MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG - COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc Microbiology
(Choice Based Credit System)
(with effect from the academic year 2016- 2017 onwards)
(44th SCAA meeting held on 30.05.2016)

Sem	Sub 'Pr. No.	Subject status	Subject Title	Hrs/ week	Cre - dits	Marks				
						Maximum			Passing minimum	
						Int.	Ext	Tot.	Ext.	Tot
III	11	Core -7	Research Methodology	6	5	25	75	100	38	50
	12	Core – 8	Medical and Pharmaceutical Microbiology	6	5	25	75	100	38	50
	13	Core – 9	Environmental and Agricultural Microbiology	6	5	25	75	100	38	50
	14	Elective III (Choose any one)	a. Taxonomy of Angiosperms and Ethan botany b. Morphology, Taxonomy & Economic Botany c. Developmental Biology and Evolution d.Horticulture e.Economic Entomology f.Bioinformatics and Biostistics	6	5	25	75	100	38	50
	15	Practical – III (Choose any one)	a.Taxonomy of Angiosperms and Ethan botany b. Morphology, Taxonomy & Economic Botany c. Developmental Biology and Evolution d.Horticulture e.Economic Entomology f.Bioinformatics and Biostistics	6	6	50	50	100	25	50
IV	16	Core -10	Food Microbiology	6	4	25	75	100	38	50
	17	Core – 11	Fermentation And Industrial Microbiology	6	4	25	75	100	38	50
	18	Core – 12	Biotechnology	6	4	25	75	100	38	50
	19	Project	Project	6	6	50	50	100	25	50
	20	Practical - IV	Practical	6	6	50	50	100	25	50

Based on the open elective paper the relevant practicals listed following the open elective theory papers should be merged with the concerned semester practical at last

Research Methodology

Unit: 1

Objectives – principles – types of research approaches – Research process – Criteria of good research – Research and Scientific method – Defining the Research problem – Selecting the problem – Techniques in defining the problem.

Unit: II

Importance and need for research ethics and scientific research - Formulation of hypothesis – Types and characteristics – Hypothesis testing – Procedures.

Unit: III

Designing a research work – Need of research design – Features of a good design – Concepts and different research design – Basic principles of experimental design.

Unit: IV

Interpretation and report writing. Meaning – Techniques and significance of report writing – Steps - Types of report – Oral presentation.

Unit: V

Scientific writing – Characteristics – Logical format for writing thesis and papers – Essential features of abstract, introduction, review of literature, materials and methods, results and discussion. Effective illustration – Tables and figures – Plates – Conclusion and Bibliography – Application of computer in research.

Textbooks recommended:

1. Vijayalekshmi, G. and C. Sivapragasam (2008). Research Methods (Tips and techniques). MJP Publishers, Chennai.
2. Gurumani, N. (2006). Research methodology for Biological Sciences. MJP Publishers, Chennai.

Medical and Pharmaceutical Microbiology .

Unit: I

Etiology, transmission, pathogenesis, clinical manifestation, lab diagnosis, chemotherapy and prophylaxis of respiratory tract infections – upper respiratory tract infections (Streptococcal pharynghgitis, Diphtheria) and lower respiratory tract infections.(Tuberculosis and bacterial pneumonia)- Urinary tract infections - Sexually transmitted infections.(Syphillis, Gonorrhea)- Gastro intestinal infections –(Bacteria-*E.coli*,*Salmonella*sp,*Shigella*sp,*Vibrio*sp, Protozoan-*E.histolytica*-Viral-Rotaviruses).

Unit: II

Studies on central nervous system infections (Bacterial:meningitis and tetanus)-Skin infections (Bacterial:PyogenicStaphylococcal and Streptococcal)-Mycobacterial disease(leprosy) – Vector borne infections (Ricketsial infections) – Protozoa infections (Malaria) – Fungal infections (Dermatophytosis, Candidiasis) – Viral infections (Rabies, Poliomyelitis).

Unit: III

Emerging infectious diseases: Emerging bacterial and viral infections – SARS – Avian – H1N1 influenza –Chikungunya,Dengue, Ebola – Zika

Unit: IV

Pyrogentesting - Sterility and toxicity test – Antimicrobial testing (Kirby- Bauer method) – MICand MBC – Types of disinfectants, antiseptics and sanitizers – Factors influencing the selection of drugs. (Dose, route, toxicity and combined therapy) – Drug resistance in microbes.

Unit: V

Standards of drugs: IP, BP, EP, and USP – sterility testing of parental products (solid and liquid products) - Sterility testing of pharmaceutical products - Sterility testing of sterile surgical device, dressings absorbable, hemostats, surgical ligatures, suture and surgical catgut.

References

1. Ananthanarayanan, R., and Panicker, J. (2000). Text Book of Microbiology. Orient Longmans.
2. Rajan, S. (2007). Medical microbiology. MJP Publisher, Chennai
3. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen and Herold, S. Ginberg, (1990), Microbiology (4th Edition), J.B. Lippincott Company, New York.
4. Prescott L.M. Harley J.P., and Klein D.A (2008). Microbiology (7th Edition). McGraw Hill, New York.
5. Larry MO Kane and Judy Kandel (1996), Microbiology – Essentials and Applications. (2nd Edition).
6. Madigan M.T., (Martinko, J.M., and Parker J., Brock TD. (1997). Biology of Micoorganisms. (8th Edition). Prentice Hall international Inc, London.
7. Mariappan C. and Murugesan A.G., (2010), Pharmaceutical microbiology and quality control theory and techniques. Nalini Publishers, India.
8. Nester, E.W., Roberts, C.V., and Nester, M.T. (1995). Microbiology, A Human Perspective. IWOA, U.S.A.
9. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7th Edition). Tata MoGraw Hill, Publishing Company Ltd, New Delhi.
10. Pelczer Jr., M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology. McGraw Hill, Inc., New York.
11. Stainer R.Y., Ingraham J.L., Wheels M.L., and Painter P.R (1986). General Microbiology, ManoMillan Education Ltd, London.
12. Starr, M.P., Stolp, H., Truper H.C., Ballows, A., and Schegel, H.C. (1991). The Prokaryotes. A Hand Book of Habits, Isolation and Identification of Bacteria, Springer Verlag.
13. Larry Mckane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2nd Edition). McGraw – Hill Inc, New York.
14. Madigan M.T., Martinako, J.M. and Parker J Brock T.D. (1997). Biology of Microorganisms. (8th Edition). Prentice Hall International Inc, London.
15. Nester, E.W., Roberts, C.V., and Nester, M.T. (1995). Microbiology, A Human Perspective. IWOA; U.S.A.
16. P. Saravanan (2006). Virology, MJP Publishers, Chennai.
17. Luria S.E, and Darnel, J.E Jr., Baltimore, D., and Campbell, A. (1978). General Virology, (3rd Edition) John Wiley and Sons, New York.
18. Dimmock – Virology.
19. Rhodes and Van Royen –Text Book of Virology.
20. Biswas and Biswas – An Introduction to Viruses.
21. Ananth Rai – Animal Viruses.
22. Green Wood – Text Book of Virology.
23. Purohit, S.S., Saluja. A.K., and Kakrani. H.N., (2003) Pharmaceutical Microbiology. Student Edition (Publ), Jodhpur.
24. Purohit. S.S., Salujia. A.K., and Kakrani. H.N. (2003). Pharmaceutical Biotechnology. Student Edition (Publ), Jodhpur.
25. Jai, N.K., Pharmaceutical Microbiology.
26. Hugo. W.B. Pharmaceutical Microbiology.

Environmental and Agricultural Microbiology .

Unit I:

Soil microbiology: soil structure and profile – Classification of soil – Physical and Chemical characteristics- Micro flora of various soil types – Quantification of soil micro flora – Factors affecting microbial community in soil – Biogeochemical cycles – Carbon, nitrogen, phosphorus and sulphur cycles).

Unit II:

Aero microbiology: Droplet nuclei – aerosol – Assessment of air quality – Solid and liquid impingement method – Airborne transmission of microbes – Diseases and preventive measures (Bacteria, fungi and viruses).

Unit III:

Aero microbiology: Aquatic environment – Freshwater habitats (ponds – lakes) marine habitats (mangroves, deep sea, hydrothermal vent –Pot ability of water, microbial assessment of water quality – waterborne diseases and control measures – water pollution Eutrophication.

Unit IV:

Rhizosphere effects – R/S ratio – Rhizoplane – Biofertilizers and role in agriculture – Bacterial – (Rhizobium, Azotobacter, Azospirillum and phosphobacteria). Algae (Blue green Algae) – and Fungi (VAM) – Biofertilizers.

Unit V:

Important diseases of horticultural crops – Symptoms – Etiology, lifecycle and management- Bacterial leaf blight of Paddy, Late blight of Potato – Apple scab – stem rust of wheat – Transgenic plants for crop improvement – Biocontrol agents of bacteria, fungi and virus.

Textbooks recommended:

1. Rangasamy. G., and Bagyaraj. D.J. (1996). Agricultural Microbiology. Prentice – Hall of India Pvt Ltd., New Delhi.
2. Atlas, R.M., and Bartha.M. (2003). Microbial Ecology – Fundamentals and applications. Benjamin – Cummings, Menlo Park,California.
3. Talaro, K.P. and Talaro. A (1999). Foundations in Microbiology. WCB Mc Graw Hill New York.
4. Dirk, J. Elasas, V., Trevors, J.T., and Wellington, E.M.H (1997). Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong.
5. Grant W.D. and Long, P.L. (1981). Environmental Microbiology. Blackie Glasgow and, London.
6. Mitchel, R. (1992). Environmental Microbiology Wiley – John Wiley and Sons. Inc. Publications, New York.
7. Vijaya Ramesh, K. (2004). Environmental Microbiology. MJP Publishers, Chennai.
8. Moshrafucidin Ahamed and Basumatary, S.K. (2006). Applied Microbiology MJP Publishers, Chennai.
9. Rajednran. P., and Gunasekaran. P, (2006) Microbial Biormediation. MJP Publishers Chennai.
10. Kalaiselvan, P.T. Arul Pandi. I. (2007). Bioprocess Technology. MJP Publishers, Chennai.
11. Benard D. Davis, Renato Dulbercco, Herman N. Eisen and Harold, S. Ginberg. (1990). Microbiology. (4th Edition). J.B. Lppincott Company, Now York.
12. Prescott. L.M., Harley J.P., and Klein D.A. (2008). Microbiology. (7th Edition McGraw Hill, New York.
13. Larry Mc Kane and Judy Kanel. (1996). Microbiology – Essentialsand Applications. (2nd Edition). McGraw-Hill Inc, New York.
14. Madigan M.T., Martinko. J.M., and Parker J., Brock TD. (1997). Biology of Microorganisms, (8th Edition). Prentice Hall International Inc, London.
15. Nester, E.W., Robeerts, C.V., and Nester, M.T. (1995). Microbiology – A Human Perspective. IWOA, U.S.A.
16. Salle, A.J., (1996). Fundamental Principles of Bacteriology. (7thEdition). Tata McGraw-Hill Publishing Company Ltd, New Delhi.
17. Pelezar Jr., M.J.Chan E.C.S., and Kreig N.R. (1993).Microbiology. McGraw Hill, Inc., New York.
18. Stainer R.Y., Ingraham J.L., Wheelis M.L., and J: Jainter P.R. (1986), General Microbiology. MacMillan Education. Ltd., London).
19. Ec Eldowney S, Hardrsan D.J., Waite D.J., and Waite S. (1993). Pollution: Ecology and Biotreatment – Longman Scientific Technical.
20. Clescri, L.S., Greenberg, A.E. and Eaton, A.D. (1998). StandardMethods for the Examination of Water and Waste Water (20thEdition). American Public Health Association.

21. Gerhardt, P., Murray, RG., Wood, W.A. and Kreig, N.R. (1994). Methods for General and Molecular Bacteriology. ASM, Publications, Washington D.C.
22. Patricia Cunning (1995). Official Methods of Analysis, Vol. I and II, (16th Edition), Arlington, Virginia, USA, AOAL.
23. Richard G. Burus and Howard Slater (1982) Experimental Microbial Ecology, Blackwell Scientific Publishers.
24. Tuffery (1996). Laboratory Animal – An Introduction. (2nd Edition). John Wiley and Sons, New York.
25. Alexander, M. (1971). Microbial Ecology. John Wiley & Sons, Inc., New York.
26. Alexander,M. (1971). Introduction to Soil Microbiology. John Willey & Sons. Inc. New York.
27. Norris, J.R. and Pettipher, G.L. (1987). Essays in Agricultural and Food Microbiology. John Wiley and Sons, Singapore.
28. Harold J. Benson, (1994). Microbiological Applications. Wm.C. Brown Publishers, Melbourne, Australia.
29. James G. Cappucclono (1996). Microbiology. The Benjamin/Cummings Pub. Go., California.
30. Burges, A. and Raw, F. (1967). Soil Biology. Academic Press, London.
31. Vanghan, D. and Malcolm, RE.(1985). Soil Organic Matter and Biological Activity. Martinus Nigh off W. Junk Publishers.
32. Marshal, K.D. (1985). Advances in Microbial Ecology. Plenum Press, New York.
33. Harry Buckman and Nyle C. Bardy. (1960). The nature and Properties of Soil. Eurasia Pub. House (Pvt.) Ltd., New Delhi.
34. Baker, W.C. and Herson, 0.S. (1994). Bioremediation,McGraw Hill Inc., New York.
35. Ernest, W.C. (1982). The Environment of the Deep Sea., Vol. II, J.G. Morin Rubey.
36. Eheinheimer, G. (1977). Microbial Ecology of Brackish Water Environment: Ecological Studies. Vol-25, Springer – Verlag Nerlin Heidellberg, New York.
37. Nybakken, W. (1982). Marine Biology – An Ecological Approach. Ames Harper and Row Publisher, New York.
38. Burns, R.C. and Slater. J.H. (1982). Experimental Microbial Ecology.Blackwell Scientific Pub, Oxford, London.
39. N.S. Subba Rao. 1999. Soil microbiology.
40. R.S. Mehrotra. 1980. Plant pathology. Sata Mc. Graw Hill. Pub Co. Ltd.

TAXONOMY OF ANGIOSPERMS AND ETHANOBOTANY

Unit: I

History and principles of classification: Detailed account of the system of classifications proposed by Bentham & Hooker, Engler&Prantl, Bessey and Cronquist (including merits and demerits). Phylogeny of Angiosperms: Origin, evolution and interrelationship.

Unit: II

Modern trends in classification: Taximetrics, Chemotaxonomy and Biosystematics: Botanical Survey of India (B.S.I) – Organization, function and contribution. National and International Herbaria and Botanical gardens. Taxonomic literature – taxonomic index, monographs and revisions. Bibliographies, catalogues and review serials, periodicals, glossaries, dictionaries, icons and floras.

Unit: III

Plant identification; Methods of Identification, Keys: types of keys; rules for construction of Keys; advantages and disadvantages. Nomenclature: International code of Botanical Nomenclature (ICBN). Typification, Priority, Publication, Author citation and retention, choice and rejection of names, current changes. Taxonomy in relation to Anatomy, floral anatomy, Palynology, Embryology and Cytology.

Unit: IV

A detailed account of the following families and their economic importances: Annonaceae, Capparidaceae, Caryophyllaceae, Portulacaceae, Rhamnaceae, Meliaceae, Sapindaceae, Aizoaceae, Rosaceae and Moringaceae.

Unit: V

Rubiaceae, Boraginaceae, Bignoniaceae, Scrophulariaceae, Chenopodiaceae. Casuarinaceae, Orchidaceae, Commelinaceae, Typhaceae, Alismataceae and Poaceae.

REFERENCES:

1. Davis, P.H. and Heywood, V.M. (1965) Principles of Angiosperm Taxonomy. Oliver and Boyd Edinburgh.
2. Gamble, J.S. and Fisher, L.E.F. (1967) The Flora of the presidency of Madras(Vol. I – III). Botanical Survey of India, Calcutta.

3. Heywood, V.H. (1967) Plant Taxonomy. Edward Arnold, Great Britain.
4. Hutchinson, J. (1973)The families of flowering plants. OxfordUniversity Press, London.
5. Jeffery, C. An Introduction to Plant Taxonomy. J & A Churchill Ltd., London.
6. Lawrence, G.H.M. (1955) The Taxonomy of vascular plants (Vol. I-IV). Central Book Depot, Allahabad.
7. Rendle, A.B. The Classification of flowering plants (Vol. I-II).
8. Singh, V. and Jain, V.K. (1989)Taxonomy of Angiosperms. Rastogi Publication, Meerut.
9. Sivarajan, V.V. (1989) Introduction to principles of plant Taxonomy. Oxford and IBH, New Delhi.
10. Subramaniyam, N.S. (1995) Modern Plant Taxonomy. Vikas Publishing House, New Delhi.

Practical -- III

TAXONOMY OF ANGIOSPERMS AND ETHANOBOTONY

1. Study of simple and complex tissues by using permanent slides.

2. Study of primary structure and sectioning of Dicot stem, Dicot root, Monocot Stem and Monocot root.

3. Anomalous secondary structures- Boerhaavia, Nyctanthes& Types of ovules. (Permanent slides).

4. Stages in Microsporogenesis and megasporogenesis. (DEMO).

MORPHOLOGY, TAXONOMY & ECONOMIC BOTANY

Unit: I

Morphology - Inflorescence - types- racemose, cymose, mixed and special types. Descriptive terminology of flower and floral parts. Fruit-classification. Details of simple ,fleshy,dry dehiscent and dry indehiscent, aggregate and multiple fruits.

Unit: II

Taxonomy:- Binomial nomenclature. Systems of classification-Bentham & Hooker and Engler&Prantl. Merits and Demerits of their systems. Herbarium Techniques.

Unit: III

A detailed study of the following families and their Economic Importance-Annonaceae,Capparidaceae, Tiliaceae, Rutaceae, Anacardiaceae, Leguminosae, (Paplionoideae (Fabaceae) Caesalpinoideae (Caesalpiniaceae) &Mimosoideae (Mimosaceae) Cucurbitaceae, Apiaceae,

Unit: IV

Rubiaceae, &Asteraceae. Apocyanaceae, Asclepiadaceae, Solanceae, Convolvulaceae,Acanthaceae, Verbeneaceae, Amarantaceae, Euphorbiaceae, Orchidaceae, LiliaceaeandGramineae (Poaceae).

REFERENCES:

TAXONOMY

1. Porter, C.L. ( ) : Taxonomy of flowering Plants Eurasia Publishing House, New Delhi.
2. Lawrence, G.H.M. (1953) : Taxonomy of Vascular Plants Oxford & IBH Publishers, New Delhi, Calcutta-823pp., 23
3. Mitra, J.N. (1964) : An Introduction to Systematic botany & Ecology The World Press (P) Ltd., Calcutta –694pp.
4. Jefferey, C. (1968) : An Introduction to Plant Taxonomy J.A. Churchill, London 142pp.,
5. Mathur, R.C. (1970) : Systematic Botany (Angiosperms) Agra Book Stores-Lucknow, Ajmer, Allahabad,Delhi, Kanpur, Meerut, Varanasi – 520pp.
6. Ramaswami, S.N., S.Lakshminarayana&V.Venkateswaralu (1976) : Taxonomy (Systematic Botany) for degree course Maruthi Book Depot, Guntur, Hyderabad 312pp.
7. Narayanaswamy, R.V. & Rao, K.N. (1976) : Outlines of botany S. Viswanathan Printers & Publishers, Chennai-31-983 pp.

8. Singh, V. & D.K. Singh (1983) : Taxonomy of angiosperms Rastogi Publications, Meerut, India-564pp.,
9. Sivarajan V.V. (1993) : Introduction to the Principles of Plant Taxonomyb (2nd Edn.,) (N.K.P. Robson(Ed.,) Oxford & IBH publishing Co., New Delhi-292pp.
10. Gurcharan Singh (1999) : Plant Systematics _Theory & Practice Oxford & IBH Publishing Co., (P)Ltd., New Delhi370pp.
11. Pandey, B.P. (1997) : Taxonomy of Angiosperms S. Chand & Co., (P)Ltd., New Delhi-600pp.
12. Naik, V.N. (1996) : Taxonomy of Angiosperms(9th Edition) Tata McGraw Hill Publishing Co., (P)Ltd., Delhi-304pp.,
13. Vashista, P.C. (1997) : Taxonomy of Angiosperms,S. Chand & Co., New Delhi, Jullunder884pp.,
14. Subramaniyan, N.S. (1999) : Laboratory Manual of Plant Taxonomy (2nd Edition) Tata McGraw Hill Publishing Co., New Delhi-685pp.
15. Jaques, H.E. (1999) : Plant Families-How to know them? Agro Botanical Publishers(India)-Bikaner-174pp.
16. Palaniyappan, S. (2000) :Angiospermgalinvagaippadu (Taxonomy of Angiosperms) V.K. Publishing House, Chennai- 224pp.
17. Mathews, K.M. (1987-90) : Flora of TamilNadu& Carnatic (1-4vols.) Rapinat Herbarium, Trichy.24.
18. Lawrence., G.H.M. ( ): An Introduction to Plant Taxonomy The Central Book Depot, Allahabad.
19. Sharma. O.P. ( ) : Plant Taxonomy Tata McGraw Hill Publishing Co., New Delhi- pp.

ECONOMIC BOTANY

1. Hill.,A.W. (1952) : Economic Botany McGraw Hill Book Co., New York. Pp.,
2. Gupta, S.K.&Kaushik, M.P. (1973) : An Introduction to Economic BotanyK. Nath& Co., Meerut, India-147pp.
3. Verma, V. (1974) : A Text Book of Economic Botany EmkayPublications, New Delhi 236pp.,
4. GovindaPraksh&sharma, S.K. (1975) : Introductory Economic Botany Jai [redacted]196pp.
4. Sambamurthy, A.V.V.S. &Subrahmanyan, N.S. (1989) : A Text Book of Economic Botany Wiley Eastern Ltd., New Delhi, Bangalore, Bombay, Calcutta, Guwahati, Hyderabad, Lucknow, Madras, Pune-875pp.,
5. Sen. S. (1992) : Economic botany New Central Book Agency, Calcutta-240pp.,
6. Ashok Bendre& Ashok Kumar (1998-99) : Economic Botany Rastogi Publications, Meerut, India-274pp.,

Pandey, B.P. (2000) : Economic Botany S. Chand & Co., New Delhi-534pp.,

Practical -- III

MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

1.Description of plants in technical terms.

2.Dissection of vegetative parts of the biodiversity of your area.

3.Floral parts of plants belonging to the availablefamilies.

4.Ten herbarium sheets with common plants shall be submitted during the practical examination.

DEVELOPMENTAL BIOLOGY AND EVOLUTION

Unit: I

Gametogenesis – Spermatogenesis – Cells in seminiferous tubules, spermiogenesis, structure and types of sperm. Oogenesis – Growth of oocyte, vitellogenesis, organization of egg cytoplasm. Polarity and symmetry – Maturation of egg, egg envelops. Types of chordate eggs. Fertilization – External and internal fertilization, sperm – egg interaction, physiological changes in the organization of egg cytoplasm, theories of fertilization.

Unit: II

Cleavage – Patterns of cleavage – radial, spiral and bilateral; Types – meroblastic, holoblastic and superficial Factors affecting cleavage; Chemodifferentiation. Blastulation – Types of blastula – Presumptive organ forming areas in frog and chick – Fate maps. Gastrulation – Gastrulation in frog and chick. Morphogenetic movements – Epiboly, emboly; Organogenesis – Development of eye Organizer concept; Embryonic induction.

Unit: III

Foetal membranes in chick; Placentation in mammals; Concept of test-tube baby; Nuclear transplantation; Factors involved in teratogenesis.

Unit: IV

Chemical origin of life; Lamarckism; Darwinism; de Vries theory of mutation; Modern synthetic theory of evolution.

Unit: V

Mimicry and animal colouration; Species concept; Isolating mechanisms; Evolution of horse; Evolution of man.

REFERENCES:

1. Arumugam.N. 1998. Developmental Biology, Saras Publications, Nagercoil.
2. Balinsky, B.I. 1981. An Introduction to Embryology. W.B. Saunders Company. Philadelphia.
3. Berry.A.K.2007. An Introduction to Embryology, Emkay Publications, New Delhi-51.
4. Verma, P.S. and Agarwal V.K. 2005. Chordate Embryology (Developmental biology) S.Chand& Company Ltd., New Delhi.
6. Arumugam, N. 1989. Organic Evolution –. Saras publication, Nagercoil.

7. Strickberger, M.W. 2000. Evolution. Jones and Bartlett Publishers.

Practical – III
DEVELOPMENTAL BIOLOGY & EVOLUTION

1.Observation of the structure of live spermatozoa of Calotes/Bull.

2.Observation of prepared micro slides to study

a. Egg, cleavage, blastula and yolk plug stage in frog.

b. Egg, 24 hrs, 36 hrs, 48 hrs, 72 hrs and 96 hrs developmental stages in chick.

3. Fossils: Trilobite, Nautilus. Mimicry: Leaf insects, Stick insects, Monarch and Viceroy butterfly.

4.Colouration: Chameleon and Lycodon.

HORTICULTURE

Unit: I

Horticulture :- Importance and scope of Horticulture, Classification of horticultural crops– fruits, vegetables crops, climate, soil, water, nutrition needs of horticultural crops,

Unit: II

Plant propagation methods, cutting, layering, grafting, budding, stock-seion relationship.Use of plant regulators in horticulture .

Unit: III

Garden designs, types of gardens – formal, informal and kitchen garden, units of garden,hedge, border, popiary arches and lawn maintenance. –

Unit: IV

Floriculture, cultivation of commercial flowers – rose and jasmines . Cultivation ofimportant fruit trees – Mangoes and Banana.

Unit: V

Green house, Indoor gardening – Bonsai – flower arrangements – nursery managementand maintenance

REPERENCES :

1. Bose, T.K. & Mukherjee, D. (1972) : Gardening in India Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi-385pp.,
2. Sandhu, M.K. (1989) : plant PropagationWiley Eastern Ltd.,New Delhi, Bangalore, Bombay, Calcutta, Madras, Hyderabad, Pune-287pp.,
3. LexLauries& Victor H. Rice- (1950) : Floriculture – fundamental and practices. McGraw Hill Publishers,
4. N.Y. Kumar , N. (1997) : Introduction to Horticulture Rajalakshmi Publications, Nagercoil, India- (28 Chapters & approx. 300pages)
5. Naik South Indian Fruits and their culture Vardhachary& Co., Madras. Edmond
6. Musser & Andres : Fundamentals of Horticulture McGraw Hill Book Co.,
7. Gardener : Basic Horticulture
8. Mac Millan, N.Y. Randhawa : Ornamental Horticulture in India Today & Tomorrow Publishers, New Delhi Sundararajan,

J.S. Muthuswamy, J. : A guide to horticulture Shanmugavelu, K.G. Balakrishnan, R. Thiruvenkadam Printers, Coimbatore

Practical -- III

HORTICULTURE

1. Identification of common, ornamental plants

2. Types of pots and containers.

3. Manures and fertilizers,insecticides, fungicides and plant growth regulators.

4. Field visit to collect the data of Horticulture

5. Preparation of bonsai.

ECONOMIC ENTOMOLOGY

Unit: I

Classification of familiar pest and beneficial insects up to orders and their diagnostic characters.

Unit: II

Destructive insects: -Bionomics and life cycle of the common pests of paddy and coconut. Common pests of brinjal – pests of stored products.

Unit: III

Insect pest management: Insect pest control- Natural ; applied –mechanical, culturalcontrol,chemical control and Biological control. Integrated pest management.

Unit: IV

House hold insect pests: Mosquito, cockroach, housefly, termites – damages caused and their control measures.

Unit: V

Beneficial insects:

1. Economic importance of honey bee, silkworm and lac insect.

Insects as pollinators, predators, parasites, weed killers, soil builders and scavengers.

REFERENCES:

1. Chapman R.F., 1993. The Insects. Structure and Funcations. ELBS., London.
2. Chandler A.C. and Read C.P. 1961. Introduction to Parasitology. John Wiley and Sons, New York.
3. David, B.V., Muralirangan, N.C. and MeeraMuralirangan. 1992. Harmful and beneficial Insects. Popular Book Depot.
4. David, B.V. and T. Kumaraswami. 1998. Elements of Economic Entomology. Popular Book Depot, Madras.
5. David, B.V. 1992. Pest management and pesticides: Indian Scenario, Namrutha publications.
6. Krishnan, N.T., 1993. Economic Entomology. JJ. Publications, Madurai.
7. Mani, M.S., 1973. General Entomology. Oxford & IBH.
8. Nayar, K.K., Ananthakrishnan T.N. and David, V.D. 1990. General and applied Entomology. Tata Mc Craw Hill, New Delhi.
9. RamakrishnanAyyar, T.V., 1984. Handbook of Economic Entomology for South India. International Books and Periodicals Supply Service, New Delhi.

Shukla.G.S& V.B.Upadhyay,1998. Economic Zoology,Rastogi Publication, Meerut

Practical - III

ECONOMIC ENTOMOLOGY

1. Collection and preservation of common insects
2. Insect metamorphosis
3. Life cycle of mulberry silkworm
4. Bioinsecticides

BIOINFORMATICS AND BIOSTATISTICS

Unit: I

Biology in the computer age: Computational Approaches to Biological questions. Basics of computers – servers,workstations, operating systems, Unix, Linux. World Wide Web. Search engines,finding scientific articles - Pubmed – public biological databases.

Unit: II

GenomicsSequence analysis – Sequencing genomes – sequence assembly – pairwise sequence comparison - geneome on the web – annotating and analysing genome sequences.Genbank – sequence queries against biological databases – BLAST and FASTA–multifunctional tools for sequence analysis. Multiple sequence alignments,Phylogenetic alignment – profiles and motifs.

Unit: III

ProteomicsProtein Data Bank, Swiss-prot - biochemical pathway databases -Predicting Protein structure and function from sequence – Determination of structure – featuredetection – secondary structure prediction – predicting 3 D structure – proteinmodeling.

Unit: IV

Biostatistics IIntroduction – Population and sample – Variables – Collection and presentation of data – Descriptive statistics - Measures of Central tendency – mean (arithmetic,harmonic & geometric) median and mode – Measures of dispersion – range, meandeviation, variance & standard deviation, Skewness and Kurtosis.

Unit: V

Biostatistics IIInferential statistics – Probability and distributions – Poisson, Binomial and Normal distribution – Chi-square test – Hypothesis test - Student’s t-test –Correlation and Regression – ANOVA.

REFERENCES:

1. W.J. Ewens, Gregory Grant,(2005). Statistical Methods in Bioinformatics: An Introduction (Statistics for Biology & Health), Springer
2. Bryan Bergeron,(2003).Bioinformatics Computing First Indian Edition, Prentice Hall,
3. Cynthia Gibas & Per Jambeck (2001). Developing Bioinformatics Computer Skills: Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai
4. HH Rashidi & LK Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London
5. Des Higgins & Willie Taylor (2002). Bioinformatics: Sequence, structure and databanks, Oxford University Press
6. Baxevanis AD & Ouellette BEF (2001) Bioinformatics: A practical guide to the analysis of genes and proteins, Wiley Interscience – New York
7. Arora PN & Malhon PK (1996). Biostatistics Imalaya Publishing House, Mumbai.
8. Sokal & Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
9. Stanton A & Clantz, Primer of Biostatistics — The McGraw Hill Inc., New York.

Gurumani.N. (2006). Research Methodology for Biological Sciences. MJP Publishers, Chennai.

Practical - III

BIOINFORMATICS AND BIOSTATISTICS

1. Perform pairwise sequence alignment for a set of two analogous proteins – Demonstration.

2. Sequence similarity search using NCBI-BLAST tool – Demonstration

3. Construction of graph and bar diagram.

4. Calculation of mean, median, mode, standard deviation and standard error Chi-Square

PRACTICAL – III

1. Transformation in *E.coli*
2. Conjugation in *E.coli*-Uninterrupted and interrupted
3. Isolation of auxotrophic mutants.
4. Checking for antibiotic markers.
5. Collection and transport of clinical specimens-methodology and media.
6. Bacteriological analysis of the following specimens.
    a) Urine
    b) Faeces
    c) Pus
    d) Sputum
    e) Ear
    f) Throat
    g) Wound swabs
7. WIDAL test: Qualitative and quantitative
8. Antibiotic sensitivity test – Kirby – Bauer disc diffusion method.
9. Estimation of dissolved oxygen.
10. Determination of BOD value.
11. Determination of COD.
12. Microbiological examination of water portability by (i) MPN method
    (ii) Membrane filter method (Demo)
13. Microbial sampling of air
14. Population assay of extra cellular enzyme activities (amylase, cellulase and lipase).
15. Microbial flora from different types – population study.
16. Isolation of Rhizobium from root modules.
17. Study of Mycorrhizae in roots of crop plants
18. Isolation of *Azotobacter* and *Azospirilium* from soil samples.
19. Plant describes tobacco mosaic bacterial blight powdery mildew and citrus canker.
20. Isolation and testing of antagonistic microorganisms from soil.

Based on the open elective paper the relevant practicals listed following the open elective theory papers should be merged with the concerned semester practical at last

Laboratory Manuals recommended:

1. Cappuccino. J.G., and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins. New York.
2. Kannan. N (1996), Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. Gunasekaran. P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005), Microbiology – Laboratory Manual. (1st Edition), Pubin Sundararaj. A, Chennai.
5. Jayaraman, J. (1985) Laboratory Manual in Biochemistry. Willey Eastern Ltd., New Delhi.
6. Plummer D.T. (1998). An introduction to Practical Biochemistry Tata McGraw Hill, NewDelhi.
7. Palanivelu.P. Analytical. Biochemistry and Separation Techniques.
8. Benson (2002). Microbiological Applications – Laboratory Manual in General Microbiology. International Edition, McGraw Hill Higher Education.
9. Collins, C.R. and Lyne. P.M. (1976). Microbiological Methods (4th edition), Butterworths, London.
10. Dubey. R.C. and Maheswari O.K. (2002). Practical Microbiology. S.Chand and Co Ltd., New Delhi.
11. Baron E.L and Finegold S.M. (1995). Diagnostic Microbiology, Stack well Scientific Press.
12. Davis. L, M.D. and Battey J.F. (1986) Basic methods in Molecular Biology. Elsevier, Amsterdam.

Food Microbiology .

Unit: I

Concept and scope of food microbiology – Food composition – Types and microorganisms in food materials. (Bacteria Mold, and Yeasts) – Factors influencing microbial growth in food. Extrinsic and intrinsic factors. (Nutrient content, p^H, buffering capacity, redox potential, relative humidity.

Unit: II

Contamination and its sources. Spoilage of foods and its classification Principles of food preservation. (Temperature – Dehydration – Osmotic pressure – Chemicals – Radiation). Contamination, spoilage and preservation of Cereals – Vegetables – fruits – Seafood's – Meat – Milk and poultry products. Canning and food additives.

Unit: III

Food vorne infections an dintoxications of Brucella, Bacillus, Clostridium, E. coli, Listeria, Salmonella, Shigella, Staphylococcus, Vibrio, Yersinia – Fungal toxins.

Unit: IV

Fermented foods – br5ead – Cheese – Vingear – Dairy products – Oriental fermented foods – fermented beverages (Beer and Wine) –Genetically engineered foods.

Unit: V

Food produced by microbes – microbial cells as food – SCP (Spirulina and Chlorella) – Mushroom cultivation – Laboratory testing procedures – Food controlling agencies and its regulations. Plant sanitations – Employees health and preventive measures.

Textbooks recommended:

1. Adams, M.R. and Moses, M.O. (1995). Food Microbiology. The Royal Society of Chemistry, Cambridge.
2. Frazier, W.C. and Westhoff, D.C. (2008). Food Microbiology. (4^{th} edition). Tata McGraw Hill Publishing Co Ltd., New Delhi.
3. Jay, J.M. (1987), Modern Food Microbiology. CBS Publishers and Distributors, New Delhi.
4. Atlas, R.M (1989). Microbiology. Fundamentals and Applications Macmillian Publishing Company.
5. Banwart, G.J. (1989). Basic Food Microbiology. Chapman & Hall New York.

6. Board, RC. (1983). A Modern Introduction to Food Microbiology. Blackwell Scientific Publications, Oxford.
7. Robinson, RK (1990). Dairy Microbiology. Elsevier Applied Science, London.
8. Hobbs. B.C. and Roberts, D. (1993). Food Poising and Food Hygiene. Edward Arnold (A Division of Hodder and Stoughton), London.
9. Robinson, R.K. (1990). Dairy Microbiology. Elsevier Applied Sciences London.
10. Vijaya Ramesh, K., (2007). Food Microbiology. MJP Publishers, Chennai.
11. Kharatyan, S.G. (1978). Microbes as Food for Humans. Annual forMicrobial, 32: 301-30).
12. Sudhir Andrews (2008). Food and Beverage Management. McGraw Hill Companies, NewDelhi.
13. Neelam Khetarpaul (2006). Food Microbiology. Daya Publishing House, New Delhi.
14. S.N.Tripathy (2006). Food Biotechnology. Dominant Publishers and Distributors, New Delhi.

References:

1. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen and Harold, S. Ginsberg. (1990). Microbiology. (4th Edition). J.B. Lippincott Company, New York.
2. Prescott LM., Harley J.P., and Klein D.A., (2008). Microbiology. (7th Edition). McGraw Hill, New York.
3. Larry Mc Kane and Judy Kandel (1996). Microbiology Essentials and Applications. (2nd Edition). McGraw – Hill Inc, New York.
4. Madigan M., T., (Martinko. J.M., and Parker J., Brock TO. (1997) Biology of Microorganisms. (8th Edition). Prentice Hall International Inc, London.
5. Nester, E.W., Roberts, C.V., and Nester, M.T. (1995). Microbiology – A Human Perspective. IWOA, U.S.A.
6. Salle, A.J., (1996). Fundamental Principles of Bacteriology, (7thEdition). Tata McGraw-Hili Publishing Company Ltd, New Delhi.
7. Pelezar Jr., M.J.Chan E.C.S., and Kreig N.R (1993). Microbiology, McGraw Hill, Inc., New York.
8. Stainer RY., Ingraham J.L., Wheelis M.L., and Painter: P.R.(1986). General Microbiology, MacMillan Education Ltd., London.
9. Tortora, Funke,Case Addison (2001), Microbiology – AnIntroduction. (7th Edition). Wesley Longman Inc.
10. Dubey R.C., and Maheswari, S. (2003) A Text Book of Microbiology.S. Chand, & Co, New Delhi.
11. John L. Ingraham and Catherine A Ingrahani. (2000) Introduction to Microbiology. Books/Cole Thomas Learning, New York.
12. Talaro. P., and Talaro. A (1999). Foundations in Microbiology. WCP McGraw – Hill, New York.

Fermentation and Industrial Microbiology .

Unit: I

Concepts and historical development of Industrial microbiology. Industrial microbes & products. Growth and product formation in industrial process. Types of processing: upstream and down stream. Screening: primary and secondary. Preservation of microbes and its types. Strain improvement. Culture collection. Media: significance, types & components. Raw materials in industrial fermentation: molasses, cellulose, corn steep liquor, soybean meal and malt extract. Role of agroindustrial wastes in media preparation. Industrial sterilization of equipment, production media and air.

Unit: II

Microbial growth kinetics. Stages of fermentation. Scale up of fermentation. Inoculum development for large scale. Inoculum development and production media. Fermenter and bioreactor: Principle and factors involved in fermentor design. Basic components and functions of fermenter.

Unit: III

Fermenter types: size: Lab, pilot scale& industrial fermentor, process: submerged and solid state. Nature: Continuous reactor, plug flow reactor, air-driven column reactors, bubble column , air lift bioreactor, fluidized bed reactor, tower fermentor and shake flask fermentor. Process control in fermentation: aeration, oxygen delivery system, foam control, temperature, pH, agitation and operation. Role of computer in process control.

Unit: IV

Down stream processing: Stages: Removal of insoluble, product isolation, purification and polishing and technologies involved. An overview on the process, types limitations and applications of filtration, flocculation, sedimentation, gravity settling, cell disruption,centrifugation, solvent extraction, precipitation, membrane processing, whole broth processing, chromatography, drying, crystallization and lyophilization.

Unit: V

Industrial products produced by microorganisms. Enzymes (Amylase, protease), organic acids (Vinegar). Solvent (Ethyl alcohol, butane diol). Amino acids (L- Lysine, L – Glutamic acid). Production of antibiotics (Penicillin, streptomycin). Vitamins (B_{12}). Beverages (Beer, wine). Yeast (Baker's, brewer and food and feed yeast production). Immobilization: principle, types, significance and applications.

Textbooks recommended:

1. Reed.G. (Editor), Industrial Microbiology, CBS Publishers, AVI Publishing Company.
2. Demain. A.L., and Soloman N.A. (1986). Manual of IndustrialMicrobiology and Biotechnology.
3. Hershnergy. CL.Queener. S.W. and Hegeman. Q Genetics and Biotechnology of Industrial Micoorganisms. ASM Press. USA.
4. Stanbury, P.F.A., Whitaker and .Hal. S.J. (1995). Principles of Fermentation Technology. (2^{nd} Edition). Pergamon, U.K.
5. Casida. L.E (1989). Industrial Microbiology. Willey Eastern Limited, New Delhi.
6. Waif Crueger and Anneliese Crueger. (2002). Biotechnology – A Text Book of Industrial Microbiology. Sinauer Associates Inc. Laderiand, USA.
7. Ward, O.P.(1998). Fermentation Biotechnology – Principles, Processand Products.
8. Jackson. A.T. Process Engineering in Biotechnology.
9. Nielson & Villadson. Bioreaction Engineering Principles.
10. Prescott & Dunn. (1992). Industrial Microbiology. (4^{th} Edition).
11. Glazer & Nikaido (1998). Microbial Biotechnology.
12. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen and Harold, S.
13. Ginsberg. (1990). Microbiology. (4^{th} Edition). J.B.Lippincott company, NewYork.
14. Kalaiselvan, P.T., ArulpandLI. (2007). Bioprocess Technology. MJPPublishers, Chennai.
15. Hershnergy C.L., Queenersw and Hegemanq (1998), Genetics and Biotechnology of Industrial Microorganism. ASM Press. USA.
16. Peppler, H.J., and Perlman, D. (1979). Microbial Technology. Vol and Academic Press.

References:

1. Prescott L.M., Harley J.P., and Klein D.A (2008). Microbiology. (7th Edition). McGraw Hill, New York.
2. Larry Mc Kane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2nd Edition). McGraw-Hill Inc, New York.
3. Madigan M., T martinko. J.M., and Parker J., Brock T.D. (1997). Biology of Microorganisms. (8th Edition). Prentice Hall International Inc, London.
4. Nester, E.W., Roberts, C.V., and Nester, M.T.(1995). Microbiology -A Human Perspective. IWOA, U.S.A.
5. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7th Edition). Tata McGraw Hill Publishing Company Ltd, New Delhi.
6. Pelezar Jr; M.J.Chan E.C.S., and Kreig N.R. (1993). Microbiology McGraw Hill, Inc, New York.
7. Stainer R.Y., Ingraham J.L., Wheelis M.L, And Painter P.R(1986). General Microbiology, MacMillan Education Ltd., London.
8. Starr, M.P., Stolp, H., Truper, H.C., Balows, A., and Schegel, H.C. (1991). The Prokaryotes. A Hand Book of Habitats, Isolation and Identification of Bacteria, Springer Verlag.
9. Tortora, Funke, Case Addison (2001), Microbiology – An Introduction (7th Edition). Wesiey Longman Inc.
10. Dubey R.C., and Miaheswari, S. (2003) A Tex Book of Microbiology. S.Chand & Co, NewDelhi.
11. John L. Ingraham and Catherine A Ingrahani (2000) Introduction to Microbiology. Books/ Cole. Thomas Learning, New York.
12. Talaro K.P., and Talaro. A. (1999).Foundations in Microbiology. WCP McGraw – Hill New York.

BIOTECHNOLOGY .

Unit: I

Definition, Concepts –History of biotechnology - Basic tools and techniques of rDNA Technology – Restriction enzymes Types I, II, and III - Modifying enzymes – Ligases – Isoshizomers – Isolation of fragments with cohesive end and blunt end – Homopolymer tailing – Isolation of nucleic acids, DNA sequencing – Maxmam Gilbert – Dideoxy and automation methods – PCR-Southern and northern blotting – DNA finger printing – RFLP – RAPD- AFLP and QTLS.

Unit: II

Cloning vectors – Derived bacterial plasmid vectors – Properties – Isolation – Special Vectors – Phage vectors – Cosmids, phasmids, M_{13} and Mu phage – Yeast cloning vectors.

Unit: III

Screening procedures – Cloning strategies – DNA hybridization, immunological assay, protein activity –Isolation of cloned genes – Gene libraries – Identification of recombinants, structural and functional analysis of recombinants in bacteria and yeast.

Unit: IV

Application of recombinant DNA technology – Genetic engineering of plants – Plant transformation, Ti plasmids, derived vectors. Physical methods of gene transfer in plants – Reporter genes in transformed cells. Developing plant strains by genetic engineering – insecticide – herbicide –viral resistant plants - Stress and senescence tolerance - flower pigmentation - plant products.

Unit: V

Transgenic animals – Transgenic mice, methodology – Direct gene transfer – Retroviral vector transfer – EEE method and application - Development and use of transgenic cattle sheep, goat, pigs, birds and fish.

Textbooks recommended:

1. Brown. T.A (1999). Gene Cloning. (3rd Edition). Chapman and Hall publications, USA.
2. Burrel, M.M. (1993). Enzymes of Molecular Biology. Humana Press.
3. Chirikiian, J.G. (1995), Biotechnology – Theory and Techniques. Vol. II, Jone and Burtlett Publishers.
4. Gerhardt, P., Murray, R.G., Wood W.A., and Kreig, N.R. (1994)Methods for General and Molecular Bacteriology. ASM Press, Washington D.C.
5. Glick, B.R. and Pasternak, J.J. (1998) – Molecular BiotechnologyPrinciples and applications of Recombinant DNA. ASM Press, Washington D.C.
6. Cafferty, M.C., J., Hoogenboom, H.R. and Chiswell, D.J. (1996) Antibody Engineering – A Practical Approach, Oxford University Press.
7. Lewin, B.(2000). Genes VII. Oxford University Press, Oxford.
8. Murray Moo Young (1992). Plant Biotechnology. Pergamon Press.
9. Radleadge, C., and Kristiansen, B. (2001). Basic Biotechnology. (2nd Edition) Cambridge University Press.
10. BIOTOC-Biotechnology (1993). Techniques for Engineering Genes, Published on behalf of Open Universitat and University of Greewnwhich, Butter Heinman Ltd, Oxford.
11. Water G. and Headon D. (1994). Frotein Biotechnology. John Wileyand Sons, New York.
12. Mariappan C.A., text book of molecular biotechnology. Pooja Publishers India.
13. Winnacker, E.L. (1987). From Genes to Clones: Introduction to GeneTechnology. VCH Publication Federal Republic of Germany.
14. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, RC. and Miller, J.H. (2002). Modern Genetic Analysis., Integrating Genes andGenomes. (2nd Edition). WH Freeman and Company, New York.
15. Blackburn, G.M. and Gait, M.J. (1996). Nucleic Acids in Chemistry and Biology. Oxford University Press.
16. Alberts, B.Brag, D., Lewis, J., Raff, M., Roberts, K., and Watson. J.D(1994). Molecular Biology of Cell. Garland Publ Inc.
17. Malacinskl G.M., and Freifelder. D. (1998). Essentials of Molecular Biology. Jones and Bartlett Publ.
18. Maloy, SR., Cronan, JR. Freifelder, D. (1994). Microbial Genetics. Jones and Bartlett Publ.
19. Macinski, G.M. and' Freifelder, D. (1998). Essentials of Molecular Biology. (3rd Edition). John Bartlett Publishers.
20. Sir John Kendrew (1994). The Encyclopedia of Molecular Biology. Blackwell Science Ltd.
21. Swaminathan. M.S.and Jana.S. (1992). Bio-diversity. Implications for Global Food Security. Mac Millan, Madras.
22. Rigby. P.W.J. (Editor). 1987.Genetic Engineering. 6th Academic Press, London.
23. Wiseman. A. (1983). Principles of Biotechnology. Chapman and Hall, New York.
24. Gupta. P.K. (1996). Elements Biotechnology. Chapman and Hall, New York.

25. Michael Boylan and Kevin. E.Brown (2003). Genetic EngineeringPearsonEducation (Singapore) Pvt Ltd., NewDelhi.
26. Mukbesh Pasupuleti (2006). Molecular Biotechnology. S. Chand and Co Ltd., New Delhi.
27. Dubey. R.C. (1996). A Text Book of Biotechnology. S. Chand and Co Ltd., New Delhi.
28. Das.H.K. (2005). Text Book of Biotechnology. Wiley Dreamtech India (P) Ltd., New Delhi.
29. Cheremisinoff. P.N. (1985). Biotechnology – Applications and Research Technomic Pub.Co.Inc. Lancaster, USA.
30. Sathyanarayana…U.(2005). Biotechnology. Books and Allied (P)., Kolkatta.
31. Peppler, H.J., and Rer/man, D. (1979). Microbial Technology. Vol I and II, Academic Press.

References:

1. Desmona.S.T., Nicholl. (19.94). An Introduction to Genetic Engineering Cambridge Press.
2. Anand Solomon. K.(2008). Molecular Modeling' and Drug. Design. MJP Publishers, Chennai.
3. Susa R. Barnum (2002) Monoclonal Antibodies. MJP Publishers, Chennai.
4. Nisonoff.A(1985). Introduction to Molecular (1) munology. (2nd Edition Sundarland, Mass.)
5. Zaltin. M., Day. P and Hollaender A. (1983). Biotechnology in Plant Sciences Relevant to Agriculture, Academic Press. London.

PROJECT .

To plan and design an appropriate viable project and statistically apply the data wherever possible and process it accordingly after the correct retrieval of relevant literature and fixation of an organized plan of work. The research project should be supported with figures, tabulations, plates and photographs along with necessitated bibliography.

The project work may be done either in the department itself or in collaboration with any other organization of advanced learning.

The final project report should be submitted to the head of the course department 15 days before the university prescribed date. The project report shall contain atleast 35 pages excluding bibliography and appendices. Each student will have to submit THREE copies of his / her project for evaluation in the fourth semester itself.

PRACTICAL – IV

1. Standard plate count of milk
2. Microbiological examination of milk
   i) Methylene blue reduction test
   ii) Rezaurin test
   iii) Phosphatase test
3. Microbiology of fermentation milk products
   i) Curd
4. Microbiological analysis of foods
   i) Soft drinks
   ii) Meat and fish
   iii) Fruits and Vegetables
   iv) Salted and dried foods
   v) Bread
5. Production of enzymes by batch fermentation (Protease and Amylase).
6. Purification of extracellular enzymes
   I. Enzyme precipitation – Ammonium sulphate and Acetone.
   II. Dialysis of crude enzymes.
   III. Ion-exchange chromatography - Demonstration.
7. Enzymes and Whole cell Immobilization.
8. Fermentative production of ethyl alcohol by yeast.
9. Wine production - Demonstration.
10. Solid-state fermentation - Demonstration.
11. Production – extraction and purification of any antibiotic (Demo).
12. Preparation of fermented product-yogurt from milk
13. Restriction enzyme Digestion with Labeled DNA – Lambda phage DNA (Demo).
14. Blue white selection with IPTG- Demonstration.
15. Cloning by desired vector – pBR322 - Demonstration.

PROJECT .

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Laboratory Manuals recommended:

1. Cappuccino.J.C:7 and Sherman. N. (196). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palani Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sundararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. Mc Graw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4tyh edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology. Elseiver, Amsterdam