JAMAL MOHAMED COLLEGE

(*Autonomous*)

(Accredited at "A" Grade by NAAC in 2009 – CGPA 3.6 out of 4.0)

TIRUCHIRAPPALLI - 620 020

Since 1951

B.Sc., MICROBIOLOGY

PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM

(2014 - 2015)

B.Sc., MICROBIOLOGY Course structure 2014-2015

Sem	*course Code*	*Part*	*Course*	*Course title*	*Hours/ Weeks*	*Credits*	*Int. Marks*	*Ext. Marks*	*Total Mark*
I	14U1LTI/LA1/LH1 /LU1/LF1	I	Language - I		6	3	40	60	100
	14UCN1 E1	II	English- I		6	3	40	60	100
	14UMB1A1	III	Allied - I	General Biochemistry	5	2	20	30	50
	14UMB1A1P	III	Allied -I	General Biochemistry- Practical	3	2	20	30	50
	14UMB1C1	III	Core I	Basic Microbiology	4	4	40	60	100
	I4UMB1M1	III	Major based Elective- I	Microbial Diversity	3	3	40	60	100
	14UCN1VE	IV	Value Education	Value Education	3	3	40	60	100
TOTAL					**30**	**20**	**240**	**360**	**600**
II	14U2LT2/LA2/ LH2/LU2/LF2	I	Language- II		6	3	40	60	100
	14 UCN2 E2	II	English-II		6	3	40	60	100
	14 UMB2A2	III	Allied- II	Bacteriology	4	2	20	30	50
	14 UMB2A2P	III	Allied- II	Bacteriology- Practical	3	2	20	30	50
	14 UMB2C2	III	Core II	Cell Biology	4	4	40	60	100
	I4 UMB2M2	III	Major based Elective- II	Social and preventive Medicine	3	3	40	60	100
	I4 U MB2N1	IV	Non Major Elective- I	Computer application in Biology	2	2	40	60	100
	I4 UCN2ES	IV		Environmental Studies	2	2	40	60	100
TOTAL					**30**	**21**	**280**	**420**	**700**
III	14U3LT3/LA3/ LH3/LU3/LF3	I	Language-III		6	3	40	60	100
	14 UCN3 E3	II	English-III		6	3	40	60	100
	14UMB3A3	III	Allied- III	Microbial Metabolism	4	2	20	30	50
	14UMB3A3 P	III	Allied- III	Microbial Metabolism- Practical	3	2	20	30	50
	14UMB3C3	III	Core III	Introductory Virology	4	4	40	60	100
	I4UMB3M3	III	Major based Elective - III	Diagnostic Microbiology	3	3	40	60	100
	I4UMB3N2	IV	Non Major Elective- II	Hematology	2	2	40	60	100
	I4UCN3S1	IV	Skill Based Elective - I	Soft Skills	2	2	40	60	100
TOTAL					**30**	**21**	**280**	**420**	**700**

IV	14U4LT4/LA4/ LH4/LU4/LF4	I	Language- IV		6	3	40	60	100
	14 UCN4 E4	II	English-IV		6	3	40	60	100
	14 UMB4A4	III	Allied- I V	Principles of Immunology	5	2	20	30	50
	14 UMB4A4P	III	Allied- IV	Principles of Immunology Practical	3	2	20	30	50
	14 UMB4C4	III	Core- IV	Clinical Microbiology	4	4	40	60	100
	14 UMB4C5P	III	Core- V	Clinical Microbiology- Practical	4	4	40	60	100
	I4 U MB4S2	IV	Skill Based Elective- II	Analytical Microbiology	2	2	40	60	100
	14 U CN4EA	V	Extension activities	NCC,NSS etc.,	-	2	-	-	-
	14UMB 4EC1		Extra credit- I	Extremophiles	-	4*	-	100*	100*
	14UMB 4EC2		Extra credit- II	Human Anatomy &Physiology	-	4*	-	100*	100*
TOTAL					**30**	**22**	**240**	**360**	**600**
V	14 UMB5C6	III	Core VI	Parasitology	5	4	40	60	100
	14 UMB5C7	III	Core VII	Pharmacology	4	4	40	60	100
	14 UMB5C8	III	Core VIII	Enzyme Technology	4	4	40	60	100
	14 UMB5C9	III	Core IX	Soil & Agricultural Microbiology	4	4	40	60	100
	14 UMB5C10	III	Core X	Environmental Microbiology	4	4	40	60	100
	14 UMB5C11P	III	Core XI	Soil & Agricultural and Environmental Microbiology- Practical	4	4	40	60	100
	I4 U MB5M4	III	Major Based Elective -IV	Bio Nanotechnology	3	3	40	60	100
	I4 U MB5S3	IV	Skill Based Elective- III	Basic Bioinformatics	2	2	40	60	100
	14UMB 5EC3		Extra credit- III	Vermitechnology	-	4*	-	100*	100*
TOTAL					**30**	**29**	**320**	**480**	**800**
VI	14 UMB6C12	III	Core XII	Food Microbiology	5	4	40	60	100
	14 UMB6C13	III	Core XIII	Fermentation Technology	5	4	40	60	100
	14 UMB6C14	III	Core XIV	Microbial Genetics	5	4	40	60	100
	14 UMB6C15	III	Core XV	Molecular Biology	4	4	40	60	100
	14 UMB6C16	III	Core XVI	Genetic Engineering	4	4	40	60	100
	14 UMB6C17P	III	Core XVII	Microbial Genetics Molecular Biology and Genetic Engineering- practical	4	4	40	60	100
	I4 U MB6S4	IV	Skill Based Elective- IV	IPR, Biosafety & Bioethics	2	2	40	60	100
	14UCN6GS	V	Gender Studies	Gender Studies	1	1	40	60	100
	14UMB 6EC4		Extra credit -IV	Biomedical Technology	-	4*	-	100*	100*
	TOTAL				**30**	**27**	**320**	**480**	**800**
GRAND TOTAL					**180**	**140**	**1680**	**2520**	**4200**

*Not considered for grand total & CGPA

SEMESTER I: ALLIED-I

GENERAL BIOCHEMISTRY

Course Code : 14 UMB1A1 **Max Marks : 50**
Hours/Week : 5 **Internal Marks : 20**
Credit : 3 **External Marks : 30**

Objective: To provide knowledge and to understand the structure and function of carbohydrates, aminoacids, enzymes , lipids and nucleic acids.

UNIT - I **15 hours**

Carbohydrates**:** Chemical structures, nature and properties. Classification and importance in biological cells. Aerobic and anaerobic metabolism.

UNIT –II **15 hours**

Amino acids: Classification and properties. Structure, Zwitterion nature. Proteins- Classification, Structure and function. Primary, Secondary, Tertiary and Quaternary structure. Proteolysis, #Transamination and Deamination#.

UNIT- III **15 hours**

Enzymes- General characteristics. Factors affecting enzyme activity. Regulation of enzyme activity. Enzyme kinetics, Km value, activation and inhibition. #Coenzymes and cofactors#. Non-protein enzymes. Applications of enzymes.

UNIT- IV **15 hours**

Lipids- Saturated and unsaturated fatty acids. Structure, classification, properties and function of lipids. Distribution and functions of lipids in microorganisms. Beta-oxidation of fatty acid.

UNIT–V **15 hours**

Nucleic acid- Purine & Pyrimidine synthesis – Intermediary Metabolism Bioenergetics- Principles of bioenergetics and high energy phosphate compounds. #Mode of energy production- Photophosphorylation#.

#---#**self study**

Text books

1. Jeremy M. Berg, Joghn L.Tymoczko and Lubert Stryer, L. Biochemistry. 5th Ed. W.H. Freeman and Company, New York. (1995).

2. WilliamH. Elliott and Daphne C.Elliott. Biochemistry and Molecular Biology – 3rd Ed. Oxford university press.

Books for reference

1. Dawn, B. Markus,. Biochemistry. Harwal Publishing, New York. (1994)

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

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

Books for Study

UNIT I	Text Book 1	Chapter 11
UNIT II	Text Book 1	Chapter 3
UNIT III	Text Book 1	Chapter 8
UNIT IV	Text Book 2	Chapter 14
UNIT V	Text Book 2	Chapter 1

SEMESTER I: ALLIED- I

GENERAL BIOCHEMISTRY - PRACTICAL

Course Code : 14 UMB1A1P **Max Marks : 50**
Hours/Week : 3 **Internal Marks : 20**
Credit : 2 **External Mark : 30**

Objective: To provide knowledge on basic biochemistry techniques

1. Qualiative Analysis: Carbohydrates and aminoacids.
2. Quantitative Analysis – Estimation of glucose (OT method) –
3. Estimation of aminoacid (ninhydrin method).
4. Estimation of ascorbic acid from biological sample (burette method)

Practical manual

1. Keith Wilson and John Walker. Principles & Techniques of Practical Biochemistry (4th edition). Cambridge University press, Britain. (1995).
2. Strolv, B.A. Makavora, V.C. Laboratory manual in Biochemistry. MIR Publisher, Moscow. (1989).

SEMESTER I: CORE I

BASIC MICROBIOLOGY

Course Code : 14 UMB1C1 **Max Marks : 100**
Hours/Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective: To make the students to understand the fundamentals on microbial techniques.

UNIT – I **12 hours**

History and Scope of Microbiology – Spontaneous generation theory –conflict – Contribution of Leuvenhoek, Louis Pasteur , Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, Waksman and John Tyndall.

UNIT – II **12 hours**

Media preparation -Solid and Liquid- Types of Media – Crude, Semi Synthetic, Synthetic, Enriched, Selective, Differential and Special Purpose Media.

UNIT – III **12 hours**

Pure culture techniques– Tube dilution, Pour plate, Spread plate, Streak plate and Micro manipulator. Anaerobic culture techniques– Wright's tube, Roll tube, #McIntosh Fildes jar method#.

UNIT – IV **12 hours**

Estimation of Microbes- Direct Microscopic count, Turbidometric assay- growth curve, TVC-indirect Method- CO_2 liberation -#----------#.

UNIT – V **12 hours**

Maintenance and Preservation of culture -Short term – Slant, Stab, Mineral oil overlay -Long term – Lyophilization, #Cryo preservation, Storage in sterile soil#, Storage in silica gel.

#--- # Self study

Text books

1. Presscott, L.M J.P. Harley and C.A. Klein. Microbiology 2nd edition Wm, C. Brown and publishers. (1995).

2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel. Microbiology Mc Graw Hill Book R. Krieg, Company Ltd. (1986).

Books for reference

1. Stainer R.Y. Ingraham J.L. Wheo lis H.H and Painter P.R. The Microbial world, 5th Edition. Eagle Works Cliffs N.J. Prentica Hall. (1986)

2. Wilson. K and Goulding. K. H. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London. (1986).

Books for Study

UNIT I	Text Book 2	Chapter 1 & 2
UNIT II	Text Book 1	Chapter 5
UNIT III	Text Book 2	Chapter 8
UNIT IV	Text Book 1	Chapter 2
UNIT V	Text Book 1	Chapter 7

SEMESTER I: MAJOR BASED ELECTIVE - I

MICROBIAL DIVERSITY

Course Code : 14 UMB1M1 **Max Marks : 100**
Hours/Week : 3 **Internal Marks : 40**
Credit : 3 **External Marks : 60**

Objective: To provide with knowledge and to understand the evolution and diversity of organisms.

UNIT – I **9 hours**

Origin and evolution of life - theories of evolution; evidence of evolution; sources of variations (mutation, recombination, genetic drift, migration, natural selection); concept of species; #Specification and isolation (geographical and reproductive)#; origin of species.

UNIT – II **9 hours**

Diversity of Life: Variety of living organisms, Systematic; need, history and types of classification (artificial,natural, polygenetic); biosystematics; binomial nomenclature; Two kingdom system, Five kingdom System, their merits and demerits , # status of bacteria and virus#.

UNIT – III **9 hours**

Fungi: General Characteristics and classification of Fungi - Life Cycle of *Aspergillus sp, Mucor sp, Phytopthora sp and #Penicillium sp* - Modes of reproduction and its economic importance#.

UNIT – IV **9 hours**

Algae: General Characterstics and Classification basic knowledge on its reproduction and its economic importance of Oscillatoria, Oedogonium, # Chlorella#, Gracilaria.

UNIT – V **9 hours**

Protozoa: General characteristics, classification, reproduction and the economic importance of Sarcodina, Mastigophora, Rhizopoda, Ciliata and Sporozoa.

#--- # Self study

Text books

1. Presscott, L.M J.P. Harley and C.A. Klein. Microbiology 2nd edition Wm, C. Brown publishers. (1995)

2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel. Microbiology Mc Graw Hill Book R. Krieg, Company Ltd. (1986).

Books for reference

1. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. The Microbial world, 5th edition. Eagle Works Cliffs N.J. Prentica Hall. (1986).

Books for Study

UNIT I Text Book 1 Chapter 19.1
UNIT II Text Book 1 Chapter 19.2 & 19.5
UNIT III Text Book 1 Chapter 19.4
UNIT IV Text Book 2 Chapter 18
UNIT V Text Book 2 Chapter 19

SEMESTER II: ALLIED - II
BACTERIOLOGY

Course Code : 14 UMB2A2 | **Max Marks : 50**
Hours/Week : 4 | **Internal Marks : 20**
Credit : 2 | **External Marks : 30**

Objective: To study the general structures of bacteria & to understand the microbial techniques.

UNIT – I **12 hours**

General characteristics and classification of Bacteria. Flagella, capsule, cilia and pili. chemical composition of bacterial cell wall, plasma membrane, outer membrane.

UNIT – II **12 hours**

Description of Domain- Arachebacteria- Classification- Cell wall- S layer- #cell membrane- composition and diversity#. Growth of Bacteria under extreme condition- Psychrophiles, acidophiles,thermophiles and halophiles.

UNIT – III **12 hours**

Staining- Stains and Staining reactions – Types of staining – Simple, Differential (Grams, Spore, AFB), Capsule staining, #Nuclear and Flagella staining#.

UNIT- IV **12 hours**

Introduction, Character, and classification of Actinobacteria and Eubacteria. Bergey's Manual systamatic and its importance.

UNIT-V **12 hours**

Sterilization and Disinfection- Principles- Methods of Sterilization – Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA) - Radiation – Chemical Sterilization - Chemical agents. Mode of action – #Phenol coefficient test- Sterility testing#.

#--- # Self study

Text books

1. Presscott, L.M J.P. Harley and C.A. Klein. Microbiology 2nd edition Wm, C. Brown and publishers. (1995).

2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel. Microbiology Mc Graw Hill Book R. Krieg, Company Ltd. (1986).

Books for reference

1. Stainer R.Y. Ingraham J.L. Wheo lis H.H and Painter P.R. The Microbial world, (5th edition). Eagle Works Cliffs N.J. Prentica Hall. (1986).

2. William claus. G.W. Understanding Microbes – A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York. (1989).

3. Wilson. K and Goulding. K. H. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London. (1986).

Books for Study

UNIT I Text Book 1 Chapter 3 Section 4.9-4.10
UNIT II Text Book 1 Chapter 3 Section 3.6 -3.7
UNIT III Text Book 2 Chapter 1
UNIT IV Text Book 2 Chapter 13
UNIT V Text Book 2 Chapter 22 & 23

SEMESTER II: ALLIED - II

BACTERIOLOGY- PRACTICAL

Course Code : 14 UMB2A2P | **Max Marks : 50**
Hours/Week : 3 | **Internal Marks : 20**
Credit : 2 | **External Marks : 30**

1. Laboratory precautions.
2. Cleaning of Glass wares.
3. Antiseptics and disinfectants.
4. Culture media preparation – Liquid and Solid medium.
5. Selective and differential media.
6. Methods of sterilization and testing of sterility.
7. Enumeration of Bacteria, Fungi and Actinomycetes from soil.
8. Pure culture techniques – pour plate, spread plate and looping method.
9. Staining of bacteria-Simple, Negative, Gram, Endospore and, Fungal wet mount

   LPC-Slide culture method.
10. Cultivation of anaerobic microorganisms – Wrights tube – Mclntosh fildes jar.
11. Micrometry.

Practical manual

1. James G. Cappuccino, Natalie Sherman. Microbiology – A laboratory manual, The Benjamin (Cummings Publishing Company, Inc.).(1996).
2. Mackie and McCartney. Practical Medical Microbiology, Churchill Livingston. (1989).

SEMESTER II: CORE II
CELL BIOLOGY

Course Code : 14 UMB 2C2 **Max Marks : 100**
Hours/Week : 4 **Internal Marks : 40**
Credit : 4 **External Marks : 60**

Objective: To understand the cellular components underlying cell division and cell signaling

UNIT- I **12hours**

Cell as a Basic unit; Classification of cell types; Cell theory; Organization of plant and animals cells; Structural comparison of Microbial, Plant and Animal cells.

UNIT- II **12hours**

Ultra structure of cells-Prokaryotic and Eukaryotic- Sub cellular Organization; structure and function of Cytosol, Nucleus, Endoplasmic reticulum and Chloroplast, Mitochondria,Vacuoles, #Peroxisomes, lyzosome#.

UNIT - III **12hours**

Chromosomes and cell division: Morphology, Structural organization, ultra Structure of chromosome, #specialized chromosomes#. Cell cycle, Mitosis, Meiosis, Cellular senescence and applications.

UNIT- IV **12hours**

Specialized cells: Motile cells (amoeboid, ciliary, flagellar movements), nerve cells and nerve impulse conduction, muscle cells and muscle contraction.

UNIT- V **12hours**

Cell-Cell adhesion, Cell signaling - types- G Protein receptors, Cell membrane traffic, Histological techniques- Sectioning, # Embedding and Mounting#.

#--- # Self study

Text books

1. Gerald Karp,.Cell Biology (7th Edition). Wiley publication. (2013).

2. Gerald Karp. Cell and Molecular biology :concepts and experiments(6th Edition).Wiley publication. (2010).

Books for reference

1.Aminul Islam. A Text Book of Cell Biology(1st edition). Books and Allied (P)Ltd, Kolkata.(2011).

2. Powar.C.B. Cell Biology. Himalaya publishing house, New Delhi. (1983).

3. Lester W.Sharp. Fundamentals of Cytology. Mc Graw Hill Company,New York.(1943).

Books for Study

UNIT I	Text Book 1	Chapter 1 Section 1.1
UNIT II	Text Book 1	Chapter 8 Section 8.3 &8.6
UNIT III	Text Book 1	Chapter 14 Section 14.1 & 14.2
UNIT IV	Text Book 2	Chapter 17
UNIT V	Text Book 2	Chapter 15

SEMESTER II: MAJOR BASED ELECTIVE - II
SOCIAL AND PREVENTIVE MEDICINE

Course Code : 14 UMB2M2 **Max Marks : 100**
Hours/Week : 3 **Internal Marks : 40**
Credit : 3 **External Marks : 60**

Objective: To understand the concepts of health and disease.

UNIT-I **9hours**

Man and medicine: Concepts of health and disease –definitions of health, ecology of health. Health situation and programmers in India. Nutrition and health.

UNTI-II **9hours**

Epidemiology principles and methods: Aim and approach, tool of measurement of mortality and morbidity, Epidemiologic methods. #Association and causation#. Use of epidemiology.

UNIT-III **9hours**

Introduction to infectious disease: General mechanism of disease cycle, disease transmission, #disease prevention and control#. Disinfection of an epidemic.

UNIT- IV **9hours**

History, origin, Transmission, Epidemiology of AIDS. Psycho-social impact of AIDS. Treatment of HIV infection – Awareness – Counseling – care for person with AIDS. #AIDS control programmes#.

UNIT- V **9hours**

Demography and Family planning. #Preventive medicine in obstetrics#, pediatrics and geriatrics. Environment and occupational health. Health information and basic medical statistics and health care of the community.

#--- # Self study

Text books

1. Park, K. Text book of preventive and social medicine , M/s. Banarsidas Bhanot Publishers, Jabalpur, India.

Books for reference

1. Scigerist henry, 1951.A History of medicine, Vol .Oxford university press, London.

2. Ahmed, P.I and Coelho, G.V.1979.Toward a new Definition of Health, Pleum, New Yark.

3. Roht, L.H.1982. Principles of epidemiology, a self – teaching guide .London academic press.

4. Lilienfeld, A.M. and Lilienfeld, D.E.1980.Foundations of epidemiology, (2^{nd} edition).oxford University.

Books for Study

UNIT I	Text Book 1	Chapter 1
UNIT II	Text Book 1	Chapter 3
UNIT III	Text Book 1	Chapter 4
UNIT IV	Text Book 1	Chapter 5
UNIT V	Text Book 1	Chapter 8

SEMESTER II: NON MAJOR ELECTIVE - I
COMPUTER APPLICATIONS IN BIOLOGY

Course Code : 14 UMB 2N1 **Max Marks : 100**
Hours/Week : 2 **Internal Marks : 40**
Credit : 2 **External Marks : 60**

Objective : To make the students to understand the applications of computers in biology.

UNIT – I **6 hours**

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

UNIT – II **6 hours**

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

UNIT – III **6 hours**

Introduction to Bioinformatics, bioinformatics – its history and its development - Biological database – NCBI, #EMBL#, DDBJ.

UNIT – IV **6 hours**

Chemiinformatics – its history and its development – #Application of Chemiinformatics# – Drug designing (any cancer drug).

UNIT – V **6 hours**

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

#--- # Self study

Text books

1. Bryan Bergeron. Bioinformatics Computing (3rd edition). Prentice – Hall of India Private Limited. New Delhi. (2005).

2. Shalini Suri. Bioinformatics.A P H Publishing Corporation New Delhi. (2006).

Books for reference

1. Norman, T.J. Bailey, 1995. Statistical methods in Biology (3rd edition). Cambridge University Press.

2. Glanty, S.A.2011. Primer for Biostatistics (7th edition). Mc Graw Hill Publication.

Books for Study

UNIT I	Text Book 1	Chapter 3
UNIT II	Text Book 1	Chapter 2
UNIT III	Text Book 1	Chapter 2
UNIT IV	Text Book 2	Chapter 3
UNIT V	Text Book 2	Chapter 5

SEMESTER III: ALLIED - III
MICROBIAL METABOLISM

Course Code : 14 UMB3A3 **Max Marks : 50**
Hours/Week : 4 **Internal Marks :20**
Credit : 2 **External Marks :30**

Objective: To provide the knowledge in microbial metabolism, nutrition growth curve, photosynthesis and metabolism.

UNIT – I **12 Hours**

Nutrition: Nutritional requirements of microorganisms – #Autotrophs#, Heterotrophs, Photo autorophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Endospore formation in Bacteria.

UNIT – II **12 Hours**

Different phases of growth: #Growth curve# – generation time – factors influencing microbial growth – temperature, pH, pressure, salt concentration, nutrients – synchronous growth, continuous cultivation and diauxic growth.

UNIT -III **12 Hours**

Photosynthesis:Oxygenic and Anoxygenic, CO_2 fixation, Biosynthesis of bacterial cell wall, biosynthesis of aminoacids (glutamic acid family).Bioluminescence.

UNIT- IV **12 Hours**

Anaerobic respiration:Sulphur, Nitrogenous compounds and Co_2 as final electron acceptor. Fermentation – alcoholic, propionic and mixed acid fermentation.

UNIT- V **12 Hours**

Metabolism: EMP, HMP, ED pathways.TCA cycle- Electron transport chain – Oxidative and #Substrate level phosphorylation#.

#--- # Self study

Text books

1. Presscott, L.M J.P. Harley and C.A. Klein. Microbiology (2nd edition) Wm, C. Brown publication 1995.

2. Tortora ,Funke and Case . Microbiology an Introduction (8th edition) 2004.

Books for Reference

1. Doelle .H.W.1975.Bacterial Metabolism (2nd edition) .Academic Press.

2. Moat. A.G.and Foster.J. W. 1988.Microbial physiology (2nd edition).Springer – Verlag.

3. Caldwell.D.R.1995,Microbial physiology and Metabolism.Wm.C Brown Publishers,England.

Books for Study

UNIT I	Text Book 1	Chapter 5
UNIT II	Text Book 1	Chapter 6
UNIT III	Text Book 1	Chapter 9
UNIT IV	Text Book 2	Chapter 9
UNIT V	Text Book 2	Chapter 8

SEMESTER III: ALLIED - III
MICROBIAL METABOLISM - PRACTICAL

Course Code :14 UMB3A3P **Max Marks : 50**
Hours/Week : 3 **Internal Marks :20**
Credit : 2 **External Marks :30**

1. Measurement of growth curve- direct and indirect methods.
2. Effect of pH on microbial growth.
3. Effect of temperature on microbial growth.
4. Carbohydrate fermentation tests: a) Glucose, b) Lactose, c) Sucrose, d) Mannitol
5. Indole production test.
6. Methyl red test.
7. VogesProskauer test.
8. Citrate utilization test.
9. Catalase test.
10. Oxidase test.
11. TSI test.
12. ONPG test.
13. Nitrate reduction test.
14. Starch hydrolysis.
15. Gelatin hydrolysis.
16. Casein hydrolysis.
17. Urea hydrolysis.

Text Book

1. Aneja, KR. Experiments in Microbiology, Plant pathology and Biochemistry (4th Edition). New age International publishers, India 2003.

2. Cappuccino and James, G. Microbiology a laboratory manual (4th edition). Addison Wesley Publishing Company Inc., England, California. 1996.

SEMESTER III: CORE III
INTRODUCTORY VIROLOGY

Course Code : 14 UMB3C3 | **Max Marks : 100**
Hours/Week : 4 | **Internal Marks :40**
Credit : 4 | **External Marks :60**

Objective: To understand mechanism of virus infection and diagnosis

UNIT – I 12 Hours

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

UNIT – II 12 Hours

Bacterial Viruses – Structure of bacteriophage, #The Lytic life cycle# (T-Even coliphages) – Lysogenic life cycle (*Escherchia coli*, #Lambda phage#).

UNIT – III 12 Hours

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

UNIT – IV 12 Hours

Animal viruses: Morphology, pathogenesis and laboratory diagnosis of prions, Rinder pest, Blue tongue, Raniketdion, Foot and Mouth Disease. Viral Vaccines.Prevention and treatment of viral diseases.Antiviral agents.

UNIT –V 12 Hours

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

#--- # Self study

Text books

1. Presscott, L.M J.P. Harley and C.A. Klein. Microbiology (2nd edition) Wm, C. Brown publication 1995.

2.Alan J.Cann. Principles of Molecular virology. (2nd edition).Academic press, California. 1997.

3. Ann Giudici Fettner. The Science of Viruses.Quill, William Marrow, New York. 1990.

4. DimmockN.J.Primrose S.B. Introduction to Modern Virology (IV edition).Blackwell Scientific Publications, Oxford. 1994.

Books for Reference

1. Morag, C. Timbury Medical Virology. X edition. Churchill Livingston. 1994.

2. Nicklin, J. Greame-Cook and Killington, R. Instant Notes in Microbiology. (2nd Edition).Viva Books private limited, New Delhi. 2003.

3. Robert I. Krasner. The microbial challenge: Human Microbe Interactions, American Society for Microbiology, Washington. 2002.

4. Roger Hull. Mathews' Plant Virology. (4thEdition).Academic press-A Harcourt Science and technology company, New York. 2002.

5. Topley & Wilson. Principles of Bacteriology, Virology and Immunity (8thedition). Vol.IV Virology, Edward Arnold, London. 1990.

Books for Study

UNIT I	Text Book1	Chapter 16
UNIT II	Text Book1	Chapter 16.6
UNIT III	Text Book 1	Chapter 17.1
UNIT IV	Text Book2	Chapter 6
UNIT V	Text Book 4	Chapter 8

SEMESTER III: MAJOR BASED ELECTIVE - III
DIAGNOSTIC MICROBIOLOGY

Course Code : 14 UMB3M3 **Max Marks : 100**
Hours/Week : 3 **Internal Marks :40**
Credit : 3 **External Marks:60**

Objective: To study about the laboratory safety, bacteriology, Mycobacteriology, media and microscopic examination and specimens for bacteria and fungi.

UNIT –I **9 Hours**

Diagnostic microbiology: Purpose of diagnostic microbiology and responsibility - #Laboratory safety#. General safety considerations– biohazards and practices specific to microbiology – classification of biological agents on the basis of hazards.

UNIT – II **9 Hours**

Special precautions for specific areas of clinical Microbiology – Bacteriology, Mycobacteriology, Mycology, Parasitology and Virology. #Specimen collection# & transport – rejection of specimen –expediting results.

UNIT – III **9 Hours**

Selection, collection and transport of specimens – Blood, Urine, Sputum, CSF, Pus &Faeces – Transport media and storage for bacteria, fungi, algae, protozoa and virus.

UNIT – IV **9 Hours**

Microscopic examination and identification of specimen for bacteria and fungi, Cultivation and isolation of viable pathogens – Media used – differential, selective, #enrichment media#. Biochemical and sugar fermentation test.

UNIT-V **9 Hours**

Management of clinical Microbiology laboratory – general approaches– rapid detection – Speeding up of identification results and susceptibility results –procedure manual – Quality assurance, statistics and computerization.

#--- # Self study

Text books

1. Bailey and Scott's. Diagnostic Microbiology (8th edition). C.V. Mosby Company. 1990.
2. Abdul Khader. Medical laboratory techniques (1stedition). Frontline Publications, Hyderabad. 2003.

Books for Reference

1. Butter worths. Medical laboratory manual for tropical countries. Microbiology by Monica chees brough (ELBS). 1985.
2. Lenetle, E., Balows, H.A., Hausler, W.J and Shadomy J., Manual of Clinical Microbiology, Bethesda American Society of Microbiology. 1985.

Books for Study

UNIT I	Text Book1	Chapter 4
UNIT II	Text Book1	Chapter 5, 13
UNIT III	Text Book1	Chapter 5
UNIT IV	Text Book2	Chapter 8
UNIT V	Text Book2	Chapter10

SEMESTER III: NON MAJOR ELECTIVE - II
HAEMATOLOGY

Course Code : 14 UMB3N2 **Max Marks : 100**
Hours/Week : 2 **Internal Marks:40**
Credit : 2 **External Marks:60**

Objective: To provide the information about the Haematology, composition of blood, RBC, WBC, preservation of blood and blood films.

UNIT –I **6 Hours**

Introduction to Hematology: Definition, History and discovery of blood group system. ABO and Rhesus blood group system. Clinical significance of blood groups.

UNIT –II **6 Hours**

Composition and function of blood: Definition of blood, composition of blood (cells, plasma /serum) Site of blood formation: #Erythropoiesis#, Leucopoiesis andThrombopoiesis.

UNIT –III **6 Hours**

RBC, WBC and Platelets: Definition, structure and function and normal value of RBC, WBC and platelets. #Anticoagulants#: Definition, uses, different types, mode of action, their merits and demerits. Morphology of normal blood cells: Normal morphology and morphology in diseases.

UNIT –IV **6 Hours**

Collection and preservation of blood: Different methods of collection, preservation, changes in stored blood. Normal and absolute values, abnormal and various methods of estimation -#Hb and ESR#-various factors affecting the ESR.

UNIT-V **6 Hours**

Blood film: Different types, Methods of preparation, Method of Staining. Roman sky stains: Principle of staining, Different stains, their composition and preparation.
#--- # Self study

Text book

1. Andrew Blann, Gavin knight and Gray Moore. 2010. Haematology. Oxford University Press

2. A Victor Hoffbrand, A. Daniel Catovsky, Edward, GD. Tuddenham, and Anthony R. Green. 2010.Postgraduate Haematology.Wiley-Blackwell Publication.

Books for Reference

1. Kanai L Mukherjee.2010.Medical laboratory technique.Vol 1& 2(2 edition), Tata McGraw Hil Education Private Ltd, New Delhi

2. Barbara J.Bain. 2006. Blood cells. Wiley Black well Publication.

Books for Study

UNIT I	Text Book1	Chapter 1
UNIT II	Text Book1	Chapter 2, 3
UNIT III	Text Book1	Chapter 4, 8
UNIT IV	Text Book1	Chapter 2
UNIT V	Text Book1	Chapter 10

SEMESTER III: SKILL BASED ELECTIVE - I
SOFT SKILL

Course Code : 14UCN3S1 | **Max Marks : 100**
Hours/Week : 2 | **Internal Marks : 40**
Credit : 2 | **External Marks :60**

SEMESTER IV: ALLIED - IV
PRINCIPLES OF IMMUNOLOGY

Course Code : 14 UMB 4A4 **Max Marks : 50**
Hours/Week: 5 **Internal Marks: 20**
Credit : 2 **External Marks: 30**
Objective:

To understand the key concepts on the role of immune system and immunological disorders.

UNIT –I **15Hours**

Introduction of Immune System- Historical Perspective, Organs of Immune system-primary and secondary lymphoid organs. Cells of Immune system: Haematopoiesis, Lymphoid cells types and function-T cells, B cells, #NK cells and granulocytes#.

UNIT –II **15Hours**

Immune Response- types of Immunity- Innate and acquired. Antigens- Properties of antigen, Immunogen, #Hapten and Adjuvants#. Immunoglobulins- Structure and types of antibody. Complement system.

UNIT –III **15Hours**

Transplantation: MHC-HLA and Transplantation, graft rejection mechanism and GVHD. Immunosuppressive drugs.

UNIT –IV **15Hours**

Immunological reaction: Hypersensitivity- Immediate and delayed type. Autoimmune diseases-systemic and organ specific.

UNIT –V **15Hours**

Antigen and Antibody Reactions- Agglutination and precipitation reactions. Immunofluorescence,# ELISA, RIA and complement fixation test#.

#--- # Self study

Text Books

1. Benjamin, E., Coico, R. and Sunshine,G. Immunology (5th edition). Wiley Publication, USA. 2003.

2. Donal, M. Weir, John Steward. Immunology (8th edition). ELBS, London , 1993.

3. David male, Jonathan Brostoff, Roth, D.B. and Ivan Roitt.Immunology(7th edition)Mosy Elsevier publication,Canada.2006.

Books for Reference

1.Ivan M. Roit . Essential Immunology – Blackwell Scientific Publications, Oxford, 1994.

2. Kuby J. Immunology (4th edition) – WH Freeman and Company, New York, 2001

3.Richard M. Hyde. Immunology (3rd edition) National Medical series, Williams and Wilkins, Harward Publishing company, 1995.

4. David male, Jonathan Brostoff, Roth, D.B. and Ivan Roitt.Immunology(7th edition)Mosy Elsevier publication,Canada.2006.

Books for Study

UNIT I Text Book 3 Chapter 1
UNIT II Text Book 3 Chapter 2
UNIT III Text Book 1 Chapter 9
UNIT IV Text Book 2 Chapter 19
UNIT V Text Book 1 Chapter 5

SEMESTER IV: ALLIED -IV
PRINCIPLES OF IMMUNOLOGY - PRACTICAL

Course Code : 14 UMB 4A4P | **Max Marks : 50**
Hours/Week: 3 | **Internal Marks: 20**
Credit : 2 | **External Marks: 30**

Objectives:

1. To learn the principles and methodology for antigen, antibody and their interaction.
2. To Practically perform and interpret the Immunological techniques for diagnisosis

1. Haemagglutination reaction- Blood grouping and Rh typing.
2. Latex agglutination-CRP Test.
3. Precipitation reactions in gels- single radial Immunodiffusion, Double immunodiffusion.
4. Immunoelectrophoresis and staining of precipitation lines.
5. Purification of Immunoglobulins: Ammonium sulphate precipitation.
6. Demonstration of ELISA.

Practical manual

Tizard,I.R. Immunology An Introduction,2nd edition. W.B.Saunders, Philadelphia, 1998.

SEMESTER IV: CORE IV
CLINICAL MICROBIOLOGY

Course Code : 14 UMB4C4 **Max Marks : 100**
Hours/Week: 4 **Internal Marks: 40**
Credit : 4 **External Marks:60**

Objectives:
1. To learn the pathogenesis and epidemiology of various types of infections and its causative agent.
2. To create awareness on microbial infection.

UNIT-I **12Hours**

Historical introduction- Host Microbe interaction- pathogenesis– virulence - mechanism of pathogenesis- invasiveness- colonization- adherence- host defense mechanism- #Toxigenesis#.

UNIT-II **12Hours**

Bacterial pathogenesis: Morphology, Pathogenicity and laboratory diagnosis of -*Staphylococcus aureus, Streptococcus pyogenes, Pneumococcus sp, Neisseria sp. Pseudomonas sp, Clostridium tetani and Mycobacterium tuberculosis.*

UNIT–III **12Hours**

Pathogenesis of Enterobacteriacae: #*E.coli*#, *Salmonella typhi*, *Proteus* sp, *Shigella* sp, *Vibrio cholerae* and *Clostridium difficile.*

UNIT –IV **12Hours**

Medical Mycology: Mycoses- superficial infections: *Dermatophytes- Microsporum, Trichophyton, Epidermophyton-* and *Candidosis.* Deep mycosis- #*Mycetoma*#, *Chromycosis, Sporotrichosis* and subcutaneous mycotic disease.

UNIT –V **12Hours**

Viral Diseases: Herpes viruses, #Pox viruses, Polio#, Measles, Mumps, Rabies, Dengue, chickungunya, Hepatitis, H1N1 and HIV.

#--- # Self study

Text book

1. David Greenwood, Richard Slack and John Peutherer . Medical Microbiology (15th edition) ChurchHill Living stone Publication, 2000.

2.Anathanarayanan and Paniker. Text book of Microbiology (8th edition).Orient Blackswan Publication,2005.

3. Jawetz E Melnic JL and Adelberg EA. A review of Medical Microbiology. Lange Medical Publications, USA,1998.

Books for Reference

1. Bailey and Scotts .Diagnostic Microbiology (9th edition). C.V. Moshby Publications,1994.

2. Mackie and McCartney. Medical Microbiology, Vol I and II Churchill Livingston , 1994.

Books for Study

UNIT I	Text Book 1	Chapter 1- 4 & 8
UNIT II	Text Book 1	Chapter 15-38
UNIT III	Text Book 3	Chapter 42-51
UNIT IV	Text Book 2	Chapter 60-63
UNIT V	Text Book 1	Chapter 64-69

SEMESTER IV: CORE V

CLINICAL MICROBIOLOGY- PRACTICAL

Course Code : 14 UMB 4C5P **Max Marks : 100**
Hours/Week: 4 **Internal Marks: 40**
Credit : 4 **External Marks:60**

Objective:
To expand the knowledge on isolation of pathogens and biochemical disorders in human beings.

1. Isolation and identification of microbes from urine sample
2. Isolation and identification of microbes from wound sample.
3. Isolation and identification of microbes from Pus sample.
4. Testing sensitivity of bacteria to antibiotics.
5. Assessing Minimum Inhibitory concentration antibiotics.
6. Determination of Minimum bactericidal concentration of antibiotics.
7. KOH mount for Dermatophytes.
8. Germ tube test.
9. Blood cell counts-total RBC Count.
10. Blood cell count-total WBC Count.
11. Differential count.
12. Estimation of Haemoglobin

Practical manual

1. Balows, A., Hauser Jr. K.L., Isenberg, H.D., Shalomy, H.J. Manual of Clinical Microbiology, ASM, Washington DC,1991.

SEMESTER IV: SKILL BASED ELECTIVE - II
ANALYTICAL MICROBIOLOGY

Course Code : 14 UMB 4S2 **Max Marks : 100**
Hours/Week : 2 **Internal Marks: 40**
Credit :2 **External Marks:60**

Objectives:

1. To know the principles of Microscopy including Light microscopes and Electron.

2. To provide the knowledge of the instrumentation and method development for the identification and quantification of natural and anthropogenic compounds at trace level.

UNIT – I **6 Hours**

Microscopy– Principles and application – Bright field, Dark field, Phase contrast, #Fluorescence Microscope#, Electron Microscope-SEM , TEM and Confocal Microscope.

UNIT – II **6 Hours**

Principles and Applications of Autoclave, Hot air oven, Incubator, Laminar air flow, BOD incubator, #Metabolic shaker and Incinerator#.

UNIT –III **6 Hours**

Principles and Applications of Centrifugation, Types:Low speed, High speed, Ultra centrifuge. pH meter and# Lyophilizer#.

UNIT –IV **6 Hours**

#Principle and applications of Colorimetry#, Spectrometry- UV and Visible Spectrophotometer and Flame Photometry.

UNIT-V **6 Hours**

Principle and applications of Chromatography – Paper, Thin layer, Column, Ion-exchange, Gas and HPLC .Electrophoresis- Agarose Gel Electrophoresis and SDS-PAGE.

#--- # Self study

Text book

1. Gedder, A. and L. E. Balser, John Wiley and Sons, Principles of applied Biomedical instrumentation.
2. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry 2nd Edition.

Books for Reference

1. Fritschen, L.J and L. W. Gay. Springer, Verlag, Environmental Instrumentation. New York, 1979.

2. Padmini,. Biochemical Calculations and Biostatistics Books and Allied 1st edition, 2007.

Books for Study

UNIT I	Text Book 1	Chapter 4 & 8
UNIT II	Text Book 1	Chapter 5&6
UNIT III	Text Book 2	Chapter 2-5
UNIT IV	Text Book 1	Chapter 10-15
UNIT V	Text Book 2	Chapter 8-10

SEMESTER IV: EXTRA CREDIT - I
EXTREMOPHILES

Course Code: 14 UMB 4EC1 **Max Marks : 100***
Hours/Week: Nil **Internal Marks :Nil**
Credit : 4* **External Marks:100***

Objective:
To know about the habitat and adaptation strategies of living microbes in all extreme origin.

UNIT – I
Concept of Extremophiles v/s conventional Microbial forms and Archaeabacteria. Physiological features, Adaptation strategies of Anaerobes, #Barophiles#, Cryophiles and Thermophiles.

UNIT – II
Characteristics and classification of Thermophiles**:** Classification, Hyperthermophilic habitats and ecological aspects. Commercial aspects of thermophiles. #Applications of thermozymes#.

UNIT – III
Halophiles and Barophiles**:** Classification, Dead Sea, discovery basin, cell walls and membranes – Purple membrane, compatible solutes.

UNIT – IV
Osmoadaptation / halotolerence. Applications of halophiles and their extremozymes. Barophiles: Classification, high-pressure habitats, life under pressure, death under pressure.

UNIT – V
Hyper-extremophiles and their novel metabolic machinery and biomolecules- future unique applications. Genome analysis from extremophiles AND Protein stability in hyper-extremophiles

#--- # Self study

Text Books

1. Thomas D Brock. Thermophiles. General, Molecular and Applied Microbiology. Wiley Interscience Publication,1986.
2. Michael, T. Madigan, John M. Martinko. Brocks Biology of Microorganisms (8thedition). Prentice Hall International Inc.1997.
3. Madian M.T., Martinko JM and Parker J Brock T.D. Biology of Microorganisms (8th edition) Prentice Hall International Inc. London, 1997.

Books for Reference

1. Clive Edward. Microbiology of Extreme Environments. Open University Press. Milton Keynes publication,1990.
2. Johri B.N. Extremophiles. Springer V erlag. , New York, 2000.
3. Kushner ,D.J. MIcrobial Life in Extreme Environments.Academic Press,London, 1978.

Books for Study

UNIT I	Text Book 1	Chapter 5
UNIT II	Text Book 1	Chapter 7
UNIT III	Text Book 2	Chapter 5
UNIT IV	Text Book 3	Chapter 2
UNIT V	Text Book 2	Chapter 6

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SEMESTER IV: EXTRA CREDIT - II
HUMAN ANATOMY & PHYSIOLOGY

Course Code : 14 UMB 4EC2 **Max Marks : 100**
Hours/Week: Nil **Internal Marks:Nil**
Credit :4* **External Marks:100***

Objectives:

1. To provide a basis for understanding human anatomy and physiology.
2. To know the identical structures and its role in human body.

UNIT- I

Introduction: overview on anatomy and physiology-introduction systems. Skeletal system-#muscular system#- Cardiovascular system, portal system collateral circulation and arteries.

UNIT- II

Respiratory system: Mechanism of breathing and exchange of gases in the lungs, Function of lungs, regulation of respiration, Respiration disorder like #anorexia, dyspnea cyanosis#. Artificial respiration lung function tests.

UNIT-III

Nerves and Endocrine: Neurons, Neuralgia, spinalcord, meninges-central and peripheral nervous system, neuromuscular transmission.

UNIT-IV

Anatomy of the Endocrine System- Hypothalamus, Pituitary Gland, # thyroid Gland and adrenal Glands#.

UNIT-V

Classification of joints - Fibrous joints, Cartilaginous joints and Synovial joints

#--- # Self study

Text Books

1. Jain, A.K.Textbook of Physiology, Volume I, Avichal Publishing Company, New Delhi, 2003.

2. Vidya rattan Handbook of Human Physiology, 7th edition, Jaypee Brothers Medical Publishers (p) Ltd, New Delhi, 2004.

Books for Reference

1. Ross and Wilson. Anatomy and Physiology in Health and Illness, 10th edition, Elsevier limited, London, 2006.

Books for Study

UNIT I Text Book 1 Chapter 2
UNIT II Text Book 1 Chapter 4
UNIT III Text Book 2 Chapter 3
UNIT IV Text Book 2 Chapter 6
UNIT V Text Book 2 Chapter 10

SEMESTER V: CORE VI
PARASITOLOGY

Course Code : 14 UMB 5C6 **Max Marks : 100**
Hours/Week :5 **Internal Marks: 40**
Credit :4 **External Marks:60**

Objectives:
1. To learn the pathogenesis and diagnosis of protozoan infections
2. To understand the concept of etiology and emerging protozoan disease

UNIT I **15 Hours**

Introduction to Medical parasitology - parasite host and Vectors. Taxonomical classification of the parasitic Protozoans and # Helminths#.

UNIT II **15 Hours**

Morphology, life cycle and lab diagnosis of Flagellates and ciliates: #*Entamoeba histolytica*#, *Giardia lamblia, Trichomonas vaginalis, Balantidium coli.*

UNIT III **15 Hours**

Morphology, life cycle and lab diagnosis of *Haemoflagallates - Leishmania donowani, Tripanosoma brucei, Malarial parasite -* #*Plasmodium* species#.

UNIT IV **15 Hours**

Morphology, life cycle and lab diagnosis of Cestodes and Trematodes: #*Taenia solium*#, *T. saginata, Paragonimus westermani, Fasciola hepatica, Fasciolopsis buski.*

UNIT V **15 Hours**

Morphology, life cycle and lab diagnosis of lumen dwelling Helminths: *Enterobius vermicularis*, *T.trichura, Ascaris lumbricoids, Wuchereria bancrofti, Enterobius vermicularis*.

#--- # Self study

Text book

1. Subhas Chandra Parija. Text book of Medical Parasitology. Second edition, All India Publishers and Distributors, Medical Books Publishers, New Delhi, 2004.

2. Jayaram Paniker C.K. Text book of Medical Parasitology. Fifth edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi,2004.

3. Ratan Lal Ichhpujani and Rajesh Bhatia. Essentials of Medical Microbiology. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi,2004.

Books for Reference

1. Karya Karte R.P. and Damle A.S. Medical Parasitology. Revised edition, Books and Allied (P) Ltd., Kolkata, 2005.
2. Monica Cheesbrough . District Laboratory Practice in Tropical Countries. Part 1 & 2 Low-Price edition, Cambridge University Press, 2003.

Books for Study

UNIT I	Text Book 1	Chapter 3
UNIT II	Text Book 1	Chapter 5
UNIT III	Text Book 2	Chapter 4
UNIT IV	Text Book 3	Chapter 5
UNIT V	Text Book 3	Chapter 12

SEMESTER V: CORE VII
PHARMACOLOGY

Course Code : 14 UMB 5C7 **Max Marks : 100**
Hours/Week :4 **Internal Marks: 40**
Credit :4 **External Marks:60**

Objectives:

1. To provide an overview on Biological derivative compound and their mode of action.
2. To learn the techniques of absorption of drug potential and toxicity.
3. To know the anti-infectivity effect of chemotherapeutics compounds.

UNIT I **12 Hours**

Introductory Pharmacology: Introduction to Pharmacology, Sources of Drugs, Dosage for and routes of administration and drug delivery system; Mechanism of action, drug receptors and cellular signaling systems. #Pharmocogenetics#.

UNIT II **12 Hours**

Pharmacokinetics: Absorption– Gastro-intestinal absorption of drugs, Mechanism of drug absorption, Metabolism – Phase-I, and Phase-II reactions, Distribution, Excretion of drugs. Principles of basic and clinical Pharmacokinetics.

UNIT III **12 Hours**

Chemotherapy & Anti-Infectives: General consideration, Antiseptics and disinfectants. β-lactam antibiotic, Aminoglycosides, Tetracyclines, Chloromphenicol, Macrolides, Quinolones & Sulphenamides, Antiamoebic, Anti tubercular, Anti fungal and #Antiviral drugs with pharmacotherapy of AIDS#.

UNIT IV **12 Hours**

Pharmacognosy: Definition, history and scope of Pharmacognosy including indigenous system of medicine. Ethnopharmacognosy / Ethnomedicine, its concept, #scope and importance#.

UNIT V **12 Hours**

Neuropharmacology: Benzodiazepines, Barbiturates, Anticonvulsants, Antiparkinsonian drugs, Neuroleptics, Anxiolytics, Lithium, Antidepressants, General Anaesthetics, Skeletal Muscle Relaxants, Local anesthetics, Opioid and Non-Opioid analgesics, Pharmacotherapy of pain and Gout.

#--- # Self study

Text books

1. Henry Hitner, Barbara Nagle. Pharmacology: An Introduction. Edition: **6** Jaypee publications, 2011.
2. Tripathi, K. D. Essentials of Medical **Pharmacology** Edition: 6th edition, 2013
3. Sharma, H. L.and Sharma , K. K. Principles of Pharmacology Paras Publications,2012.

Books for reference

1. Rang and Dale's Pharmacology, H.P.Rang M.M.Dale J.M.Ritter R.J.Flower G.Henderson, Seventh Edition.
2. Goodman and Gilman's. The Pharmacological basis of therapeutics, 12th Edition.
3. Pharmacology, Manual for undergraduates 2nd Edition by Smitha Shenoy.

Books for Study

UNIT I	Text Book 2	Chapter 2
UNIT II	Text Book 3	Chapter 6
UNIT III	Text Book 2	Chapter 4
UNIT IV	Text Book 1	Chapter 8
UNIT V	Text Book 1	Chapter 9

SEMESTER V: CORE VIII
ENZYME TECHNOLOGY

Course Code : 14 UMB 5C8 **Max Marks : 100**
Hours/Week : 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To provide an overview on enzyme classification, mechanism and their application in industry.
2. To learn the source, preparation of enzyme and its application in biosensors.

UNIT- I **12 Hours**

Properties of Enzymes: Classification of enzymes into six major groups with suitable examples. Numerical classification of enzymes. Different structural conformations of enzyme proteins. Enzymes as biocatalysts, catalytic power, activation energy, #substrate specificity and active site#.

UNIT-II **12 Hours**

Mechanism of Enzymes Action: Theories of mechanisms of enzyme action -Enzyme specificity – Active site – Study of Mechanism of enzyme reaction – Pathway of enzyme catalyzed reactions. Mechanism of action of lysozyme, chymotrypsin and ribonuclease.

UNIT -III **12 Hours**

Enzyme kinetics: Importance of enzyme kinetics, factors affecting rates of enzyme mediated reactions (pH, temperature, substrate concentration, enzyme concentration and reaction time). Derivation of Michaelis - Menton equation and its significance in enzyme kinetic studies. Lineweaver - Burke plot, Haldane-Briggs relationship.

UNIT- IV **12 Hours**

Enzyme preparation and use: Sources of enzymes – Microbial production of enzymes - Media for enzyme production- Preparation of enzymes – Centrifugation – filtration – Cell breakage – Chromatography – Safety and regulatory aspects of enzyme use - #Industrial application of microbial enzymes#.

UNIT –V **12 Hours**

Biosensors: The use of enzymes in analysis- Calorimetric biosensors – Potentiometric biosensors – Amperometric biosensors – Optical biosensors – Piezo- electric biosensors - #Immunosensors – Ribozymes – Abzymes – Synzymes#.

#--- # Self study

Text books

1. Shanmugam, S. And Sathiskumar, T. . Enzyme Technology. International Pvt Ltd,2009
2. Prescott, L.M, Harley, J.P, Klein, D.A . Microbiology, WCB Mc Graw Hill,1999.
3. Bhatt, S.M. Enzymology and Enzyme Technology. S.Chand Publication,2011.

Books for reference

1. Athel Cornish – Bowden. Principles of Enzyme Kinetics. - Portland press, 2004.
2. Chaplin, M.F. and Bucke, C. Enzyme Technology.Cambridge University press,1990.
3. Malcolm Dixon and Edwin Clifford Webb. Enzymes . 3rd Edition Academic Press, New York.

Books for Study

1. UNIT I Text Book 1 Chapter 3
2. UNIT II Text Book 1 Chapter 5
3. UNIT III Text Book 2 Chapter 14
4. UNIT IV Text Book 3 Chapter 12
5. UNIT V Text Book 3 Chapter 8

SEMESTER V: CORE IX
SOIL & AGRICULTURAL MICROBIOLOGY

Course Code : 14 UMB 5C9 **Max Marks : 100**
Hours/Week :4 **Internal Marks : 40**
Credit :4 **External Marks:60**

Objectives:

1. To understand the vital role and application of microorganisms in agricultural field.
2. To learn the microbial processes and its interaction with various hosts.

UNIT – I **12 Hours**

Introduction to soil microbiology – properties of soil (structure, texture & formation).Types and significance of soil microbes – bacteria, fungi, Algae, protozoa, nematodes, Actinomycetes, viruses.#Factors affecting microbial population#.

UNIT – II **12 Hours**

Biochemical cycle – carbon, #phosphorus#, nitrogen. Biological nitrogen fixation – nitrogen fixer, root nodule formation, nitrogenase and hydrogenase.

UNIT – III **12 Hours**

Microbial interaction: Neutralism, Commensalism, Synergism, Mutualism, Amensalism, Competition, Parasitism, Predation. Interaction of microbes with plants – Rhizosphere, mycorrhizae.# Interaction of microbes with insects & rumen#.

UNIT – IV **12 Hours**

Plant pathology: Bacterial diseases- Blight of Rice, Citrus canker. Fungal diseases- Blast of Rice, Late Blight of Potato, #Rust of wheat#, red rot of sugarcane, Wilt of cotton, Tikka leaf spot of groundnut.

UNIT – V **12 Hours**

Biofertilizer- *Rhizobium*, *Azatobacter*, Cyanobacteria, *Azolla*- Mass multiplication and crop response. Biopesticide- Bacterial, fungal and viral.

#--- # Self study

Textbooks

1. Atlas, R.I.M.. Microbiology fundamentals and applications. Mac. Millan Publishing Co, 1989.
2. Dirk J, Elas V, Trevors JT, Wellington, EMH. Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong, 1997.
3. Agrios, G.N. Plant Pathology (2^{nd} edition). Academic Press NY,1978.

Books for reference

1. Ainsworth, G.C. Introduction to the history of plant pathology Cambridge, Univ. 1981. Press, Cambridge.
2. Prescott, L.M, Harley, J.P, Klein, D.A . Microbiology, WCB Mc Graw Hill, 1999.

Books for Study

UNIT I Text Book 1 Chapter 27
UNIT II Text Book 1 Chapter 31
UNIT III Text Book 3 Chapter 4
UNIT IV Text Book 3 Chapter 7
UNIT V Text Book 2 Chapter 11

SEMESTER V: CORE X
ENVIRONMENTAL MICROBIOLOGY

Course Code : 14 UMB 5C10 **Max Marks : 100**
Hours/Week: 4 **Internal Marks: 40**
Credit :4 **External Marks:60**

Objectives:

1. To understand the vital role and application of various microbial ecosystem.
2. To learn the microbial processes on Bioleaching and treatment of waste materials

UNIT – I **12 Hours**

Ecosystem types- Introduction to microbial ecosystems- unculturable and culturable bacteria- conventional and molecular methods of studying microbial diversity.

UNIT – II **12 Hours**

Microbiology of air-airborne microorganism- Enumeration of bacteria from air- Air sampling devices – #Air sanitation#.

UNIT – III **12 Hours**

Microbiology of water- potability of water quality- Indicator organisms- water purification – #water borne disease and their control measures#.

UNIT- IV **12 Hours**

Microbiology of Sewage-chemical and biochemical characteristics of sewage – BOD and COD – sewage treatment – physical , chemical & biological (trickling filter, activated sludge and oxidation pond) treatment- #Disposal of wastes#.

UNIT – V **12 Hours**

Bioremediation: Introduction- biodegradation of Xenobiotics – bioaccumulation – Biodegradation of paper, oil and pesticide- Bioleaching of ore – Bioconversion of cellulosic ethanol.

#--- # Self study

Textbooks

1. Atlas R.M and Bartha, R. Microbial Ecology Fundamentals and Application (4th edition) - LPE, pearson Education.Inc, 2005.
2. Alexander, M. Microbial Ecology. John Wiley and Sons Inc, New York, 1971.
3. Forster, C.F. Biotechnology and Wastewater Treatment. Cambridge University Press. Cambridge, 1985.

Books for reference

1. Grant W.D. and Long P.L. Environmental Microbiology. Blackie Glasgow. London, 1981.
2. Marshall, K.C. Advances in Microbial Ecology. Vol.8, Plenum press, 1985.

Books for Study

UNIT I Text Book 1 Chapter 3
UNIT II Text Book 1 Chapter 5
UNIT III Text Book 2 Chapter 4
UNIT IV Text Book 3 Chapter 5
UNIT V Text Book 3 Chapter 12

SEMESTER V: CORE XI
SOIL, AGRICULTURAL MICROBIOLOGY AND ENVIRONMENTAL MICROBIOLOGY - PRACTICAL

Course Code : 14 UMB 5C11P **Max Marks : 100**
Hours/Week :4 **Internal Marks: 40**
Credit :4 **External Marks:60**

Objective:
To understand the principles and methodology of Microbial ecosystem.

1. Isolation and staining of vesicular and arbuscular mycorrhizae from plant/soil.
2. Isolation and culturing of Rhizobium from root nodules.
3. Isolation and testing of antagonistic microorganisms from soil.
4. Isolation of microorganisms from Rhizosphere and Rhizoplane.
5. Isolation of cellulase producing microbes from soil.
6. Isolation and identification of air-borne bio-particles.
7. Effect of high salt concentration on microbial growth.
8. Oligodynamic action of heavy metals on bacteria.
9. Algae as indicators of water pollution.
10. Assessment of water quality by MPN technique.

Practical manual

1. Aneja, KR. Experiments in Microbiology, Plant pathology and Biochemistry (4th Edition). New age International publishers, India 2003.

2. Cappuccino and James, G. Microbiology a laboratory manual (4th edition). Addison Wesley Publishing Company Inc., England, California. 1996.

SEMESTER V: MAJOR BASED ELECTIVE - IV
BIO NANOTECHNOLOGY

Course Code : 14 UMB 5M4 **Max Marks : 100**
Hours/Week : 3 **Internal Marks: 40**
Credit :3 **External Marks:60**

Objectives:

1. To provide knowledge on natural nanocomposites products and its uses.
2. To enable the students to use the bionanoparticle tools applied in diagnostics.
3. To create awareness on bio nanoparticles for drug delivery and its control system.

UNIT- I **9 Hours**

Nanotechnology: Introduction– Classification of Nanostructures -1D, 2D and 3 D. applications of nano biomaterial- Polymeric implant materials: Polyolefin; polyamides (nylon); Acrylic polymers (bone cement) and hydrogels; Fluorocarbon polymers; #Deterioration of polymers#.

UNIT- II **9 Hours**

Natural Nanocomposites: Introduction – natural nano composite materials- biologically synthesized nanostructures- biologically derived synthetic nanocomposites- protein based nanostructure formation – biologically inspired nanocomposites – #nanotechnology in Agriculture (Fertilizers and pesticides)#.

UNIT –III **9 Hours**

Nanomedicine: Developing of Nanomedicines. Nanosytems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials used in Diagnostics and Therapeutic applications - Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

UNIT- IV **9 Hours**

Biosynthesis of Nanoparticles: Microbial Nanoparticle production. Biomineralization, Magnetosomes, Nanoscale magnetic iron minerals in bacteria, virus & fungi. #DNA based Nano structures. Protein based Nano structures#.

UNIT- V **9 Hours**

Nanoparticles for drug delivery: Nanoparticles surface modification, bioconjugation, pegylation, antibodies, cell-specific targeting and controlled drug release, Multi-Functional Gold Nanoparticles for Drug Delivery: Virus Based-nanoparticles.

#--- # Self study

Textbooks

1. Mark Ratner and Daniel Ratner. Nanotechnology. Pearson Education.
2. Bandyopadhyay,A.K. Nanomaterials. New Age International Publishers
3. Hari Singh Nalwa. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology.
4. Hillery, A.M. Drug Delivery and Targeting, CRC Press, 2002.
5. Niemeyer, C.M. and Mirkin, CA. Nanobiotechnology.

Books for reference

1. Ajayan, Schadler and Braun Nanocomposite Science and Technology
2. Massimiliano DiVentra. Introduction to Nanoscale Science and Technology (Nanostructure Science and Technology)
3. Bharat Bhusha .Springer Handbook of Nanotechnology.

Books for Study

UNIT I Text Book 1 Chapter 1
UNIT II Text Book 3 Chapter 4
UNIT III Text Book 5 Chapter 9
UNIT IV Text Book 2 Chapter 5
UNIT V Text Book 4 Chapter 12

SEMESTER V: SKILL BASED ELECTIVE - III
BASIC BIOINFORMATICS

Course Code : 14UMB 5S3 **Max Marks : 100**
Hours/Week : 2 **Internal Marks: 40**
Credit : 2 **External Marks: 60**

Objective:

To enable the students to use the bioinformatics tools on Bio molecules.

UNIT – I **6 Hours**

Bioinformatics – An overview, Definition & History; Information Networks – Internet in Bioinformatics – Bioinformatics databases &[#] tools on the Internet[#].

UNIT – II **6 Hours**

General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

UNIT – III **6 Hours**

Biological Sequence analysis – Pair wise sequence comparison – Sequence queries against biological databases – BLAST and FASTA - Multiple sequence alignments -[#]Phylogenetic alignment[#].

UNIT - IV **6 Hours**

Protein secondary structure classification databases: HSSP, FSSP, CATH, [#]SCOP[#]. Protein secondary structure prediction methods: GOR, Chou-Fasman, PHD, PSI- PRED, J-Pred.

UNIT - V **6 Hours**

Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition. Protein folding, Molecular Dynamics of Protein, Molecular Docking of Protein, Small molecule and Nucleotide and [#]Concepts of Force Field[#]

#--- # Self study

Textbooks

1. Murthy, C.S.V. Bioinformatics. Himalaya publishing house, 2003.

2. Rastogi, S.C. Mendiratta, N. and Rastogi, P. Bioinformatics – Concepts, Skills & Applications, CBS Publishers & Distributors, 2003.

3. Attwood, T.K. and Parry-Smith, D.J. Introduction to Bioinformatics, Pearson Education Ltd., New Delhi, 2004.

4. Westhead, DR. Paris, JH. and Twyman, RM. Instant Notes: Bioinformatics – Viva Books Private Ltd, New Delhi, 2003.

Books for reference

1. Arthur M. Lesk. Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003 .

2. Higgins, D and Taylor, W. Bioinformatics- Sequence, structure and databanks, Oxford University Press, New Delhi, 2000.

Books for Study

UNIT I	Text Book 3	Chapter 1
UNIT II	Text Book 4	Chapter 3
UNIT III	Text Book 1	Chapter 10
UNIT IV	Text Book 1	Chapter 7
UNIT V	Text Book 2	Chapter 15

SEMESTER V: EXTRA CREDIT-III
VERMITECHNOLOGY

Course Code : 14UMB 5EC3 | **Max Marks : 100***
Hours/Week : Nil | **Internal Marks: Nil**
Credit : 4* | **External Marks: 100***

Objectives:

1. To provide knowledge on application of vermi composting
2. To promote the students to become an entrepreneurship

UNIT- I

Selection of suitable species: Epiges (*Eisenia foetida*), Endoges (*Eudrilus eugeniae*), Aneciques. Basic characteristics of suitable species. Role of earth worms in soil structure, fertility and productivity.

UNIT- II

Vermicompost preparation: Vermicomposting materials – preliminary treatment of composting material – Requirement for vermicomposting – small scale vermi composting – large scale vermicomposting – #collection of vermicompost# and vermin wash.

UNIT- III

Role of earthworms in soil structure: fertility and productivity Earthworms burrows and casts. Effect earthworms in soil structure – carbon, nitrogen and phosphorous Transformations. Earthworms as bio-indicators of soil types.

UNIT -IV

Earthworms in organic waste management**:** Management of sewage sludge by earthworms. Management of animal, vegetable and industrial organic waste by earthworms.Earthworm composts as plant growth media and its marketing. Role of earthworms in processing organic wastes applied to agricultural and other land.

UNIT -V

Advantages of Vermi culture: Production of cheap animal protein – soil and vermicast – Decomposition of Biodegradable wastes – #Vermiculture in pollution Abatement#.

#--- # Self study

Text books

1. Arvind kumar.Vermitechnology, Aph Publishing Corporation, 2005.

2. Edwards, C.A and Bohlen, P.J . Biology and ecology of earthworms III Edn. Chapman & Hall publications New York, 1996.

3. Edwards, C.A and Lofty J.R. Vermicology – The Biology of earthworm, Chapman & Hall Publications New York. 1997.

Books for reference

1. National institute of industrial Research. The Complete Technology Book on Vermiculture and Vermicompost, 2007.

2. Mary violet Christy. A. Vermitechnology, MJP publishers, 2008.

Books for Study

UNIT I	Text Book 1	Chapter 2
UNIT II	Text Book 2	Chapter 10
UNIT III	Text Book 1	Chapter 6
UNIT IV	Text Book 2	Chapter 12 & 11
UNIT V	Text Book 3	Chapter 5

SEMESTER VI: CORE XII
FOOD MICROBIOLOGY

Course Code : 14UMB 6C12 **Max Marks : 100**
Hours/Week : 5 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To familiarize the primary sources of microorganisms in meat, poultry and vegetable products as well as the establishment's environment.
2. To create awareness about food contamination and food borne illness and control measures.

UNIT – I **15 Hours**

Food as a substrate for microbes – Microbes involved in food Microbiology – mold, yeast, bacteria-# factors affecting the growth of microorganism in food#.

UNIT – II **15 Hours**

Principles of food preservation- removal of microorganisms – anaerobic condition high and low temperatures- drying, radiation, chemical preservatives and #food additives#.

UNIT – III **15 Hours**

Food spoilage- General principles – food spoilage and contamination – vegetables, fruits, meat, sea foods and canned foods.

UNIT – IV **15 Hours**

Microorganisms in milk and milk products – koumiss, kefir, butter and cheese, #quality control of milk – MBRT & SPC#.

UNIT – V **15 Hours**

Food borne diseases – food poisoning – infective and toxic, bacterial and non – bacterial food borne diseases and the diagnosis – Food sanitation and its control measures.

#--- # Self study

Textbooks

1. Adams, M.R. and Moss M.O. Food Microbiology, The Royal Society of Chemistry, Cambridge, 1995.
2. Banwart ,G.J. Basic food microbiology, Chapman & Hall, New York, 1989.
3. Frazier, W.C, Westhoff, D.C. Food Microbiology, TATA Mc Graw Hill, 1988.

Books for reference

1. Baumberg. S., Hunter. I.S. and Rhodes, P.M. Microbial Products -New approaches. Cambridge Univ. Press. Cambridge, 1989.
2. Robinson, R.K. Dairy Microbiology, Elsevier, 1990.

Books for Study

UNIT I	Text Book 3	Chapter 1
UNIT II	Text Book 3	Chapter 11
UNIT III	Text Book 3	Chapter 16
UNIT IV	Text Book 1	Chapter 9
UNIT V	Text Book 2	Chapter 7

SEMESTER VI: CORE XIII
FERMENTATION TECHNOLOGY

Course Code : 14UMB 6C13 **Max marks : 100**
Hours/Week : 5 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To provide the knowledge and interest on fermentation process and product recovery.
2. Guide the student to design, develop and operate bioreactors.

UNIT –I **15 Hours**

Industrially important strains- Screening methods- Strain development for improved yield- Mutation, Recombination and protoplasmic fusion.

UNIT –II **15 Hours**

Fermentation- submerged and solid state- component parts of CSTR- types of Fermentors (Tower, cylindroconical & airlift) – #batch fermentation – continuous Fermentation#.

UNIT –III **15 Hours**

Production of beverages – beer and wine- vitamin B12 and Riboflavin. Antibiotics- penicillin and streptomycin- production of enzymes- Amylases and Proteases- methods of immobilization.

UNIT- IV **15 Hours**

Single cell protein- Baker's yeast, Spirulina- #Details of mushroom development-Oyster (*Pleurotus*) and Button (*Agaricus*) mushroom#.

UNIT –V **15 Hours**

Downstream process- Intercellular and extracellular- Centrifugation, filtration, Floatation- solvent extraction, precipitation- #Breakage of cells- physical and Chemical methods#.

#--- # Self study

Textbooks

1. Stanburry, P.T. and Whitaker. Principles of Fermentation Technology, Pergamon Press. New York,1984.
2. Casida, L. E. Industrial Microbiology. New Age International Publishers, 1968.
3. David, A. Mitchell, Nadia Krieger, Marin Berovic .Solid-State Fermentation Bioreactors: Fundamentals of Design and Operation, Springer.

Books for Reference

1. Demain, A.L and Davies, J.E. Manual of Industrial Microbiology & Biotechnology, ASM press, 1999.
2. Prescott and Rehm. Industrial Microbiology. Wiley and Sons,1979.
3. Sikyta, B. Methods in Industrial Microbiology, Ellis Horwood Limited,1983.

Books for Study

UNIT I Text Book 1 Chapter 3
UNIT II Text Book 2 Chapter 3
UNIT III Text Book 3 Chapter 5
UNIT IV Text Book 2 Chapter 7
UNIT V Text Book 3 Chapter 10 & 13

SEMESTER VI: CORE XIV
MICROBIAL GENETICS

Course Code : 14UMB 6C14 **Max marks : 100**
Hours/Week : 5 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To provide key concepts on Genetics and genetic materials.
2. To understand the principles of genetics exchanges and its expression in host.
3. To provide an idea about gene regulations and its control.

UNIT – I **15 Hours**

Genetics - Historical introduction– Mendel's laws of inheritance. DNA as genetic material: experiments of Griffith, Avery, Hershey Chase experiment. RNA as a genetic material- Fraenkel-Conrat & Singer experiment

UNIT – II **15 Hours**

DNA Replication: Semi conservative, conservative, rolling circle mechanism, θ mode of replication. Enzymes involved in DNA replication.# Control of replication#.

UNIT – III **15 Hours**

Bacterial Genetics: concepts of haploid genomes, genetic exchange through transformation, Conjugation- F factor and #Hfr strains# and transduction (generalized and specialized).

UNIT – IV **15 Hours**

Organization of gene: Gene expression in prokaryotes and Eukaryotes- Transcription and translation.

UNIT – V **15 Hours**

Gene regulation: Concept of gene regulation – Lac operon, #tryptophan operon#, attenuation control – promoters – repressors.

#--- # Self study

Text books:

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

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

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

4. Jeremy M. Dale. Molecular Genetics of Bacteria (3rd edition).John Wiley and sons, NewYork, 1998.
5. Old, R.S. and Primrose, S.B. Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London, 1989.

Books for Reference

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

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

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

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

Books for Study

UNIT I Text Book 3 Chapter 7
UNIT II Text Book 2 Chapter 9
UNIT III Text Book 1 Chapter 14
UNIT IV Text Book 4 Chapter 2
UNIT V Text Book 5 Chapter 12&13

SEMESTER VI: CORE XV
MOLECULAR BIOLOGY

Course Code : 14UMB 6C15 **Max Marks : 100**
Hours/Week : 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To know key concepts and structure of nucleic acids.
2. To understand the principles on mutation and DNA repair.
3. To provide an idea about research on molecular genetics

UNIT – I **12 Hours**

Introduction to Nucleic acid: DNA and RNA- tRNA, mRNA and rRNA- composition and structure. Genetic code and wobble hypothesis.

UNIT – II **12 Hours**

Mutations: #spontaneous and induced#, basis pair changes, frame shifts, deletions, inversions, tandem duplications, insertions, useful phenotypes (auxotyphic, conditional lethal, resistant), reversion vs. suppression.

UNIT – III **12 Hours**

DNA repair mechanism: Systems that safeguard DNA. DNA methylation and DNA repair mechanisms - excision, mismatch, SOS, #photoreactivation#, recombination repair and glycocylase system.

UNIT – IV **12 Hours**

Genetic recombination: requirements, molecular basis, genetic analysis of recombination in bacteria- site specific, homologous, nonhomologous recombination,#reciprocal and nonreciprocal recombination#.

UNIT – V **12 Hours**

Transposons – Insertion sequences and composite transposons, phages as transposons, replicative, non-replicative and conservative transposition. Mechanism of transposition, controlling elements of maize –autonomous and non-autonomous elements. Types of transposons and their properties.

#--- # Self study

Textbooks

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

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

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

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

Books for Reference

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

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

3. Malor, S.R., Cronan, J.E. and Freifelds, D. Microbial Genetics. Jones and Bartlett Publishers,1994.

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

Books for Study

UNIT I	Text Book 1	Chapter	4&5
UNIT II	Text Book 4	Chapter	3
UNIT III	Text Book 1	Chapter	3
UNIT IV	Text Book 3	Chapter	6
UNIT V	Text Book 2	Chapter	4

SEMESTER VI: CORE XVI
GENETIC ENGINEERING

Course Code : 14UMB 6C16 **Max Marks : 100**
Hours/Week : 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objectives:

1. To improve the knowledge on genetic engineering and applications in advanced Molecular Biology research.
2. To gain information on tools involved in genetic manipulation of organisms

UNIT- I **12 Hours**

Biotechnology and Gene manipulation – Definition – concepts – history, development and Application. Restriction Enzymes, Discovery, Types and Mode of Action, #Ligases and Methylases#.

UNIT –II **12 Hours**

Vectors – cloning vectors: #Plasmids- pBR322 & pUC vectors#. λ Phage based Vectors, Hybrid Vectors- Phagemid and Cosmid. Map of a generic expression vector and its application. Biological in vitro package method.

UNIT –III **12 Hours**

Gene cloning: strategies of gene cloning- Genomic Library and cDNA Library construction by phage. Mechanism and application of PCR, RFLP and RAPD.

UNIT –IV **12 Hours**

Gene Transfer Techniques: Transfection- Physical – Biolistic Method, electroporation, electrofusion, microinjection Chemical- Calcium phosphate mediated uptake, and protoplast fusion –DEAE, DMSO Mediated and Liposomes.

UNIT- V **12 Hours**

Screening and Selection of recombinants- Insertinal inactivation, Selection by colony hybridization, FISH, Marker inactivation Methods, Immunological and Genetic Methods. #Blotting (Southern, Western, Northern) Techniques#.

#--- # Self study

Textbooks

1. Old, R.W. and Primbrose. Principle of Gene Manipulation, (5th edition). Blackwell Scientific Publication, Boston, 1995.

2. Winnecker, E.D. From gene to clones, Introduction to Gene Technology. VCH Publication, FRG, 1987.

3. Brown, T.A . An introduction to Gene Cloning (3rd edition).Champman andHall, 1995.

Books for Reference

1. Glick, B.R. and Pasternak, J.J. Molecular Biotechnology. Principles and Application of Recombinant DNA, ASM Press, Washington, 1994.

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

Books for Study

UNIT I	Text Book 1	Chapter 1
UNIT II	Text Book 1	Chapter 3 -5
UNIT III	Text Book 2	Chapter 3
UNIT IV	Text Book 3	Chapter 8
UNIT V	Text Book 3	Chapter 9

SEMESTER VI: CORE XVII
MICROBIAL GENETICS, MOLECULAR BIOLOGY AND GENETIC ENGINEERING-PRACTICAL

Course Code : 14UMB 6C17P **Max marks : 100**
Hours/Week : 4 **Internal Marks: 40**
Credit : 4 **External Marks: 60**

Objective:
To train and develop the skills on Molecular Biology experiments.

1. Isolation of bacterial Genomic DNA.
2. Isolation of Plasmid DNA.
4. Electrophoretic analysis of DNA.
5. Quantitative estimation of DNA by DPA method.
6. Restriction digestion and analysis.
7. Scoring of auxotrophic mutant.
8. Isolation of Protoplast.
9. Isolation of Spheroplast.

Practical manual

1. Aurubels . Current protocols in Molecular Biology, John Wiley, 1998.

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

SEMESTER VI: SKILL BASED ELECTIVE - IV

IPR, BIOSAFETY & BIOETHICS

Course Code : 14UMB 6S4 **Max marks : 100**
Hours/Week : 2 **Internal Marks: 40**
Credit : 2 **External Marks: 60**

Objectives:

1. To understand protection for the results of investment in the new technology development.
2. To create students where they meet in an atmosphere of mutual respect and understanding.

UNIT -I **6 Hours**

Bioethics: legal and socioeconomic impacts of biotechnology- ethical concerns of biotechnology research and innovation, #Bioethics committees'#.

UNIT- II **6 Hours**

Intellectual property rights: patent, copyright, trade mark, TRIP- GATT and PBR, WTO

UNIT- III **6 Hours**

Patent system – patenting laws-Legal development-Patentable subjects and protection in biotechnology-#The patenting living organisms#.

UNIT- IV **6 Hours**

Biosafety: GLP - Containment facilities – Biosafety levels - Genetically modified organisms and its release - #Genetically modified foods#, Biosafety guidelines in India - International guidelines. Biological Safety Cabinets, Primary Containment for Biohazards.

UNIT- V **6 Hours**

Biodiversity: #Basic concepts of Biodiversity# - Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity

#--- # Self study

Textbooks

1. Rajmohan Joshi. Biosafety and Bioethics. Isha Books, New Delhi, 2006

Books for Reference

1. Sasson, A. Biotechnologies in developing countries present and future, UNESCO publishers,1993

Books for Study

UNIT I	Text Book 1	Chapter 1
UNIT II	Text Book 1	Chapter 3
UNIT III	Text Book 1	Chapter 5
UNIT IV	Text Book 1	Chapter 10
UNIT V	Text Book 1	Chapter 14

SEMESTER VI: EXTRA CREDIT - IV
BIOMEDICAL TECHNOLOGY

Course Code : 14UMB 6EC4 **Max Marks : 100***
Hours/Week :Nil **Internal Marks:Nil**
Credit :4* **External Marks: 100***

Objectives:

1. To define key terms and describe the differences between various therapeutic compounds.
2. To know the principles of gene transfer by using viral vector and non viral vector.

UNIT- I

Vaccines and Therapeutic Agents: Subunits of vaccines – Live Recombinant Vaccines – Attenuated Vaccines – #Vector Vaccines#.

UNIT- II

DNA vaccines- Anti idiotype Vaccines.# Monoclonal Antibodies as therapeutic Agents# – Genetically Engineered Immuno therapeutic Agents.

UNITS- III

Gene therapy: Introduction, Somatic and germ line gene therapy, Gene replacement and gene addition. In vivo, ex vivo and in vitro gene therapy, transgenic animal models.

UNIT- IV

Vehicles for gene transfer-Viral vectors: #Retrovirus, Adenovirus, Adeno-associated virus#. Lentivirus, Recombinant SV40 virus, Nonviral vectors, Liposome and lipoplexes, Naked DNA.

UNIT- V

The genetic basis of cancer, Proto-oncogenes & its regulation- Oncogenes & cancer, Viral oncogenes (Viruses & Cancer) Regulation of gene expression and signal translocation on cancerous cells vs. Normal cells

#--- # Self study

Textbooks

1. Robert, F. Mueller, Ian, D. Young. Emery's Elements of Medical Genetics –, Churchill Living stone publisher, 1995.

Books for Reference

2. Glick, B.R. and Pasuroak J.J. Molecular Biotechnology – Principles and application of recombinant DNA, 2010.

Books for Study

1. UNIT I Text Book 1 Chapter 7
2. UNIT II Text Book 1 Chapter 9
3. UNIT III Text Book 1 Chapter 9
4. UNIT IV Text Book 1 Chapter 13
5. UNIT V Text Book 1 Chapter 5