Mechanism: Lock and key, Induced fit and Transition state Hypotheses. Mechanism of enzyme catalysis-Acid-base catalysis, covalent catalysis, Classification of coenzymes, Coenzymes and Cofactors- Prosthetic group. Reversible Inhibition-Competitive, Non Competitive, Un competitive.

UNIT- III

Metabolic regulation: Feedback Regulation, Allosteric Regulation, Reversible Covalent Modification and Proteolytic Activation. Organization of enzymes in the cell. Enzymes in the cell, localization, compartmentation of metabolic pathways, enzymes in membranes

UNIT- IV

Factors affecting the enzyme activity: Concentration, pH and temperature. Kinetics of a single-substrate enzyme catalysed reaction, Michealis - Menten Equation, Km, Vmax, L.B Plot, Turn over number.

UNIT- V

Clinical enzymes: Enzymes as thrombolytic agents, Anti-in flammatory agents, streptokinase, asparagines, Iso enzymes like CK and LDH, Transaminases (AST, ALT), Amylases, Cholinesterases, Phosphates. Immobilization of enzymes, ELIZA. Biosensors. Enzyme Engineering and site direct edmuta genesis, Designer enzymes

References / Textbooks

1. Fundamentals of Enzymology: Nicholas Price & Lewis Stevens
2. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry- Trevor Palmer
3. Biochemistry textbooks by Stryer,Voet and Lehninger (Relevant Chapters)
4. Proteins by Gary Walsh
5. Principles of Enzyme Technology, Khan M.Y, Khan Farha
6. www.journals.elsevier.com/enzyme-and-microbial-technology
7. https://en.wikipedia.org/wiki/Enzyme
8. https://application.wiley-vch.de/books/sample/3527329897_c01.pdf

Course Outcomes

1. The student will be able to study about basics in Enzyme
2. The student will be able to learn about mechanism of Enzyme.
3. The student will be able to Study about principle and regulations of Enzyme.
4. The student will be able to learn about Kinetic activity of Enzyme.
5. The student will be able to Study about applications of enzyme.

SKILL BASED SUBJECT
PAPER - 3

MEDICAL LAB TECHNOLOGY

Course Objectives

1. To gain the knowledge of anatomy and physiology of organ system.
2. To gain the knowledge of histopathology and tissue processing.
3. To gain the knowledge of cardiac profile and heart diseases.

UNIT- I

General Anatomy - Cell-structure & function. Tissue - Epithelium, Connective, Sclerous muscle. Systemic anatomy - Basic features of Cardio vascular system, Respiratory system, Digestive system, Excretory system, Reproductive (Male &Female) system, Nervous system.

UNIT- II

Blood -Blood cells, Haemoglobin, Blood grouping, Coagulation Factors. Haematological Disorders-Classification of Anaemia-Iron Deficiency anaemia, Megaloblastic anaemia, HaemolyticAnaemia.

UNIT- III

Cardio vascular system-Heart rate, cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse.Cardiac Profile-Description, Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases.Respiratory System-Ventilation, functions, Lungs- Volumes and capacities.

UNIT- IV

Gastrointestinal System - Process of digestion. Endocrinology - Endocrine Glands-Description. Hormones-their secretion and functions. Excretory system, Structure of nephron, Urine formation.

UNIT- V

Histopathology -Introduction. Basic steps for tissue processing-Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications.

References / Textbooks

1. Medical Laboratory Manual for Tropical Countries, Volume II: Microbiology, by Monica Chees brough ELBS.
2. Haematology: principles and procedures 6th Ed Lea &Febiger. 5. Bernadette F. Rodak, George A. Fritsma, Kathryn Doig (2007).
3. Haematology: Clinical Principles and Applications 3rd Ed, Elsevier Health Sciences.
4. Text book of Medical Physiology by G.K. Pal.
5. Medical Laboratory Technology by Lynch.
6. Medical Laboratory procedures Manual (T-M) by K.L.Mukherjee, Vol.I, II, III.
7. Hematology: principles and procedures 6th Ed Lea &Febiger. 5.Bernadette F. Rodak, George A. Fritsma, Kathryn Doig (2007).

8. Shirley Mitchell Lewis, Barbara J. Bain, Imelda Bates (2006) Dacia and Lewis Practical Haematology, 10th Ed, Churchill Livingstone /Elsevier.4.Barbara A. Brown (2008).
9. https://www.academia.edu/32040390/LECTURE_NOTES_For_Medical_Laboratory_Students
10. https://www.sciencedirect.com/book/9780407001541/introduction-to-medical-laboratory-technology

Course out Comes

1. The student will be able to know the anatomy oforgans in the human body.
2. The student will be able to understand the blood and blood related diseases.
3. The student will be able to know the cardiac profile and heart diseases.
4. The student will be able to know the gastrointestinal system and hormone secretion.
5. The student will be able to know the steps in tissue processing and staining.

SEMESTER VI

CORE PAPER - 8

PLANT & ANIMAL BIOTECHNOLOGY

Course Objectives

1. To provide the knowledge of various aspects of plant biotechnology including micro propagation.
2. To provide the knowledge of genetic improvement of plants through hybridization
3. To provide the knowledge of somatic hybridization
4. To provide the knowledge of genetic transformation.

UNIT- I

Introduction of plant tissue culture, basic requirements form plant tissue culture, plant tissue culture media, plant hormones and growth regulators in tissue culture, preparation of suitable explants.

UNIT- II

Cell culture, callus culture, anther and ovary culture for haploid plant production, somatic embryogenesis, protoplast culture, protoplast fusion, cybrids, somatic hybridization, synthetic seeds. Genetic engineering in plants-delay of fruit ripening, cytoplasmic male sterility.

UNIT- III

Introduction to animal cell culture, media preparation for animal cell culture, principles of sterile techniques and cell propagation- Preservation and characterization of animal cells organ culture-Cytotoxicity and viability assays.

UNIT- IV

Molecular diagnosis of genetic disorder, Gene therapy, transgenic animals, transgenic fish. Production of useful proteins in transgenic animals.

UNIT- V

Artificial insemination, super-ovulation, embryo transfer, In vitro-fertilization, pregnancy diagnosis, sexing of embryos, embryo splitting, cryopreservation of embryo.

References / Textbooks

1. Basic Biotechnology, S. Ignachimuthu. 1995. Tata McGraw Hill Publishers, New Delhi
2. Text book of biotechnology by U.Satyanarayana
3. Animal Biotechnology, P. Ramadas.
4. Animal cell culture, Freshney.
5. Text book of Animal biotechnology by M.M.Ranga
6. Text book of biotechnology by V.Kumaresan
7. Applied Plant biotechnology by N.Arumugam
8. Genetic engineering of animals, (Ed) A. Puhler, l993. VCH publishers Weinheim, FRG
9. https://link.springer.com/article/10.1007/s40502-013-0039-6
10. https://www.microscopemaster.com/cell-culture.html
11. https://www.sciencedirect.com/topics/nursing-and-health-professions/anther-culture
12. https://www.qiagen.com/us/service-and-support/learning-hub/molecular-biology-methods/animal-cell-culture/

Course Outcomes

1. The student will be able to know about basic plant tissue media preparation.
2. The student will be able to understand plant tissue culture techniques.
3. The student will be able to know animal cell media preparation and sterilization.
4. The student will be able to know transgenic animals.
5. The student will be able to understand in vitro fertilization.

CORE PAPER - 9

ENVIRONMENTAL BIOTECHNOLOGY

Course Objectives

1. To understand Ecosystem
2. To understand waste water treatment
3. To understand Biodegradation and xenobiotics
4. To understand Biofuel production
5. To understand Environmental Genetics

UNIT- I

Ecosystem - structure, functions. Energy flow and mineral cycle-C, N, P. Environmental problems -Ozone depletion, Green House Effect, Water, Air, Soil pollution, Land degradation.

UNIT- II

Waste water-Physical, Chemical and biological characteristics. Introduction to water microbiology, Water borne diseases. Waste water treatment - Physical, Chemical and biological. Membrane filtration and Reverse Osmosis. Waste water treatment efficiency assessment.

UNIT- III

Xenobiotics - Xenobiotic compounds, Biodegradation of xenobiotics, Biological detoxification, Hazardous waste management. Mining and metal biotechnology-Copper and Iron, Microbial transformation, accumulation and concentration of metals, Metal leaching - extraction.

UNIT- IV

Bio fuels - Introduction, Production of non-conventional fuels-Methane (Biogas), Hydrogen, Alcohols and algal hydrocarbons. Use of microorganisms in augmentation of petroleum recovery

UNIT- V

Environmental Genetics- Degradation plasmids (TOL), Release of genetically engineered microbes (GEM) in the environment, Impact of GEM in environment, Role of GEM in degradation of industrial pollutants. Bio sensors and microprobes.

References / Textbooks

1. Environmental Biotechnology by1995, S.N. Jogd and Himalaya Publishing.
2. Environmental Biotechnology by S.K.Agarwal, APH Publishing Corporation, 2001.
3. Bio degradation & Bio remediation (1999), Martin Alexander, Academic press
4. Waste water Engineering- Treatment, Disposal and Re use, Metcalf and Eddy. Inc. Tata McGraw Hill, New Delhi.1991
5. Bio remediation engineering, design and application 1995 John's. Cookson, Jr. Mc Graw Hill, Inc.
6. Environmental Biotechnology by A.K. Chatterjee, 2004 Prentice - Hall of India Pvt. Limited.
7. Alan Scragg, Environmental Biotechnology, Longman, 1999.
8. Milton Wain Wright, An Introduction to Environmental Biotechnology, Kluwer Academic Press, 1999.

Course Outcomes

1. The student will be able to know ecosystem
2. The student will be able to know waste water treatment
3. The student will be able to know biodegradation of xenobiotics
4. The student will be able to know biofuel production
5. The student will be able to know environmental genetics

INTERNAL ELECTIVE
PAPER -2
(to choose one out of three)
A. FORENSIC SCIENCE

Objective: To understand and learn the basic knowledge of Forensic Science.

UNIT I:Crime Scenario in India: Introduction to crime and history, Sociological aspects of crime and criminals in society, Types of crime and its causes – property crimes, public order crimes, violent crimes, cyber-crimes.

UNIT II:Forensic Examination of Body and Semen Fluids: Molecular mechanisms for identification of the evidences from the criminal.

UNIT III:Forensic Examination of Hair and Tissue: Molecular mechanisms for identification of the evidences from the criminal.

UNIT IV:Personal Identification: Personal identification techniques as somatoscopy, somatometery, osteometery and craniometery their importance in determination of age and sex.

UNIT V:Instrumentation & Investigation Techniques: Crime Detection Devices – Microscopy –Chromatography – Documents – Ballistics - Fingerprints Examination. New and future technologies - DNA chips - SNPs and limitations of DNA profiling.

Text Books:

1. Dr.Rukmani Krishnamurthy. Introduction to Forensic Science in Crime Investigation.Selective and scientific books publishers and distributors, New Delhi. (2005).

2. Kirby, LT. DNA Fingerprinting Technology. Palgrave Macmillan UK. (2009).

Books for Reference:

1. Richard Saferstein. Criminalistics: An Introduction to Forensic Science, 9th Ed. (2001).

2. Sharma, B.R., Forensic Science in Criminal Investigation and Trial, 4th Ed. (2008).

3. Stern C, Principles of Human Genetics, Freeman, California. (2012).

Course outcome:

- To understand the techniques for identification of the evidences from the criminal.
- To study the personal identification aspects, molecular mechanisms and its application in forensic science.
- It helps to study the sociological aspects, mechanisms and its application in forensic science
- To know about personal identification techniques.
- To understand the molecular identifications.

INTERNAL ELECTIVE
PAPER -2
B. SERICULTURE

Objective: To understand and learn the basic knowledge of silkworm and their technology.

UNIT-I

Sericulture- Introduction, History & Scope, lifecycle of *Bombyx mori*–Egg, Larva, Pupa and Adult. Species of silk worm-Tasar silk, Muga silk &Eri silk.

UNIT-II

Mori culture–Propagation–stem cutting, grafting and layering. Harvesting methods, Preservation of leaves and Medicinal uses of mulberry.

UNIT III

Rearing Facilities-Rearing appliances for rearing- Rearing stand, Ant wells, Rearing tray, Paraffin paper, Foam rubber strips, Chopsticks, appliances for feeding-Feathers, leaf basket, leaf chamber, chopping board, chopping knife,mats,feeding stand. Silk worm rearing– Disinfection, Brushing, maintenance of temperature, Feeding, Bed cleaning, Spacing, Mounting, Moulting and Harvesting.

UNIT-IV

Silk Reeling –Methods of reeling operation –a brief account on Reeling end formation, twisting, drying, reeling, re-reeling and finishing. By products of sericulture.

UNIT-V

Diseases of *Bombyx mori*– Protozoan disease – Pebrine. Bacterial disease –Flacherie. Viral disease –Grasserie. Fungal disease– Muscardine. Pest of Silkworm– Uzi fly.

SUGGESTED BOOKS:

1. Ganga, G. and J.Sulochana Chetty, 2006. An Introduction to sericulture. Oxford and IBH Publishing Co. Pvt .Ltd.

2. An Introduction to Sericulture -G. Ganga and SulochanaChetty.J, (1997) Oxford and IBH Publishing Co. Pvt. Ltd.

3.An Introduction to Sericulture-M.Madan Mohan Rao, (2019) BS Publications Co. Pvt .Ltd.

Course outcome:

CO1: To learn about History of silkworm & their life cycle.

CO2: The students able to understand the propagation methods of mulberry.

CO3: It will be very useful for studying step by step process in rearing technology.

CO4: And to identify the useful by products of sericulture.

CO5: To identify the diseases damage the silkworm.

INTERNAL ELECTIVE
PAPER -2

C.ENTREPRENEURSHIP

Objective: To Understand the concept and process of entrepreneurship - its contribution in and role in the growth and development of individual and the nation

UNIT -I

Entrepreneurship: Concept, Functions and need; Entrepreneurship: Characteristics and Competency ; Relevance of Entrepreneurship to Socio- Economic Gain: generating National Wealth, creating Wage and Self -Employment, Micro, Small and Medium Enterprises ; Process of Entrepreneurship Development – Start-up and its stages

UNIT -II

Types of Entrepreneurs: Competencies and characteristics: Ethical Entrepreneurship; Entrepreneurial Values, Attitudes and Motivation; Mindset of an employee and an entrepreneur difference; Intrapreneur: Importance in any organization

UNIT -III

Acquiring Entrepreneurial Values and Motivation: Entrepreneurial Values, Attitude and Motivation- Meaning and concept; Developing Entrepreneurial Motivation and Competency – concept and process of Achievement Motivation, Self-efficacy, Creativity, Risk Taking, Leadership, communication and Influencing Ability and Planning Action.

UNIT -IV

Entrepreneurship as Innovation and Problem Solving: Entrepreneurs - as problem solvers; Innovations and Entrepreneurial Ventures – Global and Indian ; New Industries of New Age Economy ; Role of Technology – E-commerce and Social Media.

UNIT -V

Entrepreneurial Opportunities and Enterprise Creation: Sensing Entrepreneurial Opportunities. Introduction to Market Dynamics: Understanding a Market ; Competitive Analysis of the Market ;Patents, Trademarks and Copyright

SUGGESTED BOOKS:

1. Entrepreneurial Development – Dr. S. Moharana and Dr. C.R.Dash, Pub. by RBSA Publishers, Jaipur.
2. Entrepreneurship Development – Principles, Policies and Programmes by P. Saravanavel, Publishers Ess Pee Kay Publishing House, Madras
3. Fayolle A (2007) Entrepreneurship and new value creation. Cambridge, Cambridge University Press •
4. Hougaard S. (2005) The business idea. Berlin, Springer
5. Lowe R & S Mariott (2006) Enterprise: Entrepreneurship & Innovation. Burlington, Butterworth Heinemann

Course Outcome:

CO1: Entrepreneurial attitude to the students

CO2: Opportunities available for the entrepreneurial support

CO3: IPR related understanding on the developed products

CO4: Market needs and dynamics both locally and globally

INTERNAL ELECTIVE
PAPER -3
(to choose one out of three)
A. BIOSAFETY, BIOETHICS & IPR

Course Objectives

1. To create awareness regarding safety and ethical issues
2. To know about copy rights aspects of the biotechnological products and process.

UNIT- I

Biosafety - Introduction, biosafety issues in biotechnology, historical background. Primary Containment for Biohazards, Biosafety Levels, Biosafety Levels of Specific Microorganisms.

UNIT- II

Biosafety Guidelines - Biosafety guidelines and regulations - National and International. Definition of GMOs & LMOs. Environmental release of GMOs, Risk Analysis, Assessment, management and communication.

UNIT- III

Bioethics - What is bioethics - legal and socioeconomic impacts of biotechnology, Public education of the process of biotechnology, making ethical concerns of biotechnology research and innovation.

UNIT- IV

Intellectual Property Rights - Intellectual property rights - TRIPS, GATT. International conventions patents and methods of application of patents - Legal implications - Biodiversity and farmer rights

UNIT- V

Patents and patent laws - Objectives of the patent system, Basic principles and general requirements of patent law. Biotechnological inventions and patent law. Legal development - Patentable subjects and protection in biotechnology. The patenting living organisms.

References / Textbooks

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection-Oxford and IBH Publishing Co. New Delhi
2. Hoosetti, B.B.2002. Glimpses of Biodiversity. Daya, New delhi.
3. Ethics in engineering, Martin. M.W. and Schinzinger.R. III Edition, Tata McGraw-Hill, New Delhi. 2003.
4. Senthil Kumar Sadhasivam and Mohammed, Jaabir. 2008. IPR, Biosafety and Biotechnology Management. Jasen Publications, Tiruchirapalli, India.
5. Bare Act, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
6. Journals on Intellectual Property Laws.
7. Bioethics and Health Law Journal (BHL)
8. http://www.cbd.int/biosafety/background.shtml
9. http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section 3.html.

Course Outcomes

1. The student will be able to understand about biosafety
2. The student will be able to learn about the biosafety guidelines
3. The student will be able to understand about bioethics
4. The student will be able to learn about IPR
5. The student will be able to learn about patents and patent law

INTERNAL ELECTIVE
PAPER -3
B. PHARMACEUTICAL BIOTECHNOLOGY

Course Objectives

1. Biotechnology has a long promise to revolutionize the biological sciences and technology.
2. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.
3. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.

UNIT- I

Introduction: Brief introduction to Biotechnology with reference to Pharmaceutical Sciences and pharmacology. History & principle of pharmacology. Drug names & classification systems. Routes of Drug administration, Absorption, Distribution and Metabolism. General principle of drug action - Pharmacokinetics, Pharmacodynamics. Measurement of drug action

UNIT- II

Chemotherapeutic drugs - Protein Synthesis Inhibitors, Anti-Inflammatory, Antibacterial, Antifungal, Antiviral, Antihelminthic, Anticancer Drugs. Genetic recombination and drugs-Development of hybridoma for monoclonal antibodies. Human insulin, HGH, Erythropoietins, IFN, TNF, IL, Clotting factor VIII

UNIT- III

Enzyme immobilization: Techniqes of immobilization, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.

UNIT- IV

Micro-encapsulation: Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying and other techniques, evaluation of micro capsules. Macro capsules: Advantages and disadvantages of capsule dosage form, material for production of hard and soft gelatin capsules.

UNIT- V

Design and Development of Drugs: Drug discovery process: Principles, Techniques and Strategies used in new drug discovery. Regulations for laboratory animal care and ethical requirements. Bioassays: Basic principles of bioassays, official bioassays and experimental models. Pre-clinical and clinical models employed in the screening of new drugs

References / Textbooks

1. R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege, R.R. Satoskar. Pharmacology and Pharmacotherapeutics 20th Revised Edition, Popular Prakashan (P) Ltd (2014)
2. Torchilin, V. P. (2012). Immobilized enzymes in medicine (Vol. 11). Springer Science & Business Media.
3. S.S. Purohit, Kaknani, Saleja Pharmaceutical Biotechnology
4. Handbook of Encapsulation and Controlled Release by Munmaya Mishra first edition CRC Press

5. Pharmaceutical manufacturing handbook production and processes by shayne cox gad, A John Wiley & Sons, Inc., Publication
6. Drugs: From Discovery to Approval by Rick Ng, 3rd Edition, Wiley-Blackwell
7. Research and Reviews: A Journal of Pharmacology
8. The Journal of Pharmacology and Experimental Therapeutics by American society of pharmacology and Experimental Therapeutics
9. The Journal of Pharmacology & Pharmacotherapeutics (JPP), a publication of Phcog.Net, published by Medknow Publications and Media Pvt. Ltd.
10. H.P. Rang, M.M. Pale, J.M. Moore, Churchill Livingston. Pharmacology.
11. N.Murugesh, A concise Text Book of Pharmacology. Sixth edition. Sathya Publishers, Madurai.
12. R.C. Dubey, A Text Book of Biotechnology. S.Chand& Co Ltd, New Delhi.
13. Lynn Wecker, Lynn Crespo, George Dunaway, Carl Faingold and Stephanie Watts. Brody's Human Pharmacology, Elsevier 5th Edition 2010.
14. https://www.healthline.com/health/administration-of-medication#takeaway
15. http://howmed.net/pharmacology/routes-drug-administration/
16. https://www.nature.com/scitable/topicpage/genetic-recombination-514/
17. https://www.fda.gov/patients/drug-development-process/step-1-discovery-and-development
18. https://ebrary.net/18050/environment/application_immobilized_enzymes_pharmaceutical
19. https://wis-wander.weizmann.ac.il/space-physics/immobilized-enzymes-used-pharmaceutical-industry

Course Outcomes

1. The student will be able to learn about Drugs and their action in our body
2. The student will be able to learn about Chemotherapeutic drugs, Genetic recombination and drugs
3. The student will be able to learn about Enzyme immobilization and its application in pharmaceutical industry
4. The student will be able to learn about current trending microencapsulation technique
5. The student will be able to learn about Designing and Development of Drugs

INTERNAL ELECTIVE
PAPER -3

C. HORTICULTURE & LANDSCAPING

Course Objectives:

The course aims to provide a good knowledge on the art of gardening and horticulture - the principle, types and establishment of home gardens.

UNIT - I

Introduction-Importance and scope of horticulture. Classification of horticultural crops -fruits and vegetables. Types of gardens: formal, informal, vertical and roof and kitchen gardens.

UNIT - II

Plant propagation-Plant propagation methods: cutting, layering, budding and grafting. Stock - scion relationship in important horticultural crops. Use of plant growth regulators in horticulture: Induction of rooting, flowering, fruit set, fruit development and control of fruit crops.

UNIT - III

Nursery structures and Garden Practices-Store house, potting and packing shed, nursery beds, mist chamber, propagating frames, hot beds, green house and glass house. Pot culture: Selection of pots, preparation of soil mixture, potting repotting and pot arrangements and watering. Aftercare of plants: weeding, mulching, top dressing methods of pruning, pricking, topiary. landscaping, Plants suitable for hedges and edges

UNIT - IV

Floriculture-Floriculture: cultivation of commercial flowers - Rose, Jasmine and Chrysanthemum. Cut flowers - flower preservation methods, flower arrangement, Ikebana.

UNIT - V

Landscaping-Principles, categories and components of landscaping - Planning designs for residential and non- residential gardens - vertical landscaping-Plants in the landscape - establishment, maintenance of lawns and planting methods of grass.

References / Textbooks

1. Kumar, H.D., 2010. Introduction to Horticulture, Oxford & IBH Publishers, New Delhi.
2. Hariharan, Y. ThottaKalaiyumThottaviyalum (Tamil), BharathidhasanUniversity Publications, Tiruchirappalli.
3. Chadha, 2001. Hand Book of Horticulture, ICAR Publications.
4. EdmentSenn Andrews, 1994. Fundamentals of Horticulture. Tata McGraw Hill publishing Co. Ltd, Delhi.
5. MacMillan H, 1989. A Hand Book of Tropical Plants & Gardening, Anmol Publications,
6. New Delhi.
7. Randhava, G. S., 1973. Ornamental horticulture in India, Today and Tomorrow Printers
8. and Publishers, New Delhi.

9. Yawalkar, K. S., 1961.Vegetables crops of India,Agri-Horticultural Publishing House, Nagpur.
10. Chauhan, D. V. S., 1981.Vegetable Production in India, Ram Prasad Publications, Agra.

Course outcomes:

1. The students will be able to gain knowledge on the horticultural crop propagation techniques, export, import and marketing value of horticultural crops.
2. The students will understand the principles of plant growth, quality, nutritional value, yield and resistance to insects, diseases, and environmental stresses.
3. The students will be able to elucidate the importance of kitchen garden, horticultural crops, gardening and organic farming.
4. The students will acquire knowledge on entrepreneurship related to horticulture.
5. The students will be aware of job opportunities in the fields of horticulture, seed production, fertilizers, landscaping and gardening.

LAB IN GENETIC ENGINEERING

Semester: V& VI

Core Practical-3

1. Isolation of plasmid DNA
2. PCR amplification of marker gene
3. Separation of DNA by agarose gel electrophoresis
4. Restriction digestion of DNA (Optional)

LAB IN INDUSTRIAL BIOTECHNOLOGY

Semester: V & VI

Core Practical-4

1. Isolation of industrially important bacteria
2. Isolation of industrially important fungi (yeast)
3. Immobilization of yeast, microbes and enzyme
4. Microbial Production and estimation of ethanol.

LAB IN PLANT & ANIMAL BIOTECHNOLOGY

Semester: VI

Core Practical-3

1. Plant culture media preparation and sterilization.
2. Explant selection, sterilization and inoculation.
3. Callus culture/ Anther culture
4. Isolation and quantification of DNA in plant tissue by spectrophotometer.
5. Protoplast isolation and culturing.
6. Preparation of animal cell culture media and sterilization.
7. Cell counting and viability. (Optional)

LAB IN ENVIRONMENTAL BIOTECHNOLOGY

Semester: VI

Core Practical-4

1. Estimation of total solids in industrial wastes
2. Analysis of TDS in industrial wastes
3. Estimation of suspended solids in effluent water
4. Determination of COD and BOD in sewage water
5. Analysis of Microbial contamination in air by open plate method

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