

**ST. MARY'S COLLEGE (Autonomous), THOOTHUKUDI**  
**Bachelor of Science (Microbiology)**  
**Course Structure (w.e.f 2015 -16)**

**Semester – I**

Part	Subject	Subject code	Title of the paper	Contact hours/week	Credit	Max. marks		
						CIA	ESE	TOTAL
I	Tamil French	15ULTA11 15ULFA11	Cheyyul, Elakkanam, Urainadai, Sirukathai, Elakkia Varalaaru Paper – I French Language and Culture	6	3	50	50	100
	English	15UGEN11 (Stream A/B/C)	General English	6	3	50	50	100
	CORE-I	15UMIC11	Introduction to Microbiology	4	4	50	50	100
	CORE-II	15UMIC12	Microbial Diversity	4	4	50	50	100
	ALLIED-I	15UMIA11	Basics of plant science	4	2	50	50	100
	FOUNDATION COURSE	15UFPD11	Personality development	2	2	50	50	100
	CORE PRACTICAL-I	15UMICR1	Laboratory in Microbiology and Microbial Diversity	2	1	50	50	100
	ALLIED PRACTICAL-I	15UMIAR1	Laboratory in Basics of plant science	2	2	50	50	100
				30	21	400	400	800

**SEMESTER-II**

Part	Subject	Subject code	Title of the paper	Contact hours/week	Credit	Max. marks		
						CIA	ESE	TOTAL
I	Tamil/French	15ULTA21 15ULFA21	Cheyyl, Elakkanam, Urainadai, Valkkai Varalaaru, Elakkia Varalaaru Paper – II French Language and Culture	6	3	50	50	100
	English	15UGEN21 (Stream A/B/C)	General English	6	3	50	50	100
	CORE-III	15UMIC21	Microbial metabolism and Physiology	4	4	50	50	100
	CORE-IV	15UMIC22	Bioinstrumentation	4	4	50	50	100
	ALLIED-I	15UMIA21	Biochemistry	4	4	50	50	100
	FOUNDATIO N COURSE	15UFVE21	Value Education	2	2	50	50	100
	CORE PRACTICAL- II	15UMICR2	Laboratory in Microbial metabolism, Physiology and Bioinstrumentation	2	1	50	50	100
	ALLIED PRACTICAL- II	15UMIAR2	Laboratory in Biochemistry	2	2	50	50	100
	NCC/NSS/ Sports				+1			
				30	23+1	400	400	800

### SEMESTER-III

Part	Subject	Subject code	Title of the paper	Contact hours/week	Credit	Max. marks		
						CIA	ESE	TOTAL
II	Tamil/French	15ULTA31 15ULFA31	Cheyyl, Elakkanam, Puthinam, Elakkia Varalaaru Paper – III French Language and Civilisation	6	3	50	50	100
	English	15UGEN31 (Stream A/B/C)	General English	6	3	50	50	100
	CORE-V	15UMIC31	Molecular Biology And Microbial Genetics	4	4	50	50	100
	ALLIED-II	15UMIA31	Advanced plant biology & biotechnology	4	4	50	50	100
	SBE	15UMIS31	Practicals in Medical laboratory technology	2	2	50	50	100
	NME	15UMIN31	General Microbiology	2	2	50	50	100
	FOUNDATION COURSE	15UFES31	EVS	2	2	50	50	100
	CORE PRACTICAL- III	15UMICR3	Laboratory in Molecular biology and Microbial Genetics	2	1	50	50	100
	ALLIED PRACTICAL- III	15UMIAR3	Laboratory in advanced plant biology & biotechnology	2	2	50	50	100
	Self Study Paper (Optional)	15UMISS1	Vermi technology		+1			
				30	23+1	450	450	900

**SEMESTER-IV**

Part	Subject	Subject code	Title of the paper	Contact hours/week	Credit	Max. Marks		
						CIA	ESE	TOTAL
II	Tamil/ French	15ULTA41 15ULFA41	Cheyyl, Elakkanam, Urainadai, Naadagam, Elakkia Varalaaru Paper – IV Initiation to French Literature	6	3	50	50	100
	English	15UGEN41 (Stream A/B/C)	General English	6	3	50	50	100
	CORE-VI	15UMIC41	Fundamental s of Immunology	4	4	50	50	100
	ALLIED-II	15UMIA41	Genetic Engineering	4	4	50	50	100
	SBE	15UMIS41	Computers and Biostatistics	2	2	50	50	100
	NME	15UMIN41	Food Microbiology	2	2	50	50	100
	FOUNDA TION	15UFYM41	Yoga and Meditation	2	2	50	50	100
	EXTENSION ACTIVITY				+1			
	CORE PRACTICAL -IV	15UMICR4	Techniques in Immunology	2	1	50	50	100
	ALLIED PRACTICAL -IV	15UMIAR4	Laboratory in Genetic Engineering	2	2	50	50	100
	Self Study Paper (OPTIONAL)	15UMISS2	Mushroom Technology		+1			
				30	23+2	450	450	900

**SEMESTER-V**

Part	SUBJECT	Subject code	Title of the paper	Contact hours/week	Credit	Max. Marks		
						CIA	ESE	TOTAL
III	CORE-VII	15UMIC51	Agricultural microbiology	6	5	50	50	100
	CORE-VIII	15UMIC52	Industrial microbiology	6	5	50	50	100
	CORE ELECTIVE I	15UMIE51	Microbial Nanotechnology	6	5	50	50	100
	CORE ELECTIVE II	15UMIE52	Dairy microbiology	6	5	50	50	100
	SBE	15UMIS51	Sea food processing	2	2	50	50	100
	SELF STUDY PAPER (COMPULSORY)	15UMISS3	Food preservation technology	-	+1			
	CORE PRACTICAL-V	15UMICP5	Laboratory in agricultural and industrial microbiology	4	3	50	50	100
	SBE-PRACTICAL	15UMISP51	Practicals in sea food processing	2	1	50	50	100
				30	26+1	300	300	600

**SEMESTER-VI**

<b>Part</b>	<b>SUBJECT</b>	<b>Subject code</b>	<b>Title of the paper</b>	<b>Contact hours/week</b>	<b>Credit</b>	<b>Max. Marks</b>		
						<b>CIA</b>	<b>ESE</b>	<b>TOTAL</b>
	CORE-IX	15UMIC61	Food Microbiology	6	5	50	50	100
	CORE-X	15UMIC62	Clinical Microbiology	6	5	50	50	100
	CORE XI	15UMIC63	Microbial Biotechnology	6	5	50	50	100
	CORE ELECTIVE III	15UMIE61	Marine Microbiology	6	5	50	50	100
	PRACTICAL-VI	15UMICP6	Laboratory in Food, Clinical Microbiology and Microbial Biotechnology	6	3	50	50	100
				30	23	250	250	500

<b>SEMESTER - I</b>			
<b>CORE – I - INTRODUCTION TO MICROBIOLOGY</b>			
<b>Code:15UMIC11</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits: 4</b>

## **OBJECTIVES**

1. To inculcate introductory knowledge on general microbiology
2. To inculcate about the techniques involved in culturing microorganisms.

## **UNIT -1**

The scope of Microbiology - The History and Contributions of Antony Van Leewenhoek, Joseph Lister, Pasteur, Robert Koch, Edward Jenner, Winogradsky and Beijerinck and development of microbiology – Applied fields of Microbiology.

## **UNIT II**

Microscopy – Resolving power, Numerical aperture – Limit of resolution Magnification – Types of Microscopy – Dark field microscopy – Bright field microscopy – Phase contrast microscopy – Electron microscopy.

## **UNIT III**

Microbiological staining – Types – Simple, Differential staining, Gram’s staining, Endospore staining, Capsule, Flagella, Cytoplasmic inclusion staining, Giemsa stain and their applications.

## **UNIT IV**

Structure of bacterial cells- Structure and functions of capsule, flagella, Fimbriae or pili: The cell wall- chemical composition , characteristics and functions of cell wall , Plasma membrane ( Fluid mosaic model), mesosomes, cytoplasm: Subunits and chemical composition, Nucleoids: Cytoplasmic inclusions, Spores and cysts.

## UNIT V

Sterilization – Principles – Dry heat, Moist heat, Filtration, Pasteurization, Radiation, Disinfectant – Development of Pure culture techniques – Basic component of growth media – Types of growth media, purpose – General, selective&, differential-Nutrient and Mac conkey agar, enrichment- blood agar, transport and preservation media. Isolation and purification of pure culture

### REFERENCE BOOKS:

- 1) Prescott L.M., Harley J.P., and Klein D.A.(2008). Microbiology  
(7th edition) McGraw- Hill Inc, New York.
- 2) Tortora, Funke Case Addison 2001, Microbiology – An Introduction  
(7th edition) Wesley Longman Inc.
- 3) Dubey R.C., and Maheswari, S. (2003). A Text Book of Microbiology,  
S.Chand & Co, New Delhi.
- 4) Pelczar Jr., M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology-  
McGraw- Hill Inc, New York.
- 5) Jogn L. Ingraham & Catherine A 2000, Introduction to Microbiology – 2<sup>nd</sup>  
Edn, Ingraham, Brooks / Cole, Newyork.
- 5) Roger Y. Stainer., John L. Ingraham.,Mark L. Wheelis.,PageR.Painter.General  
microbiology (5<sup>th</sup>edition).
- 6) Jeffrey C. Pommerville., Alcamo’s Fundamentals of Microbiology (Ninth edition).



<b>SEMESTER - I</b>			
<b>CORE – II MICROBIAL DIVERSITY</b>			
<b>Code : 15UMIC12</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits: 4</b>

## **OBJECTIVES**

1. To make the students aware of the ubiquitous nature of microbes.
2. To inculcate knowledge about the diversification in microorganisms

## **UNIT-I**

General principles of classification. Evolution of methods in classification – International codes of nomenclature – Taxonomic approaches and phylogeny.

## **UNIT-II**

**Bacteria:** –general introduction – type study :gram positive bacteria (*Bacillus*), Gram negative bacteria (*E.coli*). Determinative classification of Bergey’s manual, cyanobacteria.

## **UNIT-III**

**Fungi:** – General introduction, morphology, Alexopoulous classification and their general features - reproduction – filamentous fungi (Actinomycetes), molds (*Aspergillus*), macroscopic fungi (mushroom-*Agaricus bisporus*) – unicellular fungi (Yeast-*Saccharomyces cerevisiae*)

## **UNIT- IV**

**Algae :** –general characteristics –algal diversity-morphology –classification –blue green algae (*Nostoc*) – Red algae (*Gracilaria*) -**Protozoa** –General introduction – morphology –classification –Sarcodina (*Entamoeba histolytica*) –Mastigophora (*Euglena gracilis*)

## **UNIT- V**

**Viruses** : Introduction –structure –classification based on morphology and genetic material. Plant virus (TMV) –Animal virus (Adeno virus) –Bacteriophage (T4 phage).

### **Reference books:**

1. Stanier, Y. Roger, John L. Ingrahm, Mark L. Wheelis and Page R. Painter.2003.  
General Microbiology V Ed. MacMillan Press Ltd. New Jersey.
2. R.C. Dubey. Text Book of Microbiology 2004 S. Chand and Company Ltd., Topley and Wilson's Principles of Bacteriology.
3. Pelczar, Microbiology, Tata McGraw-Hill Education, 01-Aug-1998 - 900 pages
4. Lansing M. Prescott, John P. Harley and Donald A. Klein.1999. Microbiology, 5th edition. WCB/McGraw Hill Company.

<b>SEMESTER-I</b>			
<b>ALLIED I – BASICS OF PLANT SCIENCE</b>			
<b>CODE: 15UMIA11</b>	<b>Hrs/Week:4</b>	<b>Hrs/Sem:60</b>	<b>Credits:2</b>

## **OBJECTIVES**

- 1) To inculcate the student knowledge on various techniques in basic plant science.
- 2) To give the students a detailed account on the taxonomy.

## **UNIT-I**

### **PLANT TAXONOMY:**

Basics of classification: Species, Genus, Family, Nomenclature-Binomial system. Systems of classification-Artificial,Natural and phylogenetic system-Biosystematics-Aims,methods in this study-Binomial nomenclature-ICBN-Herbarium.

## **UNIT-II**

### **ANATOMY**

Tissues-meristematic & permanent tissues.Primary structure of dicot stem,monocot stem and dicot root.Normal secondary thickening in dicot stem.

## **UNIT-III**

General characters and economic importance of the following families- Fabacea (Clitoria ternatea), Rubiaceae (Ixora coccinea), Solanaceae (Datura metal), Euphorbiaceae (Ricinus communis)

## **UNIT-IV**

### **PHYSIOLOGY**

Diffusion,Osmosis,DPD and Imbibition,Absorption of water-Active and passive,Photosynthesis-Light and Dark reaction.Growth hormones-auxins,gibberellins & cytokinins-their applications.

## **UNIT-V**

### **MEDICINAL BOTANY**

Drugs from roots (Catheranthus), Drugs form bark (Cinchona), Drugs from leaves (Aloe), Drugs from flower (Eugenia). Drugs from seeds (Coriander), Carminatives and Gastro intestinal regulators (Ginger), Antitussives (vasaka),Antiseptic (Curcuma), Brain tonic (Brahmi).

**REFERENCE BOOKS:**

- 1) Textbook of biology botany – Dr.K.Ajithadoss,First edition 2005.
- 2) Plant physiology - Prof.Annie Ragland, K.Rajakumar, M.Jayakumar, K.Rajarithinam, Saras publication, Kanyakumari
- 3) Plant Anatomy –B.P.Pandey , S.Chand & 1<sup>st</sup> edition.
- 4) Plant physiology – V.Verma, Emkay Publication,Delhi 6<sup>th</sup> revised edition.
- 5) Concepts of Cell Biology – Verma & Agarwal V.K.S.Chand & Co,Rain nagar,New Delhi.

<b>SEMESTER I</b>			
<b>Foundation Course: Personality Development</b>			
<b>Code: 15UFPD11</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 2</b>

### **Objectives**

- To set a vision for realizing humanness and its inner strength
- To understand and accept one's own personality and to grow in self formation

### **Unit – I Personality**

The Self – Adolescent: Need of the Adolescent – Obstacles to Adolescent – Understanding one self – Psychology of human life . What makes me? Goal in Life-Meaning of Life – Ambition - Individuality Personality Development : Healthy personality – Knowing oneself – Self – Acceptance – Self - Image

### **Unit – II Interpersonal Relationships**

Characteristic and Elements of personality patterns – Dynamics of Inter- Personal – relationships – analysis of relations of different ego states – analysis of strokes and life positions – Socialization – Friendship – Infatuation - Peer groups – Harmful – Friendship.

### **Unit -III Motivation**

Introduction – relevance and types of motivation – motivating others

### **Unit – IV Stress Management**

Introduction – causes and impacts of stress – managing stress – conflict management – introduction – causes and management

### **Unit – V Time Management**

Time as a resource – identify important time management wasters – individual time management styles – techniques for better time management

### **Reference**

Marie Mignon Mascarenhas, Family Life Education Value Education, All India Association for Higher Education CREST, Bangalore, 1983

AIACHE – human Values development Programme, New Delhi

D.John Antony Self Psychology Counselling, Anugraha Publications

Lall and Sharma, Personal Growth Training and Development, Excel Books.

Janakiraman, Training and Development, Biztantra

Hurlock and Elizabeth B, Personality Development, Tata McGraw Hill, 1<sup>st</sup> Ed

Sahu R.K, Training for Development, Excel Books, 1<sup>st</sup> Ed

<b>SEMESTER - I</b>			
<b>CORE PRACTICAL -I</b>			
<b>LABORATORY IN MICROBIOLOGY &amp; MICROBIAL DIVERSITY</b>			
<b>Code -15UMICR1</b>	<b>Hrs/ Week: 2</b>	<b>Hrs/ Sem: 30</b>	<b>Credit: 1</b>

### **OBJECTIVES**

To impart advanced level information in the field of techniques in general microbiology, diversity and instrumentation.

1. Safety guidelines
2. Instruments used in Microbiology
3. Hay mount to show different types of microbes
4. Hanging drop technique
5. Simple staining
6. Negative Staining

7. Gram's staining
8. Serial dilution technique
9. Plating techniques pour plate, spread plate, streak plate
10. Enumeration of bacteria water and soil samples
11. Cultural characteristics of microorganisms
12. Study of selected group of Actinomycetes
13. Study of selected group of Cyanobacteria
14. Study of selected group of Fungi & Yeast
15. Lactophenol cotton blue staining-Fungi
16. Evaluation of total coliforms- MPN Method
17. Examination of water borne pathogens
18. Isolation of Actinomycetes from marine water & soil sample.

**Reference books:**

1. J.G. Cappuccino and N. Sherman 1996 MB – A lab manual Benjamin Cummins, New York.
2. Kannan, N.(1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. David Greenwood, Richard. B. Slack & John. F. Peutherer  
Medical microbiology 16<sup>th</sup> edition 2002.
4. Murray P.R; Baron E.J; Jorgerson J.H; Pfaller M.A. and Tenover F.C  
2003. Manual of Clinical microbiology, 8<sup>th</sup> edition. Vol. 1 & 2 ASM Press Washington D.C.
5. Sundararaj. T. 2005 MB Lab manual (1<sup>st</sup> edition) published by Sundararaj. A. Chennai.
6. Gunasekaran, P.(1996) .Laboratory Manual in Microbiology. New Age

International Ltd., Publishers, New Delhi.

7. Jayaraman, J.(1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
  8. Plummer, D.T.(1998). An Introduction to Practical Biochemistry. Tata McGraw-Hill. New Delhi.
  9. Palanivelu. P. Analytical Biochemistry and Separation Techniques.
  10. Kanai L. Mukherjee, Medical Laboratory Technology- A procedure Manual for routine diagnosis tests- Tata McGraw-Hill. New Delhi.
- Vol. I- III.

<b>SEMESTER I</b>			
<b>ALLIED PRACTICAL-I</b>			
<b>LABORATORY IN BASICS OF PLANT SCIENCE</b>			
<b>CODE:15UMIAR1</b>	<b>Hrs/Week:2</b>	<b>Hrs/Sem:30</b>	<b>Credits:2</b>

#### **OBJECTIVES**

To enhance the students knowledge on the various basic laboratory techniques in plant science.

1. Identification and dissection of the plants belonging to the families included in the theory syllabus.
2. Sectioning of young and old Dicot Stem
3. Sectioning of young and old Monocot Stem
4. Imbibition-Direct Weight Method
5. Rate of photosynthesis in different concentrations of bicarbonate method.
6. Osmosis
7. Economic importance of families prescribed in the theory syllabus.
8. Submission of herbarium sheets (any 5 families:2 from each)

#### **REFERENCE BOOKS:**

1. Text book of botany-Muneswaran
2. Plant Anatomy- B.P.Pandey S.Chand & 1<sup>st</sup> edn
3. Plant Physiology -V.Verma Emkay Publication Delhi 6<sup>th</sup> revised edn
4. Concepts of cell biology-Verma pls & Agarwal V.K.S.Chand & Co. Rain nagar ,NewDelhi



<b>SEMESTER - II</b>			
<b>CORE – III - MICROBIAL METABOLISM AND PHYSIOLOGY</b>			
<b>Code:15UMIC21</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits: 4</b>

## **OBJECTIVES**

- 1) To inculcate in the students on the knowledge of the microbial metabolic process
- 2) To give the students knowledge on the various types of cultures and their pathways.

### **UNIT-I**

Basic concept of metabolism – Membrane transport system – Passive and Active transport system – Facilitated Diffusion, group Translocation – Iron transport – Requirements of growth- Micro&Macro nutrient elements.

### **UNIT-II**

Assimilatory and dissimilatory pathways – Respiratory pathways – Glycolysis, Krebs cycle – ETS – ATP generation – Chemiosmotic theory-. Fermentation pathways- Homo and Hetero lactate fermentation- Ethanol Fermentation by bacteria and yeast – Mixed acid fermentation- Butanediol, acetate and propionate.

### **UNIT-III**

Anaerobic respiration: Nitrate, sulphur, carbonate and methane – Bioluminescence components in Vibrio sp.

### **UNIT-IV**

Growth – Batch, continuous– Growth curve – Factors affecting growth – Physical, chemical and biological factors. Endospore – structure and mechanism of sporulation.

### **UNIT-V**

Photosystem I&II- Pigments( Chlorophyll and bacteriorhodopsin) – Nitrogen fixation – Types(Symbiosis, non-symbiosis ) – structure and functions of nitrogenase.

## REFERENCE BOOKS:

1. Rajapandian K.,(2010). Microbial physiology – PBS Book Enterprises India, Chennai.
2. Lansing M.Prescott,John P.Harley and Donald A,Klein(2003). Microbiology (5<sup>th</sup> edition). McGraw –Hill Company, Newyork
3. Microbial physiology- Meena kumari.
- 4.Tortora, Funke Case Addison 2001, Microbiology – An Introduction (7th edition) Wesley Longman Inc.
5. Dubey R.C., and Maheswari, S. (2003). A Text Book of Microbiology, S.Chand & Co, New Delhi.
- 6.Pelczar Jr., M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology- McGraw- Hill Inc, New York

<b>SEMESTER- II</b>			
<b>CORE - IV – BIOINSTRUMENTATION</b>			
<b>Code: 15UMIC22</b>	<b>HRS/WEEK: 4</b>	<b>HRS/SEM: 60</b>	<b>CREDITS: 4</b>

## **OBJECTIVE**

1. To impart knowledge about the basic instrumentation.
2. To discuss about the principles and applications of various instruments.

## **UNIT - I**

Buffers - Preparation of buffers - Standard buffers - pH meter - pH – titration curve –  
Techniques of pH measurement.

## **UNIT – II**

Principles and application – Colorimetry – Spectrophotometry – (UV, Visible), Centrifuge –  
Types of centrifuge – Types of rotors.

## **UNIT – III**

Paper chromatography – Thin layer chromatography- Column chromatography- Affinity  
chromatography - Gel chromatography – Gas chromatography, HPLC.

## **UNIT - IV**

Electrophoresis – Principles and application – SDS PAGE – Vertical slab gel –Horizontal –  
Tube gel types – Paper electrophoresis – Immunoelectrophoresis.

## **UNIT – V**

Advanced instrumentation –Principles and application -IR Spectroscopy – Raman  
spectroscopy – X-ray spectroscopy , Atomic Absorption Spectroscopy

## **REFERENCE BOOKS:**

1. Jayaraman. J. (1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi
2. Plummer. D.T. (1998). An Introduction to Practical Biochemistry. Tata McGraw Hill, New Delhi.
3. Palanivelu. P. (2001) Analytical Biochemistry and Separation Techniques – A Laboratory Manual.
4. Keith Wilson and Walker. J. (2003) Practical Biochemistry – Cambridge Univ Press.
5. Veerakumari. L. (2006). Bioinstrumentation. MJP Publishers, Chennai.
6. Gurumani. N. (2006). Research Methodology for Biological Sciences. MJP publishers, Chennai.

<b>SEMESTER - II</b>			
<b>ALLIED-I BIOCHEMISTRY</b>			
<b>Code : 15UMIA21</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits:4</b>

## **OBJECTIVIES**

To enhance the students with knowledge on various biochemical aspects of the biomolecules.

### **UNIT I**

Structure of atom – chemical bonds – principles of bioenergetics Laws of thermodynamics – Structure and functions of energy rich phosphate ATP,PEP and creatine phosphate – Role of pH and buffers in biological systems.

### **UNIT II**

Biomolecules: Carbohydrates- Mono, Di and Polysaccharides Structure, classification and functions.

### **UNIT III**

Biomolecules: Proteins –Amino Acids – Peptides – Types, Structure, classification and functions. Nucleic acids – structure and forms of DNA and RNA.

### **UNIT IV**

Biomolecules – Lipids – Classification – Structure and functions. Enzymes: Classification – Active site – Allosterism – Determination of Michaelis Menten constant – Factors affecting Km Value – Mode of Enzyme action (Lock and Key model and Induced fit model)- coenzymes – Cofactors – Isozymes and Inhibitors.

### **UNIT V**

Vitamins – Introduction – Fat soluble vitamins (A,D,E&K) – Water Soluble vitamins (B-complex and C) – sources, functions ,deficiency and syndromes.

**Reference Books:**

1. Stryer, L. 1995. Biochemistry. Ed. W. H. Freeman and company, New York.
2. Fundamental of Biochemistry- J. L. Jain, S. Chand & company Ltd, New Delhi.
3. Santhyanarayana. U 2002. Essentials of Biochemistry. (1<sup>st</sup> Edition) Books and Allied Ltd., Kolkata ,
4. A. C. Deb 1999. Concepts of Biochemistry. (7<sup>th</sup> Edition), Books and Allied (P) Ltd., Kolkata
5. Hubert, Stryer, 1995. Biochemistry – Freeman and Company, New York.
6. Principle of Biochemistry. Lehninger. 3<sup>rd</sup> edition by Nelson and Cox (Worth) 2009.

<b>SEMESTER II</b>			
<b>Foundation Course: Value Education</b>			
<b>Code: 15UFVE21</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 2</b>

## **Objectives**

To help students to imbibe the best cherished behaviour pattern as individuals, citizens and members of the community

To develop high ethic standards and moral values

### **Unit I**

Me-Myself-College-Life and Values-on protests and demonstration – on beliefs – ethical matters – Values – internalization of values – transformation of self.

### **Unit II**

Life Enrichment skills; Purpose for life – sensitization towards gender equality, physically challenged, intellectually challenged. Respect to age, experience, maturity, family members, neighbours, Co-Workers.

### **Unit III**

Forgiveness, Integrity, Humility, Truthfulness, Sacrifice, Sincerity, Self Control, Altruism, Scientific vision.

### **Unit IV**

Constitutional or national values – democracy, socialism, secularism, equality, justice, liberty, freedom, fraternity. Social values, self control universal brotherhood. Religions-Path to God, Religions – Expressions of God Experience- Religious Tolerance. Art: The Meaning of the term – Nature and Function of Art-Art Appreciation-Art for a fuller living – Modern Art – Art and Morality.

### **Unit V**

Control of mind through

- a. Simplified physical exercise
- b. Meditation – objectives, types, effect on body, mind & soul
- c. Activities
  - i) Moralization of desires
  - ii) Neutralization of anger
  - iii) Eradication of worries
  - iv) Benefits of blessing

#### **Reference Books:**

AIACHE – human Values development Programme, New Delhi

Thomas Anchukandam, Grow Free Live Free, Krisu Jyoti Publications, Salesians, Bangalore, 1998

D. John Antony Self Psychology Counselling, Anugraha Publications

Prof. N.S. Raghunathan, Value Education, Margham publications, Chennai 2015

Marie Mignon Mascarenhas, Family Life Education Value Education, All India Association for Higher Education CREST, Bangalore, 1983



<b>SEMESTER - II</b>			
<b>CORE PRACTICAL -II</b>			
<b>LABORATORY IN MICROBIAL METABOLISM, PHYSIOLOGY &amp; BIOINSTRUMENTATION</b>			
<b>Code -15UMICR2</b>	<b>Hrs/ Week: 2</b>	<b>Hrs/ Sem: 30</b>	<b>Credit: 1</b>

## **OBJECTIVES**

To impart advanced level information in the field of techniques in general microbiology, diversity and instrumentation.

1. Construction of growth curve
2. Effect of environmental factors on growth of bacteria.
  - i) Temperature
  - ii) P<sup>H</sup>
  - iii) Osmotic pressure
  - iv) UV light
3. IMVIC test
4. Carbohydrate fermentation -Glucose.
5. TSI test
6. Production of extracellular enzyme
  - a) Starch hydrolysis
  - b) Casein hydrolysis
  - c) Lipid hydrolysis
  - d) Gelatin hydrolysis
7. H<sub>2</sub>S test
8. Urease test
9. Nitrate reduction test
10. Catalase test
11. Preparation of Buffer and determination of pH using pH meter.
12. Verification of Beer-Lambert's Law using Spectrophotometer

**Reference books:**

1. J.G. Cappuccino and N.Sherman 1996 MB – A lab manual Benjamin Cummins, New York.
2. Kannan, N.(1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. David greenwood, Richard. B. Slack & John. F. Peutherer Medical microbiology 16<sup>th</sup> edition 2002.
4. Murray P.R; Baron E.J; Jorgerson J.H; Pfaller M.A. and Yolker R.H 2003. Manual of Clinical microbiology, 8<sup>th</sup> edition. Vol. 1 & 2 ASM Poem Washington D.C.
5. Sundararaj. T. 2005 MB Lab manual (1<sup>st</sup> edition) publN Sundararaj. A. Chennai.
6. Gunasekaran, P.(1996) .Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
7. Jayaraman, J.(1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
8. Plummer, D.T.(1998). An Introduction to Practical Biochemistry. Tata McGraw-Hill. New Delhi.
9. Palanivelu. P. Analytical Biochemistry and Separation Techniques.
10. Kanai L. Mukherjee, Medical Laboratory Technology- A procedure Manual for routine diagnosis tests- Tata McGraw-Hill. New Delhi.

<b>SEMESTER - II</b>			
<b>ALLIED PRACTICAL -II</b>			
<b>LABORATORY IN BIOCHEMISTRY</b>			
<b>Code -15UMIAR2</b>	<b>Hrs/ Week: 2</b>	<b>Hrs/ Sem: 30</b>	<b>Credits: 2</b>

## **OBJECTIVES**

To impart advanced level information in the field of Biochemistry

1. Qualitative analysis of Carbohydrates, Proteins, Urea, Creatinine, Cholesterol.
2. Determination saponification value of fats.
3. Determination of Acid value of fats.
4. Effect of pH on activity of enzyme
5. Effect of temperature on activity of enzyme
6. Estimation of reducing sugar by Benedict's quantitative method.
7. Estimation of amino acids by formal titration.
8. Estimation of ascorbic acid by titrimetric method using 2,6-dichlorophenol indophenol.
9. Estimation of Carbohydrates
10. Estimation of Proteins (Lowry's method)
11. Separation of amino acids by paper chromatography

## **Reference Books:**

1. Practical Biochemistry- David Plummer
2. Practical Biochemistry – J. Jayaraman
3. Biochemical methods – Sadasivam and Manickam
4. Biochemistry –Practical Approach – Kieth Wilson and J. Walker
5. Introductory Practical Biochemistry- Randhir Singh and Sawhney
6. Analytical Biochemistry and separation techniques- P.Palanivelu.
7. Principles of practical Biochemistry – Wilson.K and Walker.J

<b>SEMESTER – III</b>			
<b>CORE – V– MOLECULAR BIOLOGY AND MICROBIAL GENETICS</b>			
<b>Code : 15UMIC31</b>	<b>HRS/WEEK- 4</b>	<b>HRS/SEM – 60</b>	<b>CREDITS – 4</b>

### **Objectives**

1. To learn about the various aspects of genetics.
2. To enhance knowledge on various concepts of nucleic acids.

### **Unit I**

Genetics- Historical Introduction- experiments of Hershey, Chase and Griffith- DNA structure- circular and super helical - RNA – types, structure. RNA as the genetic material- Genetic code. Replication of DNA- Reverse transcriptase.

### **Unit II**

Bacterial plasmids (F-plasmid, R plasmid, col plasmid, degradative plasmid, virulence plasmid) - Structure, types and properties of plasmids- Plasmid replication- Transposons and IS elements- Structure, types and properties.

### **Unit III**

Transcription –Translation - Bacteriophages- Structure- Classification- Lytic cycle and lysogenic cycle (T4 and Lambda phage only).

### **Unit IV**

Mutations- Spontaneous, induced, basepair changes, frameshift, deletion, insertion, duplications, transversions- Genotypic and phenotypic mutants- Reversion and suppression- Ames test.

### **Unit V**

Gene transfer mechanisms- Conjugation (Cell transmissible plasmids, F factor and Hfr strains- Transformation (Natural transformation, competence, DNA uptake, role of natural transformation, artificially induced competence and electroporation)- Generalised and specialised transduction.

**Reference Books:**

1. Watson, J.D., Hopkins N.H., Roberts JW., Steitz JA and Weiner A.A.M. (1987). Molecular Biology of the gene. The Benjamin/ cummings publishing company.
2. Lewin B. (2007). Genes IX Oxford University press, UK.
3. Freifelder D., (1991). Molecular Biology. narosa publishing house.
4. Talaro, K.P., And talaro. A. (1999). Foundations in Microbiology. WCP Mc Graw-Hill, New York.
5. Jeyanthi G.P. (2008) Molecular biology. MJP publisherrs, chennai.
- 6.R.C. Dubey. Text Book of Microbiology 2004 S. Chand and Company Ltd., Topley and Wilson's Principles of Bacteriology.
7. Pelczar, Microbiology, Tata McGraw-Hill Education, 01-Aug-1998 - 900 pages
8. Prescott, Harley and Klein's Microbiology, 5th edition

<b>SEMESTER – III</b>			
<b>ALLIED – II - ADVANCED PLANT BIOLOGY &amp; BIOTECHNOLOGY</b>			
<b>CODE:15UMIA31</b>	<b>Hrs/ Week: 4</b>	<b>Hrs/ Sem: 60</b>	<b>Credits: 4</b>

**OBJECTIVES**

1. To impart knowledge on advancements in plant biology.
2. To enhance the students about the various pharmacognosy aspects and economic botany .

**UNIT I**

Plant cell and Plant tissue culture – Nutrient medium – Types -MS and B5 - totipotency –Types & maintenance of culture. Micro propagation.

**UNIT II**

Protoplast culture –isolation,maintenance and regeneration – protoplast fusion. Synthetic seeds. Application of Plant tissue culture in agriculture, horticulture and forestry.

**UNIT III**

Economic botany – coir production uses. Sugar industry, extraction of juice, clarification, evaporation and crystallization. Biodiesel, Biocontrol agents - Plant extract,Biogas.

**UNIT IV**

Genetic engineering in plants for crop improvement, herbicide resistance,insect resistance, virus resistance,stress tolerance ( heat & salt) and delay of fruit ripening- plants as bioreactors.

**UNIT V**

Genetic modification in Agriculture – transgenic plants, genetically modified foods, application, future applications, ecological impact of transgenic plants.

## **REFERENCE BOOKS :**

1. Basic biotechnology. Rev.Fr.Dr.Ignacimuthu.S.J.Tata McGraw Hill Publication,Co. New Delhi.
2. Book of pharmacognosy – K.R.Arumugam and N.Murugesh athya Publishers 1993.
3. Text book of Pharmacognosy – T.E.Wallis. Fifthe Edition CBS publishers and distributors. New Delhi.
4. Herbs cultivation and medicinal uses – H.Panda NIIR Publication New Delhi.

<b>SEMESTER –III</b>			
<b>Foundation Course: Environmental Studies</b>			
<b>Code: 12UEVS11</b>	<b>Hrs/week:2</b>	<b>Hrs/sem:30</b>	<b>Credits: 2</b>

**Objectives**

- To make the students environment conscious.
- To sensitize the students about the environmental crisis and environmental protection.
- To create an awareness among the students about sustainable utilization and conservation of natural resources.

**Unit I Environment – Natural Resources**

Environment – Definition, Components, need for public Awareness, Natural Resources – Renewable and non-renewable. Forest Resources – Uses, Over exploitation, Deforestation, Water Resources – Uses and Conservation, rain water harvesting. Energy Resources – Renewable and Nonrenewable. Solar, Wind and Biomass energy. Role of Individuals in conservation of natural resources.

**Unit II Ecosystem**

Ecosystem – Concepts, components – Abiotic and Biotic components (Producer, Consumer and Decomposer), Energy Flow – Food chain, food web and Ecological Pyramids, Structure and Function of Grass Land (Terrestrial) and Pond (Aquatic) Ecosystem.

**Unit III Environmental Pollution**

Definition, causes, effects and control measures of Air Pollution, Water Pollution and Soil Pollution, Nuclear Hazards, Solid Waste Management. Disaster Management – Flood, Earth quake, Tsunami. Role of individuals in the prevention of pollution.

**Unit IV Biodiversity and Conservation**

Definition and Levels of Biodiversity (Genetical, Ecological and Species Diversity) Values of Biodiversity. Threats and Loss of Biodiversity – Causes. Hot Spots of Biodiversity (with special reference to India). Conservation of Biodiversity – *In situ* and *Ex situ* Conservation.

**Unit V Social Issues and Environment**

Sustainable Development, Consumerism and Waste Products, Climate Change – Global Warming, Ozone Layer depletion. Waste Land Reclamation. Population Explosion – Family Welfare Programme, HIV / AIDS, The Environment (Protection) Act – 1986. International Union for Conservation of Nature and Natural Resources (IUCN), World Wild Life Fund (WWF), Man and Biosphere Programme (MAB).

**Reference Books:**

1. Kaushik, A. and Kaushik, C.P.K., Perspectives in Environmental Studies – New Age, International Pvt. Ltd., New Delhi, 2004.



2. Odum, E.P., Fundamentals of Ecology, Natraj Publishers, New Delhi, 1996.
  3. Saha, T.K. Ecology and Environmental Biology, Arunabha Sen Books & Allied Pvt. Ltd., Kolkata, 2007
  4. Sharma, Environmental Biology, Rastogi Publications, Meerut, 2006.
  5. Miller, Tyller g., Environmental Science, Thompeson Brooke / Cole, Singapore, 2004.
- Vijayalakshmi, G.S. Murugesan A.G. and Sukumaran, N., Basic Environmental Science, Manonmaniam Sundaranar University Publications, Tirunelveli, 2006.

<b>SEMESTER – III</b>			
<b>SKILL BASED ELECTIVE</b>			
<b>PRACTICALS IN MEDICAL LABORATORY TECHNOLOGY</b>			
<b>Code – 15UMIS31</b>	<b>HRS/WEEK-2</b>	<b>HRS/SEM - 30</b>	<b>CREDITS – 2</b>

## **OBJECTIVES**

To impart basic level information for doing test in medical field

1. Estimation of glucose
2. Estimation of cholesterol
3. Estimation of iron
4. Estimation of hemoglobin
5. Estimation of chlorides
6. Estimation of triglyceride
7. Identification of carbohydrates ( Qualitative tests)
8. Identification of proteins (Qualitative tests)
9. Staining of blood smear
10. Blood grouping
11. Examination of urine- physical, chemical, &microscopic
12. Urine analysis: Glucose, protein, urea, creatinine and billirubin.
13. Culture tests- urine, nasal, throat swab, stool&pus
14. Antimicrobial susceptibility testing
15. Pregnancy test-Demo
16. ESR
17. CRP- Demo
18. Testing of malarial parasite
19. Testing of stool samples for parasites (ova& cysts)
20. Isolation &identification of Mycobacteria- Demo
21. Cultivation of viruses: Bacteriophage isolation

22. Isolation & identification & identification of fungi

23. Cultivation & identification of protozoa

24. Identification of Escherichia coli

25. Isolation of bacteria from blood.

### **Reference Books:**

1. Cappucino.J.g., and Sherman. N.(1996). Microbiology - a laboratory manual . Benjamin Cummins. New york.

2. Kanan.N.(1996). A laboratory manual in general Microbiology. Palani paramount publication, Palani.

3. Gunasekaran. P. (1996). laboratory manual in Microbiology. a new age International Ltd., publishers, new Delhi.

4. Sundaraj. T. (2005). Microbiology - A laboratory manual. 1st Edition Publication. Sundaraj. Chennai.

5. Jayaraman. J. (1985) Laboratory manual in Biochemistry. Wiley Eastern Ltd., New Delhi.

6. Plummer. D.T. (1998) An introduction to Practical Biochemistry. Tata Mc Graw Hill, New delhi.

7. Palanivelu. p. Analytical Biochemistry and Seperation techniques.

8. Benson (2002). Microbiological applications - A Laboratory manual in general microbiology. International Edition, Mc Graw hill Higher Eductaion.

9. Renganathan. S., Gkul Shankar S., Ranjit.M.S, Pankajalakshmi.v., sivramakrishnan.M., Selvakumar.B.N., and mohhamed aejaaz. (2001). Fungal Diseases and Diagnosis. (vol I)

10. Kanai Mukerjee L., medical Laboratory technology - a procedure manual for routine diagnosis tests- Tata mc Graw Hill Publishing Co. Ltd., New Delhi. Vol III.

<b>SEMESTER III</b>			
<b>CORE PRACTICAL III</b>			
<b>Laboratory in Molecular biology and Microbial Genetics</b>			
<b>Code : 15UMICR3</b>	<b>HRS/WEEK-2</b>	<b>HRS/SEM - 30</b>	<b>CREDITS – 1</b>

## **OBJECTIVES**

To impart basic level laboratory training in the subject of Microbial genetics .

1. Isolation of spontaneous mutants.
2. Isolation of induced mutant by UV
3. Isolation of antibiotic resistant mutants by gradient plate technique
4. UV induced auxotrophic mutants production and isolation of mutants by replica plating technique
5. Plasmid DNA isolation from *E.coli* (Demonstration)
6. Agarose Gel Electrophoresis (Demonstration)
7. Genetic recombination in Bacteria by conjugation (Demonstration)
8. Polymerase chain reaction (Demonstration)

## **REFERENCE BOOKS**

1. Cappuccino.J.G., and Sherman. N. (1996). Microbiology – A Laboratory Manual. Benjamin Cummins. New York.
2. Kannan. N. (1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. Guansekaran.P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
4. Sundararaj,T. (2005), Microbiology – Laboratory Manual. (1<sup>st</sup> Edition). Publ. Sundararaj. T, Chennai.
5. Jayaraman, J. (1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
6. Palanivelu. P. Analytical Biochemistry and Separation Techniques.

<b>SEMESTER III</b>			
<b>ALLIED PRACTICAL-III</b>			
<b>LABORATORY IN ADVANCED PLANT BIOLOGY &amp; BIOTECHNOLOGY</b>			
<b>CODE:15UMIAR3</b>	<b>Hrs/Week:2</b>	<b>Hrs/Sem:30</b>	<b>Credits:2</b>

## **OBJECTIVES**

To enhance the students knowledge on the various advancements in the techniques of plant biology & biotechnology.

1. Preparation of different nutritive media of plant tissue culture – Preparation & sterilization of explants-Demonstration
2. Organoleptic studies of plants included in theory part– starch.
3. Estimation of proteins & lipids-*Aloe*, Ginger
4. Antimicrobial study of various medicinal plants
  - a) Neem b)Tulsi c) Fenugreek d) Turmeric e) Ginger
5. Phytochemical analysis on different flowers and leaves (Steroids, Phenol, Glycosides, Quinone, Flavonoids, Tannin, Furanoid, Alkaloids, Triterpenoids).
6. Pigment separation by paper Chromatography.
7. Thinlayer chromatography of alkaloids from the medicinal plants in the theory part.
8. Models and charts
9. A visit to sugarcane industry

## **REFERENCE BOOKS**

1. Basic biotechnology. Rev.Fr.Dr.Ignacimuthu.S.J. Tata McGraw Hill Publication,Co. NewDelhi
2. Book of pharmacognosy – K.R.Arumugam and N.Muruges sathya Publishers 1993.
3. Text book of Pharmacognosy – T.E.Wallis. Fifth Edition CBS publishers and distributors. NewDelhi.
4. Herbs cultivation and medicinal uses – H.Panda NIIR Publication Newdelhi.

<b>SEMESTER – IV</b>			
<b>CORE – VI – FUNDAMENTALS OF IMMUNOLOGY</b>			
<b>Code : 15UMIC41</b>	<b>HRS/WEEK-4</b>	<b>HRS/SEM - 60</b>	<b>CREDITS – 4</b>

## **OBJECTIVES**

- 1) To impart basic level information in the subject of Immunology.
- 2) To study about the various immune responses of the human system towards the pathogens

### **UNIT – I**

History of immunology (Joseph Lister, Louis Pasteur and Elie Metchnikoff) – Innate and acquired- structure, composition, functions of the cells in immune system Detailed aspects of T and B cells

### **UNIT – II**

Organs of Immune systems – primary lymphoid organs(thymus, bone marrow) – secondary lymphoid tissues(lymph nodes, Peyer’s patches, tonsils, spleen) MALT and GALT.

### **UNIT - III**

Antigens – types – properties – Haptens – adjuvant –immunoglobulins – structure, types, properties and functions – complements: components and pathways. Major Histocompatibility Complex (MHC)- Human leukocyte antigen (HLA) - Humoral immune response-cell mediated immune response.

### **UNIT – IV**

Antigen – antibody reactions – In vivo methods (Precipitation reactions, agglutination and complement fixation) – Immunofluorescence – ELISA – RIA –Transplantation immunology.

### **UNIT – V**

Hypersensitivity reactions – Antibody mediated – Type I : Anaphylaxis – Type II: Antibody – dependent cell cytotoxicity – Type : III: immune complex reactions –Type IV hypersensitivity reaction – Auto immune disease (rheumatoid arthritis)

### Reference Books:

1. Donald. M. Weir and John Steward. (1993) Immunology (7<sup>th</sup> Edition). ELBS, London.
2. Hus Davis. (1997). Introduction Immunology (1st Edition). Chapman & Hall Publisher, London.
1. Ivan M. Roit (1998). Essential Immunology- Blackwell Scientific Publications, Oxford.
2. Paul (1998). Essential Immunology, (2<sup>nd</sup> Edition), Raven Press, New York.
3. Peter J. Delves and Ivan M. Roit (Eds) (1998) Encyclopedia of Immunology – (2<sup>nd</sup> Edition) Academic Press.
4. Ridklad, M. Ayl (1995). Immunology, (2<sup>nd</sup> Edition), Baltimore, Hong Kong, NMS Publication.
5. Roit, J.M. Brostoff, J.J. and Male, D.K. (1996). Immunology (4<sup>th</sup> Edition) C.V. Mosby publisher, St. Louis.
6. Stewart Sell. (2001) Immunology, Immunopathology and Immunity. (6<sup>th</sup> Edition), ASM Press, USA.
7. Ananthanayanan, R., and Panicker, J. (2000). Text Book of Microbiology. Orient Longmans.
8. Rajan, S. (2007). Medical microbiology. MJP Publisher, Chennai.
9. Fathimunisa Begum (2008). Monoclonal antibodies: The hopeful drugs. MJP Publisher, Chennai.
10. Kannan, I. (2007) Immunology. MJP Publisher, Chennai.

<b>SEMESTER – IV</b>			
<b>ALLIED II- GENETIC ENGINEERING</b>			
<b>Code : 15UMIA41</b>	<b>Hrs / Week: 4</b>	<b>Hrs / Sem: 60</b>	<b>Credits: 4</b>

**OBJECTIVES:**

1. To impart basic level information in the subject of Genetic Engineering.
2. To enhance the knowledge on the applications of Genetic Engineering.

**UNIT-I**

Cloning- Introduction, steps in cloning- enzymology of cloning - construction of rDNA –Gene transfer methods - screening of chimeric DNA.

**UNIT-II**

Cloning vectors for rDNA (plasmids, phages, cosmids, viruses, transposons)- Binary and shuttle vectors.

**UNIT-III**

Expression vectors for high level cloned genes (*E.coli*, yeast, insect cell, mammalian cell)-Expression cassettes- DNA libraries.

**UNIT-IV**

Blotting techniques-(southern blot, western blot, northern blot) - PCR and its modification- RFLP, RAPD – DNA finger printing.

**UNIT-V**

Applications of genetic engineering - Transgenic plants - Development of crops for disease resistance (Bt cotton) herbicide tolerance- Transgenic animals (sheep) - Transgenic fish (Tilapia) – Medicine (insulin) – Environment - role of superbug in biodegradation and industries (ethanol).

**REFERENCE BOOKS:-**

1. Glick, B.R. and Pasternak, J.J (1998). Molecular Biotechnology – Principles and Applications of Recombinant DNA. ASM Press, Washington D.C.
2. Lewin, B. (2000). Genes VII. Oxford University Press, Oxford.
3. Brown, T.A. (1999). Gene Cloning (3<sup>rd</sup> Edition). Chapman and Hall Publications.USA.
4. Sathyanarayana .U. (2008). Biotechnology. Books and Allied (P) Ltd.Kolkata.



5. Rastogi S.C.(2007).Biotechnology Principles and applications. Narosa Publishing House Pvt. Ltd. NewDelhi.
6. HD Kumar (2009).Modern concepts of Biotechnology. Vikas Publishing House Pvt. Ltd. Noida.
7. Dubey R.C.(2001). A Text Book of Biotechnology 1<sup>st</sup> Edition.S.Chand & Company Ltd., NewDelhi.
8. E.J.Gardener *et al.*, (1991).Principles of Genetics.(8<sup>th</sup> Ed.)John Wiley & sons, Newyork.
9. Mohan P.Arora (2005).Biotechnology. Himalaya Publishing House. Mumbai.
10. Dr.Prakash S Lohar (2012). Text Book of Biotechnology.MJP Publishers,Chennai.
11. Jogdhand. S.N. Gene Biotechnology (2007).Himalaya Publishing House Pvt.Ltd. Mumbai.

<b>SEMESTER – IV</b>			
<b>SKILL BASED ELECTIVE – COMPUTERS &amp; BIOSTATISTICS</b>			
<b>Sub code:15UMIS41</b>	<b>HRS/WEEK- 2</b>	<b>HRS/SEM - 30</b>	<b>CREDITS:2</b>

## **OBJECTIVES**

To impart advance level information in the subject of computer & biostatistics

### **Unit I**

Introduction to computer- computer generation- classification of computers – computer memory and its types.

### **Unit II**

Introduction to computer software- operating system-Compiler&interpreter – Internet networking.

### **Unit III**

Software, MS windows, MS excel, MS power point.

### **Unit IV**

Introduction to biostatistics- Basic concepts of biostatistics population (data, sample, variable)- Collection of data-( Primary& Secondary)- Sampling-Processing of data.

### **Unit V**

Diagrammatic presentation of data- Graphic presentation of data( Bar diagram, Pie diagram, Line graph, Pictogram, Histogram, Frequency polygon, Frequency curve, Ogive).

## **Reference Books:**

1. Introduction to Information Technology, Pearson Education, New Delhi.
2. Norton, Peter, Introduction to Computers, Tata McGraw Hill, New Delhi.
3. Douglas, Comer E., Computer Networks and Internet, Pearson Education, New Delhi.
4. Rajaraman, V., Fundamentals of Computers, Prentice Hall of India, New Delhi.
5. Office 2000: No Experience Required, BPB Publications, New Delhi

6. Spiegel M. R., Schiller J.J., Srinivasan R. A. , A. Srinivasan Schaum's Outline of Probability and Statistics. McGraw-Hill Trade.
7. Arora PN & Malhon PK (1996). Biostatistics Imalaya Publishing House, Mumbai.
8. Sokal & Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
9. Stanton A & Clantz, Primer of Biostatistics (2005). The McGraw Hill Inc., New York.

<b>SEMESTER IV</b>			
<b>Foundation Course: Yoga and Meditation</b>			
<b>Code: 15UFYM31</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 2</b>

### **Objectives**

To enable students to have good health  
 To impart value for mental hygiene and possess emotional stability  
 To integrate moral values in order to live a purpose driven life.

### **Unit-I. Physical Character and Functions**

Yoga – Brief introduction – importance of Yoga Life – Simple methods for adopting Yoga in Daily Life Nature Cure: Brief history and principles – Health and Disease – Techniques of Healthy Living Rules & Regulations – asanas, Pranayama, mudra, bandha

### **Unit- II. Exploring the traditions of Yoga:**

The Secret of Change – The Mind: Agent of Change – The Twelve steps of Spiritual Recovery – Raja yoga – Hatha Yoga – Jnana Yoga – Karma Yoga – Bhakthi Yoga – Mantra Yoga – Tantra Yoga – Surya Namaskar

### **Unit- III. Greatness of Life Force**

Philosophy of kayakalpa-physical body- bio magnetism, mind-Kayakalpa practical - sex and spirituality-value of sexual vital fluid, married life-chastity- jeeva Samadhi - intensifying bio magnetism through exercise- lamp gazing-rules-benefits - mirror gazing-rules-benefits, passes for healing.

### **Unit - IV. Self Discipline**

Self-Discipline, Diet: You are what you eat – Yogic and Naturopathic treatment for Common Ailments: Common Cold, Cough, Headache, Constipation, Gastric trouble, Menstrual Disorders – Obesity – And General Steps for being healthy.

### **Unit- V Special Meditation**

Pranayama – Physiological value of Pranayama – Practice of Pranayama – Nature Meditations

### **Reference Books**

Mind – Vethathiri Maharashi  
 Karma Yoga - Vethathiri Maharashi  
 Sound health through Yoga – Dr. K. Chandrasekar  
 Yoga for Modern Age – Vethathiri Publications

Department .of AYUSH, Yogic and Naturopathic treatment for Common Ailments  
Edi IV, Ministry of Health and Family Welfare, Gove. Of India, 2010

Georg Feuerstein & Benda Feuerstein, Yoga: A beginners Guide, Rashmi Graphics,  
#3, Amrutwel CHS.Ltd Mumbai, 2014

<b>SEMESTER IV</b>			
<b>CORE PRACTICAL IV</b>			
<b>Techniques in Immunology</b>			
<b>Code : 15UMICR4</b>	<b>HRS/WEEK-2</b>	<b>HRS/SEM - 30</b>	<b>CREDIT – 1</b>

## **OBJECTIVES**

To impart basic level laboratory training in the subject of Immunology .

1. WIDAL test – qualitative assay
2. WIDAL test – quantitative assay
3. Latex agglutination test (ASO)
4. RPR test for syphilis
5. Agglutination reaction with reference to blood grouping
6. Agglutination reaction with reference to RH typing.
7. Demonstration of C-reactive Protein
8. Demonstration of Antigen – Antibody reaction – Ouchterlony technique-ODD
9. Demonstration of Antigen – Antibody reaction - Single radial immunodiffusion
10. Demonstration of western blot

## **Reference Books:**

1. Microbiology laboratory manual T. Sundaraj, Aswathy Sundararaj, Chennai, 2002.
2. Practical microbiology R.C. Dubey & Maheswari, S. Chand & Co.Ltd., New Delhi, 2002.
3. Cappuccino & Sherman, Microbiology a laboratory manual, 2002. Experiments in Microbiology Plant pathology & Biotechnology, K.R. Aneja, Fourth edition, New age international (p) Limited, Publishers.
4. Kannan. N. (1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
5. Kanai L. Mukherjee, Medical Laboratory Technology – A procedure manual for routine diagnosis tests – Tata McGraw – Hill Publishing Co., Ltd., New Delhi. Vol.I-III.
6. Palanivelu. P. Analytical Biochemistry and Separation Techniques.

<b>SEMESTER – IV</b>			
<b>ALLIED PRACTICAL IV</b>			
<b>LABORATORY IN GENETIC ENGINEERING</b>			
<b>Code : 15UMIAR4</b>	<b>Hrs / Week: 2</b>	<b>Hrs / Sem: 30</b>	<b>Credits: 2</b>

**OBJECTIVES:**

To impart advanced level of laboratory techniques in the field of Genetic Engineering.

1. Isolation of genomic DNA from bacteria and detection by AGE.
2. Bacterial Transformation.
3. Restriction Digestion of DNA.
4. DNA Ligation.
5. Isolation of bacteriophages (Demonstration).
6. Southern blotting (Demonstration).
7. Western Blotting (Demonstration).
8. Amplification of DNA-PCR (Demonstration).
9. RFLP (Demonstration).
10. RAPD (Demonstration).

**REFERENCE BOOKS:**

1. Janarthanan.S. and Vincent .S.(2007) Practical Biotechnology.Universities press (India) private limited.Hyderabad.
2. Gunasekaran.P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
3. Molecular Cloning – A Laboratory Manual, Vol. 1,2,3 by J. Sambrook, E. F. Fritsch and T. Maniatis
4. Dubey, R.C.and Maheswari,D.K. (2002).Practical Microbiology, 1<sup>st</sup> Edition Chand and Company Ltd., India.

<b>SEMESTER- V</b>			
<b>CORE VII - AGRICULTURAL MICROBIOLOGY</b>			
<b>Code : 15UMIC51</b>	<b>HRS/WEEK: 6</b>	<b>HRS/SEM: 90</b>	<b>CREDITS: 5</b>

**OBJECTIVES:**

1. To enhance knowledge of various microbial activities and its impact on the environment.
2. To study about various beneficial aspects of soil microbes.

**UNIT-I**

Soil- physical and chemical properties of soil- Microbial flora of soil (Bacteria, fungi, algae and nematodes) - Role of microbes in biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

**UNIT-II**

Microbial interactions-Mutualism, commensalisms, competition, amensalism, parasitism and predation. Interactions between microbes and plants-rhizosphere, phyllosphere.

**UNIT-III**

Nitrogen fixation and its mechanism - Symbiotic (*Rhizobium* sp) - Asymbiotic (*Azotobacter* sp) – Associative (*Azospirillum* sp). Phosphate solubilising bacteria. Bacterial biofertilizers- Definition, isolation, mass production and commercial applications of *Rhizobium*, *Azotobacter*, *Azospirillum*, *Phosphobacteria*, *Cyanobacteria* (*Anabaena*, *Nostoc*)- Mycorrhizae – VAM.

**UNIT-IV**

Plant diseases - symptoms, etiology, life cycle and control measures - Bacterial (Soft rot of vegetables, Blight of paddy, Citrus canker), fungal (Red rot of sugarcane, Stem rust of wheat, Tikka leaf spot of groundnut, Late blight of potato) and viral (TMV, CMV, Banana bunchy top virus).



## UNIT-V

Biopesticides - Bacterial (*Bacillus thuringiensis*)- Fungal (*Trichoderma viridae*)- Viral (NPV,CPV & GV)- mode of action and applications- Biopesticide developments.

### REFERENCE BOOKS:

1. Shiva Aithal, C. (2010). Modern approaches in Soil, Agricultural and Environmental Microbiology. Himalaya Publishers, New Delhi.
2. Atlas, R.M., and Bartha, M. (2003). Microbial Ecology – Fundamentals and applications. Benjamin – Cummings, Mento Park, California.
3. Martin Alexander (1983). Introduction to Soil Microbiology, Wiley eastern Ltd., New Delhi.
4. Subba Rao, N.S. (1997). Biofertilizers in Agriculture and Forestry III Ed, Oxford and IBH Publishing Co, Pvt. Ltd, New Delhi.
5. Subba Rao, N.S. (1995). Soil Microorganisms and Plant growth. Ed, Oxford and IBH Publishing Co, Pvt. Ltd, New Delhi
6. Wheeler, B.E. (1976). An introduction to Plant disease. ELBS and John Wiley and sons, Ltd.
7. Rangaswamy, G., and Bagyaraj, D.J. (1996). Agricultural Microbiology. Prentice-Hall of India Pvt Ltd., New Delhi.
8. Dirk, J. Elsas, V., Trevors, T., and Wellington, E.M.H. (1997). Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong.
9. Dubey R.C. (2001). A Text Book of Biotechnology. S Chand & Co. New Delhi.
10. Gupta, S.K. (2014). Approaches and trends in plant disease management. Scientific publishers. Jodhpur, India.

<b>SEMESTER- V</b>			
<b>CORE – VIII – INDUSTRIAL MICROBIOLOGY</b>			
<b>Code-15UMIC52</b>	<b>HRS/WEEK: 6</b>	<b>HRS/SEM: 90</b>	<b>CREDITS: 5</b>

## **OBJECTIVE**

1. To study about different types of fermenters.
2. To inculcate knowledge on industrial production of alcohol, enzymes and antibiotics.

## **UNIT-I**

Historical development and concepts – Principles, screening and selection of industrial microorganisms-Strain improvement (Bacteria, fungi and yeast).

## **UNIT-II**

Industrial sterilization-- Fermentor designing and their uses- Types of fermentation –Batch, continuous, fed batch, submerged and solid state.

## **UNIT-III**

Fermentation media(natural&synthetic)- Role of buffers,precursors,inhibitors, inducers and antifoam agents.Down stream processing( introduction, separation, purification& collection technique).

## **UNIT-IV**

Production of alcoholic beverages (Beer and wine making)- Enzymes (protease)-Amino acid (Glutamic acid)-Solvents (Acetone )- Organic acids (citric acid).

## **UNIT-V**

Antibiotics- Production and formulations- Inoculum production- Commercial production of antibiotics (Penicillin)-Production of vitamins (riboflavins).Newer approaches to industrial waste and sewage treatment and disposal.

## REFERENCE BOOKS:

1. Reed.G. (Editor), Industrial Microbiology. CBS Publishers, AVI Publishing Company.
  2. Stanbury,P.F.A., Whitaker and Hal.S.J. (1995). Principles of Fermentation Technology. (2<sup>nd</sup> Edition). Pergamon, U.K.
  3. Casida.I.e. (1989). Industrial Microbiology. Willey Eastern Limited, New Delhi.
  4. Walf Crueger and Anneliese Crueger. (2002). Biotechnology – A Text Book of Industrial Microbiology. Sinauer Associates Inc. Laderiand, USA.
  5. Ward,O.P.(1998).Fermentation Biotechnology-Principles, Process and Products.
  6. Preascott&Dunn. (1992). Industrial microbiology.4<sup>th</sup> Edition).
  7. Glazer & Nikaido (1998). Microbial Biotechnology
- Hershnergy.C.L. Arulpandi.I. (2007). Bioprocess Technology. MJP Publishers, Chennai.

<b>SEMESTER –V</b>			
<b>CORE ELECTIVE - I – MICROBIAL NANOTECHNOLOGY</b>			
<b>CODE: 15UMIE51</b>	<b>HRS/WEEK: 6</b>	<b>HRS/SEM: 90</b>	<b>CREDITS:5</b>

**Objectives:**

To understand the basics of nanotechnology and microbial applications of nanotechnology.

**UNIT I**

Introduction to nanotechnology - Structural and functional principles of nanotechnology - Applications of nanotechnology. Bionanoparticles – Carbon nanotubes, Carbon nanocones.

**UNIT II**

Nanotechnology : Nanoparticle synthesis by plants, bacteria and yeast. Methods of Nanobiotechnology - Analysis of bimolecular Nanostructures by Atomic Force Microscopy, Scanning Probe Electron Microcopy and XRD.

**UNIT III**

Biosensors – optical nanosensors, multi-functional biochip (MFB) and Detection of the *Mycobacterium* by MFB.

**UNIT IV**

Application of Nanobiotechnology in medicine – Cancer diagnosis and treatment, Drug designing and delivery.

**UNIT V**

Nanotechnology and Food safety – Food Packaging and Processing. Nanotechnology in Agriculture – crop improvement and Pest management. Bio security

## **Text Books**

1. M.H. Fulekar, 2010, Nanotechnology: Importance and Applications, I. K. International Pvt Ltd, New Delhi
2. Bernd Rehm, 2006. Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures, Horizon Scientific Press, 2006
3. R. K. Rathi, 2009, Nanotechnology 1st Edition. S. Chand & Company Ltd, New Delhi.
4. Biomaterials Sciences: An Introduction to Materials in Medicine 2nd Edition, Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons.
5. Lehninger's Principles of Biochemistry, 4th Edition, David L. Nelson and Michael M. Cox, 2006
6. Nanobiotechnology: Concepts, applications and perspectives, Christof M. Niemayer, Chad A. Mirkin, Wiley VCH publishers 2004.
7. Bionanotechnology: Lessons from Nature, David. S. Goodsell. Jhonwiley 2006.
8. Naobiotechnology: Molecular Diagnosis, K.K. Jain, Tailor L. Francis Group.

<b>SEMESTER- V</b>			
<b>CORE ELECTIVE – II DAIRY MICROBIOLOGY</b>			
<b>Code :15UMIE52</b>	<b>Hrs/ Week: 6</b>	<b>Hrs/ Sem: 90</b>	<b>Credits: 5</b>

## **OBJECTIVES**

To impart current knowledge of basic and applied microbiological aspects of fluid milks and dairy products for improved quality and food safety

### **Unit I**

Milk - Introduction, composition,. Microorganisms in Milk – Bacteria, Yeasts, Moulds. Starter Cultures – Starter cultures their biochemical activities. (Streptococcus thermophilus, Lactobacillus bulgaricus) starter culture preparation, mesophilic and thermophilic organisms.

### **UNIT II**

Dairy processing unit operations: Clarification, separation, standardization, toning of milk, Pasteurization, UHT treatment, homogenization, Membrane processing, storage, transportation and distribution of milk. Judging and grading of milk and its products.

### **Unit III**

Milk and milk products – Definitions, composition, food and nutritive value of milk, properties of milk and its constituents- Cheese, yogurt, fermented milk, Kefir.

### **Unit – IV**

Hygiene in Manufacturing Milk Products: Microorganisms of concern – HACCP - Pasteurization - Cleaning of Dairy Equipment - Instantization of milk and milk products. In-plant cleaning system. Dairy Processing Plant Sanitation . Probiotic role of lactic acid. Quality assurance: Microbiological quality standards of milk - FDA, EPA, ISI.

## **Unit V**

Milk borne diseases, antimicrobial systems in milk, sources for contamination of milk. Bacterial – mastitis, tuberculosis, viral- foot and mouth, cow pox, fungal- ring worm , protozoa- coccidiosis disease in cattles-control measures.

### **References**

1. Fundamentals of Dairy Microbiology by Prajapati.
2. Dairy Microbiology by Robinson R.K.1990 Volume II and I. Elsevier Applied Science, London.
3. Applied dairy microbiology edited by Elmer Marth and James Steele.
4. Milk & Milk Products - Fourth edition - clarence henry eckles, Tata McGraw Hill publishing company Limited, New Delhi, 1957
5. Dey, S. 1994. Outlines of Dairy Technology. Oxford Univ. Press, New Delhi. MaCrae
6. Robinson, R.K. (2 vol. set). 1986. Modern Dairy Technology Elsevier Applied Science, UK.
7. Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.
8. Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.
9. Yarpar, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westp

<b>SEMESTER V</b>			
<b>SKILL BASED ELECTIVE – SEA FOOD PROCESSING</b>			
<b>CODE:15UMIS51</b>	<b>Hrs/Week:2</b>	<b>Hrs/Sem:30</b>	<b>Credits:2</b>

## **OBJECTIVES**

1. To understand the different food sources from the sea environment.
2. To gain knowledge in sea food processing.

### **UNIT – I**

Sea environmental science: Marine eco system, marine food sources, marine pollution. Nutritional benefits of marine resources – fish, fish oil, seaweeds and other marine sources

### **UNIT - II**

Scope and importance of food processing - principles and methods of food preservation - Sun drying, Smoking, Salt curing, Chilling, Pickling,

### **UNIT - III**

Other preservation methods: Canning and Frying, irradiation process, value addition.

### **UNIT – IV**

Microbiology of fish products - storage and handling, preservation – freezing techniques and, preparation of fish products (fermented fish, fish products, fish soups, fish powder, prawn powder and cutlets), seaweed products like pickles and hydrocolloids.

### **UNIT – V**

Introduction to packaging and labeling - packaging principles and operation - packaging materials - deteriorative changes in foodstuff and packaging methods for prevention - shelf life of packaged foodstuffs - methods to extend shelf life, requisites of good packages.

## **REFERENCES**

1. Venugopal, V (2006) Seafood processing: Adding value through quick freezing, retort able packaging, cook-chilling & other methods, (Food science & technology, VOL.13)



2. Ranganna, S. 1986. Handbook of Analysis and Quality Control for Fruits and Vegetable Products. Tata McGraw Hill, New Delhi.
3. Painy, F.A. and Painy, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.
4. Scicharow, S. and Griffin, R.C. 1970. Food Packaging. AVI, Westport.
5. Freezing preservation of foods. Vol 3. Commercial food freezing operations of fresh foods.
6. Trawlers .D.K. and Others (Edn) VI Connecticut .
7. Canning technology. Howard, A .J. Churchill, London.

<b>SEMESTER – V</b>	
<b>SELF STUDY PAPER (COMPULSORY) -FOOD PRESERVATION TECHNOLOGY</b>	
<b>Code : 15UMISS3</b>	<b>Credit: +1</b>

## **OBJECTIVES**

To make students aware of various Food Preservation methods.

### **UNIT-I**

Preservation of food by use of high temperature – Pasteurization of milk, Canning.

### **UNIT-II**

Preservation of food by use of low temperature – Chilling of fruits and vegetables, Freezing of meat.

### **UNIT-III**

Preservation of food by drying – Solar drying – Sun dried raisins, Drying by mechanical dryers – Dried milk.

### **UNIT- IV**

Preservation of food by food additives – Sugar (Canned fruits), Salt (Pickles)

### **UNIT- V**

Preservation of food by radiation – UV (Fruit juices) - Smoking (Fish).

## **REFERENCES:**

1. William C. Frazier ., Dennis C. Westhoff ., Food Microbiology. Fourth Edition. Tata Mc Graw – Hill Publishing Company Ltd, New Delhi.
2. Kalaichelvan.P.T ., Arul Pandian. I. Bioprocess Technology. MJP Publishers, Chennai.
3. Adams, M.R. and Moss, M.O. (1995). Food Microbiology. The Royal Society of chemistry, Cambridge.
4. Jay, J.M. (1987), Modern Food Microbiology. CBS Publishers and Distributors, New Delhi.
5. Atlas, R.M. (1989), Microbiology – Fundamentals and Applications, Macmillian Publishing Company.
6. Banwart, G.J. (1989). Basic Food Microbiology. Chapman & Hall New York.

7. Board, R.C. (1983), A modern Introduction to food Microbiology Blackwell Scientific Publication, Oxford.
8. S.N. Tripathy (2006). Food Biotechnology, Dominant Publishers and Distributors, New Delhi.
9. Robinson.R.K. (1990). Dairy Microbiology. Elsevier Applied Sciences, London.
10. Vijaya Ramesh, K., (2007) Food Microbiology, MJP Publishers, Chennai.

<b>SEMESTER- V</b>			
<b>CORE PRACTICAL V</b>			
<b>LABORATORY IN AGRICULTURAL AND INDUSTRIAL MICROBIOLOGY</b>			
<b>Code : 15UMICR5</b>	<b>HRS/WEEK: 4</b>	<b>HRS/SEM: 60</b>	<b>CREDITS: 2</b>

**OBJECTIVES OF THE COURSE:**

1. To impart knowledge on isolation of microbes from soil.
2. To enhance advanced level laboratory training in the Industrial Microbiology.
  1. Quantitative assay of microbes in soil.
  2. Isolation of phosphate solubilising bacteria.
  3. Isolation of *Rhizobium* from root nodules of leguminous plants.
  4. Isolation of *Azotobacter sp* from soil.
  5. Identification of *Cyanobacteria* from soil. (*Anabaena* and *Nostoc*).
  6. Staining of VAM.
  7. Preparation of biofertilizers (Demonstration).
  8. Isolation of yeast from grapes.
  9. Production of Ethanol from cane sugar using yeast cells (Demonstration).
  10. Wine production using yeast – (Demonstration).
  11. Antibiotic production by bacteria or actinomycetes- (Demonstration).

**REFERENCE BOOKS:**

1. Gunasekaran. P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
2. Dubey, R.C.and Maheswari,D.K. (2002).Practical Microbiology, 1<sup>st</sup> Edition Chand and Company Ltd., India.
3. Aneja K.R.(1993). Experiments in Microbiology,Plant Pathology and Tissue Culture. Wishwa Prakashan.NewDelhi.India.
4. Benson. (2002). Microbiological Applications – Laboratory Manual in General Microbiology. International Edition, McGraw Hill Higher Education.

<b>SEMESTER V</b>			
<b>SKILL BASED ELECTIVE</b>			
<b>PRACTICALS IN SEA FOOD PROCESSING</b>			
<b>CODE:15UMISP51</b>	<b>HRS/WEEK:2</b>	<b>HRS/SEM:30</b>	<b>CREDITS:2</b>

**OBJECTIVE:**

- 1.To get a basic idea on the fish processing techniques and quality control
2. To empower students with present day technologies involved in fish processing and to provide a firm understanding on the various quality requirements in seafood industry.

1. Determination of moisture content in fish and other seafood products.
2. Quality evaluation of fish & prawn.
3. Enumeration of bacteria in fish,prawns & Crabs-Vibrio cholera, Staphylococcus aureus, Streptococci
4. Enumeration of coli form-*E.coli*
5. Identification of various seafood diseases
6. Antibiotic residual analysis by microbiological assay
7. Prophylaxis for the prevention of outbreak of fish disease
8. Processing & Preservation – freezing Drying,salting
7. Fish product formulation - canning
9. Assessment of sanitation-swab method
10. Preparation of by products-fish,prawn

**REFERENCES:**

1. K.Gopakumar, Fish Processing Technology, ICAR, New Delhi
2. T.K. Govindan, Fish Processing Technology Oxfor & IBH Publication Co.
3. K.K. Balachandran Fish Canning – Principles & Practices.
4. Borgstrom,G. Fish as Food.
5. K.K. Balachandran, Postharvest Technology in Fish and Fishery Products.
6. Moorjani,M.V. Fish Processing in India.
7. Connell,J.J. Advances in Fishery science and Technology.
8. CIFT. Manual of Quality Control in Fish and Fishery Products.
9. Gopakumar,K. Fish Packaging Technology
10. A.M.Martin, Fisheries – Processing Chapman & Hall, Madras
11. Ed.G.M.Hall – Fish Processing Technology Chopra & Hall. Madras.

SEMESTER- VI			
CORE IX - FOOD MICROBIOLOGY			
Code : 15UMIC61	HRS/WEEK: 6	HRS/SEM: 90	CREDITS: 5

**OBJECTIVES OF THE COURSE:**

1. To impart advanced level information in the subject of Food Microbiology.
2. To enhance students with basic knowledge on food preservation techniques.

**UNIT - I:**

Food as a substrate for microorganisms- Microorganisms important in food microbiology- Bacteria, Molds and Yeasts- Brief account of each group – General characteristics and importance –Microbiological examination of food - Microscopic techniques. Direct microscopic examination, total colony counts and differential enumeration.

**UNIT- II:**

Microbial contamination of foods - spoilage of food by microbes in cereals and cereal products- Eggs and poultry – meat – fruits, vegetables and its dried products- pickles- bread – canned foods.

**UNIT- III:**

Methods of food preservation: Aseptic handling, removal of microorganisms, anaerobic conditions, heat processing, refrigeration and freezing, drying, osmotic pressure- Chemical preservatives - Radiation- UV light, irradiation - Canning- Food Hygiene and sanitation.

**UNIT- IV:**

Food poisoning- Food borne diseases- Food intoxication and Food infection- Bacterial toxins (*Staphylococcus*, *Clostridium*, *Escherichia* and *Salmonella*) – Fungal (Mycotoxins) – Viral (Hepatitis) – Protozoan (*Entamoeba*).

**UNIT-V:**

Quality and safety assurance in food industry- - Microbial standards in food – *fssai* – Hazard Analysis Critical Control point (HACCP) - Food laws and Regulations- FAO,FDA,WHO,AGMARK, ISI, ISO. - BIS Laboratory Services, BIS product certification and licensing quality systems.

## REFERENCE BOOKS:

1. Adams, M.R. and Moss, M.O. (1995). Food Microbiology. IV Edition Mc Graw Hill, New York.
2. Frazier, W.C. and Westhoff, D.C. (2008). Food Microbiology. (4th Edition). Tata Mc Graw Hill publishing Co Ltd., New Delhi.
3. Jay, J.M. (2006). Modern Food Microbiology. CBS Publishers and Distributors, New Delhi.
4. Vijaya Ramesh, K. (2007). Food microbiology. MJP Publishers, Chennai.
5. Neelam Khetarpaul (2006). Food Microbiology. Daya Publishing House, New Delhi.
6. S.N. Tripathy (2006). Food Biotechnology. Dominant publishers and distributors, New Delhi.
7. Hobbs, B.C. and Roberts, D. (1993). Food Poisoning and Food Hygiene, Edward Aarnold  
(A division of Hodder and Sloughton), London.
8. Michael P. Doyle *et al.*, (2001). Food Microbiology. Fundamentals and Frontiers. 2<sup>nd</sup> ed American Society for Microbiology. U.S.A.

SEMESTER- VI			
CORE - X- CLINICAL MICROBIOLOGY			
CODE:15UMIC62	Hrs/week: 6	Hrs/sem: 90	Credits: 5

## OBJECTIVES

To impart advanced level information in the subject of Clinical Microbiology

### UNIT-I:

Normal microbial flora of the human body- Sources of infection: Food, water, vector and air – Modes of transmission – Koch's postulates– Invasiveness and pathogenicity.

### UNIT-II

Diagnostic microbiology – Collection and transport of specimen for microbiological examination- General methods for isolation and identification of bacteria – skin,LRT,URT and urinary tract infections.

### UNIT-III

Clinical symptoms- Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following bacterial (a) Tuberculosis (b) Leprosy, (c) Gastro intestinal disorders- Typhoid, cholera (d) Sexually transmitted diseases- Syphilis and gonorrhoea. (e) Anaerobic wound infection- Tetanus.

### UNIT-IV

Clinical symptoms- Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following viral infections ( a) Respiratory infections-common cold, influenza, measles, and mumps (b) Liver diseases: Hepatitis A & B (c) Immunodeficiency diseases-AIDS and Herpes Simplex Viruses.

### UNIT-V:

Clinical symptoms- Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following fungal and protozoan infections (a) Fungal – Superficial (*Tinea nigra*), subcutaneous and systemic mycoses (Candidiasis), (b) Protozoan: Amoebiasis and malaria, (c) Helminthes – ascariasis (d) zoonotic diseases – Rabies.

## REFERENCE BOOKS:

1. Anathanarayanan, R., and Panicker, J. (2000). Text book of microbiology. Orient Longmans.
2. Rajan, S. (2007). Medical microbiology. MJP publisher, Chennai.
3. Prescott L.M., Harley J.P., and Klein D.A.(2008). Microbiology



- (7th edition) McGraw- Hill Inc, New York.
4. Pelczar Jr., M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology- McGraw- Hill Inc, New York
  5. Tortora, Funke Case Addison 2001, Microbiology – An Introduction (7th edition) Wesley Longman Inc.
  6. Dubey R.C., and Maheswari, S. (2003). A Text Book of Microbiology, S.Chand & Co, New Delhi.
  7. Kanai L. Mukherjee, Medical Laboratory Technology- A Procedure Manual for routine diagnosis tests - Tata McGraw- Hill Publishing Company Ltd, New Delhi. Vol I –III.

<b>SEMESTER – VI</b>			
<b>CORE - XI - MICROBIAL BIOTECHNOLOGY</b>			
<b>CODE: 15UMIC63</b>	<b>HRS/WEEK: 6</b>	<b>HRS/SEM: 90</b>	<b>CREDITS: 5</b>

## **OBJECTIVES**

To impart advanced level information in the subject of Microbial Biotechnology.

### **UNIT-I**

Biotechnology - Definition – Concepts - History – Achievements - Milestones in biotechnology - Enzyme biotechnology – enzyme production from microbes – applications – enzyme immobilization.

### **UNIT-II**

Cloning - History of cloning – Transgenic Plant (Bt Cotton, Golden Rice) – Transgenic Animal (Dolly) – Genetically Engineered Microorganism (Super bug).

### **UNIT-III**

Production of biotechnological products. Food - SCP (Algae, Yeast, Mushroom). Fuel (Ethanol) – Pharmaceuticals – Antigens, Interferons, Vaccines, Edible vaccines, Insulin, Hormones and Gene therapy methods – Hybridoma and Monoclonal antibodies – Biosensors.

### **UNIT- IV**

Bioconversions – Lignocellulosic waste to ethanol, Bioleaching – micro organisms involved – Mechanism of Bioleaching – Commercial process - Bioleaching of Copper and Uranium, Bio gas – Microbes involved - Factors influencing methane production – stages of methane generation, Biodegradation of Petroleum, Waste water treatment, Solid waste treatment.

### **UNIT- V**

Intellectual Property Rights (IPR) and Protection (IPP) – Forms of protection – Patents (reading a patent – description, claims, patenting strategies) – Copy right, Trade Mark, Plant variety protection – WTO, GATT, TRIPs.

## REFERENCE BOOKS:

1. Glick, B.R. and Pasternak, J.J. (1998). Molecular Biotechnology Principles and Applications of Recombinant DNA. ASM Press, Washington D.C.
2. Dubey, R.C. (1996). A Text Book of Biotechnology. S. Chand & Co, New Delhi.
3. Satyanarayana,U.(2005). Biotechnology. Books and Allied (P). Kolkata.
4. Kalaichelvan. P.T., Arul Pandian. I., (2007) Bioprocess Technology. MJP Publishers, Chennai.
5. Singh.B.D., Biotechnology (2008). Kalyani Publishers.
6. Shiva Aithial, C.(2010). Modern approaches in Soil, Agricultural and Environmental Microbiology. Himalaya Publishers, New Delhi.
7. Vijaya Ramesh. Environmental Microbiology. MJP Publishers.
8. Dubey Microbiology

<b>SEMESTER –VI</b>			
<b>CORE ELECTIVE III – MARINE MICROBIOLOGY</b>			
<b>Code : 15UMIE61</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits: 5</b>

## **OBJECTIVES**

To impart advanced level information in the subject of Marine Microbiology

### **UNIT-I:**

Classification of marine organisms- Marine ecosystem: Intertidal zones, inhabitants- Ecology of estuaries, salt marshes, mangroves, swamps, coral reefs and deep sea- Conventional and modern methods of studying microorganisms- Archaeobacteria and other special groups- Methanogens.

### **UNIT-II:**

Methods of studying marine microorganisms- Collection, enumeration, isolation and identification based on morphological, physiological and biochemical characteristics- Preservation of marine microbes( Halophilic, psychrophilic, hydrothermalvents, barophilic etc.,) Microbial nutrition- Influence of environmental factors on microbial growth and activity.

### **UNIT-III:**

Role of marine microbes in oil degradation- Marine food chain- primary production- Eutrophication-Effect of global warming in marine ecosystem- Microbial Degradation of natural and synthetic waste materials.

### **UNIT-IV:**

Microbial indicator organism and pollution- Probiotic bacteria and their importance in aquaculture. Biofilms and Microbial mats- diseases of marine organisms and its impact on marine biodiversity.

### **UNIT-V**

Bio fouling and prevention- Microbes of Biotechnological importance- Primary and secondary metabolites- Bioactive compounds from marine microbes.

## **REFERENCE BOOKS:**

1. Atlas, R.M., and Bartha.M. (2003). Microbial ecology- Fundamentals and Applications. Benjamin- Cummings, Menlo Park, California.
2. Talaro, K.P., and Talaro. A. (1999). Foundations in Microbiology. WCB Mc Graw Hill, New York.
3. Brock, T.D., and Madigan, M.T. (1997).Biology of Microorganisms. (8<sup>th</sup> edition). Prentice Hall, Inc, New York.
4. Grant, W.D. and Long, P.L.(1981). Environmental Microbiology. Blackie Glasgow and London.
5. Mitchel,R. (1992). Environmental Microbiology.Wiley- John Wiley and Sons. Inc. New York.
6. Vijaya Ramesh, K. (2004). Environmental Microbiology. MJP Publishers Chennai.
7. C.B. Munn (2003) Marine Microbiology: Ecology and applications.
8. Vijaya Ramesh, K. (2004). Environmental Microbiology.MJP Publishers, Chennai.

<b>SEMESTER –VI</b>			
<b>CORE PRACTICAL – VI</b>			
<b>LABORATORY IN FOOD, CLINICAL MICROBIOLOGY &amp; MICROBIAL BIOTECHNOLOGY</b>			
<b>CODE : 15UMICP6</b>	<b>HRS/WEEK: 6</b>	<b>HRS/SEM: 60</b>	<b>CREDITS: 3</b>

**OBJECTIVES:**

To impart advanced level laboratory training in the subject of Food and Clinical Microbiology

1. Evaluation of Milk quality- Methylene blue reduction test.
2. Milk testing by Resazurin method.
3. Microbiological analysis of food product- Curd.
4. Microbial Examination of fruits and vegetables - Surface washing and internal tissues- TVC.
5. Microbial examination of Meat- Surface washing and internal tissues- TVC.
6. Testing of soft drinks.
7. Antibiotic susceptibility testing by Disc diffusion method (*Escherichia coli* and *Staphylococcus aureus*).
8. ELISA test – Demonstration.
9. Immobilization of bacterial cells (*Escherichia coli* and *Bacillus*).
10. Preparation of Single cell Protein (*Spirulina*) - Demonstration
11. Mushroom cultivation – Demonstration.

**REFERENCE BOOKS:**

1. J.G. Cappuccino and N.Sherman 1996 MB – A lab manual Benjamin Cummins, New York.
2. Kannan, N.(1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. David greenwood, Richard. B. Slack & John. F. Peutherer Medical microbiology 16<sup>th</sup> edition 2002.
4. Murray P.R; Baron E.J; Jorgerson J.H; Pfaller M.A. and Tenover F.C 2003. Manual of Clinical microbiology, 8<sup>th</sup> edition. Vol. 1 & 2 ASM Press Washington D.C.
5. Sundararaj. T. 2005 MB Lab manual (1<sup>st</sup> edition) publnd Sundararaj. A.

Chennai.

6. Gunasekaran, P.(1996) .Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
7. Jayaraman, J.(1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
8. Plummer, D.T.(1998). An Introduction to Practical Biochemistry. Tata McGraw-Hill. New Delhi.
9. Palanivelu. P. Analytical Biochemistry and Separation Techniques.
10. Dubey, R.C.and Maheswari,D.K. (2002).Practical Microbiology, 1<sup>st</sup> Edition Chand and Company Ltd., India.
- 11.Harley Precott (2002).Laboratory Exercises in Microbiology.V Edition.The Mac Graw – Hill companies.
- 12.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.