



Bachelor of Microbiology Course Structure under CBCS

(For the candidates admitted from the academic year 2018-2019 onwards)



Semester	Part	Course	Course Code	Title of the Course	Ins. Hours/ Weeks	Credit	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
I	I	Language Course-I (LC) – Tamil*/Other Languages ** #	18UT1	Tamil-I (Ilakiyam-Kavithai, Sirukathai, Urainadai, Ilakkiya Varalaru)	6	3	3	25	75	100
	II	English Language Course-I (ELC)	18UE1	English-I (Prose for Effective Communication and Grammar)	6	3	3	25	75	100
	III	Core Course – I (CC)	18UMB1CC1	Basic Microbiology	6	6	3	25	75	100
	III	Allied Course –I (AC)	18UMB1AC1	General Biochemistry	4	4	3	25	75	100
	III	Core Practical - I (CP)	18UMB2CP1	Basic Microbiology & Microbial Taxonomy and Physiology (P)	3	--	-	--	--	--
	III	Allied Practical -I (AP)	18UMB2AP1	General Biochemistry & Cell Biology (P)	3	--	-	--	--	--
	IV	Value Education	18UVE	Value Education	2	2	3	25	75	100
					Total	30	18			
II	I	Language Course-II (LC) – Tamil*/Other Languages ** #	18UT2	Tamil-II (Idaikkala Ilakkiyam, Nadagam, Puthinam, Ilakkiya Varalaru)	6	3	3	25	75	100
	II	English Language Course-II (ELC)	18UE2	English-II (Poetry for Effective Communication and Grammar)	6	3	3	25	75	100
	III	Core Course – II (CC)	18UMB2CC2	Microbial Taxonomy and Physiology	6	6	3	25	75	100
	III	Allied Course – II (AC)	18UMB2AC2	Cell Biology	4	2	3	25	75	100
	III	Core Practical - I (CP)	18UMB2CP1	Basic Microbiology & Microbial Taxonomy and Physiology (P)	3	3	3	40	60	100
	III	Allied Practical -I (AP)	18UMB2AP1	General Biochemistry & Cell Biology (P)	3	3	3	40	60	100
	IV	Environmental Studies	18UES	Environmental Studies	2	2	3	25	75	100
					Total	30	22			
III	I	Language Course-III (LC) – Tamil*/Other Languages ** #	18UT3	Tamil-III (Kappiya Ilakkiyam , Nadagam, Ilakkiya Varalaru)	6	3	3	25	75	100
	II	English Language Course-III	18UE3	English-III(Short Story and Effective	6	3	3	25	75	100

	(ELC)		Communication Skill)							
III	Core Course – III (CC)	18UMB3CC3	Immunology	6	6	3	25	75	100	
III	Allied Course – III (AC)	18UMB3AC3	Bioinformatics	4	4	3	25	75	100	
III	Core Practical - II (CP)	18UMB4CP2	Immunology & Bacteriology and Parasitology (P)	3	--	-	--	--	--	
III	Allied Practical - II (AP)	18UMB4AP2	Bioinformatics & Biostatistics (P)	3	--	-	--	--	--	
IV	Non Major Elective-I	18UBT3NME1	Mushroom and Vermi Technology	2	2	3	25	75	100	
			Total	30	18				500	
IV	I	Language Course–IV (LC) – Tamil*/Other Languages ** #	18UT4	Tamil-IV (Palan Ilakkiyam, Ilakiya Varalaru, Podhu katturai)	6	3	3	25	75	100
	II	English Language Course-IV (ELC)	18UE4	English-IV(One Act Play and Effective Communication Skill)	6	3	3	25	75	100
	III	Core Course – IV (CC)	18UMB4CC4	Bacteriology and Parasitology	5	5	3	25	75	100
	III	Allied Course – IV (AC)	18UMB4AC4	Biostatistics	3	4	3	25	75	100
	III	Core Practical - II (CP)	18UMB4CP2	Immunology & Bacteriology and Parasitology (P)	3	3	3	40	60	100
	III	Allied Practical - II (AP)	18UMB4AP2	Bioinformatics & Biostatistics (P)	3	3	3	40	60	100
	IV	Non Major Elective-II	18UBT4NME2	Quality Control and Hygiene Practices	2	2	3	25	75	100
	IV	Skill based elective - I	18UMB4SBE1	Basic Computer Applications in Biology	2	2	3	25	75	100
			Total	30	23				800	
V	III	Core Course – V (CC)	18UMB5CC5	Virology and Mycology	5	5	3	25	75	100
	III	Core Course – VI (CC)	18UMB5CC6	Environmental and Agricultural Microbiology	5	5	3	25	75	100
	III	Core Course – VII (CC)	18UMB5CC7	Microbial Genetics and Molecular Biology	6	5	3	25	75	100
	III	Core Practical – III (CP)	18UMB5CP3	Virology and Mycology, Environmental, Agricultural Microbiology & Microbial genetics and Molecular biology (P)	3	3	3	40	60	100
	III	Major based elective - I	18UMB5MBE1	Plant and Animal Biology	5	5	3	25	75	100
	IV	Skill based elective - II	18UMB5SBE2	Entrepreneurship in Microbiology	2	2	3	25	75	100
	IV	Skill based elective - III	18UMB5SBE3	Microbial Products	2	2	3	25	75	100
IV	Soft Skills Development	18USSD	Soft Skills Development	2	2	3	25	75	100	

				Total	30	29				800
VI	III	Core Course – VIII (CC)	18UMB6CC8	Food Microbiology	6	6	3	25	75	100
	III	Core Course – IX (CC)	18UMB6CC9	Industrial Microbiology	6	6	3	25	75	100
	III	Core Practical – IV (CP)	18UMB6CP4	Food Microbiology & Industrial Microbiology (P)	6	5	3	40	60	100
	III	Major based elective - II	18UMB6MBE2	Bioinstrumentation	6	6	3	25	75	100
	III	Major based elective - III	18UMB6MBE3	Bioethics and Biosafety	5	5	3	25	75	100
	V	Gender studies	18UGS	Gender studies	1	1	3	25	75	100
	V	Extension activities*			-	1	-	-	-	-
					Total	30	30			
Grand Total					180	140				3900

List of Allied Courses:

First Allied Course I **General Biochemistry**
 First Allied Course II **Cell Biology**

Second Allied Course I **Bioinformatics**
 Second Allied Course II **Biostatistics**

List of Non Major Elective (For 2018 – 2019)

Elective	Semester	Course Code	Title of the Course
NME-I	III	18UBT3NME1	Mushroom and Vermitechnology
NME-II	IV	18UBT4NME2	Quality Control and Hygiene Practices

List of Skill Based Elective (For 2018 – 2019)

Elective	Semester	Course Code	Title of the Course
SBE-I	IV	18UMB4SBE1	Basic Computer Applications in Biology
SBE-II	V	18UMB5SBE2	Entrepreneurship in Microbiology
SBE-III	V	18UMB5SBE3	Microbial Products

List of Major Based Elective (For 2018 – 2019)

Elective	Semester	Course Code	Title of the Course
Elective-I	V	18UMB5MBE1	Plant and Animal Biology
Elective-II	VI	18UMB6MBE2	Bioinstrumentation
Elective-III	VI	18UMB6MBE3	Bioethics and Biosafety

Paper Details:

Tamil Part I	- 4
English Part II	- 4
Core Paper	- 9
Core Practical	- 4
Allied Paper	- 4
Allied Practical	- 2
Non-Major Elective	- 2
Skill Based Elective	- 3
Major Based Elective	- 3
Environmental Studies-	1
Value Education	- 1
Soft Skill Development-	1
Gender Studies	- 1
Extension Activities	- 1 (Credit Only)

* for those who studied Tamil up to 10th +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

those who studied Tamil up to 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

** Extension Activities shall be outside instruction hours

Non Major Elective I & II – for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students

b) Special Tamil I & II for those who studied Tamil up to 10th or +2 but opt for other languages in degree programme

Note:

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

SEMESTER – I

CORE COURSE 1 - BASIC MICROBIOLOGY

Course Code: 18UMB1CC1
Hours: 6
Credit: 6

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

Basic microbiology deals with

- Basic concepts of what microorganism is & its characteristics
- Various types of microscopes
- Staining techniques for identification of microbes
- The various transport systems available for different organisms for their nutritional uptake
- Cultivation techniques for microbial isolation
- The effect of agents on microbial inhibition

Unit I - Introduction

Definition, scope and history of microbiology. Difference between the prokaryotic and eukaryotic microorganisms. Prokaryotic and eukaryotic structure and functions of their organelles. General introduction of classification and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept.

Unit II - Microscopy

Principles and applications of simple, compound, bright field, dark field, phase contrast, fluorescent and electron microscope (SEM & TEM). Differentiation of light and electron microscope. Principles of staining: Nature of dyes, types of staining – simple, differential, negative, capsule, acid-fast and spore staining. Fungal mounting – LCB, KOH and slide culture techniques.

Unit III - Classifications

Classification, general characteristics and nature of Bacteria, Archaeobacteria, Cyanobacteria, Mycoplasmas, Extremophiles, Actinomycetes, Protozoa, Algae, Fungi and Viruses.

Unit IV – Ultra structure of prokaryotes

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. Membrane transport mechanisms – diffusion, active and passive transport.

Unit V – Media and sterilization

Culture techniques - Types of media simple, defined, differential, selective, enriched and transport media. Sterilization: Principles and methods – physical (moist heat, dry heat, filtration, pasteurization, tyndallization, radiations) and chemical (alcohols, aldehydes, phenols, halogens and hypochlorites). Methods of maintenance and preservation of microbes.

Text Book:

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

Reference Books:

1. Lansing M. Prescott., John P. Harley and Donald A.Klein. (2003). Microbiology (5th edi). McGraw Hill, New York.
2. 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.
3. James G. Cappuccino and Natalie Sheman.(1996). Microbiology-A laboratory manual.(4th edition).The Benjamin/Cummings publishing company Inc, California.
4. Moselio Schaechter. and Joshua Leaderberg. (2004). The Desk encyclopedia of Microbiology. Elsevier Academic press, California.

SEMESTER – I

ALLIED COURSE I - GENERAL BIOCHEMISTRY

Course Code: 18UMB1AC1

Hours: 4

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- Mainly to know the existence of biomolecules in nature and living things
- To understand the importance of biomolecules
- To know about the proteins and enzymes classification
- To know mode of action of enzymes and membrane

Unit I – Carbohydrates

Carbohydrates: Classification and structural elucidation of glucose and fructose. Interconversion of sugars. Properties, structure and biological functions of monosaccharides, disaccharides, and polysaccharides.

Unit II – Proteins

Proteins: classification and Biological importance. Primary structure, Secondary, tertiary and quaternary structure- forces stabilizing the structure of proteins. Amino acids - Structure – Classification- Essential and Non essential amino acids - Physical and Chemical properties of Amino acids.

Unit III – Nucleic acids and Lipids

Nucleic acids: Nucleotides and Nucleosides - Pyrimidines and Purines. DNA – Composition – Structure- forms and functions - RNA – Types and Composition - Structure and functions. Denaturation and renaturation.

Lipids: Nomenclature- Classification and Biological significance – Simple Lipids- Types of fatty acids – Triglycerides – waxes – steroids - prostaglandins and their properties - Compound lipids – Phospholipids - sphingolipids and glycolipids - Lipoproteins.

Unit IV – Enzymes

Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes. pKa value – Lock and key concept.

Unit V – Vitamins and Hormones

Vitamins: Sources – structure - Biological role of Vitamins - Fat soluble vitamins A,D,E and K - Water soluble vitamins- B complex and vitamin C - Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12. Phytohormones and plant's secondary metabolites – structure and functions of auxin, gibberellins, cytokinins and abscisic acid.

Text Book:

1. J.L. Jain, Fundamentals of Biochemistry, S. Chand & Company LTD, 1999.

Reference Books:

1. D.L Nelson and M.M Cox, “Lehninger’s Principles of Biochemistry”, W.H Freeman Publications, 5th edition, 2008.
2. Dawn, B.Markus, (1994). Biochemistry. Harwal Publishing, New York.
3. Donald Voet and Judith Voet. (1990). Biochemistry. John Wiley and Sons, New York.
4. Henry, R. Mahler and Eugene, H. Cerdasz, (1966). Biological Chemistry. Harper International Edition, New York.

SEMESTER – I & II
CORE PRACTICAL I - BASIC MICROBIOLOGY & MICROBIAL TAXONOMY AND
PHYSIOLOGY

Course Code: 18UMB2CP1
Hours: 3
Credit: 3

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- Basic microbial laboratory skills.
- Handling of instruments and laboratory safety measures are included in practicals.
- Principles of Microbiology.
- Methods for Microbiology.

Basic Microbiology

1. Basic microbial laboratory skills.
2. Handling of instruments and laboratory safety measures are included in practicals.
3. Microscope and its operation
4. Cleaning of glassware and sterilization methods – autoclaving and hot air oven
5. Preparation of culture media
6. Demonstration of ubiquitous nature of microorganisms.
7. Quantification of microbial population by viable cell count and haemocytometer.
8. Observation of permanent slides to study the structural characteristics of algae (*Anabena*, *Nostoc*, *Spirulina*, *Oscillatoria*), fungi (*Pythium*, *Rhizopus*, *Saccharomyces*, *Penicillium*, *Aspergillus*, *Agaricus*) and protozoa (*Entamoeba histolytica* and *Plasmodium* spp.).
9. Isolation of microorganism from soil and water.
10. Pure culture techniques - Streak plate (simple, quadrant & T), Pour plate and Spread plate.
11. Enumeration of bacteria and yeast cells through spread method from solid and liquid sample
12. Test for motility of bacteria – Hanging drop method.
13. Staining techniques – Simple staining, Gram's staining, Ziehl-Neelsen, Spore-staining and Capsular staining.
14. Isolation of fungi and cyanobacteria
15. Micrometry: Determination of size of bacteria, yeast. Fungal filaments.

Microbial Physiology

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 and carbohydrate tests.

Text Book:

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

Reference Books:

1. Mackie and McCartney. (1989). Practical Medical Microbiology, Churchill Livingston.
2. Albert Balows, Hens G. Truper., Martin Dworkin, Wim, Hardses, Karl-heinz Schoeifer (eds). (1992). A Hand book on the biology of bacteria, ecophysiology, isolation, identification and applications, Springer Verlag.
3. Alcamo, Fndamentals of Microbiology, Blackwell Publications
4. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
5. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.

SEMESTER – I & II

ALLIED PRACTICAL I - BASIC BIOCHEMISTRY AND CELL BIOLOGY

Course Code: 18UMB2AP1

Hours: 3

Credit: 3

Total Marks: 100

External Marks: 60

Internal Marks: 40

Objectives

- To learn basic biochemistry techniques
- To qualitative and quantitative analyses of macromolecules
- To study the structures of macromolecules

Biochemistry

1. Qualitative and quantitative estimation of carbohydrates, amino acids, proteins, lipids and nucleic acids.
2. Estimation of ascorbic acid (from biological sample)
3. Estimation of glycine by formal titration method
4. Separation of lipid by TLC

Cell biology

1. Separation of nucleic acid bases by paper chromatography
2. Microscopy - Theoretical knowledge of light and electron microscope
3. Demonstration - Study of structure of cell organelles through electron micrographs
4. Study of the following techniques through electron / photo micrographs: Fluorescence microscopy, autoradiography, positive staining, staining, freeze fracture, freeze etching, shadow casting

Permanent slide preparation

1. Cytochemical staining of DNA-Feulgen
2. Cytochemical staining of DNA and RNA- Methyl Green Pyronin (MGP)
3. Cytochemical staining of Polysaccharides-Periodic Acid Schiff's (PAS)
4. Cytochemical staining of Total proteins- Bromo-phenol blue

Text Book:

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

Reference Books:

1. Oser, B.L.Hawks, (1965). Physiological Chemistry, TATA McGraw Hill.
2. An introduction to practical biochemistry by David T Plummer
3. Laboratory manual in biochemistry by Pattabiraman& acharya
4. Practical biochemistry by Jayaraman
5. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
7. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

SEMESTER – II

CORE COURSE II - MICROBIAL TAXONOMY AND PHYSIOLOGY

Course Code: 18UMB2CC2

Hours: 6

Credit: 6

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- Giving a broader edge to the students about the process of growth cycle, morphogenesis, endospore formation and photosynthesis
- The pathways for utilization of nutrients incorporated by the organism to gain their living

Unit I – Microbial taxonomy

Microbial taxonomy – definition and systematics, nomenclature - hierarchical organization and the position of microbes in the living world classification systems – artificial and phylogenetic – dendogram. Major characteristics used in taxonomy – morphological, physiological, metabolic, genetic and molecular. Numerical and chemotaxonomy of microorganisms.

Unit II - 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 phases of growth. Growth measurements – batch, continuous and synchronous.

Unit III - Metabolism of carbohydrates

Anabolism – photosynthesis – oxygenic – anoxygenic, synthesis of carbohydrate – catabolism of glucose – Embden Mayer – Hoff – Parnas pathway – Pentose pathway, Krebs's cycle (TCA) – electron transport system and ATP production.

Unit IV - Metabolism of protein & Bacterial enzymes

Metabolism of protein: Metabolic pathways of nitrogen utilization, synthesis of amino acids, peptides, proteins. Bacterial enzymes: Classification, properties, coenzymes, cofactors and isozymes.

Unit V - Respiration

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

Text Book:

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

Reference Books:

1. Doelle, H.W. (ed.) (2005). Microbial Metabolism, Academic Press. Gerhart, G., (1986). Bacterial Metabolism, Springer Verlag.
2. Mathews C.K., and Holde K.E.V. (1996). Biochemistry – The Benjamin/Cummings Publishing company, Inc.
3. Murray R.K. Granner M.D., Mayes P.A. and Rodwell V.W. (1990) Biochemistry – Prentice Hall International Inc.
4. Stryer L. (1995). Biochemistry (4th edn.) W.H.Freeman and company, New York.
5. Zubey C.L. Parson W.W., and Vance D.E. (1994) Principles of Biochemistry – Wim.C. Brown Publishers, Oxford, England.

SEMESTER – II
ALLIED COURSE II - CELL BIOLOGY

Course Code: 18UMB2AC2
Hours: 4
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To study the fundamental concepts of plant and animal cells
- To understand the process of cell cycle and cell division
- Provide the knowledge about functions of intracellular organelles
- To know about the cellular communication and cell signaling

Unit I - Introduction

Cells as Unit of Life - Diversity of cell size and shape - Prokaryotic and Eukaryotic cells – Isolation and growth of cells - Differences and similarities in plant and animal cells. Structure and biochemical composition of cell wall and plasma membrane – fluid mosaic model. Trilaminar model, receptor concept, sodium potassium pumps.

Unit II - Structural organization and function of intracellular organelles

Intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Unit III - Membrane structure and function

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Unit IV - Cell division and cell cycle

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Microbial Physiology - Growth, yield and characteristics, strategies of cell division, stress response. Chromosomes - structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin.

Unit V - Cellular communication

Cellular communication: Principles of cell communication - cell adhesion - roles of different adhesion molecules - Gap junctions - extracellular matrix - Integrins - neurotransmission - Hematopoiesis and its regulation. Cell signaling - Hormones and their receptors - cell surface receptor - signaling through G-protein coupled receptors - signal transduction pathways - regulation of signaling pathways.

Text Book:

1. Principles of Biochemistry, Geoffrey L. Zubay, William, W. Parson, Dennis E. Vance, 1995, Wim C. Brown communications

Reference Books:

1. Stryer, L.1995.Biochemistry. 4th Ed. W.H. Freeman and Company, New York.
2. Biological Chemistry. Harper International Edition, New York.
3. Molecular Cell Biology, James Darnet, Harvey Lodish, David Baltimore, 1986. Scientific Americal Books Ins.,
4. Cell and Molecular Biology, E.D.P. Derobertis, E.M.F. DeRobertis, 1988. 8th edition, International edition ISBN

SEMESTER – I & II
CORE PRACTICAL I - BASIC MICROBIOLOGY & MICROBIAL TAXONOMY AND
PHYSIOLOGY

Course Code: 18UMB2CP1

Hours: 3

Credit: 3

Total Marks: 100

External Marks: 60

Internal Marks: 40

Objectives

- Basic microbial laboratory skills.
- Handling of instruments and laboratory safety measures are included in practicals.
- Principles of Microbiology.
- Methods for Microbiology.

Basic Microbiology

1. Basic microbial laboratory skills.
2. Handling of instruments and laboratory safety measures are included in practicals.
3. Microscope and its operation
4. Cleaning of glassware and sterilization methods – autoclaving and hot air oven
5. Preparation of culture media
6. Demonstration of ubiquitous nature of microorganisms.
7. Quantification of microbial population by viable cell count and haemocytometer.
8. Observation of permanent slides to study the structural characteristics of algae (*Anabena*, *Nostoc*, *Spirulina*, *Oscillatoria*), fungi (*Pythium*, *Rhizopus*, *Saccharomyces*, *Penicillium*, *Aspergillus*, *Agaricus*) and protozoa (*Entamoeba histolytica* and *Plasmodium* spp.).
9. Isolation of microorganism from soil and water.
10. Pure culture techniques - Streak plate (simple, quadrant & T), Pour plate and Spread plate.
11. Enumeration of bacteria and yeast cells through spread method from solid and liquid sample
12. Test for motility of bacteria – Hanging drop method.
13. Staining techniques – Simple staining, Gram's staining, Ziehl-Neelsen, Spore-staining and Capsular staining.
14. Isolation of fungi and cyanobacteria
15. Micrometry: Determination of size of bacteria, yeast. Fungal filaments.

Microbial Physiology

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 and carbohydrate tests.

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SEMESTER – I & II

ALLIED PRACTICAL I - BASIC BIOCHEMISTRY AND CELL BIOLOGY

Course Code: 18UMB2AP1

Hours: 3

Credit: 3

Total Marks: 100

External Marks: 60

Internal Marks: 40

Objectives

- To learn basic biochemistry techniques
- To qualitative and quantitative analyses of macromolecules
- To study the structures of macromolecules

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1. Qualitative and quantitative estimation of carbohydrates, amino acids, proteins, lipids and nucleic acids.
2. Estimation of ascorbic acid (from biological sample)
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4. Separation of lipid by TLC

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1. Separation of nucleic acid bases by paper chromatography
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3. Demonstration - Study of structure of cell organelles through electron micrographs
4. Study of the following techniques through electron / photo micrographs: Fluorescence microscopy, autoradiography, positive staining, staining, freeze fracture, freeze etching, shadow casting

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5. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
7. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

SEMESTER – III

CORE COURSE III - IMMUNOLOGY

Course Code: 18UMB3CC3

Hours: 6

Credit: 6

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

Immunology explains

- The working of immune system and immune molecules
- Its response to antigenic substances
- Mechanisms of immune response, autoimmune disorders
- Hypersensitivity reactions of immune system
- Immuno diagnosis, cancer immunology, and transplantation immunology

Unit I - Introduction

Introduction: History of immunology, Immunohematology – Blood groups – Blood transfusion, Host parasite relationship, Microbial infections.

Unit II – Immune system

Structure, Composition and Function of cells and organs involved in immune system. Immunity - Innate immunity, acquired immunity.

Unit III - Antigens

Antigens: Antigens, types, properties, adjuvant, vaccines, toxoides-antitoxin. Immunoglobulin – structures type and properties. Complement structure properties and functions- pathways. Theories of antibody production. MHC complex – structures, functions.

Unit IV - Hypersensitivity

Hypersensitivity reactions – antibody mediated-type I, anaphylaxis- Type II, antibody dependent and cytotoxicity, Type III and cell mediated immune response Type IV – lymphokines , cytokines.

Unit V - Antigen – Antibody reactions

Antigen – Antibody reactions - *Invitro* methods – Agglutination, Precipitation, Complement fixation, Immunofluorescence, HAI, ELISA, RIA, Flow cytometry and Fluorescence immunoblotting; *In vivo* methods –Skin tests, Immune complex tissue demonstrations.

Text Book:

1. Kuby, Immunology – Richard A Goldsby, Thomas J. Knidf. Barbara A. Osborne (2000) 4th Edition

Reference Books:

1. Tizard K (1983) Immunology- An Introduction. Saunders College Publishing, Philadelphia.
2. Roitt. I.M. (1988). Essential Immunology. Black Well Scientific Publishers.
3. Lefell, Donnenberg, A: and Rose, H. (1997). Hand book of Lunar Immunology BOCA Raton Fla;CRC Press
4. Abbas, A.K. Lichtman, A.M. and Pober, J.S. (1992). Cellular and Molecular Immunology 3rd Edition Philadelphia: M.B. Saunders.

SEMESTER – II

ALLIED COURSE III - BIOINFORMATICS

Course Code: 18UMB3AC3

Hours: 4

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- To understand the basics of bioinformatics with biological databases
- To know about the sequence alignment tools with algorithms
- To understand about the structure prediction
- To know about the genomics and proteomic applications

Unit I - Introduction to Bioinformatics

Introduction: Definition – Objectives of Bioinformatics - History of Bioinformatics – Scope of Bioinformatics – Biological Data integration and analysis - Applications of Bioinformatics.

Unit II - Genomics and Proteomics

Genomics and Proteomics: Genomics – Functional Genomics - Structural Genomics – Pharmacogenomics – Comparative genomics - Proteomics – Types and applications - Human Genome Project – Systems Biology.

Unit III - Tools for Bioinformatics

Tools for Bioinformatics: Scoring matrices – Blosum and PAM Matrix – Dot plots - Sequence Alignment – Pair wise sequence alignment – BLAST and FASTA – Gap Penalty - Alignment Algorithms: Needleman Wunsch Algorithm and Smith Waterman Algorithm - Multiple Sequence Alignment – Clustal W – Phylogenetic Analysis-.

Unit IV - Protein Structure Prediction

Protein Structure Prediction: Secondary structure Prediction – FSSP, PDB, SCOP and CATH - Chou-Fasman method –GOR method- Comparative Modeling – Fold recognition – Ab initio prediction – Structure Visualization tools – Rasmol and Phymol.

Unit V - Biological Databases

Biological Databases: Genbank - Nucleic acid Sequence Databases – NCBI, EMBL and DDBJ - Protein Sequence Databases - Swiss Prot, Uniprot and PIR – Structural Databases- PDB - Literature Databases – Pubmed - Specialized sequence Databases – Pattern and motif searches - PROSITE, BLOCKS, PRINTS, PFAM.

Text Book:

1. Attwood T K, D J Parry-Smith, “Introduction to Bioinformatics”, Pearson Education, 2005.
2. Rastogi S.C., Namita Mendiratta, Parag Rastogi. (2011) Bioinformatics – Concepts, Skills and Applications (Second Edition) CBS Publishers, New Delhi.

Reference Books:

1. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
2. Harshwardhan, P. (2005) Bioinformatics principles and application. Tata Mc Graw Hill Publishers. New Delhi.
3. Mount, D.W. 2005. Bioinformatics Sequence and genome analysis (II edition) CBS Publishers. New Delhi

SEMESTER – III & IV
CORE PRACTICAL II - IMMUNOLOGY & BACTERIOLOGY AND PARASITOLOGY

Course Code: 18UMB4CP2
Hours: 3
Credit: 3

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- To diagnose infectious diseases
- To identify the medically important pathogen
- To know the knowledge about various diagnosis method
- To familiarize with morphologic criteria to differentiate the most common parasites

Immunology

1. Blood collection and plasma/serum separation.
2. ABO blood grouping, Rh Typing
3. Examinations of Blood Cells i. Total Count ii. Differential Count
4. WIDAL test, RPR, CRP,RIA, ASO and Pregnancy test (Direct/Indirect)
5. Precipitation reaction i. RPR card test / VDRL test; ii. Ouchterlony double immunodiffusion test;
iii. Counter immune-electrophoresis
6. Demonstration of HIV by Tri - dot test

Bacteriology and Parasitology

1. General requirements of collections and transport of clinical specimens
2. Simple, differential and special staining of Clinical material such as Throat swab, Pus, Urine, Sputum, Stool and etc
3. Identification of *Escherichia coli*, *Streptococcus pneumonia*, *Staphylococcus aureus* and *Klebsiella pneumonia* and etc
4. Antibiotic sensitivity test – Kirby – Bauer disc diffusion, well diffusion, MIC and MBC methods
5. Saline and iodine wet mount
6. Giemsa staining for the demonstration of blood parasites, KOH and LCB mount
7. Wet mount examinations of stool for parasites
8. Blood smear examination for malaria parasite (*Plasmodium vivax* and *P. malariae*)

Text Book:

1. Myer's and Koshi's Manual of Diagnostic Procedures in Medical Microbiology and Immunology/Serology. Published by Department of Clinical Microbiology, CMC and Hospital, Vellore, Tamil Nadu.

Reference Books:

1. Ivan Roitt, Jonathan Brostoff and David Male. (2002). Immunology (6th edition). Elsevier science Ltd., New York.
2. Janis Kuby. (1994). Immunology. (2nd edition). W.H. Freeman and company, New York.
3. Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.
4. Bailey and Scott's Diagnostic Microbiology by Baron et al.

SEMESTER – III & IV
ALLIED PRACTICAL II - BIOINFORMATICS AND BIOSTATISTICS

Course Code: 18UMB4AP2
Hours: 3
Credit: 3

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- To train the students in using basic bioinformatics techniques
- To train the students in using Ms-Excel / SPSS for solving the biological problems
- To get the knowledge about basic biological databases and tools

Bioinformatics

1. Study of Nucleic acid sequence databanks – NCBI, EMBL and DDBJ
2. Study of protein data banks - Swissprot, Uniprot. and PIR
3. Study of Protein Structure databases – PDB, PDBSUM, SCOP and CATH.
4. Pair wise sequence alignment using BLAST
5. Multiple sequence alignment by Clustal W
6. Compute protein parameters using Protparam
7. Calculate structural parameters using SOPMA
8. Evaluation of protein structure by Swiss PDB viewer and structure visualization using Rasmol tool.

Biostatistics

1. Frequency Distribution (Discrete Series), (Inclusive method) and (Exclusive method)
2. Bar diagram, Pie diagram and Histogram
3. Mean, Median and Mode (Discrete Series) and (Continuous Series)
4. Mean Deviation and Standard Deviation (Discrete Series) and (Continuous Series)
5. Skewness and Kurtosis
6. Scatter Diagram
7. Karl Person Correlation Coefficient
8. Spearman Rank correlation (Tide Rank) and (Repeated Rank)
9. Regression coefficient and Fitting Regression lines
10. Regression line x on y and Regression line y on x
11. Chi-square test for Goodness of Fit
12. Chi-square test for Independence of Attributes
13. Independent t-test of sample means
14. Paired t-test of sample means
15. F-test for equality of sample variances

Text Book:

1. Rastogi S.C., Namita Mendiratta, Parag Rastogi. (2011) Bioinformatics – Concepts, Skills and Applications (Second Edition) CBS Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V.K.: “Fundamentals of Mathematical Statistics”, Sultan & Chand & Sons, New Delhi, 11th Ed, 2002.

Reference Books:

1. Harshawardhan, P. (2005) Bioinformatics principles and application. Tata Mc Graw Hill Publishers. New Delhi.
2. Mount, D.W. 2005. Bioinformatics Sequence and genome analysis (II edition) CBS Publishers. NewDelhi
3. Veerarajan T.. “Probability, statistics and Random processes, Tata McGraw-Hill Education, 3rd Ed, 2002.

SEMESTER – III
NON MAJOR ELECTIVE I - MUSHROOM AND VERMI TECHNOLOGY

Course Code: 18UBT3NME1
Hours: 2
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To facilitate self-employment
- To know the nutrient value of mushroom
- To know about the vermicomposting and its agricultural value

Unit I – Introduction of Mushroom

Edible and non-edible mushroom (Historical account, most commonly cultivated mushrooms in the world, distribution and production in various countries). Cultivation of button mushroom -morphology raising a pure culture & spawn preparation. Cultivation of oyster and paddy straw mushroom - preparation of pure culture & spawn cultivation methods, harvest.

Unit II – Cultivation

Preparation of compost & cultivation of *Agaricus bisporus*, *Pleurotus flabellatus*, harvest. Pests and diseases of Edible mushrooms (Environmental, fungal, bacterial, viral, insect pests and Nematode diseases and competitor moulds).

Unit III – Earthworms

Soil biota -Earthworms -Ecological classification of earth worms as Epigeics -Introduction to earthworm biology -physical and chemical effects of earth worms on soils - Role of earthworms in soil -classification of earthworms based on ecological strategies- Burrowing activity of earthworms- Drilospheres - Microorganisms and their relationship with earthworms. Composing - anaerobic composing, aerobic composing, types of composing, vermicompost- earthworm species used in vermicompost production - endemic species, exotic species.

Unit IV – Vermicomposting

Vermicompost -setting up vermicompost quality N, P, K, C, N, Microbial quality applications - vermiculture –vermiwash - role of vermicompost in organic farming - its quality and advantages over chemical inputs. Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions.

Unit V – Applications of Mushroom and Vermicomposting

Antiviral value, antibacterial effect, antifungal effect, anti-tumour effect, haematological value cardiovascular & renal effect, in therapeutic diets, adolescence, for aged persons & diabetes mellitus. Delicious recipies of mushroom-Economic importance of mushrooms. Vermicomposting as a tool for solid waste management - a small scale industry and it's economics.

Text Book:

1. Changs. T. W.A. Hayanes 1978. "Biology and cultivation of Mushrooms" Acad Press.N.Y.

Reference Books:

1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman.
3. Zadrazil. F & K. Grabbe 1983 "Edible Mushroom, Biotechnology" Vol. 3, Weinheim: Verlag Chemie, Berlin.
4. Kannaiyan. 2001. Handbook of Edible Mushrooms" TNAU Publication.

SEMESTER – IV
CORE COURSE IV - BACTERIOLOGY AND PARASITOLOGY

Course Code: 18UMB4CC4
Hours: 5
Credit: 5

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

Bacteriology and Parasitology deals with

- The study of bacteria and parasites with respect to the disease causing nature and characteristics
- Microbial pathogenesis and epidemiology
- The study of disease pathology and immunology
- The study the clinical manifestations, prevention and treatment

Unit I – Introduction of Bacteria and Parasite

Introduction: Normal microbial flora of human body; General attributes and virulence factors of bacteria and parasites causing infections. Host Parasite relationships. Zoonotic diseases and their control; Hospital acquired infections and their control. Specimen Collection, Transport and Storage; Specimen processing (Blood, Urine, GSF, Sputum, other body fluids).

Unit II – Bacterial diseases I

Classification morphology, cultural characteristics, pathogenicity, epidemiology, laboratory diagnosis, treatment, prevention and control of diseases caused by: Staphylococci, Streptococci, Pneumococci, Neisseriae (Gonococci and Meningococci), Corynebacterium, Mycobacterium, Clostridium and Haemophilus.

Unit III - Bacterial diseases II

Classification morphology, cultural characteristics, pathogenicity, epidemiology, laboratory diagnosis, treatment, prevention and control of diseases caused by: Salmonella, Shigella, Vibrios, Brucella, Bordetella, Escherichia, Mycoplasmas and Ureoplasmas.

Unit IV – Parasitic diseases I

Classification Morphology, Pathogenicity, lab diagnosis of common protozoan diseases - Amoebiasis, Giardiasis, Balantidiosis, Trypanosomiasis, Malaria, Toxoplasmosis, Leishmaniasis, *Trichomonas vaginalis*.

Unit V - Parasitic diseases II

Classification Morphology, Pathogenicity, lab diagnosis of common parasitic metazoan diseases – Ascariasis, Hook worm, Filariasis, Hydatidosis, Taenia infection.

Text Book:

1. Parija, S.C. (1996). Textbook of Medical Parasitology. Orient Longman.
2. Salle, A.J. (1992). Fundamental Principles of Bacteriology. 7th Edi, Mc. Graw Hill Publishing Co. Ltd., New York.

Reference Books:

1. K.D. Chatterjee, M.D. Parasitology 12th Edi. Chatter (1980) Joe media Publishers Culcutta.
2. Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman.
3. Baron, E.J. and Finegold S.M. (1995). Scientific Company. Diagnostic Microbiology. Blackwell Scientific Company.

SEMESTER – IV

ALLIED COURSE IV - BIOSTATISTICS

Course Code: 18UMB4AC4
Hours: 3
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To understand the various applications of statistics with reference to biological sciences

Unit I – Collection and Presentation of data

Statistics: Definition - Collection of data – Primary & Secondary - Population and Samples - Types of sampling (SRS, Stratified, systematic) - Describing a sample - Frequency table - Frequency graphs – Data handling - Diagrammatic representation of data (Line, Bar, Pie, Histogram, Pictogram and etc).

Unit II – Measures of averages and Dispersions

Mean, Median and Mode. Measures of variability: Range, Mean deviation, Standard deviation and coefficient of variation- Simple problems. Skewness and Kurtosis.

Unit III – Correlation

Correlation: types of correlation - Scatter diagram - Pearson's coefficient of correlation - Rank correlation-Tied and Repeated ranks.

Unit IV – Simple regression

Regression: Meaning of regression lines - Regression equations Y on X and X on Y only - Regression Coefficient - Simple problems.

Unit V – Tests of hypothesis

Null hypothesis – Level of Significance – Standard Error-Two kinds of errors - Chi-square test, Goodness of fit, Test for independence - F test: Equality of variances.

Text Book:

1. Saxena H.C.: “Elementary Statistics”. S. Chand & Co., 17th Ed, 2013.

Reference Books:

1. Gupta, S.C. and Kapoor, V.K.: “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi, 10th Ed, 2014.

SEMESTER – III & IV
CORE PRACTICAL II - IMMUNOLOGY & BACTERIOLOGY AND PARASITOLOGY

Course Code: 18UMB4CP2
Hours: 3
Credit: 3

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- To diagnose infectious diseases
- To identify the medically important pathogen
- To know the knowledge about various diagnosis method
- To familiarize with morphologic criteria to differentiate the most common parasites

Immunology

1. Blood collection and plasma/serum separation.
2. ABO blood grouping, Rh Typing
3. Examinations of Blood Cells i. Total Count ii. Differential Count
4. WIDAL test, RPR, CRP,RIA, ASO and Pregnancy test (Direct/Indirect)
5. Precipitation reaction i. RPR card test / VDRL test; ii. Ouchterlony double immunodiffusion test;
iii. Counter immune-electrophoresis
6. Demonstration of HIV by Tri - dot test

Bacteriology and Parasitology

1. General requirements of collections and transport of clinical specimens
2. Simple, differential and special staining of Clinical material such as Throat swab, Pus, Urine, Sputum, Stool and etc
3. Identification of *Escherichia coli*, *Streptococcus pneumonia*, *Staphylococcus aureus* and *Klebsiella pneumonia* and etc
4. Antibiotic sensitivity test – Kirby – Bauer disc diffusion, well diffusion, MIC and MBC methods
5. Saline and iodine wet mount
6. Giemsa staining for the demonstration of blood parasites, KOH and LCB mount
7. Wet mount examinations of stool for parasites
8. Blood smear examination for malaria parasite (*Plasmodium vivax* and *P. malariae*)

Text Book:

1. Myer's and Koshi's Manual of Diagnostic Procedures in Medical Microbiology and Immunology/Serology. Published by Department of Clinical Microbiology, CMC and Hospital, Vellore, Tamil Nadu.

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1. Ivan Roitt, Jonathan Brostoff and David Male. (2002). Immunology (6th edition). Elsevier science Ltd., New York.
2. Janis Kuby. (1994). Immunology. (2nd edition). W.H. Freeman and company, New York.
3. Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.
4. Bailey and Scott's Diagnostic Microbiology by Baron et al.

SEMESTER – III & IV
ALLIED PRACTICAL II - BIOINFORMATICS AND BIOSTATISTICS

Course Code: 18UMB4AP2
Hours: 3
Credit: 3

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- To train the students in using basic bioinformatics techniques
- To train the students in using Ms-Excel / SPSS for solving the biological problems
- To get the knowledge about basic biological databases and tools

Bioinformatics

1. Study of Nucleic acid sequence databanks – NCBI, EMBL and DDBJ
2. Study of protein data banks - Swissprot, Uniprot. and PIR
3. Study of Protein Structure databases – PDB, PDBSUM, SCOP and CATH.
4. Pair wise sequence alignment using BLAST
5. Multiple sequence alignment by Clustal W
6. Compute protein parameters using Protparam
7. Calculate structural parameters using SOPMA
8. Evaluation of protein structure by Swiss PDB viewer and structure visualization using Rasmol tool.

Biostatistics

1. Frequency Distribution (Discrete Series), (Inclusive method) and (Exclusive method)
2. Bar diagram, Pie diagram and Histogram
3. Mean, Median and Mode (Discrete Series) and (Continuous Series)
4. Mean Deviation and Standard Deviation (Discrete Series) and (Continuous Series)
5. Skewness and Kurtosis
6. Scatter Diagram
7. Karl Person Correlation Coefficient
8. Spearman Rank correlation (Tide Rank) and (Repeated Rank)
9. Regression coefficient and Fitting Regression lines
10. Regression line x on y and Regression line y on x
11. Chi-square test for Goodness of Fit
12. Chi-square test for Independence of Attributes
13. Independent t-test of sample means
14. Paired t-test of sample means
15. F-test for equality of sample variances

Text Book:

1. Rastogi S.C., Namita Mendiratta, Parag Rastogi. (2011) Bioinformatics – Concepts, Skills and Applications (Second Edition) CBS Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V.K.: “Fundamentals of Mathematical Statistics”, Sultan & Chand & Sons, New Delhi, 11th Ed, 2002.

Reference Books:

1. Harshawardhan, P. (2005) Bioinformatics principles and application. Tata Mc Graw Hill Publishers. New Delhi.
2. Mount, D.W. 2005. Bioinformatics Sequence and genome analysis (II edition) CBS Publishers. NewDelhi
3. Veerarajan T.. “Probability, statistics and Random processes, Tata McGraw-Hill Education, 3rd Ed, 2002.

SEMESTER – IV

NON MAJOR ELECTIVE – II - QUALITY CONTROL AND HYGIENE PRACTICES

Course Code: 18UBT4NME2
Hours: 2
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

Quality control & Hygiene practices explains,

- To learn the basic quality control techniques
- To maintain the microbiological quality in all the needy environment
- To learn the hygienic healthy practices and Health from environmental factors

Unit I – Quality control

Quality assessment of Equipment's, chemicals, glass wares and laboratory environments – Variance – Quality control calculations – Quality management – Maintenance of records and reports.

Unit II – Quality assurance and policy I

Quality assurance – Definition, designing of microbiology laboratory, applications. In house Committee for quality assurance, Persons involved, Internal Microbial Quality control Policy, Quality Check at every step from collection of raw materials till it reaches the customer, Implementation of ISO standards and history, definitions, principles and use of HACCP in Food Industry.

Unit III – Quality assurance and policy II

Quality assessment of disposal – decontaminated matters and other biological effluents. Quality management in transportations of cultures. BIS - Biological parameters references and standards. Good laboratory practices – Management of laboratory hazards and knowledge in First aid procedures.

Unit V – Quality control organizations

Role, function, monitoring and mitigation activities of quality control (National, international and non-govt.) organizations – ISO/TC 34, 48, 93, 147, 190, 194, 255; ISO 9000; ISO 22000; ISO 9001; ISO 9004; ISO 19011; AS9100; ISO 13485; ISO/TS 16949; MBNQA; Lean; Six Sigma; TQM, USDA, FDA, HARPC, IFPTI, Food Safety and Standards Authority of India.

Unit V – Hygienic practices

Hygienic practices in industries- antibiotics, disinfectants, definition, sources, determination of antimicrobial efficiency, evaluation of disinfectants, factory and hospital hygiene, good manufacturing practices, sterilization control and sterility assurance.

Text Book:

1. Rajesh Bhatia and Rattan lal Ichhpujani. 1995. I ed. "Quality assurance in Microbiology".

Reference Books:

1. Food Microbiology – Frazier and D.C. Westhoff, Third Ed, TATA McGra Hill Pub. New Delhi.
2. Industrial Pharmaceutical Microbiology- II: Standards & Controls. Editors – Dr Norman Hodges and Professor Geoff Hanlon (University of Brighton). (REF; www.euromed.uk.com).
3. Water Analysis – A practical guide to Physico – Chemical & Microbiological water examination and Quality assurance – W.Schneider, W.Fresenius & K.E. Quentin. Springer – Verlag Pub. Heidelberg.

SEMESTER – IV

SKILL BASED ELECTIVE – II - BASIC COMPUTER APPLICATIONS IN BIOLOGY

Course Code: 18UMB4SBE1

Hours: 2

Credit: 2

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- To understand the fundamentals of computer
- To know about the functions of operating systems
- Provide the knowledge about internet and web browsers
- To understand the process of database management systems

Unit I - Introduction

Introduction to Computers: History of Computers – Generation of Computers – Characteristics of Computer - Input and Output Devices – - Bits and Bytes –Binary code-Memory-RAM and ROM

Unit II - Hardware and Software

Hardware and Software: Operating Systems – Classification of Operating Systems –Windows, Unix and Linux – disc operating systems.

Unit III – World Wide Web

World Wide Web: Working of Internet and Intranet – Email and its applications –Local area network-Metropolitan area network- Wide area network – Internet Protocols - Network Topologies – Applications of Internet.

Unit IV – Web Browsers

Types of files: HTML, Text and PDF –Search engines - Types and applications – Searching of information through web browsers – Internet Explorer – Firefox – Google chrome – Netscape – Opera.

Unit V – Applications in Biology

MS Word, Excel and Power point. Entrez, DBGET/Link, SRS, Tools in Expasy Server (GlycoMod, FindMod, AACompIdent). Applications of Computers in Biology.

Text Book:

1. Alexis Leon and Mathews Leon. “Fundamentals of Information Systems” co-published by Vijay Nicole Imprints Pvt Ltd, 2004.

Reference Books:

1. Operating Systems – E. Madnick & John J.Donavan, Tata McGraw Hill Publishing Co., Limited
2. Harshawardhan, P. (2005) Bioinformatics principles and application. Tata Mc Graw Hill Publishers. New Delhi.

SEMESTER – V
CORE COURSE V - VIROLOGY AND MYCOLOGY

Course Code: 18UMB5CC5

Hours: 5

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

Virology and Mycology deals with

- The study of virus and fungi with respect to the disease causing nature and characteristics
- Microbial pathogenesis and epidemiology
- The study of disease pathology and immunology
- The study the clinical manifestations, prevention and treatment

Unit I – Introduction of Virus and Fungi

Virus: General properties, classification, cultivation, isolation and identification of viruses (plant and animal) – Serodiagnosis and Molecular diagnosis of viral infections. Fungi: Morphological features of fungi, Classification of medically important fungi, Diagnosis of fungal infections

Unit II –Human diseases and Viral assays

Human Viruses: Herpes, HIV, Hepatitis, Polio, Influenza, mumps, measles, Rubella and Cytomegalo viruses Assays: Assay, purification and characterization of viruses, separation and characterization of viral components and quantification of viruses. Viral vaccines. Prevention and treatment of viral diseases. Antiviral agents

Unit III – Plant, Animal and Bacterial diseases

Plant viruses: Common plant viral diseases; TMV, Bunchy top of banana, satellite virus, Viroid – Double stranded DNA virus – Assay methods

Animal viruses: Morphology, pathogenesis and laboratory diagnosis of prions, Blue tongue, Foot and Mouth Disease

Bacterial viruses: Structure of bacteriophage, Lytic life and lysogenic life cycle

Unit IV – Fungal diseases

Morphology, classification, culture characters, pathogenicity, laboratory diagnosis, control and treatment of following organisms. Superficial mycosis – Pityriasis versicolor, Tinea nigra, Cutaneous mycosis – Dermatophytosis; Subcutaneous mycosis – Sporotrichosis, Mycetoma. Chromoblastomycosis

Unit V - Fungal diseases

Morphology, classification, culture characters, pathogenicity, laboratory diagnosis, control and treatment of following organism's Systemic mycosis – Histoplasmosis. Opportunistic mycosis – Candidosis, Cryptococcosis – Aspergillosis. Myco toxins.

Text Book:

1. Jagdish Chandra. (1996) Textbook of Medical mycology. Orient Longman.
2. Ananthanarayan R & Jayaram Paniker CK (2000). Text book of Microbiology. 6th Edition, Orient Longman Limited, Chennai.

Reference Books:

1. Mehrotra RS and Aneja KR (1990). An introduction to Mycology. New Age International Publishers.
2. Morag C. and Timbury M.C. (1994). Medical Virology, 10th Edition. Churchill Livingstone London.
3. Dimmock N.J., Primrose S.B. (1994). Introduction to Modern Virology 4th Edi. Blackwell Sci Publications. Oxford.

SEMESTER – V
CORE COURSE VI - ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Course Code: 18UMB5CC6

Hours: 5

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

Agricultural and environmental microbiology explains

- The distribution of microorganisms in water and air environment
- To know the microbial interactions with living things
- To know the solid and liquid waste treatment and its usefulness
- To know the role and effect of microbes on non-living things

Unit I – Microbial ecology

Concepts of microbial ecology: Relationship between microorganism and different environments land, water and air. Microbiology of air – organisms in air, distribution and sources. Proplet, Droplet nuclei, aerosol. Air borne diseases, assessment of air quality. Types of aquatic ecosystems: fresh water – ponds, lakes, streams, Water borne diseases. Marine habitats – estuaries, mangroves, deepsea. Zonations – upwelling – eutrophication – food chain. Microflora of soil.

Unit II – Microbial interaction

Microbial interaction between microbes – Neutralism, Commensalism, Synergism, Mutualism, Amensalism, Symbiosis, Competition, Parasitism and Predation. Interaction of Microbes with plants – Rhizosphere and Mycorrhizae. Interaction of microbes with animals – insects and rumen.

Unit III – Waste treatment

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification, gasification and composting. Liquid waste treatment. Treatment methods – primary, secondary and tertiary treatment. Potability of water – microbial assessment of water quality – water purification.

Unit IV – Utilization of waste

Utilization of solid and liquid wastes – food (SCP, mushroom, yeast); fuel (ethanol, methane, hydrogen); fertilizers (composting), fertilizers (Cyanobacteria).

Unit V – Biodeterioration and Bioremediation

Biodeterioration: Deterioration of paper, leather, wood, textiles, metal corrosion, mode of deterioration, organisms involved, its disadvantages and mode of prevention. Bioremediation – Biodegradation of toxic substances – Bio sorption – Bioleaching – Biomining. Transmission of harmful microbes through air and water.

Text Book:

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

Reference Books:

1. Subba Rao NS (2004). Soil Microbiology. 4th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Atlas, R. M. and Bartha. R. (1992). Microbial Ecology: Fundamentals and Applications. 3rd Ed. Benjamin-Cummings. Redwood city. CA.
3. Baker, W.C. and Herson, D.S.(1994). Bioremediation – McGraw Hill Inc., New York Blackie.(1998). Plant Molecular Biology. (2nd edition).Chapman Hall, New York.
4. Christon J.Hurst. (2002). Manual of Environmental Microbiology. (2nd edition).American Society for Microbiology, Washington.
5. Marshall, K.C. (1985). Advances in Microbial Ecology. Vol-8. Plenum press.

SEMESTER – V
CORE COURSE VII - MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Course Code: 18UMB5CC7

Hours: 6

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- To know the genetic materials and its functions
- Various gene transfer mechanisms with applications of genetics
- To know about the rDNA technology and role of gene, vectors, enzymes and etc
- To use the technologies for nucleic acid and protein identifications

Unit I – Introduction of genetic materials and its functions

History: Experiments of Hershey Chase and Griffith, Avery – MacLeod – McCarty experiment - DNA as the genetic material – discovery of DNA structure – RNA as a genetic material – Replication of DNA – rolling circle model – theta model. Replication of RNA – reverse transcriptase. Transcription and Translation. Genetic code.

Unit II – Vectors and Enzymes

Vectors: Plasmids, phages and cosmids, Ti-plasmid, pBR322, pSC101, pUC. Structure and assay methods. Enzymes – Nucleases, ligases, polymerases, DNA modifying enzymes, Topoisomerases – their uses and applications.

Unit III – rDNA technology

Principles and applications of recombinant DNA technology and strain improvement. Biosafety guidelines – levels I, II, III and IV - GLSP - Risk Assessment and Management.

Unit III – Gene

Define Gene: Concept of gene – Lac operon, tryptophan operon, attenuation control – promoters – repressors – gene expression and regulation. Gene transfer mechanisms – conjugation – transformation – transduction.

Unit V - Nucleic acid and protein hybridization techniques

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

Text Books:

1. David Freifelder (1999). Molecular biology, Narosa publishing House.
2. Robert H. Tamarin (2004). Principles of Genetics – 7th Edition, Tata McGraw Hill Publication, New Delhi.

Reference Books:

1. Friedberg E.C., Walter GC, Sied. W (1995). DNA repair and mutagenesis. ASM press.
2. Gardner, E.J. Simmons, M.J and D.P Snustard (1991). Principles of Genetics. 8th Edition John Wiley & Sons.
3. Gerald Karp (2002), Cell and Molecular Biology. 3rd Edition. John Wiley & Sons, Inc.
4. Peter J Russell (2002). Genetics – Benjamin Cummings.
5. Peter Snustard D., Michael J. Simmons (2003). Principles of Genetics, Third Edition, John Wiley & Sons..

SEMESTER – V
CORE PRACTICAL III - VIROLOGY AND MYCOLOGY & ENVIRONMENTAL AND
AGRICULTURAL MICROBIOLOGY & MICROBIAL GENETICS AND MOLECULAR
BIOLOGY

Course Code: 18UMB5CP3

Hours: 3

Credit: 3

Total Marks: 100

External Marks: 60

Internal Marks: 40

Objectives

- To diagnose infectious diseases and the medically important pathogen
- To know what types of microorganisms are found in air, terrestrial and aquatic environments
- To provide a sound background in microbial processes and their applications in agriculture
- To provide information on ecological relationship among soil microorganisms
- To isolate DNA from plasmid and bacteria
- To impart hands on training on molecular biology, genetic engineering

Virology and Mycology

1. Demonstration of mechanical transfer of viruses in plants
2. Demonstration of cultivation of viruses by chick embryo fibroblast technique and embryonated egg.
3. Spotters – T4 phage, M13 Phage, TMV, CaMV, HIV, Influenza, HSV, HBV, Rabies and Blue tongue virus
4. Examination of fungi by KOH and LCB staining – Dermatophytes, skin scrapping and other fungi
5. Examination of *Candida albicans* by Gram's stain, Germ tube and Sugar assimilation test.

Environmental and Agricultural Microbiology

1. Isolation of Rhizobium from legume nodule, cyanobacteria from water, fungi from molting leaves and *Xanthomonas malvacearum* from infected cotton plants
2. Mycorrhizae in infected plant root
3. Water analysis by MPN technique
4. Microbial assessment of air quality – open plate method and air sampler-technique.
5. Isolation and counting of faecal bacteria from water and soil

Microbial Genetics and Molecular Biology

1. Isolation of plasmid from bacteria, spontaneous mutant - antibiotic resistant mutants.
2. Transformation techniques.
3. Separation of proteins by polyacrylamide gel electrophoresis

Text Book:

1. 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.

Reference Books:

1. James, C. Cappuccino. (1996). Microbiology. The Benjamin/Cummings Pub. Co. California.
2. Morag, C. Timbury (1994). Medical Virology. X edition. Churchill Livingston.
3. Jeanne Dijkstra and Cees P.de Jager.1998.Practical Plant Virology. Springer-Verlag Berlin Heidelberg.
4. Rangaswamy, G. and Bagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Ed. Prentice Hall of India Pvt. Ltd.
5. Subba Rao, N.S. (2002). Soil Microbiology, 4th Ed. (soil Microorganisms and plant growth), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Maniatis T., Fritsch E.F. & Sambrook J. Cold Spring, Molecular Cloning, A laboratory manual, Cold Spring Harbor laboratory (2002).
7. David R.W, Botstein D & Roth J.R., Advanced bacterial genetics, Cold Spring Harbor laboratory (1980).

SEMESTER – V
MAJOR BASED ELECTIVE I - PLANT AND ANIMAL BIOLOGY

Course Code: 18UMB5MBE1
Hours: 5
Credit: 5

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To understand the plant and animal taxonomy and classification kingdom
- Provides the knowledge about plant breeding and conventional methods
- To know about the animal cell culture and genetic engineering of animals

Unit I – Plant and animal taxonomy

Principles of Taxonomy as applied to the systematics and Classification of Plant Kingdom: Taxonomic structure; Biosystematics; Plant geography; Floristics.

Principles of taxonomy as applied to the systematics and classification of the animal kingdom: Classification and interrelationship amongst the major invertebrate phyla; Minor invertebrate phyla, Functional anatomy of the nonchordates; Larval forms and their evolutionary significance.

Unit II - Evolutionary Biology

Origin of life (including aspects of prebiotic environment and molecular evolution); Concepts of evolution; Theories of organic evolution; Mechanisms of speciation; Hardyweineberg genetic equilibrium, genetic polymorphism and selection; Origin and evolution of economically important microbes; plants and animals.

Unit III – Plant Breeding

Principles of plant breeding - Important conventional methods of breeding self and cross pollinated and vegetative propagated crops - Non conventional methods – Polyploidy - Genetic variability - Plant diseases and defensive mechanisms

Unit IV – Genome Organization

Plant genome organization: Organisation of chloroplast and mitochondrial genome - cytoplasmic male sterility - Genomic interaction – Protoplasmic fusion - Genetic engineering in plants - Pest resistance, Herbicide resistance - Resistance to fungi and Bacteria.

Unit V – Gametogenesis

Fundamentals - Facilities and Applications - Media for Animal cells - Types of cell culture - cell transformation - cell lines - stem cell cultures - Cell viability and cytotoxicity - Biology of cultured cells - Gametogenesis in animals - Molecular events during fertilization.

Text Books:

1. Grierson, D., and S.N. Covey. 1988. Plant Molecular Biology. Blackie & Sons. Ltd. Glasgow.
2. Freshney, E. D. 2000. Animal Cell Culture: A practical approach. John Wiley Pub., New York.
- Mather, J.P. and Barnes, D. (Eds.). 1998.

Reference Books:

1. Lycett, G.W. and D. Grierson (Eds). 1990. Genetic Engineering of Crop Plants. Heinemann, London.
2. Chrispeeds, M.J. and D.F. Sadava .1994. Plants, Genes and Agriculture.. Jones and Bartlett, Boston.
3. Mantel. S. H, Mathews. J. A, Mickee. R.A. 1985. An Introduction to Genetic Engineering in Plants. Blackwell Scientific Publishers, London
4. Animal Cell Culture Methods (Methods in Cell Biology. VOL. 57). Academic Press, London.

SEMESTER – V
SKILL BASED ELECTIVE II - ENTREPRENEURSHIP IN MICROBIOLOGY

Course Code: 18UMB5SBE2
Hours: 2
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To facilitate self-employment
- To know the organizations which helps to an entrepreneur
- To study the skills for entrepreneurs and financial supporters
- To learn the products making and marketing strategies

Unit I - Introduction

Evolution of the concept of entrepreneur – Entrepreneurship: Definitions – concept of Entrepreneurship, development – need – role of resource, talent and spirit – process of Entrepreneurship to socio-economic gains.

Unit II – Organizations and schemes

Institutions and schemes of Government of India – Schemes and programmes, Department of Science and Technology schemes, Nationalized banks – other financial institutions – SIDBI, NSIC, NABARD, IDBI, IFCI and ICICI.

Unit III - Skills for entrepreneurs

Skills for entrepreneurs – Communication skills, problem solving skills; Business plan development; Market need – Market research, SWOT analysis, identifying competitors. Financial plan – Financial support for business, business insurance, Marketing – Mix-product, distribution, price, promotion and market goal setting.

Unit IV – Projects implementations

Project – idea generation – Sources of idea generation – Trade Fairs and Exhibitions – Project identification – classification – project formulation – project appraisal. Composting of domestic, agricultural and industrial wastes, vermicomposting. SCP production; Mushroom cultivation.

Unit V – Production and marketing

Biofertilizers and biopesticides. Production of teaching kits (plasmid DNA isolation, serum electrophoresis) and diagnostic kits (WIDAL test kits, ABO blood grouping kits). Marketing strategies.

Text Books:

1. Nagendra S., (2008) Entrepreneurship and management Sanguine technical publishers
2. Bhatia, B.S. and G.S Batra, (2003) Entrepreneurship and small business management. Deep and deep publications

Reference Books:

1. Naidu, N.V.R, (2008) Management and entrepreneurship. I.K. International Pvt. Ltd.
2. Greene, (2000) Entrepreneurship ideas in action. Thomson learning
3. Tilak, K.V.B.R., (1990). Bacterial Biofertilizers. IARI Publications, New Delhi.
4. Venkataraman, G.S. (1972). Algal Biofertilizers and Rice Cultivation. Today and Tomorrow's Printers and Publishers, New Delhi.

SEMESTER – V
SKILL BASED ELECTIVE III - MICROBIAL PRODUCTS

Course Code: 18UMB5SBE3
Hours: 2
Credit: 2

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To give an idea about microbial products by using beneficial microorganisms

Unit I – Microbes as a product

Scope of microbial products – Diversity of microorganisms – *Spirulina*, Yeasts, *Streptomyces*, *Dunaliella*. Single cell protein

Unit II – Commercial products

Bioinsecticides – thuricide. Biopolymer - dextran, alginate, xanthan, PHA and its derivatives. Biotransformation of Steroids, Methanogenesis, Bioluminescence, Anticorrosive products and green fluorescence proteins.

Unit III – Probiotics

Probiotics: Prebiotics use of *Lactobacilli*, homo and heterolactic fermentations and their therapeutic and nutritional value. Fermented dairy products and their nutritional values of buttermilk, acidophilus milk, cream, kefir, koumiss, and cheese and yoghurt.

Unit IV – Primary metabolites

Primary metabolites from algae, actinomycetes, bacteria, fungi and its applications.

Unit V – Secondary metabolites

Drugs and bioactive compounds from algae (*Phaeophyceae* and *Chlorophyceae*), actinomycetes (*Streptomyces* and *Micromonospora*), bacteria (*Bacillus* and *Amycolatopsis*) fungi (*Cephalosporium* and *Penicillium*), etc.

Text Books:

1. Creuger and Creuger. Biotechnology, A textbook of industrial Microbiology, Sinauer associates.
2. Baumberg. S., Hunter. I.S. and Rhodes, P.M. 1989. Microbial Products -New approaches. Cambridge Univ. Press. Cambridge.

Reference Books:

1. Demain, A.L , Davies, J.E. 1999. Manual of Industrial Microbiology & Biotechnology, ASM press.
2. Prescott ,L.M. Harley, J.P, Klein, D.A .1999. Microbiology , WCB Mc Graw Hill.
3. Robinson ,R.K. 1990. Dairy Microbiology, Elsevier.
4. Tortora, G.J, Funke, B.R, Case, C.L .2001. Microbiology – An introduction , Benjamin Cummings.
5. Frazier, W.C, Westhoff, D.C. 1988. Food Microbiology, TATA Mc Graw Hill.

SEMESTER – VI
CORE COURSE VIII – FOOD MICROBIOLOGY

Course Code: 18UMB6CC8
Hours: 6
Credit: 6

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

Food & Dairy Microbiology explains about

- Food borne pathogens, fermentation, food quality & safety, food processing & packaging, Food laws, Food technology and product development
- Role of microbes in food production and food spoilage
- Common bacterial, viral, fungal and protozoan microbes involved in food contaminations
- Principles of biosecurity

Unit I – Food nutrition & microbes in food

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. Source of contamination - Food as a substrate for microbes – Microbes involved in food microbiology – Mould, Yeast, Bacteria – Factors affecting the growth of Microorganisms in food.

Unit II – Food Preservations

Principles of food preservation – Methods of food preservation – Physical and chemical methods - Asepsis, removal of microorganism anaerobic conditions, high temperature- low temperature, drying and food additives – Canning.

Unit III – Food spoilages

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

Unit IV – Food borne diseases

Food borne diseases and food poisoning – *Staphylococcus*, *Clostridium*, *Escherichia coli* and *Salmonella* and *Shigella* infections, Amoebiasis and Mycotoxins – Food poisoning.

Unit V – Quality control

Quality control of food products – MBRT, SPC, Phosphatase tests. Food sanitation and its control measures. Principles of biosecurity – Farm / plant sanitation and disinfection.

Text Book:

1. Frazier, W.C and Westhoff, D.C (1988). Food microbiology, 4th edition, Tata Mac Graw Hill, New Delhi.

Reference Books:

1. Adams, M.R and Moss M.O (1995) Food Microbiology New Age International (p) Limited Publishers.
2. Banwart, G.J., (1989). Basic Food Microbiology, 2nd Edition CBS Publishers and Distributors, New Delhi.
3. Robinson R.K (1990). Dairy Microbiology, Elsevier Applied science, London.
4. Hobbs BC Roberts D (1993). Food Poisoning and Food Hygiene Edward Arnold, London.

SEMESTER – VI
CORE COURSE IX – INDUSTRIAL MICROBIOLOGY

Course Code: 18UMB6CC9

Hours: 6

Credit: 6

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- To study the basic concepts of fermentation.
- To study the types of upstream and downstream process
- To know about the industrial important microbial products

Unit I - Introduction

History, industrially important microorganisms, major classes of products and processes. Improvement of industrially important microbial stains.

Unit II - Up-stream processing

Design of a fermenter, types of fermenters and basic functions. Up-stream processes – Strain selection, cultivation, seed preparation, fermentation media formulation strategies, role of physical and other parameters for microbial growth, types of fermentation.

Unit III - Down-stream processing

Down-stream processes - The recovery and purification of fermentations products (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, ultrafiltration, drying and etc.

Unit IV – Pharmaceutically valuable products

Microbial products of pharmaceutical value – raw materials, organism and industrial processes involved in the production of penicillin, vitamin B12 and insulin.

Unit V – Industrially valuable products

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.

Text Book:

1. Reed. G. (1982). Prescott and Dunn's Industrial Microbiology. Macmillan Publishers. Sikyta, B.(1983). Methods in Industrial Microbiology, Ellis Horwood limited.

Reference Books:

1. Click, B.R., .Pasternak, J.J. (1994). Molecular Biotechnology – ASM Press.
2. Demain A.L. Solomon, N.A. (1986). Manual of Industrial Microbiology and Biotechnology. ASM Press
3. Prave, P. Faust, V, Sitting, W., Sukatsch, D.A. (1987). Fundamentals of Biotechnology. ASM Press.
4. Stanbury, P.F. Whitaker, A. Hall, S.J. (1995). Principles of Fermentation Technology, Pergamon Press.

SEMESTER – VI
CORE PRACTICAL IV - FOOD MICROBIOLOGY & INDUSTRIAL MICROBIOLOGY

Course Code: 18UMB6CP4
Hours: 6
Credit: 5

Total Marks: 100
External Marks: 60
Internal Marks: 40

Objectives

- To become familiar with methods used to determine microorganisms and their products in foods.
- To identify the types of microorganisms found in foods.
- To highlight the importance of microorganisms in the production of useful human products.
- To dispel the age long fear that microorganisms can only cause sicknesses and diseases.
- To provide the fundamental knowledge of bioinstrumentations.
- To learn the principles and working of instruments used in biology.
- To familiarize students with various medical equipments and their technical aspects.

Food Microbiology

1. Assessment of milk quality by methylene blue reduction test
2. Isolation of bacteria from bread, tomato and any one beverage
3. Wet mount preparation of spoiled bread, tomato, grapes and potato
4. Observation of food samples to study *Leuconsostoc* sp. *Lactobacillus* sp., *Streptococcus lactis* and *Saccharomyces* sp. and etc
5. Isolation of *Lactobacilli* and *Staphylococci* from curd

Industrial Microbiology

1. Demonstration of batch fermentation using Erlenmeyer flask
2. Wine production and estimation of ethanol
3. Whole cell immobilization – Sodium alginate
4. Screening for amylase and protease producing bacteria and fungi from soil samples

Bioinstrumentation

1. Handling and maintenance of compound microscope
2. Handling of laboratory instruments such as Autoclave, Hot air oven, Laminar air flow and pH meter
3. Principles and operations of incubators and shakers, Centrifuge, Colorimeter and Spectrophotometer
4. Electrophoresis techniques.

Text Book:

1. Principles of Fermentation Technology. Manual of Industrial Microbiology and Biotechnology by Demain and Devis.

Reference Books:

1. Industrial Microbiology by Prescott and Dunns.
2. S.S. Purohit (2005) Biotechnology. Fundamental and applications 3rd Edition, Published by student edition. Behind Nasrani Cinema, Chopasani Road, Jodhpur.
3. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.
4. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai

SEMESTER – VI
MAJOR BASED ELECTIVE II - BIOINSTRUMENTATION

Course Code: 18UMB6MBE2
Hours: 6
Credit: 6

Total Marks: 100
External Marks: 75
Internal Marks: 25

Objectives

- To study the principle and working procedure of different type of instruments in biological science.
- To know the knowledge about the applications of instruments.

Unit I – Introduction of basic instruments

Basic rules of a Microbiology Laboratory – Basic requirements Microbiology Laboratory – Basic principles, operating mechanism and applications of autoclave, hot air oven, Laminar air flow and pH meter. Centrifuge - Basic principles of sedimentation – relative centrifugal force – Types of centrifuges (clinical, high speed, refrigerated and ultra). Centrifugation - Principles and various types – Applications.

Unit II – Spectrophotometry based instruments

Calorimetry – principle, Beer – Lambert’s law – Applications. Spectrophotometry – UV & Visible, Parts of a spectrophotometer – IR, NMR & Atomic absorption spectrophotometry – Applications.

Unit III - Chromatography based instruments

Chromatography – Paper, TLC, Column, Adsorption, Ion exchange, GC & HPLC – Principle & applications.

Unit IV – Electrophoresis based instruments

Electrophoresis techniques: Proteins and nucleic acids – Types of electrophoresis – Paper, Gel, 2D, PFGE, Immunoelectrophoresis.

Unit V – Radioisotope based instruments

Radioisotopes and their applications. Radioisotopic techniques – RIA. Detection and measurement of radioactivity – GM counter, Scintillation counter, Autoradiography. Biosensor & its types.

Text Book:

1. Principles of Applied Biomedical Instrumentation – A. Geddes and L.E Baker John Wiley & Sons.

Reference Books:

1. Keith Wilson and John Walker, 1994. Practical Biochemistry – principles and techniques. Cambridge Press
2. Instrumental methods of analysis – Den, Williard & Merrit. Asian Edition.
3. Prakash M and Arora CK. Laboratory instrumentation. Anmol Publications Pvt. Ltd.
4. Keith Wilson & John Walker (2003) Practical Biochemistry Principles & techniques. 5th edition, Cambridge university press.
5. Palanivelu P (2001). Analytical biochemistry and separation Techniques A Laboratory manual. 2nd edition, Published by Tulsi Book Centre, Madurai, Tamilnadu.

SEMESTER – VI
MAJOR BASED ELECTIVE II - BIOETHICS AND BIOSAFETY

Course Code: 18UMB6MBE3

Hours: 5

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

Objectives

- To know about the biosafety guidelines and regulations with biosafety levels and cabinets
- To provide the knowledge about Bioethics

Unit I - Bioethics

General Ethical Concerns - Reducing Genetic Diversity - Biological Warfare - Public perception of Science - Medical Ethics – Hippocratic tradition – Profession and Philanthropy - Adoption to the oath by western medicine - Retaining the Hippocratic Oath.

Unit II – Human Embryonic Research

Status of Human Embryo - Human Embryonic Development - Ethics through Embryo Development – Fertilization - Scientific Research on Human Embryos - Experimental goals of Human Embryo Research. Stem cell research.

Unit III – Animal Rights

Animal Rights: Making New Strains of Animal - Ethical limits of Animal use -Religious and Philosophical views of Animal status - Human Gene therapy - Ethics of Somatic Cell Gene Therapy – Humanized mouse - Safety of Transferred Genes – Applications of gene therapy

Unit IV - Biosafety

Introduction: biosafety issues in biotechnology-historical background; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals.

Unit V - Biosafety Guidelines

Biosafety guidelines and regulations: Operation of biosafety guidelines and regulations of Government of India - Definition of GMOs and LMOs - Roles of IBC, RCGM, GEAC - GMO applications in food and agriculture - Environmental release of GMOs - Risk Analysis; Risk Assessment; Risk management and communication - Cartagena Protocol.

Text Book:

1. Nancy, S. Jecker., Albert R. Johnson, Robert A. Pearlman. Bioethics: An Introduction to history, methods and practice (1997).

Reference Books:

1. Ethics in engineering, Martin. M.W. and Schinzinger.R. III Edition, Tata McGraw-Hill, New Delhi. 2003.
2. Sudbury, M.A.; Jones and Barlett Publishers. Tom, L. Beauchamp., Childress, F. Principles of biomedical ethics, 5th Edition, Oxford University Press. 2000.
3. Senthil Kumar Sadhasivam and Mohammed, Jaabir. 2008. IPR, Biosafety and Biotechnology Management. Jasen Publications, Tiruchirapalli, India.