BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.
B.Sc. Microbiology – Course Structure under CBCS
(For the candidates admitted from the academic year 2010-2011 onwards)

Semester	Part	Course	Title	Instru Hours/ Week	Credit	Exam Hours	Marks		Total
							Int.	Extn.	
I	I	Language Course – I (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - I (ELC)		6	3	3	25	75	100
	III	Core Course – I (CC)	Fundamentals of Microbiology	6	5	3	25	75	100
		Core Course – II (CC)	Practicals Pertaining CCI & CCIII	3		***	-	-	
		First Allied Course –I (AC)	Biochemistry I - Theory	6	4	3	25	75	100
		First Allied Course – II (AC)	Biochemistry - Practical	3		***	-	-	
				30	15				400
II	I	Language Course – II (LC) - Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – II (ELC)		6	3	3	25	75	100
	III	Core Course – II (CC)	Practicals Pertaining CCI & CCIII	3	4	3	40	60	100
		Core Course – III (CC)	Microbial Metabolism	4	4	3	25	75	100
		First Allied Course – II (AC)	Biochemistry - Practicals:	3	2	3	40	60	100
		First Allied Course – III (AC)	Biochemistry II - Theory	4	4	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	IV	Value Education		2	2	3	25	75	100
				30	24				800
III	I	Language Course – III (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - III (ELC)		6	3	3	25	75	100
	III	Core Course – IV (CC)	Introductory Virology	5	4	3	25	75	100
		Core Course – V (CC)	Practicals Pertaining CCIV & CCVI	3	-	***	-	-	-
		Second Allied Course – I (AC)	Biostatistics – Theory	**5**	4	3	25	75	100
		Second Allied Course– II (AC)	Practicals: Biostatistics	3	-	***	-	-	-
		Non Major Elective I - for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Mushroom Technology	2	2	3	25	75	100
				30	16				500
IV	I	Language Course –IV (LC) - Tamil*/Other Languages ** #		6	3	3	25	75	100

	II	English Language Course – IV (ELC)		6	3	3	25	75	100
	III	Core Course – V (CC)	Practicals Pertaining CCIV & CCVI	3	4	3	40	60	100
		Core Course – VI (CC)	Immunology	4	4	3	25	75	100
		Second Allied Course - II	Practicals: Biostatistics	3	2	3	40	60	100
		Second Allied Course – III	Computer Application in Biology - Theory	4	4	3	25	75	100
	IV	Non Major Elective II - for those who studied Tamil under Part I I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Microbial Diseases	2	2	3	25	75	100
		Skill Based Elective I		2	**4**	3	25	75	100
				30	**26**				800
V	III	Core Course – VII (CC)	Medical Microbiology	3	4	3	25	75	100
		Core Course – VIII (CC)	Agricultural and Environmental Microbiology	4	4	3	25	75	100
		Core Course – IX (CC)	Microbial Genetics	4	4	3	25	75	100
		Core Course – X (CC)	Practical Pertaining CCVII, CCVIII, CCIX	5	4	3	40	60	100
		Major based Elective – I	Bio ethics	5	5	3	25	75	100
		Major based Elective – II	Bio inoculants	5	5	3	25	75	100
	IV	Skill based Elective –II		2	**4**	3	25	75	100
		Skill based Elective – III		2	**4**	3	25	75	100
				30	**34**				800
VI	III	Core Course – XI (CC)	Molecular Biology	**6**	5	3	25	75	100
		Core Course – XII (CC)	Industrial Microbiology	**6**	5	3	25	75	100
		Core Course – XIII (CC)	Microbial Biotechnology	**6**	5	3	25	75	100
		Core Course – XIV (CC)	Practical Pertaining CCXI, CCXII, CCXIII	6	4	3	40	60	100
		Major based Elective III	Food Microbiology	**5**	4	3	25	75	100
	IV	Extension activities			1				
		Gender Studies		1	1	3	25	75	100
				30	25				600
			Total	180	140				3900

* for those who studied Tamil upto +2 (Regular Stream)

** Syllabus for other Languages should be on par with Tamil at Degree level

those who studied Tamil upto 10^{th} or +2, but opt for other languages in degree level under Part I should study special Tamil in Part IV

*** Examination at the end of the next semester.

Extension activities shall be out side the instruction hours.

கற்பிக்கும் கால அளவு

மொழிப் பாடங்கள் - 1 மதிப்பீடு = 2 மணிநேரம் கற்பித்தல் வகுப்பு

கலை மற்றும் அறிவியல் பாடங்கள்: 1 மதிப்பீடு = 1 மணிநேரம் கற்பித்தல் வகுப்பு [Lecture]

= 2 மணிநேரம் பயிற்சி வகுப்பு [Tutorial]

= 2-3 மணிநேரம் செய்முறை வகுப்பு [Practical]

Core Course I – Fundamentals of Microbiology

Unit – I

Introduction – Definition, scope and history of microbiology. Difference between the prokaryotic and eukaryotic microorganisms. Classification of microorganisms – general principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept. Classification and characterization of bacteria according to Bergey's Manual of Systematic Bacteriology (9th edition). Basic understanding of classification of viruses, algae, fiungi and protozoa.

Unit – II

Microscopy: Principles and applications of simple, compound, bright field, dark field, phase contrast, fluorescent and electron microbiology. Principles of staining : Nature of dyes, types of staining – simple, differential, negative and spore staining, Sterilization : Principles and methods – physical (moist heat, dry heat, filtration, pasteurization, tyndallization, radiations) and chemical (alcohols, aldehydes, phenols, halogens and hypochlorites).

Unit – III

General characteristics and nature of Archaebacteria, Eubacteria, Cyanobacteria, Mycoplasmas, Rickettsiae, Chlamydias, Spirochaetes, Actinomycetes, Protozoa, Algae, Fungi and Viruses.

Unit – IV

Microbial cell : Ultrastructure of bacteria, subcellular structures and cell envelope – slime, capsule, cell wall, pili, flagella, cell inclusions, biosynthesis of bacterial cell wall, cell membrane – Biomembrane, liposomes – membrane transport – diffusion, active and passive transport and osmoregulation.

Unit – V

Culture techniques: Types of media simple, defined, enriched and transport media with specific examples for each type. Methods of maintenance and preservation of microbes.

Reference:

Constantine J. Alexopoulus and Charles W.Mims.(1993). Introductory Mycology(3rd edition).Wiley Eastern Ltd, New Delhi.

Elizabeth Moore-Landecker.(1996). Fundamentals of the fungi.(4th edition).Prentice Hall International, Inc, London.

Gerhardt. P. Murray R. Ce., Wood W.A., and Kreig N.R.(edtr.) (1994). Methods for General and Molecular Bacteriology – American Society for Microbiology, Wasington D.C.

Goodfellow M., and O'Dennell A.C. (1994). Chemical Methods in Prokaryotic Systematics – John Wiley & Sons, New York.

Heritage, J Evans, E. G. V. and Killington,R.A. (1996). Introductory Microbiology, Cambridge University press.

Holt J.S., Krieg N.R., Sneath P.H.A. and Williams S.T (1994). Bergey's Manual of Determinative Bacteriology. (9th edition) – William & Wilkins, Baltimore.

James G. Cappuccino and Natalie Sheman.(1996). Microbiology-A laboratory manual.(4th edition).The Benjamin/Cummings publishing company Inc, California.

John webster.(1993). Introduction to Fungi.(2nd edition).Cambridge University Press, Cambridge.

Lansing M. Prescott., John P. Harley and Donald A.Klein.(2003). Microbiology (5th edition) McGraw Hill, New York.

Larry Mc Kane and Judy Kandel.(1996). Microbiology-Essentials and applications. (2nd edition). Mc Fraw Hill Inc, New York.

Michael T. Madigan, Jhon M. Martinko and Jack Parker. (1997). Brock Biology of Microorganisms.(8th edition).Prentice Hall International Inc, London.

Moselio Schaechter. and Joshua Leaderberg. (2004). The Desk encyclopedia of Microbiology. Elseiver Academic press, California.

Salle, A.J. (1996). Fundamental principles of Bacteriology.(7th edition).Tata McGraw-Hill publishing company Ltd, New Delhi.

CORE COURSE II (CC) – PRACTICAL – FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL METABOLISM

Fundamentals of Microbiology

1. Microscope and its operation
2. Preparation of culture media, Cleaning of glasswares and sterlization methods – autoclaving and hot air oven
3. Demonstration of ubiquitous nature of microorganisms.
4. Quantification of microbial population by viable cell count and haemocytometer.
5. Observation of permanent slides to study the structural characteristics of algae (*Anabena, Nostoc, Spirulina, Oscillotoria*), fungi (*Pythium, Rhizopus, Saccharomyces, Pencillium, Aspergillus, Agaricus*) and protozoa (*Entamoeba hystolytica* and Plasmodium spp.).
6. Isolation of microorganism from soil and water .
7. Pure culture techniques - Streak plate, Pour plate and Spread plate.
8. Test for motility of bacteria – Hanging drop method.
9. Staining techniques – Simple staining, Gram's staining, Spore-staining, Capsular staining.
10. Isolation of fungi and cyanobacteria

Microbial Metabolism

1. Bacterial growth curve: Cell count/viable count/absorbance(total count)
2. Carbohydrate fermentation tests:Glucose, Lactose, Sucrose and Mannitol.
3. Biochemical test for identification of bacteria: IMViC tests - TSI agar test-Urease- Catalase-Oxidase.

Reference:

James G. Cappucina, Natalie Sherman. (1996). Microbiology – A laboratory manual, The Benjamin (Cummings Publishing Company, Inc.)

Mackie and McCartney. (1989). Practical Medical Microbiology, Churchill Livingston.

Albert Balows, Hens G. Truper., Martin Dworkin, Wim, Hardes, Karl-heinz Schoeifer (eds). (1992). A Hand book on the biology of bacteria, ecophysiology, isolation, identification and applications, Springer Verlag.

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FIRST ALLIED COURSE– I (AC) – BIOCHEMISTRY

Unit – I

Carbohydrate – Definition, Classification, structure of glucose, biological significance, digestion and absorption – Colorimetric method of estimation.

Unit – II

Proteins – Definition, classification and structure (Primary, secondary, tertiary), Amino acids – Structure - classifications (Essential and nonessential, protein and non-protein amino acids- Estimation of proteins.

Unit – III

Lipids: Definition, classification, structure, properties and functions, Estimation of lipids.

Unit – IV

Nucleic acids – DNA structure, form and functions – RNA types structure and functions. Estimation of Nucleic acids.

Unit – V

Vitamins – Introduction – Fat soluble vitamins (A, D, E, & K). Water soluble vitamins (B Complex & C). Sources, functions and deficiency syndromes of Vitamins B complex and Vitamin C.

Reference:

Dawn, B.Markus, (1994). Biochemistry. Harwal Publishing, New York.
Donald voet and Judith voet. (1990). Biochemistry. John Wiley and Sons, New York.
Henry, R. Mahler and Eugene, H. Cerdesz, (1966). Biological Chemistry. Harper International Edition, New York.
Stryer, L. (1995). Biochemistry. 4th Ed. W.H. Freeman and Company, New York.
William, J. Marshall and Stephan, K. Bangert. (1995). Clinical Biochemistry – Metabolic and Clinical Aspects – Churchill Livingston, New York.

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FIRST ALLIED COURSE – II (AC)– PRACTICAL – BIOCHEMISTRY

1. Qualitative and quantitative estimation of carbohydrates, amino acids, proteins, lipids and Nucleic acids.
2. Estimation of ascorbic acid (from biological sample)

Reference:

Keith Wilson and John Walker. (1995). Principles & Techniques of Practical Biochemistry.(4th edition).Cambridge University press, Britain.

Oser, B.L.Hawks, (1965). Physiological Chemistry, TATA Mc Graw Hill.

Shawn O' Farrell and Ryan T. Ranallo. (2000). Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.

Strolv, B.A. Makavora, V.C.(1989). Laboratory manual in Biochemistry. MIR Publisher, Moscow.

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Core Course III (CC) Microbial Metabolism

Unit – I

Nutrition and growth of microorganisms: Nutritional types of microorganisms, nutritional requirements. Factors influencing the growth of microorganisms – temperature, pH, Osmotic pressure, moisture, radiations and different chemicals, Physiology of growth – Significance of various phages of growth. Growth measurements – batch, continuous and synchronous.

Unit – II

Bacterial enzymes – classification, properties, coenzymes and cofactors, isozymes.

Unit – III

Metabolism of carbohydrates : Anabolism – phototsynthesis – exygenic – anoxygenic, synthesis of carbohydrate – catabolism of glucose – Embden Mayer – Hoff – Parnas pathway – Pentose pathway, Kreb's cycle (TCA) – electron transport system and ATP production.

Unit – IV

Metabolism of protein – metabolic pathways of nitrogen utilization, synthesis of amino acids, peptides, proteins.

Unit – V

Anaerobic Respiration – Nitrate, sulphate & Methane respiration – Fermentations – alcohol, mixed acid, lactic acid fermentation - Anabolic and catabolic processes of lipids.

Reference:

Doelle, H.W. (ed.) (2005). Microbial Metabolism, Academic Press.

Gerhart, G., (1986). Bacterial Metabolism, Springer Verlag.

Hall D.C., and Rao K.K. (1995). Phototsynthesis – Cambridge University Press.

Lansing M. Prescott, .John P., .Harley and Donald A.Klein.(2003). Microbiology.(5th edition).McGraw-Hill company, New York.

Mathews C.K., and Holde K.E.V(1996). Biochemistry – The Benjamin/Cummings Publishing company, Inc., New York.

Murray R.K. Granner M.D., Mayes P.A. and Rodwell V.W (1990) Biochemistry – Prentice Hall International Inc., London.

Salle,A.J. (1996). Fundamental principles of Bacteriology(7th edition).Tata McGraw-Hill publishing company limited, New Delhi.

Stryer L.(1995). Biochemistry (4th edn.) W.H.Freeman and company, New York.

Zubey C.L. Parson W.W., and Vance D.E.(1994) Principles of Biochemistry – Wim.C. Brown Publishers, Oxford, England.

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First Allied Course – III – Biochemistry

UNIT – I

Blood – origin of blood cells, composition characterization and coagulation.

UNIT – II

Cytochemistry – structure and biochemical composition of cell wall and plasma membrane – fluid mosaic model. Trilaminar model, receptor concept, sodium potassium pumps.

UNIT – III

Endocrine glands – pituitary, thyroids, parathyroid, pancreas, adrenal, testis and ovary. Hormones – Definition – classification , functions, diseases associated with deficiency of hormones.

UNIT – IV

General account and biosynthesis major and accessory plant pigments – chlorophylls, carotenoids, phycobilins and anthocyanins.

UNIT – V

Phytohormones and plant's secondary metabolites – structure and functions of auxin, gibberellins, cytokinins and abcisic acid.

Reference:

1.Stryer, L.1995.Biochemistry. 4th Ed. W.H. Freeman and Company, New York.

2Donald voet and Judith voet.1990. Biochemistry. John Wiley and Sons, New York.

3. Henry, R.Mahler and Eugene, H.Cerdesz, 1966. Biological Chemistry. Harper International Edition, New York.

4. Hubert, Styer, 1995. Biochemistry – Freeman and Company, New York.

5. Dawn, B.Markus, 1994. Biochemistry. Harwal Publishing, New York.

6. William, J.Marshall and Stephan, K.Bangert.1995. Clinical Biochemistry – Metabolic and Clinical Aspects – Churchill Livingston, New York

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Core Course IV (CC) - Introductory Virology

UNIT – I

Introduction – Definition, History of virology. General properties of viruses – cultivation of Viruses – Structure and replications viruses – classification of Viruses.

UNIT - II

Virus: Assay, purification and characterization of viruses, separation and characterization of viral components and quantification of viruses.

UNIT – III

Bacterial Viruses – structure of bacteriophage, The Lytic life cycle (T-Even coliphages) – Lysogenic life cycle (Escherchia coli, Phage Lambda).

UNIT – IV

Plant Viruses, common plant viral diseases : TMV, Bunchy top of banana, satellite virus, Viroid – Double standed DNA virus – Assay methods.

UNIT – V

Animal viruses : morphology, pathogenesis and laboratory diagnosis of prions, Rinder pest, Blue tongue, Raniket dion, Foot and Mouth Disease. Human Viruses – Herpes, HIV, Hepatitis Viruses. Viral Vaccines. Prevention and treatment of viral diseases. Antiviral agents.

Reference:

1. Alan J.Cann. (1997). Principels of Molecular virology.(2nd edition).Academic press, California.
2. Ann Giudici Fettner.(1990).The Science of Viruses.Quill, William Marrow, New York.
3. Dimmock N.J.Primrose S.B.(1994). Introduction to Modern Virology. IV edition. Blackwell scientific Publications, Oxford.
4. James, C. Cappuccino. (1996). Microbiology. The Benjamin/Cummings Pub. Co. California.
5. Morag, C. Timbury (1994). Medical Virology. X edition. Churchill Livingston.
6. Nicklin, J. Greame-Cook and Killington, R. (2003). Instant Notes in Microbiology.(2nd edition).Viva Books private limited, New Delhi.
7. Robert I. Krasner. (2002). The microbial challenge: Human Microbe Interactions, American society for Microbiology, Washington.
8. Roger Hull.2002.Mathews' Plant Virology.(4thEdition).Academic press-A Harcourt Science and technology company, New York.
9. Topley & Wilson's(1990). Principles of Bacteriology, Virology and Immunity. VIII edition Vol.IV Virology, Edward Arnold, London.

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NON MAJOR ELECTIVE I – MUSHROOM TECHNOLOGY

Unit – I

Introduction – history – scope of edible mushroom cultivation – Types of edible mushroom available in India – Calacybe indica, Volvariella Volvacea, Pleurotus sp., Agaricus bisporus

Unit – II

Pure culture – preparation of media (PDA and Oatmeal agar media) sterilization – Preparation of test tube slants to store mother culture – culturing of Pleurotus mycelium on petriplates – Preparation of mother spawn in saline bottle and polypropylene bags and their multiplication.

Unit – III

Cultivation Technology : Infra structure, Substrates (locally available) polythene bag, vessels, Inoculation hood – inoculation loop – low cost stove – sieves – Culturel rack mushroom unit (Thatched house) – Mushroom bed preparation – Paddy straw, sugarcane trash, maize straw, banana leaves.

Unit – IV

Storage and nutrition : Short term storage – Long term storage (scanning, Pickles, papads, drying, storage in salt solutions) – Nutrition : Proteins, amino acids, mineral elements. Nutrition : Carbohydrates – Crude fiber content, vitamins.

Unit – V

Food preparation, Types of foods prepared from mushroom - soup, cutlet, omelette, samosa, pickles, curry. Research Centres – National level and Regional Level Cost benefit ratio – Marketing in India and abroad – Export value

Reference:

1. Marimuthu et al., (1991) Oyster Mushrooms, Dept. of Plant pathology, TNAU, Coimbatore.
2. Nita Bahl (1988) Hand book of Mushrooms, II edition, Vol.I & II.
3. Paul Stamets, J.S. and Chilton, J.S. (2004). Mushroom Cultivator: A practical guide to growing mushrooms at home, Agarikon Press.
4. Shu-Ting Chang, Philip G. Miles, Chang, S.T. (2004). Mushrooms: Cultivation, nutritional value, medicinal effect and environmental impact, 2nd ed, CRC press.
5. Swaminathan M. (1990) Food and Nutrition, Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
6. Tewari and Pankaj Kapoor S.C. (1988) Mushroom cultivation, Mittal Publications, Delhi.

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Core Course – V (CC) – Practicals II
Introductory Virology and Immunology

Virology

Isolation on Bacteriophage from Sewage
Concentration of bacteriophages
Demonstration of Mechanical transfer of viruses in plants
Demonstration of cultivation of viruses by chick embryo fibroblast technique and embryonated egg.
Study of selected bacterial, Plant and Animal viuses – T4 phage, M13 Phage, TMV, CaMV, HIV, Influenza, HSV, HBV, Rabies and Blue tongue virus

Immunology

ABO blood grouping, Rh Typing
WIDAL test, RPR, CRP and ASO
Double immune diffusion
Demonstration of ELISA
Demonstration of Lymphoid organs in rat

Reference

1. James, C. Cappuccino. (1996). Microbiology. The Benjamin/Cummings Pub. Co. California.
2. Morag, C. Timbury (1994). Medical Virology. X edition. Churchill Livingston.
3. Ivan Roitt. Jonathan Brostoff and David Male. (2002). Immunology (6th edition). Elsevier science Ltd., New York.
4. Janis Kuby (1994). Immunology. (2nd edition). W.H. Freeman and company, New York.
5. Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.
6. Mackett M. and Wiliamson J.D.1995. Human vaccines and vaccination. BIOS Scientific Publishers.
7. Patrick,S and Larkin, M.J.1995.Immunological and molecular aspects of bacterial virulence. Jhon Wiley and sons, England.
8. Playfair,J.H.L.1996.Immunology at a glance.(6th edition). BlackwellScience, London.
9. Richard A., .Goldsby Thomas J. Kindt and Barbera A. Osborne. (2000). Kuby 10.
Immunology.(4th edition).W.H. Freeman and company, New York.
11. Richard M. Hyde (1995). Immunology III edition. National Medical series, Williams and Wilkins. Hardward Publishing company.
12. Richard M. Hyde.(1992). Immunology-The National Medical series for independent study.(2nd edition).Harwal publishing, Pennsylvania.
13. William E. Paul (1993). Fundamental Immunology. II edition, Raven press, New York.

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Core Course – VI (CC) Immunology

UNIT – I

Introduction: Terminologies – History of Immunology – Immunohematology, Blood groups, Blood transfusion – Rh – incompatibilities – immunity – types of immunity – innate and acquired.

UNIT – II

Immune systems: Anatomy of lympho- recticular system – Primary lymphoid organ. Secondary lymphoid tissue – cells of the immune system – detailed aspects of T and B cells – receptors – activation and function.

UNIT – III

Antigens: Types, properties, haptanes – adjuvants – vaccines – types –toxids antitoxins, Immunoglobulins – structure types and properties. Theories of antibody production.

UNIT – IV

Antigen – antibody reactions – in vitro methods; Agglutintion – Precipitation, Complement fixation, Immunofluoressecence, ELISA, RIA, in vivo methods; Skin tests – immune complex tissue demonstrations.

UNIT – V

Hypersensitivity reactions – antibody mediated, Type I anaphylaxis, Type II – Antibody dependent cell cytotoxicity, Type III – immune complex reactions – respective diseases and immunologic methods of diagnosis – cell mediated immune responses – Lymphokines, Cytokines. Type IV – Hypersensitivity reactions, MHC and transplanation.

Reference:

Abul K. Abbas. Andrew H. Lichtman and Jordan S.Pober.(1994). Cellular and Molecular Immunology.(2nd edition).W.B. Saunders company, Philadelphia.

Charles A. Janeway,Jr. Paul Travers. Mark Walport and Donald Capra,J.(1999). Immunobiology-The immune system in health and disease.(4th edition).Current Bilology Publications, London.

Donald M. Weir, John, steward, (1993). Immunology VII edition. ELBS, London.

Donald M. Weir and John Stewart.(1993).Immunology.(7th edition).ELBS,UK.

Eli Benjamin, Richard Coico and Geoffrey Sunshine.(2000). Immunology-A short course.(4th edition).John Wiley and sons, New York.

Ivan Roitt. Jonathan Brostoff and David Male. (2002). Immunology(6th edition).Elsevier science Ltd., New York.

Janis Kuby (1994). Immunology. (2nd edition). W.H. Freeman and company,New York.

Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.

Mackett M. and Wiliamson J.D.1995. Human vaccines and vaccination. BIOS Scientific Publishers.

Patrick,S and Larkin, M.J.1995.Immunological and molecular aspects of bacterial virulence. John Wiley and sons, England.

Playfair,J.H.L.1996.Immunology at a glance.(6th edition). BlackwellScience, London.

Richard A., .Goldsby Thomas J. Kindt and Barbera A. Osborne. (2000). Kuby Immunology.(4th edition).W.H. Freeman and company, New York.

Richard M. Hyde (1995). Immunology III edition. National Medical series, Williams and Wilkins. Hardward Publishing company.

Richard M. Hyde.(1992). Immunology-The National Medical series for independent study.(2nd edition).Harwal publishing, Pennsylvania.

William E. Paul (1993). Fundamental Immunology. II edition, Raven press, New York.

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SECOND ALLIED COURSE – I (AC) – BIOSTATISTICS

UNIT – I

Introduction to biostatistics – Definition, statistical methods, biological measurement, kinds of biological data, functions of statistics and limitation of statistics.

UNIT – II

Collection of data, sampling and sampling design, classification and tabulation, types of representations, graphic – bar diagrams, pie diagrams and curves.

UNIT – III

Measures of central tendency, mean, meridian, mode, geometric mean

UNIT – IV

Measures of dispersion and variability, changes. Deviations –mean deviation, standard deviation, coefficient of variation, Lorenzen's curve.

UNIT – V

Skewness, Kurtosis, Moments, Meaning, test of skewness, characteristics of dispersion and skewness, measures of skewness, objectives, Karl Perarson's coefficient of skewness, Bocoley's coefficient of skewness.

Reference:

1. Fundamental of Biostatistics Bemad Rosner, Duxbury Press, 4th Bt & DSK ed. (June 1995)
2. Principles of Biostatistics Maicello Pagano, Kimberlee Gauvreau, Duxberry Press 2nd Ed. 2000.
3. Statistical & Data Handling Skills in Biology, Roland Ennos 1999, Prentice Hall
4. Biostatistical Analysis 4th Ed. Jerrold Zar, Pearson Education
5. Introduction to Biostatistics & Research Methods – 4/e. Sundar Rao & Richard Prentice Hall
6. An Introduction to biostatistics a manual for students in health sciences, P.S.S. Sundar Rao, J. Richard., Prentice Hall & India.

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SECOND ALLIED COURSE II (AC) PRACTICALS – BIOSTATISTICS

1. Collection of data, sampling designs, tabulation and graphic representation using biological materials.
2. To find mean, mode, meridian, coefficient of variance using biological materials.
3. Tests of significance ‘t’ test, ‘chi’ square, standard error and standard deviation.
4. t TEST, chi square, statistical error, standard deviation also, to be practically done through SPSS programme [statistical Package for Social Sciences].

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SECOND ALLIED COURSE – III (AC)

COMPUTER APPLICATIONS IN BIOLOGY

UNIT – I

Introduction to Computers – History of Computers – its developing technology and generation of Computers – Operating Systems – Windows, Unix – Hardware, Software, disc operating systems.

UNIT – II

Working of Internet – Local area and wide area network – Types of files – HTML, TXT, PDF –Search engines and its types and applications.

UNIT – III

Introduction to informatics, bioinformatics – its history and its development -
Biological database – NCBL, EMBL, DDBJ.

UNIT – IV

Chemiinformatics – its history and its development – Applications Chemiinformatics – Drugdesigning (any cancer drug)

UNIT - V

Applications of Bioinformatics, Brief outline on Genomics, Proteomics, Patenting rights.

References:

1. Statistical methods in Biology, Norman T.J. Bailey – Cambridge Edition
2. Primer for Biostatistics, S.A. Glanty – Mc Graw Hill

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NON MAJOR ELECTIVE II – MICROBIAL DISEASES

Unit I

Introduction - Early discovery of pathogenic microorganisms; development of bacteriology as scientific discipline; contributions made by eminent scientists. Classification of medically important micro organisms; Normal microbial flora or human body; role of the resident flora; normal flora and the human host.

Unit II

Clinical conditions and diagnosis of the following Bacterial diseases

a. Pneumonia - Streptococcus pneumoniae
b. Whooping cough - Bordetalla pertusis
c. Meningitis - Haemophlius influenzae
d. Diptheria - Corynebacterium diphtheriae
e. Pulmonary Tuberculosis - Mycobacterium tuberculosis
f. Leprosy Mycobacterium - leprae.

Unit III

Clinical conditions and diagnosis of the following Bacterial diseases.

g. Typhoid - Salmonella typhi
h. Cholera-Vibrio cholerae.
i. Tetanus -Clostridum tetani
j. Syphilis -Treponema pallidum
k. Gonorrhea -Neisseria gonorrhoeae
l. Dental caries -Streptococus mutans
m. Dysentery -Shigella dyseneteriae
n. Bacterial food poisoning - Closteridium botulinum
o. Gasteroenteritis- Escherichia coli

Unit IV

Clinical conditions and diagnosis of the following Viral diseases.
Virus: Small pox, Influenza, Measles, Poliomyetitis, Common cold (Rhino virus),
Hepatitis, Encephalitis, Rabies, AIDS.

Unit V

Clinical conditions and diagnosis of the following Protozoan, Helminthic and other diseases
Protozoa: Amoebiasis – Entamoeba hostolytica, Malaria– Plasmodium vivax, P. malariae.
Helminths: Liverfluke – Fasciola hepatica, Filariosis –Wuchereiria bancrofti.
Hospital acquired infection and Zoonotic diseases

Reference:

Collee, J.G., Duguid, J.P., Fraser, A.G. and Marimoin, B.P. (`1989). Mackie and Mc Cartney Practcial Medical Microbiology, 13th edition. Churchill Livingstone.

David Greenwood, Richard CD., Slack, John Forrest Peutherer. (1992). Medical Microbiology. 16th edition. ELBS with Churchill Livingstone.

Joan Stokes, E., Ridgway GL and Wren MWD (1993). Clinical Microbiology, 7th edition, Edward Arnold. A division of Holder and Stoughton.

Tom Parker, M., Leslie H. Collier (1990). Topley & Wilson's Principles of Bacteriology, Virology and Immunity (VIII Edition).

CORE COURSE VII (CC) -MEDICAL MICROBIOLOGY

UNIT – I

Normal microbial flora of the human body, Host-microbe interactions – virulence factors of microbes. Invasiveness and pathogenicity.

UNIT – II

Diagnostic Microbiology – collection and transport of specimen for Microbiological examination – General methods for isolation and identification of bacteria.

UNIT – III

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following bacterial infections (a) Streptococcal infections, (b) Staphylococcal infections, (c) Meningits, (d) Tuberculosis, (e) Leprosy, (f)Gastrointestinal disorders – typhoid, cholera, bacillary dysentery, (g) Sexually transmitted diseases – syphilis, gonorrhea. (h) Anaerobic wound infection – tetanus, gas gangrene.

UNIT – IV

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following viral infections (a) respiratory diseases, common cold, influenza, measles. (b) neurological diseases – Dengue,
Rabies (c) Liver diseases : Hepatitis A,B,C,D & E (d) Immunodeficiency diseases - AIDS.

UNIT – V

Clinical symptoms. Epidemiology, pathogenesis, laboratory, prevention and treatment of the following fungal and protozoan infections (a) Fungal – superficial and subcutaneous mycoses, (b) Protozoan: Amoebiasis, Malaria (c) Helminths – Filariasis, Ascariasis, Zoonotic diseases, Hospital acquired infections.

Reference:

Rajan.S. Medical Microbiology. MJP Publishers, Chennai. 2007.

David Greenwood. Richard C.B. Slack and John F. Peutherer.(1992). Medical Microbiology.(14th edition). ELBS with Churchill Livingstone.

E. Joan Stokes, G. L. Ridgway and M. W. D. Wren (1993). Clinical Microbiology. 7th edition. Edward Arnold. A division of Hodder and Stoughton.

Huge W.B. and Russell A.D.(1989). Pharmaceutical Microbiology. IV edition. Blackwell Scientific Publicaiton, Oxford.

J. C. Collee, J.P., Duguid, A. C. Fraser, B.P. and Marimon (1989). Mackie and Mc Carteny Practical Medical Microbiology – 13th Edition, Churchill Livingstone.

Joan stokes, E. Ridgway, G. L and Wren, M.W.D. (1993). Clinical Microbiology(7th edition). Edward Arnold.A division of Hodder and stoughton.

Schaechter, M. Medoff, G. and Eisenstein, B.C.(1993). Mechanism of Microbial Diseases. 2nd edition. Williams & Wilkins, Baltimore.

Topley & Wilson's (1990). Principles of Bacteriology, Virology and Immunity, VIII edition, Vol.III Bacterial Diseases, Edward Arnold, London.

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CORE COURSE – VIII (CC)
AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

UNIT – I

Concepts of microbial ecology: Relationship between microorganism and different environments land, water and air. Microorganism inhabiting extreme environments. Microbiology of air – organisms in air, distribution and sources. Droplet nuclei, aerosol, assessment of air quality. Brief account of air borne transmission of harmful microbes.

UNIT – II

Types of aquatic ecosystems: fresh water – ponds, lakes, streams. Marine habitats – estuaries, mangroves, deepsea. Zonations – upwelling – eutrophication – food chain. Potability of water – microbial assessment of water quality – water purification – brief account of water – borne diseases.

UNIT – III

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes – food (SCP, mushroom, yeast); fuel (ethanol, methane, hydrogen); fertilizers (composting).

UNIT – IV

Liquid waste treatment. Treatment methods – primary –secondary (anaerobic – methanogenesis; aerobic- tricking activated sludge – oxidation pond – tertiary treatment. Utilization of liquid wastes – food (SCP, Yeast) – fuel (methane), fertilizers (Cyanobacteria).

UNIT – V

Biodeterioration: Deterioration of paper, leather, wood, textiles, metal corrosion, mode of deterioration, organisms involved, its disadvantages and mode of prevention.

REFERENCE:

Baker, W.C. and Herson, D.S.(1994). Bioremediation – McGraw Hill Inc., New York

Blackie.(1998). Plant Molecular Biology.(2nd edition).ChapmanHall,New York.

Burns, R.C. and Slater, J.H. (1982). Experimental Microbial Ecology – Blackwell Scientific Publications, Oxford, London.

Christon J.Hurst. (2002). Manual of Environmental Microbiology.(2nd edition).American Society for Microbiology,Washington.

Duncan Mara and Nigel Horen. (2003). The Handbook of water and waste water Microbiology. Academic press-An imprint of Elsevier.

Ec Eldowney, S., Hardman, D.J. and Waite, S. (1993). Pollution : Ecology and Biotreatment – Longman Scientific Technical

Gareth M. Evans and Judith C. Furlong. (2003). Environmental Biotechnology-Theory and Application, John Wiley and sons Ltd.

Marshall, K.C. (1985). Advances in Microbial Ecology. Vol-8. Plenum press.

Munn,C.B. (2004). Marine Microbiology-Ecology and Applications.Bios Scientific publishers, New York.

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CORE COURSE – IX (CC) PRACTICALS
Medical Microbiology, Agricultural and Environmental Microbiology and Microbial genetics

Medical Microbiology

Isolation of Bacteria from Urine, Stool and Sputum
Identification of Escherichia coli, Strptococcus pneumonia, Staphylococcus aureus and Klebsiella pneumonia.
Saline and iodine wet mount
Giemsa staining for the demonstration of blood parasites
KOH and Lactophenol Cotton blue mount
Germ tube technique

Agricultural and Environmental microbiology

Water analysis by MPN technique – presumptive coliform test – confirmed coliform test and completed coliform test.
Microbial assessment of air quality – open plate method and air sampler-technique.
Isolation and counting of faecal bacteria from water.

Different tests for water borne pathogens identification : Indole test, Methyl Red test, Voges- Proskauer, Citrate utilization, TSI, Oxidase and Catalase.

Soil Analysis -PH, chlorides, nitrate, calcium, magnesium and total phosphorus.

Isolation of cyanobacteria from water (any two),
Isolation of Rhizobium form legume nodule.

Microbial genetics

Isolation of Auxotrophic mutants
Plasmid isolation from bacteria

Reference:

Atlas, R.M. and Bartha, R. (1993). Microbial Ecology: Fundamentals and Applications, 3rd Ed., Benjamin and Cummings Pub. Co. New York.

David M. Sylvia, Jeffry J. Fuhrmann, Peter Hastell, David A. Zuberer, 1st Ed. Prentice Hall.

James G. Cappuccino and Natalie Sherman. (1996). Microbiology-A Laboratory Manual(4th edition).The Benjamin publishing company, New York.

Jeanne Dijkstra and Cees P.de Jager.1998.Practical Plant Virology.Springer-Verlag Berlin Heidelberg, Germany.

Paul, I.A., and Clark, F.E. (2000). Soil Microbiology and Biochemistry, 2nd Ed. Academic press.

Rangaswamy, G. and Bagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Ed. Prentice Hall of India Pvt. Ltd., New Delhi.

Russell F. Bey. (2001). Microbiology Laboratory Manual, BROOKS/COLE, Australia. Schaechter, M. Medoff, G. and Eisenstein, B.C. (1993). Mechanism of Microbial diseases. 2nd edition. Williams & Wilkins, Baltimore.

Subba Rao, N.S. (2002). Soil Microbiology, 4th Ed. (soil Microorganisms and plant growth), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

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CORE COURSE – IX (CC) MICROBIAL GENETICS

UNIT – I

History – experiments of Hershey Chase and Griffith, DNA as the genetic material – discovery of DNA structure – RNA as a genetic material – Genetic code.

UNIT – II

Organization and functioning of genetic material – Bacterial and viral. Details of *E.coli* chromosome. Brief account of plasmid – structure – types. Replication of DNA – rolling circle model – theta. Model. Replication of RNA – reverse transcriptase.

UNIT – III

Concept of gene – Lac operon, tryptophan operon, attenuation control – promoters – repressors – gene expression and regulation.

UNIT – IV

Gene transfer mechanisms – conjugation – transformation – transduction.

UNIT – V

Mutagenesis – mutation – mutants – phenotypic mutants – genotypic mutants – IS elements – transposons – repair mechanism, Carcinogenicity testing.

Reference:

Daniel L. Hartl and Elizabeth W. Jones.(2001). Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK.

David Frifelder.(1990). Microbial Genetics, Narosa publishing house, New Delhi.

Friedberg E.C., Walker C.C., Siede W. (1995). DNA repair and mutagenesis – ASM Press.

Gardner E.J., Simmons M.J., Snustad D.P. (1991). Principles of Genetics. John Wiley & sons.

Jeremy M. Dale. (1998). Molecular Genetics of Bacteria (3rd edition).John Wiley and sons,NewYork.

Larry Synder and Wendy Champness. (2003). Molecular Genetics of Bacteria (2nd edition).American Society for Microbiology, Washington.

Lodish, H., Baltimore, D. Berk, A. Zipsury, S.L., Matsudaira, P. Darnell, J. (1995). MolecularCell Biology. Scientific American Books.

Malor Sr, Cronan Jr. JE. Freifelds D (1994). Microbial Genetics. Jones and Bartlett Publishers.

Maxine Singer and Paul Berg. (1991).Genes & Genomes. University science books, California.

Monroe W.Stickberger.2003.Genetics(3rd edition).Prentice/Hall of India Pvt. Ltd., NewDelhi.

Old, R.S. and Primrose, S.B. (1989). Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London.

CORE COURSE – XI (CC) – MOLECULAR BIOLOGY

UNIT – I

Nucleic acids: Structure of DNA and RNA, Types and forms – DNA, t-RNA, r-RNA, m-RNA – Definition and functions.

UNIT – II

Vectors – plasmids, phages and cosmids, Ti-plasmid, pBR322, pSC101, pUC. Structure and assay methods.

UNIT – III

Enzymes – Nucleases, ligases, polymerases, DNA modifying enzymes, Topoisomerases – their uses and applications.

UNIT – IV

Gene and its manipulation techniques – Definition of a gene, structure, cloning techniques,genomic library, C-DNA, expression systems. Gene rearrangement by RNA and DNA splicing.

UNIT – V

Nucleic acid and protein hybridization technique – Southern, Northern and Western methods of hybridization. DNA amplification techniques – PCR. DNA fingerprinting and its applications.

Reference:

Blackburn CM, Gait MJ. (1996). Nucleic acids in Chemistry and Biology – Oxford University Press.

Eckstein F, Lilley D.M. (1996). Catalytic RNA – Springer – Verlag.

Eckstein F, Lilley DM. (1992). Nucleic acids and Molecular Biology – Springer – Verlag.

Freifelder D. (1991). Molecular Biology. Narosa Publishing Home

Frieldberg EC, Walker GC, Siede W. (1995). DNA repair and Mutagenesis. ASM press.

George M. Malacinski. And David Freifelder. (1998). Essentials of Molecular Biology 93rd edition).Jones and Bartlett publishers, UK.

James D. Watson. Michael Gilman. Jan Witkowski and MarkZoller. (2001). Recombinant DNA. Scientific American Books, New York.

Lewin, B. (2000). Genes VII. Oxford University press.

Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J. (1995). Molecurlar Cell Biology. Scientific American Books.

Maloy S.R, Cronan Jr. JE, Freifelder D. (1994). Microbial Genetics. Jones and Bartlett Publishers.

Michael Blackburn and Michael J. Gait. (1996). Nucleic acids in chemistry and Biology.(2nd edition).Oxford University press.

Old, R.S. and Primrose, S.B. (1989). Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London.

Richard M. Twyman. (2003). Advanced Molecular Biology(1st edition).Viva Books private Ltd, New Delhi.

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CORE COURSE – XII (CC) – INDUSTRIAL MICROBIOLOGY

UNIT – I

Historical development of Industrial Microbiology, Industrially important microorganisms, Major classes of products and processes. Improvement of Industrially important microbial stains.

UNIT – II

Design of a fermenter, types of fermenters and basic functions. Fermentation media formulation strategies, economical means of providing energy, carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams, types of fermentation.

UNIT – III

The recovery and purification of fermentations products (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, ultrafiltration, drying, cell immobilizations and its applications.

UNIT – IV

Microbial products of pharmaceutical value – raw materials, organism and Industrial processes involved in the production of pencillin, Vitamin B12 and rabies vaccine.

UNIT – V

Microbial products of industrial value – raw materials, organism and Industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid. Recycling and safe disposal of industrial wastes through microbes.

Reference:

Click, B.R., .Pasternak, J.J. (1994). Molecular Biotechnology – ASM Press.

Demain A.L. Solomon, N.A. (1986). Manual of Industrial Microbiology and Biotechnology. ASM Press

Prave, P. Faust, V, Sitting, W., Sukatsch, D.A. (1987). Fundamentals of Biotechnology. ASM Press.

Reed. G. (1982). Prescott and Dunn's Industrial Microbiology. Macmillian Publishers.

Sikyta, B.(1983). Methods in Industrial Microbiology, Ellis Horwood limited.

Stanbury, P.F. Whitaker, A. Hall, S.J. (1995). Principles of Fermentation Technology, Pergamon Press.

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CORE COURSE – XIII (CC) – MICROBIAL BIOTECHNOLOGY

UNIT – I

Biotechnology – Definition – concepts – history and development.

UNIT – II

Enzyme production technology through microbes: Problems and applications – enzyme immobilization and its applications.

UNIT – III

Microalgal technology – Industrial cultivation methods of Spirulina – biotechnological potentials of microalgae – food – feed – fuel production – pharmaceutically valuable compounds from microalgae.

UNIT – IV

Principles and applications of recombinant DNA technology and strain improvement (rDNA technology).

UNIT – V

Production of biotechnological products. Food-SCP (algae, yeast, mushroom). Biofertilizer – (Cyanobacteria, Rhizobia, Azospirillum, Azotobactre, Frankia , VAM). Bioinsecticide (Bacillus thuriengiensis). Fuel – ethanol. Pharmaceuticals – antigens, interferons, vaccines, insulin, hormones, gene therapy methods. Hybridomas and monoclonal antibodies.

Reference:

Desmond, S.T. Nicholl (2002). An Introduction to Genetic Engineering.(2nd edition).Cambridge university press.

Erics Grace.(1997). Biotechnology unzipped-promises and realities. Joseph Henry press, Washington.

Glick, B.R. and Pasternak, J.J. (2001). Molecular Biotechnology, ASM press, Washington DC.

Helen Kreuzer and Adrianne Massey.(1996). Recombinant DNA and Biotechnology, American Society for Microbiology, Washington.

Old R.W. and S.B.,Primrose. 1994. Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London.

Prave, P., Paust, V., Sitting, W. and Sukatasch, D. 2000. Fundamentals of Biotechnology. VCH verlasgesellschaftr - mbH, Weinhkeim.

Trevan, M.D, Boffey, S. Coulding K.H. and Stanbury, P. (1990). Biotechnology – The basic principles – Tata McGraw Hill edition.

Watson, J. D. Gilman, M., Witkowski, J., Zoller, M. (1992). Recombinant DNA- 2nd edition, Scientific American Books.

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Core course – XIV (CC) – Practical

Food and industrial Microbiology, molecular biology and microbial Biotechnology

Assessment of milk quality by methylene blue reduction test

Isolation of bacteria from bread, tomato and any one beverage

Wet mount preparation of spoiled bread, tomato, grapes, potato.

Whole cell immobilization – alginate – polyurethane foam.

Estimation of ethanol

Demonstration of fermenting ability of yeast

Observation of food samples to study Leuconsostoc sp. Lactobacillus sp., Streptococcus lactis and Saccharomyes sp.

Demonstration
Transformation techniques
Isolation of auxotrophic mutants.

Preparation of fermented food – Youghurt, cheese

Reference:

Alan S. Gerstein. (2001). Molecular Biology problem solver. Wiley-Liss-A Jhon wiley and sons publication, New York.

Anton D.L. Akkermans. Jan Dirk Van Elsas. and Frans J. De Bruijn. (1995). Molecular Microbial Ecology Manual. Kluwer Academic publishers.

Aurubels et al., (1998). Current protocols in Molecular Biology, John Wiley.

Baker, K.H. and Herson, D.S. (1994). Bioremediation – McGraw Hill Inc., New York.

Benson, H.J. (1994). Microbiological Applications, Wm, C. Brown Publishers, Oxford.

Collina, C.H. and Lyne, P.M. (1985). Microbiological methods – Butterworths, London.

Dharmalingam, K. (1986). Experiments with M13. Mc Millan India Ltd., Madras.

EcEldowney, S. Hardman, D.J. and Waite, S. (1993). Pollution: Ecology and Biotreatment. Longman Scientific Technical.

Jeffrey H. Miller. (1992). A short course in Bacterial Genetics. Cold Spring Harbor Laboratory press.

Old, R.W. and S.B. Primrose. (1994). Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London.

Sambrook, J. Fritsch, E. F. And Maniatis, T. (1989). Molecular cloning- A Laboratory Manual (2nd edition). Cold Spring Harbor Laboratory press, U.S.A.

Tuan, R.S. (1997). Recombinant Gene Expression Protocols – Humana Press.

Watson, J.D. Gilman, M. Witkowaki, J. and Zoller M. (1992). Recombinant DNA Scientific American Books.

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MAJOR BASED ELECTIVE I - BIOETHICS

UNIT I:

General Ethical Concerns: The use of nature , Different views of Nature, Dynamic Nature, Interfering with Nature, Integrity of Species; Reducing Genetic Diversity ; Biological Warfare; Public perception of Science.

UNIT II:

Medical Ethics., History and Culture: The Hippocratic tradition: A Profession ,
Philantrophy, Do no harm. Adoption to the Oath by Western Medicine. Competing Ethical Traditions; Retaining the Hippocratic Oath.

UNIT III:

Status of Human Embryo: Human Embryonic Development; Ethics through Embryo
Development: Fertilization, The Fetus and feeling pain; Scientific Research on Human Embryos: Experimental goals of Human Embryo Research, Human Development; How much Embryo Experimentation in Ethical?

UNIT IV:

Animal Rights: Making New Strains of Animal: Ethical limits of Animal use: Religious
Views of Animal status; Philosophical views of Animal status; Regulations.

UNIT V:

Human Gene Therapy: Ethics of Somatic Cell Gene Therapy: Efficiency of treatment;
Safety of Transferred Genes; Protecting Human life; Affect on family life; Economic factors; When we should use Gene therapy?

References:

Nancy, S. Jecker., Albert R. Johnson, Robert A. Pearlman. Bioethics: An Introduction to history, methods and practice (1997). Sudbury, M.A.; Jones and Barlett Publishers.

Tom, L. Beauchamp., Childress, F. Principles of biomedical ethics, 5th Edition, Oxford Univerisity Press. 2000.

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MAJOR BASED ELECTIVE II – BIOINOCULANTS

Unit – I

General account of the microbes used as biofertilizers for crop plants and their advantages. Symbiotic N2 fixers : Rhizobium - Isolation, characterization, identification, Classification, inoculum production and field application.
Frankia - Isolation, characterization – actinorrhizal nodules – non-leguminous crop symbiosis.

Unit – II

Non – Symbiotic N2 fixers – Azospirillum – Free living - Azotobacter – free isolation, characterization, mass inoculum production and field application.

Unit – III

Symbiotic N2 fixers – Cyanobacteria, Azolla – Isolation, characterization, mass multiplication – Role in rice cultivation – Crop response – field application - immobilization.

Unit – IV

Phosphate solubilizers – Phosphate solubilizing microbes – Isolation, characterization, mass inoculum production, field application – Phosphate solubilization mechanism.

Unit – V

Mycorrhizal bioinoculants – classification – importance of mycorrizal

Ectomycorzhizae – Endomycorrhizae – Ectendo mycorrhizae – Taxonomy of mycorrhizae – Isolation of VA mycorrhizae – Quantification and assessment of VAM in roots – Mass inoculum production of VAM – field applications of Ectomycorrhizae and VAM.

Reference:

Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.

Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.

Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.

Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.

Subba Rao N.S. (1988) Biofertilizers in Agriculture and forestry Oxford and IBH Publishing Co., Ltd., New Delhi.

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MAJOR BASED ELECTIVE III : FOOD MICROBIOLOGY

Unit I

Food – Uses, Nutrition – types of Nutrition, Food used in different ages – infants, children, school age, adult, pregnant women and old age. Importance of mother milk.

Unit II

Types of microorganisms in Food- Source of contamination- Factors influencing microbial growth in food

Unit III

Contamination, spoilage and preservation of cereals and cereals products, sugar and sugar products, Vegetables and fruits, meat and meat products.

Unit IV

Food borne diseases and food poisoning – *Staphylococcus*, *Clostridium*, *Escherichia coli* and *Salmonella* infections, Hepatitis, Amoebiosis and Mycotoxins

Unit V

Food preservations: principles- methods of preservations-Physical and chemical methods, food sanitations.

Reference :

1. Frazier and Westhoff, DC. 1988. Food Microbiology. TATA McGraw Hill Publishing Company LTD., New Delhi
2. Adams, M.R and Moss, MO. 1995. Food Microniology. The Royal Society of Chemistry, Cambridge
3. Maheshwary. Nutrition and dietetic. New Delhi

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