Department of Microbiology

The American College, Madurai

(An autonomous institution affiliated to Madurai Kamaraj University)

Since 1881

B.Sc. Microbiology

PROGRAM COURSE DESCRIPTIONS

&

SYLLABI

(2015- 2016 ONWARDS)

THE AMERICAN COLLEGE, MADURAI
DEPARTMENT OF MICROBIOLOGY
Choice Based Credit System
Program for B.Sc - Microbiology 2015-2016 onwards

SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
I	I	XXX 0000	Tamil/French/Hindi	3	2	30
I	II	ENG 0000	Functional English I	3	2	30
I	III-C	MIC 1531	General Microbiology	5	5	75
I	III-C	MIC 1433	Lab in General Microbiology	4	4	60
I	III-C	MIC 1435	Microbial Taxonomy and Diversity	4	4	60
I	III-S	MIC 1401	Biochemistry	5	4	60
I	IV-E	XXX 0000	Non Major Elective -I	3	2	30
I	IV-LS	XXX 0000	Life Skill -I	3	2	30
I	V	XXX 0000	Extension Activity (NSS/PED)	-	-	-
Total				**30**	**25**	**375**

SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
II	I	XXX 0000	Tamil/French/Hindi	3	2	30
II	II	ENG 0000	Functional English II	3	2	30
II	III-C	MIC 1532	Food and Dairy Microbiology	5	5	75
II	III-C	MIC 1434	Lab in Food and Dairy Microbiology	4	4	60
II	III-C	MIC 1436	Microbial Genetics	4	4	60
II	III-S	MIC 1402	Microbial Physiology and Metabolism	5	4	60
II	IV-E	XXX 0000	Non Major Elective -II	3	2	30
II	IV-LS	XXX 0000	Life Skill -II	3	2	30
II	V	XXX 0000	Extension Activity -NSS/PED	-	**1**	**15**
Total				**30**	**25+1**	**375/390**

THE AMERICAN COLLEGE, MADURAI
DEPARTMENT OF MICROBIOLOGY
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SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
III	I	XXX 0000	Tamil/French/Hindi	3	2	30
III	II	ENG 0000	Functional English II	3	2	30
III	III-C	MIC 2531	Clinical Bacteriology and Mycology	5	5	75
III	III-C	MIC 2433	Lab in Clinical Microbiology	4	4	60
III	III-C	MIC 2535	Molecular Biology	5	5	75
III	III-C	MIC 2537	Bioinstrumentation	5	5	75
III	III-S	MIC 2403	Fundamentals of Pharmacology	5	4	60
III	V	XXX 0000	Extension Activity -NSS/PED	-	-	-
Total				**30**	**27**	**405**

SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
IV	I	XXX 0000	Tamil/French/Hindi	3	2	30
IV	II	ENG 0000	Functional English II	3	2	30
IV	III-C	MIC 2532	Immunology	5	5	75
IV	III-C	MIC 2434	Lab in Immunology	4	4	60
IV	III-C	MIC 2536	Industrial Microbiology	5	5	75
IV	III-C	MIC 2538	Clinical Virology and Parasitology	5	5	75
IV	III-S	MAS XXXX	Biostatistics	5	4	60
IV	V	XXX 0000	Extension Activity -NSS/PED	-	**1**	**15**
Total				**30**	**27+1**	**405/420**

SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
V	III-C	MIC 3731	Genetic Engineering	7	7	105
V	III-C	MIC 3533	Lab in Genetic Engineering	5	5	75
V	III-C	MIC 3635	Plant and Animal Cell Culture	6	6	90
V	III-C	MIC 3537	Lab in Plant and Animal Cell Culture	5	5	75
V	IV-LS	XXX 0000	Life Skill -III	3	2	30
V	ES	MIC 3200	Environmental Studies	4	2	30
Total				**30**	**27**	**405**

SEM	PART	COURSE NO	COURSE TITLE	HRS	CREDITS	MARKS
VI	III-C	MIC 3732	Environmental and Agricultural Microbiology	7	7	105
VI	III-C	MIC 3534	Lab in Environmental and Agricultural Microbiology	5	5	75
VI	III-C	MIC 3636	Medical Laboratory Technology	6	6	90
VI	III-C	MIC 3538	Lab in Medical Laboratory Technology	5	5	75
VI	IV-LS	XXX 0000	Life Skill - IV	3	2	30
VI	VE	XXX 0000	Value Education	4	2	30
Total				**30**	**27**	**405**
GRAND TOTAL				**180**	**158+2**	**2370/2400**

C-Core Courses NME - Non - Major Elective LS-Life Skill

S – Supportive Courses VE- Value Education ES- Environmental Studies

SUPPORTIVE COURSES (5 Hrs/W- 4 Cr)

SEMESTER	COURSE CODE	NAME OF THE COURSES
I	MIC 1401	1. Biochemistry
II	MIC 1402	2. Microbial Physiology and Metabolism
III	MIC 2403	3. Fundamentals Of Pharmacology
IV	MAS XXXX	4. Biostatistics

LIFE SKILL COURSES (3 Hrs/W- 2Cr)

SEMESTER	COURSE CODE	NAME OF THE COURSES
I	MIC 1241	1. Infectious Diseases
II	MIC 1242	2. Health Awareness
V	MIC 3243	3. Bioinformatics
VI	MIC 3244	4. Pollution and Waste Management

NON MAJOR ELECTIVE COURSES (3 Hrs/W- 2Cr)

SEMESTER	COURSE CODE	NAME OF THE COURSES
I	MIC 1231	1. Health and Hygiene
II	MIC 1232	2. Nutritive Value of Food

Programme Specific Outcomes

PSO No	Upon completion of the BSc degree programme in Microbiology, the graduates will be able to
1	Formulate, articulate, retain and apply specialized language and knowledge relevant to the core concepts in microbiology.
2	Demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods
3	Communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.
4	Apply the Microbiology discipline through involvement in research or internship activities
5	Assess how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.
6	Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats and play an integral role in disease, microbial and immunological methodologies are used in disease treatment and prevention
7	Evaluate examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human wellbeing
8	Outline that microorganisms have an indispensable role in the environment, including biogeochemical cycles, bioremediation and others
9	Demonstrate the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment.
10	Identify and discuss the ethical issues and responsibilities of doing science

Mapping of Programme Specific Outcomes (PSO) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	X	X		X		X			X	X
PSO2		X	X	X	X	X	X		X	
PSO3	X	X		X	X	X	X		X	
PSO4	X	X	X	X	X		X	X		X
PSO5	X	X		X	X	X	X			
PSO6	X	X		X	X	X	X		X	
PSO7	X	X	X		X	X	X	X		
PSO8	X	X	X		X	X	X			X
PSO9				X		X	X	X	X	X
PSO10		X		X		X	X	X	X	X

Mapping of Courses with Programme Specific Outcomes (PSOs)

COURSE CODE	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10
MIC 1531	✓									
MIC 1433		✓	✓							
MIC 1435	✓									
MIC 1401	✓									
MIC 1231						✓				
MIC 1241						✓				
MIC 1532								✓		
MIC 1434								✓		
MIC 1436					✓					
MIC 1402					✓					
MIC 1232								✓		
MIC 1242						✓				
MIC 2531								✓		
MIC 2433		✓						✓		
MIC 2535					✓					
MIC 2537		✓							✓	
MIC 2403								✓		
MIC 2532						✓				
MIC 2434						✓				
MIC 2536								✓		
MIC 2538								✓		
MIC 3731								✓		
MIC 3533								✓		

MIC 3635							✓			
MIC 3537							✓			
MIC 3200							✓		✓	
MIC 3732							✓		✓	
MIC 3534							✓		✓	
MIC 3636				✓						
MIC 3538				✓						

MIC 1531 GENERAL MICROBIOLOGY 5 Hrs/Wk-5Cr

This course is designed to provide students a wide knowledge on basic aspects of microbiology, in first semester. The first section focuses on the historical perspective, contributions of eminent scientists, concepts, types and applications of microscopes. A thorough understanding of the organization of prokaryotic cell is engrossed. Students will also know about various sterilization techniques, culturing and storage of microbes. The last section includes aspects of modern developments in microbiology.

Course Outcomes

Upon completion of this course, students will be able to

i. Outline the contributions of eminent scientists in the field of Microbiology.
ii. Explain the organization of prokaryotic cell.
iii. Analyze the ways to control the growth of microbes by physical and chemical methods.
iv. Explain the methods of isolation of organisms, pure culture techniques and maintenance.
v. Critique the recent developments in Microbiology.

UNIT - I History and scope of microbiology: Abiogenesis- biogenesis theory- contributions of eminent scientists- Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming and Winogradsky. Microscopy- simple, compound, light, dark field and phase contrast microscopy. Electron Microscopy – TEM, SEM.

UNIT - II Prokaryotic cell organization: Prokaryotic cell- size, shape, and arrangement- bacterial cell wall components –gram positive and gram negative– cell membrane- pili – flagella- fimbriae- capsule- internal structure of prokaryotes. Endosymbiosis and evolution of eukaryotes.

UNIT – III Sterilization techniques: Aseptic maintenance- physical methods – dry heat, moist heat, radiation, filtration and osmotic pressure - chemical methods- phenolic compound, alcohol, halogens, aldehyde, synthetic detergent and their applications – phenol co-efficient- concept of containment facilities.

UNIT – IV Microbial cultures and preservations: Culture media – types - enrichment cultures - pure culture- isolation methods - preservation and maintenance - low temperature, deep freezing, cryopreservation. Fungal storage- silica gel, soil and water storage.

UNIT – V Modern developments in microbiology: Principles of bacterial communication systems- quorum sensing and its importance in bacterial virulence. Microbial fuel cells- single cell protein.

TEXT BOOK

Prescott L.M, Harley J. P and Klein D.A, (2006) Microbiology, 8th edn, McGraw Hill Book Co, New Delhi.

REFERENCES

1. Pelczar MJ, Chan E. C. S, Kreig NR (1986) Microbiology, 5th edn, McGraw Hill, New Delhi.
2. Dubey, R.C. and Maheswari, D.K. (2005) A Text book of Microbiology. S. Chand & Company Ltd. New Delhi.
3. Jacquelyn G. Black (2013), Microbiology, 8th edn, John Wiley & Sons International Publication.

Bloom's Taxonomy		**K1: Remembering**	**K2: Understanding**	**K3: Applying**	**K4: Analyzing**	**K5: Evaluating**	**K6: Creating**
Unit 1	**CO1**	**1**					
Unit 2	**CO2**					**5**	
Unit 3	**CO3**				**4**		
Unit 4	**CO4**		**2**				
Unit 5	**CO5**			**5**			
							M=3.4

MIC 1433 LAB IN GENERAL MICROBIOLOGY 4Hrs/Wk-4Cr

In this laboratory course, students will be trained to explore skill based knowledge in aseptic maintenance, handling microscopes and glassware. Laboratory exercises include technical hands-on-training in preparation of selective and differential media, isolation and maintenance of pure culture. Students will also identify the morphological characteristics of microbes using various staining methods.

Course Outcomes:

Upon completion of this course, students will be able to

i. Apply the aseptic techniques and proper handling of glassware and equipments.
ii. Prepare various culture media for the cultivation of microbes.
iii. Demonstrate pure culture isolation and maintenance.
iv. Use various staining techniques for morphological characterization of microbes.
v. Utilize storage technique for bacteria and fungi

Laboratory exercises include

1. Aseptic techniques and laboratory safety methods.
2. Preparation of selective and differential media.
3. Isolation and characterization of bacteria from soil.
4. Pure culture techniques – pour, spread, streak methods.
5. Pure culture storage and maintenance.
6. Staining methods – simple, gram's stain, capsular stain.
7. Isolation and characterization of fungi from soil.
8. Identification of fungi - Lacto phenol cotton blue staining.
9. Isolation and characterization of Actinomycetes from soil.
10. Motility test - Hanging drop method.
11. Oligodynamic action of heavy metals on microbes.
12. Study of microbial taxonomy using Biochemical tests.

TEXT BOOK

Cappucino R. (2001) Microbiology – A Laboratory Manual 6^{th} edn, Benjamin / Cummin Pub Co. California.

REFERENCES

1. Gunasekaran P (1995) Laboratory Manual in Microbiology, New Age International Pvt. Ltd, Madras.

2. Collins C. H., Patricia M. Lyne (2001) Microbiological Methods, 7th edn, London, Co Published in USA.

3. Aneja K. R. (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, 2nd edn, WishwaPrakashan New Age International PVT, New Delhi.

Bloom's Taxonomy		**K1: Remembering**	**K2: Understanding**	**K3: Applying**	**K4: Analyzing**	**K5: Evaluating**	**K6: Creating**
Unit 1	**CO 1**			**3**			
Unit 2	**CO 2**						**6**
Unit 3	**CO 3**				**4**		
Unit 4	**CO 4**						**6**
Unit 5	**CO 5**			**3**			
							M=4.4

MIC 1435 MICROBIAL TAXONOMY AND DIVERSITY 4 Hrs/Wk –4Cr

This course focuses on the principles of microbial diversity, phylogeny and taxonomy. Students will learn about different taxonomic groups, identify their differences, classification system, characteristics, and phylogenetic relevance of diversified prokaryotes. The course includes aspects such as eukaryotic diversity, characteristics, cultivation and symbiotic relationship. A chapter on virus gives special emphasis on morphology, taxonomy, replication and virus-like particles.

Course Outcomes

Upon completion of this course, students will be able to

i. Outline the general features and categories of microbes.
ii. Explain the Bergey's manual of classification of bacteria.
iii. Discuss the common characteristics, importance and Alexopoulos classification of fungi.
iv. Identify the morphological characteristics, importance and classification of algae and protozoa.
v. Assess the Baltimore and ICTV Classification system of viruses.

UNIT-I Classification system: Characteristics of microorganisms - classical and molecular. Binomial nomenclature –taxonomic hierarchy- Whittaker's five kingdom and Carl Woese three kingdom classification- polyphasic taxonomy- phylogenetic tree.

UNIT-II Archaea and eubacteria: Bergey's manual of systematic bacteriology- phylogenetic overview – archaea - deeply branching and phototropic bacteria- proteobacteria- low G+C gram positive bacteria- high G+C gram positive bacteria and other phylum of bacteria.

UNIT-III Fungi: Distribution, importance, structure, nutrition and reproduction of fungi. Taxonomy – Alexopoulos classification system - Chytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota, Microsporidia - Fungi of special interest - molds and yeast-Lichens-symbiotic relationship.

UNIT –IV Algae and protozoa: Characteristics of algae – occurrences –biological and economic importance –classification – archaeplastida, rhizaria and excavata, chromista and alveolata. Free living and symbiotic protozoa, morphology –characteristics -classification - amoeboid, flagellated, spore-forming and ciliated protozoa –importance and reproduction.

UNIT-V Virus: Outline classification - characteristics – morphology – host specificity – viral taxonomy and phylogeny –Baltimore and ICTV Classification system - RNA and DNA viruses –cultivation of virus- replication – bacteriophages – lytic and lysogenic cycle – virus-like particle - satellites, viroids and prions.

TEXT BOOK

Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton (2011), Prescott's Microbiology, 8th edn, McGraw Hill International Publication.

REFERENCES

1. Jacquelyn G. Black (2013). Microbiology, 8th edn, John Wiley & Sons International Publication.
2. Larry Makane and Judy Kendel (1996). Microbiology – Essentials and Applications, 2nd edn, McGraw- Hill, Inc., Publication.
3. Michael J. Pelczar, JR, E.C.S.Chan, Noel R Krieg (1993), Microbiology, 5th edn, TATA McGraw – Hill Publication.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1		2				
Unit 2	CO2				4		
Unit 3	CO3					5	
Unit 4	CO4					5	
Unit 5	CO5		2				
							M=3.6

MIC 1401 BIOCHEMISTRY 5Hrs/Wk-4Cr

The focus of this course is to offer students, a basic exposure to the science of biochemistry. The course elaborates the molecules, chemical bonds, chemical reactions pH and buffer. It provides students an opportunity to understand the structure, chemistry, properties and functions of macromolecules such as carbohydrates, lipids, amino acids and proteins. A section on enzymes and vitamins will offer an insight into enzyme classification, mechanism, inhibition and biological functions of enzymes and vitamins.

Course Outcomes:

After completion of this course, students should be able to

i. Outline the basic concepts such as chemical bonds, functional groups, chemical reactions, pH and buffers.
ii. Discuss the structure, properties and function of carbohydrates.
iii. Analyze the structure, properties and function of lipids.
iv. Explain the general structure, properties and classification of proteins.
v. Assess the classification, properties and biological functions of enzymes and vitamins.

UNIT-I Basic concepts: Molecules - chemical bonds, functional groups, types of chemical reactions- acid, base reactions, pH measurements, buffer - molarity and normality.

UNIT-II Carbohydrates: Classification--structural aspects of monosaccharides, properties, disaccharides, polysaccharides, homopolysaccharide and heteropolysaccharide- glycoprotein. Functions of carbohydrates.

UNIT-III Lipids: Classification-simple, compound, derived lipids-properties – fatty acids – triglycerols, phospholipids, glycolipid, lipoproteins, steroids-cholesterol-ergosterol. Functions of lipids.

UNIT-IVAmino acids and proteins: General structure- classification- properties. Protein– classification- properties- structure – primary, secondary, tertiary and quaternary. Biological importance of proteins.

UNIT-V Enzymes and vitamins: Nomenclature and classification-properties-coenzymes and co factors- mechanism of enzyme action- factors influencing enzyme activity- Michaelis-Menton equation-enzyme inhibition- enzyme specificity. Biological functions of enzymes.Occurrence and biological functions of vitamins.

TEXT BOOK

Satyanarayana U, and U. Chakrapani (2013) Biochemistry – 4th edn Elsevier publication.

REFERENCES

1. Voet D and Voet G (1995) Biochemistry 2nd edn. John Wiley & Sons, New York,

2. Moat AG and Foster JW (1998) Microbial physiology 2nd edn. John wiley and sons, New York
3. Stryer L (1995) Biochemistry 4th edn. WH Freeman and Co, New York.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3				4		
Unit 4	CO4		2				
Unit 5	CO5					5	
M=3.4							

MIC 1231 HEALTH AND HYGIENE 3Hrs/Wk – 2Cr

In this course, students will understand the basic ideology and importance of health, and the need for best hygiene practices. This course also provides students an opportunity to explore the significance of health planning and health education for better health care of the community.

Course Outcome:

Upon the completion of this course, students will be able to

i. Explain the concepts and trends in dimensions of health.
ii. Revise the hygienic awareness and practices.
iii. Compile the health planning objectives.
iv. Assess the need for health education and communication.
v. Rate the levels of health care system in current scenario.

UNIT - I Concept of health: Definitions of health and changing concepts - dimensions of health- concept of well-being - spectrum and determinants of health - right to health - responsibility for health - indicators of health. Health promotion - health scenario of India - past, present and future.

UNIT - II Hygiene: Definition - hygiene factors- types of hygiene-personal hygiene- hygiene levels - individual and community hygiene – food hygiene- hygiene behaviour – hygiene hazard- health education and hygiene practices.

UNIT – III Health planning and management: Objectives- planning cycle- management methods- techniques- need and demands – health plan and systems in India - public health in India – role of health ministry.

UNIT – IV Health education and communication: Objectives and basic principles - approaches to public health - ideas and practices - key elements in communication - barriers of communication - practice of health education - administration and organization.

UNIT – V Health care of the community: Concept and levels of health care- health state - principles - health problems - health care systems - resources - health problem in India - health insurance.

TEXT BOOK

Parker J. E. and K. Park (1989) Text Book of Preventive and Social Medicine, 12th edn, BanarsidasBhanot Publishers, India.

REFERENCE BOOKS

1. Jawetz, E., Melnic, J. L. Adlberg, E. A. (2004) Medical Microbiology 19th edn, Lange Medical Publications, USA.

2. Kathleen Talaro, Arthur Talaro (1996) Foundations in Microbiology, 2nd edn, WnC. Brown Publishers, Chicago.
3. Melvin H.Williams (2005) Nutrition for Health, fitness and Sports, 7th edition, MC Graw Hill international Edition,

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3			3			
Unit 4	CO4				4		
Unit 5	CO5						6
M=3.2							

MIC 1241 INFECTIOUS DISEASES 3Hrs/Wk - 2Cr

This course aims to provide students with the understanding of positive and negative host microbe interaction. Students will also learn about the mechanism of pathogenesis for the establishment of infectious diseases, immune effector mechanism and control strategies for healthy life.

Course Outcome:

Upon the completion of this course, students will be able to

i. Outline the epidemiology, various phases and stages of infection.
ii. Identify the normal microflora and their host interactions.
iii. Discuss the mode of pathogenesis in infectious diseases.
iv. Analyze the hospital acquired infections and their impact.
v. Formulate strategies for the prophylaxis.

UNIT-I Epidemiology: Infection – phases and stages, diseases and their types- list of infectious diseases, pathogenicity – morbidity and incubation, virulence – lethality and opportunistic pathogens.

UNIT-II Normal microbiota: Overview- distribution of normal microbiota in the body- type of interaction – positive and negative – commensalism, mutualism, parasitism – establishment and importance of normal microbiota.

UNIT-III Mechanism of pathogenesis: Reservoir-transmission- portal entry- adherence-invasion-colonization and pathogenesis of infectious diseases of human.

UNIT-IV Nosocomial infections: Definition-sources- mode of transmission-diagnosis-treatment-preventive measures-responsibilities of health care personals.

UNIT-V Control strategies: Good health practices - health awareness- prophylaxis - immunization – active and passive immunization - role of antibiotics.

TEXT BOOK

Ananthanarayanan and JayaramPanikkar (1992) Text book of Medical Microbiology, 4th edn, Orient Longman Ltd. Madras.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandi ng	K3: Applying	K4: Analyzin g	K5: Evaluatin g	K6: Creating
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3					5	
Unit 4	CO4				4		
Unit 5	CO5						6
							M=3.6

MIC 1532 FOOD AND DAIRY MICROBIOLOGY 5Hrs/ Wk - 5Cr

This course is designed to make students understand the nutritional significance of day today food, its composition, factors influencing spoilage, microbes causing spoilage and preservation procedures for different kinds of foods. It provides information about food - borne infection and intoxication. This curriculum also facilitates the understanding about composition, types of milk, microbial spoilage, qualitative analyses, preservation of milk and milk products. Students will also gain knowledge about fermented food products, food sanitation and regulatory bodies.

Course Outcomes

Upon completion of this course, students will be able to

i. Outline the sources and components of food and their preservation techniques.
ii. Analyze the factors influencing the food spoilage.
iii. Apply principles of various facets of food fermentation technology .
iv. Design appropriate techniques for the recovery of fermented products
v. Compare the production processes of various fermented foods.

UNIT – I Food microbiology and preservation: Food composition – food groups – balanced diet - scope and role of microbiologist in food industry - factors influencing microbial growth – intrinsic and extrinsic factors - food preservation methods – physical, chemical, biological methods.

UNIT – II Food spoilage and food - borne diseases: Sources - types of food spoilage - spoilage of cereals, vegetables and fruits, meat, fish, egg and poultry. Food - borne diseases – intoxication and food poisoning – bacterial, fungal and viral food - borne diseases.

UNIT – III Milk microbiology: Composition – types of milk - microbes in milk - contamination – pasteurization - spoilage and preservation of milk – microbial analyses of milk and milk products– adulteration of milk – packaging.

UNIT – IV Fermented food products: Microbes involved in fermentation - starter cultures - butter milk, cream, yoghurt, kafir, acidophilus milk - cheese and its types. Fermented vegetables – sauerkraut and pickles.

UNIT – V Food safety: Food quality assurance - GMP – HACCP, food sanitation. International agencies – federal and state agencies – FDA – regulation - health of employees.

TEXT BOOK

William C. Frazier and Dannis C. Westhoff (1997) Food Microbiology, 4th edn, Tata McGraw – Hill, New Delhi.

REFERENCES

1. Michael P. Doyle, Larry R. Beuchat and Thomas J. Montville (1997) Food Microbiology – Fundamentals and Frontiers, ASM Press, Washington D.C.
2. Sukumar De (1997) Outlines of Dairy Technology - Oxford University Press, New Delhi.
3. Martin R Adams and Mourice O Moses (2008) Food Microbiology, 3rd edn, The Royal Society of Chemistry, UK.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2				4		
Unit 3	CO3			3			
Unit 4	CO4						6
Unit 5	CO5					5	
							M=3.8

MIC 1434 LAB IN FOOD AND DAIRY MICROBIOLOGY 4 Hrs/ Wk – 4 Cr

This lab course is designed to provide a platform to train students on microbial analyses of bakery products, eggs, cool and soft drinks, pickles, packed and canned foods and spoiled foods. Laboratory exercises like grading of milk, microbial and qualitative analyses of raw, pasteurized milk and its products will be examined. Besides, students will gain knowledge by visiting various processing units related to food and dairy microbiology.

Course Outcomes

Upon completion of this course, students will be able to

i. Analyze the microbial contaminants found in the food products.
ii. Identify and characterize specific organisms found in spoiled food.
iii. Apply the techniques to grade food products.
iv. Demonstrate the production of fermented food products.
v. Plan visits to food industries.

Laboratory exercises include

- Microbial examination of bakery products
- Microbial analyses of eggs
- Microbial investigation of cool and soft drinks
- Microbial examination of pickles
- Microbial analyses of packed and canned foods
- Isolation and identification of microorganisms from spoiled foods
- Grading of raw and pasteurized milk
- Qualitative analyses of milk
- Microbial quality of milk products
- Industrial visit to food production / processing units

TEXT BOOK

Cappucino R. (2001) Microbiology – A Laboratory Manual 6th edn.Benjamin / Cummin Pub Co. California.

REFERENCES

1. Gunasekaran P. (1995) Laboratory Manual in Microbiology, New Age International Pvt. Ltd, Madras.
2. Collins C. H., Patricia M. Lyne (2001) Microbiological Methods, 7th edn, London, Co Published in USA.
3. Aneja K. R., (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, 2nd edn, WishwaPrakashan New Age International PVT, New Delhi.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO 1					5	
Unit 2	CO 2		2				
Unit 3	CO 3			3			
Unit 4	CO 4					5	
Unit 5	CO 5				4		
							M=3.8

MIC 1436 MICROBIAL GENETICS 4Hrs/Wk-4Cr

This course will provide students focus on hereditary aspects of prokaryotic microbes. It provides insights on the use of mutations and complementation test in genetic analysis. Various mechanisms of gene transfer in microorganism and extra chromosomal inheritance shall be elucidated. This course will enable students to acquire knowledge in reproducing ideas and impacts in genetics and in understanding microbial forms of life.

Course Outcomes

Upon completion of this course, students will be able to

i. Evaluate the importance of mutations and their effects.
ii. Discuss the properties of plasmids and mobile genetic elements.
iii. Assess the competency of microbes to uptake DNA.
iv. Compare different mechanisms of gene transfer.
v. Outline the biology of phages and their role in gene transfer.

UNIT-I Essentials of genetics: Genetic nomenclature- mutants and mutations-isolation and characterization of mutants-significance-analysis of mutants- genetic recombination-mapping- complementation analysis.

UNIT-II Microbial genome: Plasmids -characteristics-detection- types - plasmid replication- control of copy number- amplification- incompatibility. Transposons-types-structure- transposition- replicative and non-replicative.

UNIT-III Transformation: Griffith experiment-detection–natural competency- DNA uptake- molecular mechanism- gene linkage and mapping-artificial transformation.

UNIT-IV Conjugation: F factor-R factor-conjugation machinery- transfer of plasmid DNA-Hfr transfer- mapping- merodiploids.

UNIT-V Transduction: Life cycle of phage λ-generalized transduction- co transduction-mapping- specialized transduction- strain construction.

TEXT BOOK

Maloy, S. R., Cronan J. E. and Freifelder D (1994). Microbial Genetics 2nd edn, Jones and Bartlett publication.

REFERENCES

1. Nancy Trun and Janine Trempy (2004). Fundamentals of Bacterial Genetics. 1stedn.Blackwell Publishing Company.
2. Gardner, E. J., Simmons MJ and Snustad DP (1991). Principles of Genetics. 8thedn. John Wiley & Sons. New York.
3. Anthony JF Griffiths, Jeffrey H Miller, David T Suzuki, Richard C Lewontin, and William M Gelbart(2000).An Introduction to Genetic Analysis, 6thedn. W.H Freeman and Company, New York.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1					5	
Unit 2	CO2		2				
Unit 3	CO3	1					
Unit 4	CO4					5	
Unit 5	CO5				4		
							M=3.4

MIC 1402 MICROBIAL PHYSIOLOGY AND METABOLISM 5Hrs/WK- 4Cr

This course provides students the components of physiology and metabolism of microbes. It emphasizes on the nutritional diversifications and uptake of nutrients by microbes and their growth. Students are exposed to the basic idea on nature of energy, concepts of thermodynamics and oxidation reduction reaction. It gives an opportunity to learn the basic principles and processes common to metabolism of all microbes.

Course Outcomes

Upon completion of this course, students will be able to:

i. Outline the diverse nutritional needs of microbes
ii. Explain the physiological changes in microbes during growth
iii. Evaluate the laws of Thermodynamics in metabolic reactions.
iv. Compare microbial aerobic and anaerobic respiration.
v. Assess the microbial metabolism of proteins and fats, and the role of photoautotrophs.

UNIT-I Microbial nutrition: Macronutrients and micronutrients –growth factors – nutritional types of microorganisms. Uptake of nutrients – passive diffusion, facilitated diffusion, active transport, group translocation and iron uptake.

UNIT-II Microbial growth: Bacterial cell cycle –binary fission – growth curve – measurement of microbial growth - factors affecting bacterial growth , endospore formation , bioluminescence, biofilm, microbial cell to cell communication.

UNIT-III Basic concepts in thermodynamics: Laws of thermodynamics-Gibbs free energy-entropy and enthalpy-redox reactions-electron carriers-energy rich molecules-anabolism and catabolism.

UNIT-IV Metabolism of carbohydrates: Anaerobic metabolism- glycolysis and fermentation- aerobic metabolism- respiration- Kreb's cycle-electron transport and oxidative phosphorylation- chemiosmosis.

UNIT-V Metabolism of fats and proteins: Overview of fat metabolism – protein metabolism. Other metabolic pathways- bacterial photosynthesis- amino acid biosynthesis - interconversion.

TEXT BOOK

Daniel R. Caldwell (1995) Microbial Physiology and Metabolism, Wm.C.Brown Publication.

REFERENCES

1. Albert G. Moat, John W. Foster, Michael P. Spector (2004). Microbial Physiology, 4th edn, John Wiley & Sons International Publication.
2. Lehninger AL Nelson DL and Cox MM (2000). Principles of biochemistry, 5th edn. CBS Publishers and distributors. New Delhi. ISBN-10; 0716743396

3. Jacquelyn G. Black (2013) Microbiology, 8th edn, John Wiley & Sons International Publication

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1	2				
Unit 2	CO2				4		
Unit 3	CO3					5	
Unit 4	CO4			3			
Unit 5	CO5					5	
							M=4

MIC 1232 NUTRITIVE VALUE OF FOOD 3Hrs/Wk - 2Cr

This course is designed to make students understand the classification of foods based on nutrients and their functions. It provides information on classification, composition and nutritive value of vegetables, fruits, dairy products, fish, and meat and poultry food. This course also emphasizes the significance about food standards, functional, organic, GM foods and various strategies to overcome nutritional problems.

Course Outcomes:

Upon completion of this course, students will be able to

i. Outline the basic classification of food and its nutritive value.
ii. Analyze the constituents, composition and nutritional aspects of vegetables and fruits.
iii. Discuss the quality processing, storage and preservation techniques of milk and milk
iv. products.
v. Explain the detection and mechanism of spoilage in foods.
vi. Evaluate the significance of next generation foods and strategies to combat nutritional problems.

UNIT – 1 Food and nutrition: Functional and nutritional classification of foods-calorific value of food-food pyramid-balanced diet. Food control - enforcement and control agencies.

UNIT - II Vegetables and fruits: Classification-composition and nutritive value- loss of nutrients- colour- texture-flavour. Browning reaction-storage and availability-methods of cooking.Nutritional aspects of raw and processed vegetables and fruits.

UNIT - III Dairy products and poultry: Milk and milk products-composition, classification-properties-quality processing-nutritive value of milk, butter, curd, butter milk, khoa, cheese, and ice-cream. Egg – structure and composition, grading, quality-selection, storage and preservation.

UNIT – IV Fish and meat: Classification-nutritive value- uses- spoilage of fresh and processed meat-detection and mechanism of spoilage-spoilage of fish-post-mortem changes-factors affecting tenderness.

UNIT – V Food standards: -Basics of probiotics-functional foods-organic food and Genetically Modified (GM) foods. Strategies to combat nutritional problems-fortification-supplementation-immunization programme-nutrition education.

TEXT BOOK

ShakuntalaManay N and M. Shadaksharaswamy (2001) Foods – Facts and Principles, 2nd edn, New Age International (P) Limited, Publishers, New Delhi.

REFERENCES

1. Tripathy SN (2004) Food Biotechnology.1st edn, .Dominant Publishers and Distributors- New Delhi.
2. Adams M. R and M. O. Moss (2003) Food Microbiology, 2nd edn, Panima Publishing Corporation, New Delhi.
3. Paul P.C. and Palmer H.H. (1972) Food Theory and Applications, John Wiley and Sons, New York.

Bloom's Taxonomy		**K1: Remembering**	**K2: Understanding**	**K3: Applying**	**K4: Analyzing**	**K5: Evaluating**	**K6: Creating**
Unit 1	**CO 1**	**1**	**2**				
Unit 2	**CO 2**				**4**		
Unit 3	**CO 3**			**3**			
Unit 4	**CO 4**				**4**		
Unit 5	**CO 5**						**6**
							M=4

MIC 1231 HEALTH AND HYGIENE 3Hrs/Wk – 2Cr

In this course, students will understand the basic ideology and importance of health, and the need for best hygiene practices. This course also provides students an opportunity to explore the significance of health planning and health education for better health care of the community.

Course Outcome:

Upon the completion of this course, students will be able to

i. Explain the concepts and trends in dimensions of health
ii. Evaluate the hygienic awareness and practices
iii. Discuss the health planning objectives
iv. Critique the need for health education and communication
v. Assess the levels of health care system

UNIT - I Concept of health: Definitions of health and changing concepts - dimensions of health- concept of well-being - spectrum and determinants of health - right to health - responsibility for health - indicators of health. Health promotion - health scenario of India - past, present and future.

UNIT - II Hygiene: Definition - hygiene factors- types of hygiene-personal hygiene- hygiene levels - individual and community hygiene – food hygiene- hygiene behaviour – hygiene hazard- health education and hygiene practices.

UNIT – III Health planning and management: Objectives- planning cycle- management methods- techniques- need and demands – health plan and systems in India - public health in India – role of health ministry.

UNIT – IV Health education and communication: Objectives and basic principles - approaches to public health - ideas and practices - key elements in communication - barriers of communication - practice of health education - administration and organization.

UNIT – V Health care of the community: Concept and levels of health care- health state - principles - health problems - health care systems - resources - health problem in India - health insurance.

TEXT BOOK

Parker J. E. and K. Park (1989) Text Book of Preventive and Social Medicine, 12th edn, BanarsidasBhanot Publishers, India.

REFERENCE BOOKS

4. Jawetz, E., Melnic, J. L. Adlberg, E. A. (2004) Medical Microbiology 19th edn, Lange Medical Publications, USA.

5. Kathleen Talaro, Arthur Talaro (1996) Foundations in Microbiology, 2nd edn, WnC. Brown Publishers, Chicago.

6. Melvin H.Williams (2005) Nutrition for Health, fitness and Sports, 7th edition, MC Graw Hill international Edition,

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3			3			
Unit 4	CO4				4		
Unit 5	CO5						6
							M=3.2

MIC 2531 CLINICAL BACTERIOLOGY AND MYCOLOGY 5Hrs/Wk – 5Cr

The course aims to provide students with the foundations in Clinical Bacteriology and Mycology and enhance their understanding about the importance of epidemiology, concept of normal flora and its importance, mechanisms for transmission, virulence and pathogenicity of microorganism of medical importance. (Bacteria & Fungi) It also emphasizes prophylactic and therapeutic strategies.

Course Outcome

Upon completion of this course, students will be able to,

i. Identify the importance of epidemiology.
ii. Utilize the concepts of normal microflora and their importance in human health.
iii. Explain mechanisms of pathogenesis (Bacteria & Fungi) with clinical importance.
iv. Evaluate modern laboratory diagnostic methods.
v. Outline the significance of prophylaxis and therapeutic management.

UNIT - I Concepts of pathogenicity Epidemiology- scope and applications , Normal Microbial flora of human body .Infection- stages and transmission . Factors predisposing to microbial pathogenicity - mechanism of adhesion, colonization and invasion of mucous membranes. Nosocomial infection.

UNIT–II Bacterial Pathogens I: Study of Morphology, cultural characteristics, pathogenesis/disease caused & laboratory diagnosis, Prophylaxis and Chemotherapy for *Staphylococcus, Streptococcus, Neisseira gonorrhoea, Cornybacterium diptheriae, Mycobacterium.*

UNIT –III Bacterial Pathogens II: Study of Morphology, cultural characteristics, pathogenesis s& lab diagnosis, Prophylaxis and Chemotherapy for *E.coli, Salmonella, Vibrio, Mycoplasma*&*Spirochaetes.*

UNIT–IV Fungal Pathogens I: General characteristics, Tissue reactions to fungi, pathogenicity, Laboratory diagnosis, prophylaxis and chemotherapy Cutaneous, Sub cutaneous, superficial and Systemic Mycosis, Opportunistic fungal infections and yeast like fungi including *Candida, Cryptococcus and Malassezia*.

UNIT -V Fungal pathogens II: Pathogenicity, Pathogenesis, Laboratory diagnosis, Prophylaxis and Chemotherapy of Mycelial fungi including *Aspergillus, Fusarium, &* Dimorphic fungi -*Histoplasma, Blastomyces.*

TEXT BOOK

Ananthanarayanan and Jayaram Panikkar (1922) Text book of Medical Microbiology, 4th edn, Orient Longman Ltd. Madras.

REFERENCES

1. Cruickshank (1975) Medical Microbiology, Vol II ELBS, Churchill Livingstone Pub.

2. Jawetz E Melnic J. L and Adelberg E. A (1998), Review of Medical Microbiology Lange Medical Publications, USA.
3. Pelczar M. J, Chan E. C. S., Kreig N. R (1986) Microbiology, McGraw Hill, New Delhi.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2			3			
Unit 3	CO3		2				
Unit 4	CO4			3			
Unit 5	CO5					5	
							M=3

MIC 2433 LAB IN CLINICAL MICROBIOLOGY 4Hrs/Wk – 4Cr

Exercises will be on the methods of collecting body fluids, culture and identification of clinical specimens of anaerobic, food poisoning and fastidious bacteria. Efficacy of disinfectants and antibiotic sensitivity tests will also be covered.

Course Outcome

Upon completion of this course, students will be able to

i. Identify the common pathogens and the diseases they cause.
ii. Demonstrate the methods of sample collection and transport of biological specimen.
iii. Apply techniques to culture microbes of clinical importance.
iv. Identify and characterize fungi microscopically.
v. Predict the susceptibility of microorganisms to drugs.

Laboratory exercises include,

1. Screening of normal flora in human body.
2. Screening of blood borne pathogens.
3. Nosocomial infection – isolation screening and characterization
4. Determination of susceptibility to dental caries.
5. Screening for Ocular Infection
6. Screening of upper respiratory tract infection.
7. Screening and identification of urine samples.
8. Screening of Dermatophytic infection
9. Microscopic screening of fungal pathogens
10. Antagonistic and synergistic effects of drugs.
11. Anti-microbial activity of body fluids.

REFERENCES:

1. Cappucino R. (2001) Microbiology – A Laboratory Manual 6th edn. Benjamin/Cummin Pub Co. California.
2. Gunasekaran P (1995) Laboratory Manual in Microbiology New Age International Pvt. Ltd, Madras.
3. Collins C. H., Patricia M. Lyne (2001) Microbiological Methods, 7th edn. London, Co Published in USA.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1		2				
Unit 2	CO2		2				
Unit 3	CO3			3			
Unit 4	CO4				4		
Unit 5	CO5						6
							M=3.4

MIC 2535 MOLECULAR BIOLOGY 5Hrs/Wk-5Cr

This course deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It provides insights on molecular mechanisms of DNA replication, repair, transcription, splicing, protein synthesis, and gene regulation in different organisms. Emphasis given on prokaryotic and eukaryotic gene regulation studies.

Course Outcomes

Upon completion of this course, students will be able to:

i. Discuss the structure, properties and functions of nucleic acids
ii. Compare the mechanisms of DNA replication and repair between prokaryotes and eukaryotes
iii. Explain the process of transcription in prokaryotes and eukaryotes.
iv. Compare the mechanisms involved in translation between prokaryotes and eukaryotes
v. Assess the concept of gene regulation in prokaryotes and eukaryotes

UNIT I Molecular Biology of the Gene: Introduction to gene structure and function. Nucleic acids-structure-DNA double helix and alternative forms- denaturation and melting curves- renaturation.RNA- types- structure. Genetic code and Wobble hypothesis

UNIT II DNA Replication: DNA the central dogma-models of replication –semi conservative, conservative and dispersive. Modes of replication - bidirectional and unidirectional.Molecular mechanism and enzymatic apparatus for DNA replication in prokaryotes and eukaryotes.DNA damage and repair mechanism.

UNIT III Transcription: Transcription in prokaryotes–RNA Polymerase-initiation, elongation and termination. Eukaryotic RNA polymerases – general transcriptional factors of eukaryotes – initiation, elongation and termination. Post transcriptional modifications– RNA editing.

UNIT IV Translation: Protein synthesis in prokaryotes and eukaryotes – initiation, elongation and termination– post translational modifications of proteins.

UNIT-V: Regulation of gene expression: Gene regulation in prokaryotes– Operon concept-inducible and repressible operon. Gene regulation in eukaryotes-Britten-Davidson model–homeobox in gene regulation.

TEXT BOOKS

Freifelder D (2007), Molecular Biology, 2nd Edn.Narosa Pub, New Delhi.India.
Watson JD, Hopkins NK, Roberts JW, Stertz JA and Weiner AM (1994), Molecular Biology of the Gene.Benjamin and Cummings Pub. Co., California, USA.

REFERENCES

1. AlbertsB,WilsonJ,Hunt T, (2008) Molecular biology of the cell . 5 Edn , Garland Science, New York ,USA.
2. Lodish H, Berk H, Zipursky S L, Matsudaira P, Baltimore D, and James Darnell (2000) Molecular Cell Biology, 4th edition. W. H. Freeman, New York, USA.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3					5	
Unit 4	CO4		2				
Unit 5	CO5						6
							M=3.2

MIC 2537 BIOINSTRUMENTATION 5Hrs/Wk-5Cr

This course will introduce students with the basic principles of techniques that are used routinely in modern biochemistry and molecular biology. The course focuses on separation techniques includes electrophoresis, chromatography and centrifugation. It deals with measurement of light absorption of colored substances in solutions using colorimeter and spectrophotometer. The last section is to provide knowledge on radioactivity and their applications in modern research field.

Course outcomes:

Upon the completion of this course, students will be able to

- Outline the principles, types and applications of chromatography
- Explain the basic principles and compare the various types of centrifuges
- Analyze the principle and applications of colorimetry
- Discuss the principles, types and applications of electrophoresis
- Assess the safety and utility of radioisotopic techniques

UNIT-I Chromatographic techniques: General principles- Types- Paper, Adsorption, TLC, gel filtration, Ion-exchange, GC-MS, GLC and HPLC- Applications.

UNIT-II Centrifugation techniques: Basic principles of sedimentation-relative centrifugal force-conversion of G to rpm- rotors -types of centrifuges (clinical, high speed, refrigerated and ultra)- - Applications.

UNIT-III Colorimetry- Beer-Lambert's law- complementary color- standard graph preparation. Spectrophotometer- UV and Visible- IR, X-ray crystallography and atomic absorption spectrophotometry- applications.

UNIT-IV Electrophoretic techniques: General principles- types of electrophoresis- AGE, PAGE, 2-D, Iso-electric focusing, and immunoelectrophoresis.

UNIT-V Radio isotopic techniques: Radioactive substance- radioactivity- Detection and measurement of radioactivity- GM counter, Scintillation counter, Autoradiography- Applications- safety aspects.

TEXT BOOKS

Wilson.K and J. Walker, (1994) Practical Biochemistry – Principles and Techniques, Cambridge Press, New York.

Palanivelu.P (2001) Analytical Biochemistry and Separation Techniques.A Laboratory Manual 2nd edn. Published by Tulsi Book Centre, Madurai, Tamil Nadu.

REFERENCES

1. Voet D and G Voet (1995) Biochemistry II edn. John Wiley and sons, New York.
2. John G. Webster (2004) Bioinstrumentation, Students Edition. John Wiley & Sons Ltd.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1					5	
Unit 2	CO2		2				
Unit 3	CO3				4		
Unit 4	CO4		2				
Unit 5	CO5				4		
							M=3.4

MIC 2403 FUNDAMENTALS OF PHARMACOLOGY 5Hrs/Wk-4Cr

This course will familiarize students with general concepts of drugs and drug action in man at the level of molecules, cells, and tissues. It provides ample understanding about the battle against diseases at the cellular and molecular level. Students will explore the pharmacological effect of drugs, the specific biochemical processes with which they affect the molecular target and interactions. Emphasis will also give to the Pharmaceutical regulations, clinical trials, marketing and patenting. This would help students with an awareness of the wide scope of applications of microorganisms in industry; the applications of fermentation technology and potentials for future development.

Course Outcome:

Upon completion of this course, students will be able to

i. Outline the history and scope of pharmacology
ii. Explain the structure of drug and drug targets
iii. Design routes and drug delivery systems
iv. Formulate drug dosage and clinical trials pertaining to regulatory agencies
v. Evaluate assays for sterile pharmaceutical and immunological products

UNIT I Introduction to Pharmacology: History and scope of pharmacology- Drug and Classification, sources of drugs-plant, animal, microbial and synthetic drugs. Discovery of drugs, Drugs and Diseases- control measures.

UNIT II Drug targets: Introduction-structure, function, and cellular location of ligand-gated channels, enzymes, nuclear hormone receptors, Carrier Proteins, Structural proteins, G-protein receptors, Nucleic Acids, Lipids and Carbohydrates. Agonists, Antagonists and partial agonists.

UNIT III Pharmacodynamics and Pharmacokinetics: Drug absorption, distribution, metabolism-biotransformation of drugs, Drug excretion-. Drug dosage-Routes of drug Administration- Mechanism of drug action- drug assay- Drug toxicity and side effects.

UNIT IV Pharmacology and Pharmaceutical Regulations: Drug Formulations- Dosage Preparation, Drug load- Stability. Clinical trials- phases; Regulatory bodies- FDA, IDA, NDA, Fast Tracking, Orphan Drugs, Labeling; Scientific code regulations- GLP and GMP. Marketing- Patenting of drugs.

UNIT V Microbial Aspects of Pharmaceutical Processing: Ecology of microorganisms in pharmaceutical industry-Sterile pharmaceutical products-Production of antibiotics, immunological products- Quality control-Bioassays.

TEXT BOOK

Patrick, G (2002), Medicinal Chemistry, First Edition, Viva Books Private Limited, (ISBN-81-7649-271-X).

REFERENCES

1. Stephen P. Denyer, Norman A. Hodge and Sean P. Gorman (2004), Hugo and Russell's Pharmaceutical Microbiology, Seventh Edition, Black Well Publishers, UK.
2. Prescott L.M, Cecil G. Dunn (2004) Industrial Microbiology, 4th edn, CBS Publishers & Distributors, New Delhi.
3. Vyas, S.P., (2002) Pharmaceutical Biotechnology CBS Publishers &Distributors, Ne4w Delhi.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1	1					
Unit 2	CO2			3			
Unit 3	CO3						6
Unit 4	CO4						6
Unit 5	CO5					5	
							M=4.2

MIC 2532 IMMUNOLOGY 5Hrs/Wk -5Cr

This course attempts to provide a basic understanding in Immunology. The course covers cells and organs of the immune system, antigens, antibody structure, antibody diversity, antigen-antibody interactions, cell mediated and humoral immune response and complement. In the section on disorders of immune system, autoimmunity, hypersensitivity reactions, immunodeficiency disorders that include AIDS are dealt.

Course Outcome

Upon completion of this course, students will be able to

i. Identify the basic concepts in Immunology such as cells, and organs of immune system.
ii. Explain antigens, antibodies and their interactions.
iii. Assess humoral immune response and antibody diversity
iv. Discuss cell mediated immune response
v. Outline the regulation of immune response and disorders of the immune system

UNIT – I Cells and organs of the immune system: Introduction –historical perspectives – innate (non-specific) and acquired (specific) immunity – cells involved – primary & secondary lymphoid organs – tertiary lymphoid tissues.

UNIT – II Antigen, antibody and their interactions: Epitopes, haptens – immunogenicity-adjuvants - antibody structure-Deducing- structure of IgG, IgM & IgA. Biological properties of various Ig classes. Primary interactions-affinity and avidity-secondary interaction-agglutination-precipitation

UNIT – III Antibody diversity and humoral response: Multigene organization of Ig genes – generation of antibody diversity- Role of T_H cells in humoral response-primary and secondary response-affinity maturation-class switching-generation of plasma cells and memory cells.

UNIT – IV Cell mediated immunity: Structure and functions of MHC- Antigen processing and presentation- Activation of cytotoxic T cells-NK cells-antibody dependent cell mediated cytotoxicity (ADCC) – delayed type hypersensitivity (DTH).

UNIT – V Regulation of immune response, complement and disorders of immune system: Immune tolerance-regulation of immune response-complement. Classical and alternative pathways – biological properties of complement components. Auto-immunity-hypersensitivity reactions- Immunodeficiency disorders – AIDS.

TEXT BOOK

Goldsby RA *et al*., (2000). Kuby, Immunology, WH Freeman and Co, New York, 4th edn.

REFERENCES

1. Coico R, Sunshine G (2009). Immunology – a short course, Wiley Blackwell, New York, 6th edn.
2. Roitt IM, Brostoff J, Male D (2001). Immunology, 6th edn, Mosby, London.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	**CO**		**2**				
Unit 2	**CO**				**4**		
Unit 3	**CO**					**5**	
Unit 4	**CO**				**4**		
Unit 5	**CO**		**2**				
							M=3.6

MIC 2434 LAB IN IMMUNOLOGY 4Hrs/Wk 4Cr

The laboratory component includes identification and enumeration of blood cells, location of lymphoid organs in selected vertebrates, preparation of antigens. Immunization techniques, methods of raising polyclonal antibodies, repetitive bleeding methods, antibody titration, complement mediated hemolysis, ELISA test for AIDS and skin test for allergy reactions.

Course Outcome:

Upon completion of this course, students will be able to

i. Identify the primary and secondary lymphoid organs.
ii. Assess the steps involved in raising polyclonal antibodies
iii. Demonstrate the diagnostic tests based on antigen-antibody interactions
iv. Perform ABO blood grouping and detection of HIV
v. Apply skin tests for allergy reactions.

The Laboratory component includes exercises as follows:

1. Total and differential count of blood cells
2. Lymphoid organs in vertebrates I – fish and amphibians
3. Lymphoid organs in vertebrates II-reptiles, birds and mammals
4. Raising polyclonal antibodies I-preparation of antigens
5. Raising polyclonal antibodies II-routes of immunization
6. Raising polyclonal antibodies III- bleeding techniques and separation of serum
7. Raising polyclonal antibodies IV-antibody titration
8. Complement mediated hemolysis
9. Ouchterlony double immunodiffusion (ODI)
10. Mancini's single radial immunodiffusion (SRID)
11. Immunology of ABO blood grouping
12. ELISA test for AIDS
13. Skin test for allergy reactions

REFERENCES:

1. Garvey JS, Cremer NE and Sussadorf DH (1977). Methods in Immunology, The Benjamin Cummings Pub co., Massachusetts, pp 345, 3rd edn.
2. Hudson L and Hay F (1989). Practical Immunology, Blackwell Sci Pub, Oxford, PP 507, 3rd edn.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1		2				
Unit 2	CO2				4		
Unit 3	CO3					3	
Unit 4	CO4			4			
Unit 5	CO5		2				
							M=3

MIC 2536 INDUSTRIAL MICROBIOLOGY 5 Hrs/Wk – 5 Cr

This course deals with the development of industrial Microbiology and role of Microbiologist in industries. This course also explains the screening, development and preservation of industrially important strains and also emphasizes the formulation of media. The other part elucidates the types of fermentations, bioreactors, downstream process and the production of various fermented products.

Course Outcome

Upon completion of this course, students will be able to

i. Revise the history and development of Industrial Microbiology
ii. Explain the methods of screening, strain improvement and preservation of production strains
iii. Analyze the source, components, importance and sterilization of fermentation media
iv. Demonstrate the basic design of a fermenter and its types
v. Discuss the steps in downstream processing and assess the nature and utility of various fermented products

UNIT – I History and Scope: Development – Contributions of Louis Pasteur and fermentation – discovery of antibiotics – growth of industrial fermentations – Applied branches of Industrial Microbiology and role of Microbiologist in industries.

UNIT – II Screening and development of strains: Isolation – crowed plate, auxanography and other methods – development and improvement – Mutation and Genetic engineering techniques. Preservation of cultures – Storage – agar slants, lyophilization and liquid nitrogen.

UNIT – III Formulation of media: Preparation of media – source and components – Agricultural and industrial waste – saccharide, starch, cellulose, nitrogen, enhancers and precursors - Medium sterilization.

UNIT – IV Fermentation and Bioreactors: Fermentation process - surface, solid state, submerged, batch and continuous fermentation – Fermentors – components of basic fermentor – pH, temperature, foam controlling device – shaft, baffle, impeller and sparger – Types of fermentors – batch and continuous fermentors, aerated and agitated fermenters and air lift fermenter.

UNIT – V Downstream processing and fermented products: Recovery of intracellular and extracellular products – removal of insoluble components – product isolation – purification – polishing. Fermented products – production of alcohol – beverages –industrially important enzymes – foods – organic acids – antibiotics and other medically important products.

TEXT BOOKS

Patel A. H., (2012) Industrial Microbiology, 1st Edition, Macmillan Publishers, India.

Crueger, W., Crueger, A., and Brock, T. D. (2005) Biotechnology: A Textbook of Industrial Microbiology, 3rd Edn, Panima Publishing Corporation, New Delhi.

El – Mansi E.M.T and C.F.A. Bryce (2005) Fermentation Microbiology and Biotechnology, Replika Press Pvt. Limited, India.

REFERENCES

1. Peter F. Stanbury, Allan Whitaker, Stephen J. (2009) Principles of Fermentation Technology, 2nd Edition Hall Elsevier Science Ltd.
2. Prescott L.M, Reed G. Dunn (2004) Industrial Microbiology, 4th Edition, CBS Publishers & Distributors, New Delhi.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3				4		
Unit 4	CO4					5	
Unit 5	CO5				4		
							M=3.2

MIC 2538 CLINICAL VIROLOGY AND PARASITOLOGY 5Hrs/Wk-5Cr

This course aims to provide students about general properties of viruses and parasites their mechanism of pathogenesis, clinical conditions and therapeutic management. Emphasis also given on specimen collection, identification, prophylaxis and treatment.

Course Outcomes:

Upon completion of this course, students will able to

i. Outline the general characteristics and pathogenesis of viruses
ii. Discuss the various replication strategies of viruses and the human diseases they cause.
iii. Compare the life cycles and diseases caused by medically important protozoan parasites
iv. Assess the worldwide burden of helminth infections and the diseases caused by helminths
v. Compile the different diagnostic procedures, and treatment strategies for viral and parasitic infections

UNIT - I Characteristic of virus: History - General Properties - Classification and replications of viruses - Epidemiology and Pathogenesis of viral infections.

UNIT - II DNA viruses & RNA viruses: Properties- life cycle and pathogenesis of Pox virus- Herpes virus - Papilloma virus- Hepatitis B. Polio- Rabies – Influenza – Ebola – Dengue - Human Immunodeficiency Virus.

UNIT - III Protozoan parasites: Introduction to medical parasitology – morphology, classification, life cycle and pathogenesis of Protozoa – Entamoeba- Plasmodium, Leishmania - Trypanosoma – Giardia – Trichomonas.

UNIT - IV Helminths parasites: Properties - life cycle and pathogenesis of Platyhelminthes – Taenia – Schistosoma and Nemathelminthes – Ascaris – Trichuris – Wuchereria.

UNIT - V Laboratory diagnosis & Treatment: Isolation & identification of viruses - Cultivation of viruses - Serological diagnosis of virus infections. Examination of faeces for ova and cysts – concentration methods. Blood smear examination for parasites. Vaccines and interferon - Antiviral - antiparasitic agents.

TEXT BOOKS

Flint SJ, Enquist LW, Krug RM, Racaniello VR and AM Skalka (2000) Principles of Virology, ASM Press, USA.

Cheng C.G (2006). General parasitology, 2nd edn, Academic press (An imprint in Elsevier).

REFERENCES

1. Cruickshank (1975) Medical Microbiology, Vol II ELBS, Churchill Livingstone Pub.
2. Ananthanarayanan and Panikkar J (1922).Text book of Medical Microbiology, 4th edition, Orient Longman Ltd. Madras.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1		2				
Unit 2	CO2				4		
Unit 3	CO3					5	
Unit 4	CO4	1					
Unit 5	CO5						6
							M=3.6

MIC 3731 GENETIC ENGINEERING 7Hrs/Wk-7Cr

This course aims to acquaint students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology. It provides theoretical basis to DNA modifying enzymes, cloning vector types, host genotype specificities for selection and screening of recombinants. Current experimentation and progress in these fields as well as ethical considerations of this research will be discussed.

Course Outcomes

Upon completion of this course, students will be able to

i. Explain the mechanisms of action of restriction endonucleases and DNA modifying enzymes.
ii. Discuss the biology of cloning and expression vectors and their methods of gene transfer into bacteria, plants and animals.
iii. Evaluate the cloning strategies of genomic library & cDNA construction, PCR, blotting techniques and DNA sequencing.
iv. Compare the various methods of selection and screening of recombinants
v. Assess the various applications of genetic engineering

UNIT I Tools for Genetic Engineering: Principles and techniques– historical development in gene technology – Restriction endonucleases and DNA modifying enzymes used in cloning. Preparation and purification of DNA from living cells.

UNIT II Vectors for gene cloning: –Cloning vectors for *E.coli*- plasmids- properties- pBR322- Bacteriophage vectors-cosmids, phagemids, insertion and replacement vectors. Yeast plasmid vectors- Artificial chromosome vectors -BAC, YAC– vectors for cloning in higher plants– vectors for animal cells. Expression vectors and properties. Introduction of DNA into living cells- transformation- transfection and *in vitro* packaging- Alternative DNA delivery systems.

UNIT III Gene cloning Strategies and techniques: Cloning from DNA, mRNA-Genomic libraries, cDNA libraries. Techniques used in genetic engineering: nucleic acid hybridization, blotting techniques, Polymerase chain reaction, Methods of DNA sequencing

UNIT IV Selection and Screening of recombinants: Direct selection through marker rescue- methods of screening – genetic methods, immunological methods, plus and minus screening, HRT and HART.

UNIT V Applications of genetic engineering: Production of recombinant pharmaceuticals – recombinant insulin, human growth hormone- somatotropin, Recombinant vaccines-DNA vaccines. Disease diagnosis and gene therapy. Production of transgenic plants, animals – methods involved - limitations and obstacles and its applications. Recombinant DNA debate and Bioethics

TEXT BOOK

Brown TA, (2001) Gene cloning and DNA analysis- an Introduction 4th edn. Blackwell, Oxford.

REFERENCES

1. Old, R.S. and Primrose, S.B. (1995) Principles of Gene manipulation. An Introduction to genetic Engineering. 5th Edition. Blackwell Scientific Publication, London.
2. Glick BR and Pasternak JJ (1996) Molecular Biotechnology – Principles and Applications of Recombinant DNA, Panima Publishing Co, New Delhi.
3. Desmond S.T. Nicholl (1994) An Introduction to Genetic Engineering, Cambridge University, Oxford.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1		2				
Unit 2	CO2		2				
Unit 3	CO3					5	
Unit 4	CO4					5	
Unit 5	CO5					5	
							M=3.8

MIC 3533 LAB IN GENETIC ENGINEERING 5Hrs/Wk – 5Cr

This laboratory course is focused on genetic engineering methods and their underlying molecular biology.

Course Outcomes:

Upon completion of this lab course, students will able to

i. Perform isolation of genomic DNA and plasmids from bacteria.
ii. Perform isolation & purification of DNA from yeast, plant and animal tissues.
iii. Demonstrate quantification of DNA by spectrophotometric and electrophoretic methods
iv. Analyze the restriction digestion of DNA fragments
v. Demonstrate SDS-PAGE and silver staining of proteins

Laboratory exercises include,

1. Isolation of genomic DNA from bacteria.
2. Isolation of genomic DNA from plants.
3. Isolation of genomic DNA from animal tissue.
4. Isolation and purification of plasmid.
5. Estimation of DNA (Spectrophotometric method).
6. Analysis of DNA on Agarose Gel Electrophoresis.
7. Restriction digestion of genomic DNA.
8. Isolation of RNA from Mammalian tissue and yeast.
9. Estimation of molecular weight of proteins using SDS – PAGE.
10. Silver staining of protein gel.

REFERENCES

1. Sambrook J and Russell D.W (2001) Molecular Cloning: A Laboratory Manual, Volume 1, CSHL Press.
2. Robertson D. Shore A. S. and Miller D. M (1997) Manipulation and Expression of Recombinant DNA – A Laboratory Manual, Academic Press, San Diego.
3. Scheppler J. A. Cassin P. E and Gambier R. M (2000) Biotechnology Explorations – Applying the fundamentals, ASM Press, Washington DC.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1			3			
Unit 2	CO2			3			
Unit 3	CO3				4		
Unit 4	CO4				4		
Unit 5	CO5			3			
							M=3.4

MIC 3635 PLANT AND ANIMAL CELL CULTURE 6Hrs/Wk-6Cr

This course provides students an overview of plant and animal cell culture. First section emphasizes on the basic requirements of plant tissue culture, callus culture, protoplast culture, and somatic hybridization. It also focuses on Micro propagation, organogenesis, embryogenesis and in-vitro conservation. Next section focuses on animal cell culture lab requirements, culture media, primary explants, and characterization of cultured cells. The last section provides insights on organotypic models, hybridoma technology and stem cells.

Course outcomes

Upon completion of this course, students will be able to

i. Outline the requirements and techniques of plant tissue culture.
ii. Explain the micropropagation and *in vitro* conservation process.
iii. Discuss concepts of animal cell culture and types of media.
iv. Demonstrate the techniques of primary explantation, monolayer culturing, and cell line characterization.
v. Assess the applications of animal cell culture.

UNIT I Basics of Plant tissue culture: Historical perspective - containments –culture types – tissue culture media – callus culture initiation – cell culture – plant regeneration – scale up process –single cell isolation – protoplast culture – fusion – somatic hybridization – haploid plant production – diploidization.

UNIT II Micro propagation and Germplasm conservation: Somoclonal variants – isolation method –micro propagation – techniques – multiplication by axillary buds, apical and adventitious shoots – organogenesis –embryogenesis –embryo culture. Germplasm conservation – cryopreservation –genetically modified crops.

UNIT III Basics of Animal Cell Culture: History- types- scope- requirements- equipments- culture vessels – contamination – aseptic condition – sterilization –advantages and limitations – applications. Culture media – Physico-chemical properties – serum and serum free media.

UNIT IV Primary cell culture & Characterization: Primary culture – tissue isolation technique –primary explants – cell lines – selection and maintenance; subculture – monolayer and suspension – scale up process –culture system. Characterization of cultured cells – cell line identification – growth parameters – cell viability.

UNIT V Organotypic models & Tissue engineering – Organ culture techniques –histotypic – 3D culture – organotypic culture.Tissue engineering –Hybridoma technology –monoclonal antibody production. Stem cells - applications.

TEXT BOOKS

Gambora O.L, and G.C. Phillips, (1995) Plant cell, tissue and organ culture – Fundamental methods, Narosa Publication.

Freshney I, (2005), Culture of Animal cells, A manual of Basic technique, 5th edition, A. John Wiley & Sons, INC, Publication.

REFERENCES

1. Satyanarayana U, (2011) Biotechnology, Books & Allied publication Ltd.
2. Dubey C.R, (2006) Textbook of Biotechnology, 4th edition, S.Chand & Company Ltd.
3. S.M Bhatt (2011) Animal Cell Culture – Concepts and Applications, Narosa Publishing House Private Limited, New Delhi.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3					5	
Unit 4	CO4			3			
Unit 5	CO5					5	
							M=3.2

MIC 3537 LAB IN PLANT AND ANIMAL CELL CULTURE 5Hrs/Wk-5Cr

This lab course is designed to provide students a technical skill on plant and animal cell culture. Students will familiarize in media preparation, development of shoot and root and preparation of synthetic seeds. Techniques like tissue explant preparation; monolayer culturing and cell viability test will be done.

Course Outcomes:

Upon completion of this course, students will be able to

i. Prepare plant and animal cell culture media.
ii. Perform culturing of callus, shoot & root.
iii. Demonstrate primary explant culture and cell culture preparation,
iv. Identify the monolayer and suspension culture.
v. Assess the viability of the cultured cells.

Laboratory exercises include,

Plant cell and tissue culture

1. Preparation of Tissue Culture Media.
2. Callus Induction.
3. Shoot and root induction.
4. Isolation of protoplasts.
5. Synthetic seed preparation.
6. Cell suspension culture.

Animal cell and tissue culture

7. Sterilization & Preparation of Tissue and Cell Culture Media.
8. Primary explants culture from chick embryo.
9. Disaggregation of tissue – Physical method.
10. Disaggregation of tissue – Enzymatic method.
11. Primary cell culture – Monolayer Cells.
12. Primary cell culture – Suspension Cells.
13. Sub culturing technique/Secondary cell culture method.
14. Cell counting and viability – Trypan blue dye exclusion test.

TEXT BOOKS

Aneja K R (1996) Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production technology, New Age International Publications, India.

Freshney I, (2005), Culture of Animal cells, A manual of Basic technique, 5th edition, A. John Wiley & Sons, INC, Publication.

REFERENCE

Bhatt S.M (2011) Animal Cell Culture – Concepts and Applications, Narosa Publishing House Private Limited, New Delhi.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO 1			3			
Unit 2	CO 2						6
Unit 3	CO 3				4		
Unit 4	CO 4				4		
Unit 5	CO 5					5	
							M=4.5

MIC 3243 BIOINFORMATICS 3Hrs/Wk – 2Cr

Generation of abundant molecular biological information, especially the genetic and protein sequences, would made the human mind to exhaust when if tried to compare and contrast so as to find out the links or homology between sequences. Fortunately, at this juncture a perfect blend of molecular biology and computer evolved the discipline bioinformatics making molecular biologists to explore extensively. In this course, data generation, biological databases, data storage, data retrieval, sequence alignment and application of bioinformatics were given emphasis.

Course Outcomes:

Upon completion of this course, students will be able to

i. Explain the history of bioinformatics
ii. Outline computational tools of bioinformatics
iii. Compare DNA, RNA and protein sequences for analytical studies
iv. Assess phylogenetic methods
v. Identify new research fields in biology.

UNIT I Fundamentals of Computer: Introduction to Computers: – Characteristics of Computers. Classification of Computers – Programming Languages: Machine Language – Assembly Language – Features of commonly used operating systems e.g. DOS, Windows, UNIX, and LINUX. Input Devices- Keyboard – Mouse - Trackball – Output Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD & LED Printers: Hard Disk – CD –DVD – primary memory, Introduction to Internet.

UNIT II Basics of Internet Use and Search Engines: Fundamentals of Internet, WWW, HTML, URLs Browsers, Netscape/Opera/Explorer Search Engines: Google, PUBMED, NCBI EMBL, GENBANK, Entrez, Unigene, PDB, SwissProt, And TrEMBL. Introduction to search; Indices, Boolean, Fuzzy and neighbouring search.

Unit III Bio-informatics Basics: Bio-informatics- Its Definitions, Introduction, History - Objectives, Applications, Its need, Scope, Opportunities in Bioinformatics. Emerging areas of Bioinformatics - Bioinforrnatics scenario in India and the rest of the world.Origin of Bioinformatics, Overview of available Bioinformatics resources on the web NCBI/ /EBI/EXPASY etc.

UNIT IV Sequences used in Bioinformatics: Central dogma - DNA, RNA, Protein. Dawn of sequencing.Features of the DNA, Protein, and RNA molecules.

UNIT V Biological Databases: Introduction to data types and Source. Population and sample, Classification and Presentation of Data.Quality of data, private and public data sources.General Introduction of Biological Databases; Types of Biological Databases, Nucleic acid databases (NCBI, GenBank, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB).

TEXT BOOK

Lesk, A.M. (2002) Introduction to Bioinformatics. Oxford University Press.

Atwood T K, Parry Smith D J and Phukan S. Introduction to bioinformatics, Pearson Education, Ltd. & Dorling Kindersley Publishing Inc., 2013 - New Delhi, India.

REFERENCES

1. Zoe Lacroix and Terence Critchlow (2003) Bioinformatics – Managing Scientific Data, Morgan Kaufmann Publishers, New Delhi.
2. Andreas D. Baxevanis and Francis B. F. Francis Ouellette (2006) Bioinformatics – A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience, Inc, Publications, USA.
3. Setubal, J. and Meidanis, J. (1996) Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3			3			
Unit 4	CO4				4		
Unit 5	CO5					5	
							M=3

MIC 3200 ENVIRONMENTAL STUDIES 4Hrs/Wk-2Cr

This course is designed to introduce students the importance, scope and problems in environment. It focuses on the natural resources, energy flow and types of ecosystems. Values of biodiversity, hotspots, endangered species and conservation are emphasized. It also highlights the social issues and population explosion in the environment.

Course Outcomes:

Upon completion of this course, students will be able to

i. Outline the values of renewable and non-renewable resources.
ii. Evaluate the concept, functions and types of ecosystems.
iii. Discuss the values of biodiversity and importance of conservation.
iv. Compare different types of pollution and assess the various waste management strategies
v. Critique the importance of sustainable development, climate change and population explosion.

UNIT I Natural Resources: Ecology –scope – importance- components –awareness – renewable resources – forest, water, mineral, food, land and energy resources – renewable and non-renewable energy –conservation.

UNIT II Ecosystems: Concepts –structure and function – food chain & web and ecological pyramids –energy flow in the ecosystem –ecological niche –ecological succession. Types of ecosystems - Forest, grassland, desert and aquatic ecosystems.

UNIT III Biodiversity: Introduction – levels – values of biodiversity – Global, National and local biodiversity – hotspots – major threats –endangered species. Conservation of biodiversity –*In situ* and *Ex situ* conservation.

UNIT IV Environmental pollution: Definition – source, types, effects and control measures of air, water, soil, marine, noise, thermal pollution – nuclear hazards – solid waste management –disaster management.

UNIT V Social issues and population: Sustainable development –water conservation - environmental ethics – global climate change problem –role of environmental legislation (acts). Human population growth – population explosion –human rights –value education.

TEXT BOOK

Kaushik A and C.P.Kaushik (2014), Perspectives in Environmental Studies, 4th multicolour edition, New Age International (P) Limited Publishers.

REFERENCES

1. Bharucha E (2013), Textbook of Environmental studies for Undergraduate courses, 2nd edition, Universities press (India) Private Ltd.
2. Thatheyus A.J (2011) Textbook of Environmental Studies, Narosa Publishing House, New Delhi.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1		2				
Unit 2	CO2			3			
Unit 3	CO3			3			
Unit 4	CO4					5	
Unit 5	CO5			3			
							M=3.2

MIC 3732 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY 7Hrs/Wk-7Cr

The main objective of this course is to make students familiar with microorganisms without which human could not survive as these microbes occur in large number in most natural environment and bring about many desirable and undesirable changes. Beside their role in evolution of life on this planet, the microbial activity is linked directly with processing and removal of dead bodies and sewage. Thus, their role as scavengers is encouragable. The study of this course will help students to develop the sustainable environment.

Course Outcome:

Upon completion of this course, students will be able to

i. Revise information on microbial communities of air and water
ii. Explore the types of microbial interactions.
iii. Compare the soil profiles and their perspectives of ecological zonation
iv. Apply principles and applications of microbes in environmental clean up
v. Design organic farming methods for sustainable agriculture

UNIT I Microbiology of Air & Water: Atmospheric dispersal of microbes- Microbial diversity of thermophiles- Mesophiles- Psychrophiles - deep sea- hyper saline habitats and metal-contaminated environments. -Air-borne diseases-control of bio- aerosols- air sanitation. Microbial communities in pelagic & benthic habitats- biological analysis of water sampling - Microbial processes in waste water treatment.

UNIT II Microbial Interactions: Microbe–microbe Interactions – Mutualism, Commensalism, and Amensalism, Microbe–plant interactions – Phylloplane – Phyllosphere - Rhizosphere and Mycorrhizae.

UNIT III Soil microbiology: Soil - general properties -soil microflora-microbes in soil surface and different zones of soil – role of microbes in soil fertility – soil and environmental influence on microbes - decomposition of plant and animal residues by microorganisms in soil.

UNIT IV Bioremediation & Biodegradation: Bioremediation and its types- Principles and application of Bioaccumulation- Xenobiotics- Microbial degradation of hydrocarbons. Biodegradation of pesticides.

UNIT V Role of microbes in sustainable agriculture: Traditional agricultural practice and organic farming. Applications of microbes in agriculture. Bio fertilizers - symbiotic and non-symbiotic microorganisms – vermicomposting - bio pesticides- bacterial, fungal and viral.

TEXT BOOKS

Atlas R and Bartha R (1998) Microbial Ecology 4th edn. Benjamin/Cummings Publishing Co, Inc. California.

Subba Rao NS (2000) Soil Microbiology 4th edn. Oxford & IBH, New Delhi.

REFERENCES

1. Alexander M (1977) Introduction to Soil Microbiology. Wiley, New York.

2. Rheinheimer G (1980) Aquatic Microbiology 2nd edn. Wiley New York.
3. Mitchell R (1992) Environmental Microbiology Wiley-John Wiley Sons, Inc. Publications, New York.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2				4		
Unit 3	CO3			3			
Unit 4	CO4			3			
Unit 5	CO5						6
							M=3.4

MIC 3534 LAB IN ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY 5Hrs/Wk - 5Cr

In this laboratory course, students will be trained on isolation and identification of various microorganisms from soil, techniques to assess physico-chemical parameters of various organisms. It also helps them to identify eco-friendly organisms of our environment

Course outcomes

Upon completion of this course, students will be able to

i. Identify beneficial organisms from different ecosystems.
ii. Utilize their skill based techniques in agricultural field.
iii. Compare the importance of biofertilizers.
iv. Rate new technologies for the betterment of the environment.
v. Design experiments to study various environments.

Laboratory exercises include,

Environmental Microbiology

1. Enumeration of bacteria present in different types of soil.
2. Isolation of rhizobium from leguminous plant.
3. Isolation and identification of *Azotobacter*.
4. Isolation and identification of *Phosphobacter*.
5. Isolation and Enumeration of fungi from soil.

Agricultural Microbiology

6. Isolation and enumeration of major groups of microorganisms from rhizosphere and Non-rhizosphere soil.
7. Isolation and identification of microorganisms from phylloplane region.
8. Isolation and identification of microorganisms from phyllosphere region.
9. Isolation of microflora from different industrial effluents.
10. Determination of BOD and COD.
11. Vermicomposting.
12. Cultivation of plants using biofertilizers – Pot culture technique.

REFERENCES

1. Cappucino R (2001) Microbiology - A laboratory manual 6th edn. Benjamin/Cummings, California.
2. Gunasekaran P (1995) Lab manual in Microbiology, New Age International Pvt Ltd. Madras.
3. Motsana MR, Bhattacharya and BeenaSrivastava (1995) Biofertilizers Technology, Marketing and usage. Publication Division, Ministry of Agriculture, New Delhi.

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	CO1			3			
Unit 2	CO2			3			
Unit 3	CO3				4		
Unit 4	CO4					5	
Unit 5	CO5						6
							M=4.25

MIC 3636 MEDICAL LABORATORY TECHNOLOGY 6Hr/Wk-6Cr

This course is meant for developing the knowledge and technical skills necessary to perform basic laboratory tests. Emphasis is given on use and maintenance of laboratory equipment, quality control and biosafety techniques. Collection of samples in clinical biochemistry, clinical pathology, haematology and blood banking analysis and interpretation of results will be dealt with.

Course Outcomes:

Upon completion of this course, students will able to

i. Outline the infrastructure of a clinical laboratory
ii. Assess the various metabolic disorders and their diagnosis
iii. Explain the techniques for handling, examination and storage of different body fluids for clinical examination
iv. Assess blood collection methods and various hematological techniques
v. Explain the methods of slide preparation for histopathological examination.

UNIT I Organization of the laboratory: Safety precautions in laboratory - personal cleanliness and care with regard to infected materials and chemical burns — Maintenance and applications of biomedical instruments – haemocytometer, Gluco meter, Sphygmomanometer - Disposal of bio-medical wastes.

UNIT II Clinical Biochemistry: Disorders and diagnosis of carbohydrate metabolism – diabetes mellitus, lipids metabolism – hypercholesterolemia , Protein metabolism – phenylketonuria and tyrosinemia.

UNIT III Clinical Pathology: Types of clinical specimens: urine, feces, sputum, CSF, Semen. Methods of collection –transportation- handling. Physical – chemical - microscopical and microbiological examination of clinical specimen.

UNIT IV Haematology: Laboratory preparation – Blood components, Collection of blood, Determination of Haemoglobin, blood cell count, bleeding time - clotting time – Prothrombin time, Estimation of ESR, Anemia and its types, Leukemia, blood banking.

UNIT V Histopathology: Preparation of specimen, paraffin section, embedding- frozen section, fixation, microtome –types, decalcification, deparaffinization, staining.

TEXT BOOK

Godkar, P. B. Godkar D. P (2002). A Text Book for Medical Lab Technology, 2nd edition, Bhalami Publishing House, Mumbai.

REFERENCES

1. Mukherjee, K.L (1989). Medical Laboratory Technology (Vol –I to III) Tata McGraw Hill, New Delhi.

2. Sood, R (1996). Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1						6
Unit 2	CO2		2				
Unit 3	CO3				4		
Unit 4	CO4					5	
Unit 5	CO5			3			
							M=4

MIC 3538 LAB IN MEDICAL LABORATORY TECHNOLOGY 5Hr/Wk-5Cr

This laboratory course focuses on the techniques in the examination various body fluids. Students is trained to analysis physical and chemical properties of biological fluids as well as microscopic examination.

Course Outcomes:

Upon completion of this course, students will able to

i. Evaluate and analyze various clinical samples
ii. Demonstrate basic hematology techniques
iii. Apply the biochemical tests to analyze serum and urine samples
iv. Analyze pus and stool samples.
v. Plan visits to different medical laboratories

Laboratory exercises include,

1. Sample collection, preservation and transportation of various clinical samples.
2. Determination of E.S.R., Packed cell volume in blood.
3. Estimation of Haemoglobin.
4. Bleeding Time, Clotting Time and Platelet count in Blood
5. Determination of Differential blood count.
6. Biochemical estimation of serum- total protein, albumin, globulin, sugar.
7. Biochemical estimation of serum - cholesterol, urea, Creatinine.
8. Biochemical estimation of Urine - urea, Uric acid and Creatinine.
9. Microscopic and macroscopic examination of urine.
10. Microscopic examination of Pus and Stool.
11. Visit to Hospital laboratory

TEXT BOOK

Mukherjee, K.L (1989). Medical Laboratory Technology (Vol –I to III) Tata McGraw Hill, New Delhi.

REFERENCES

1. Godkar, P. B. Godkar D. P (2002). A Text Book for Medical Lab Technology, 2nd edition, Bhalami Publishing House, Mumbai.

2. Sood, R (1996). Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi

Bloom's Taxonomy		K1: Remembering	K2: Understanding	K3: Applying	K4: Analyzing	K5: Evaluating	K6: Creating
Unit 1	**CO1**				**4**		
Unit 2	**CO2**		**2**			**5**	
Unit 3	**CO3**				**4**		
Unit 4	**CO4**					**5**	
Unit 5	**CO5**			**3**			
							M=4.6

MIC 3244 POLLUTION & WASTE MANAGEMENT 3Hrs/Wk-2Cr

Environmental management is actively moving toward strategies of reduction and prevention of pollution and waste management. Planning for pollution prevention is recognized as a vital component of this process. The purpose of this course is to introduce students the basic aspects of air, soil water and soil pollution, its effects and preventive measures. In the last two units they will gain knowledge on waste and disaster management.

Course Outcomes:

Upon completion of this course, students will be able to

i. Outline information on air and soil pollutants and their control measures
ii. Assess standards and control measures for water and noise pollution
iii. Compare global and regional perspectives of environmental pollution
iv. Identify the sources, causes and types of solid wastes
v. Plan techniques for solid waste disposal and disaster management

UNIT I Air and Soil Pollution: Definition-causes – sources - air pollutants - particulates and gaseous pollutants - harmful Effects –prevention & control technologies of Air Pollution. Soil pollution-causes -sources –industrial waste effluents – heavy metals - degradation of soil quality- remediation of Contaminated Soil

UNIT II Water and Noise Pollution: Water pollutants and their sources; Pollution of stream, lakes -Eutrophication- waste water treatments systems -water quality standards-prevention & control measures. Noise pollution-causes-sources-Decibel scale-noise instrumentation and monitoring procedure- impacts of noise pollution-control and preventive measures.

UNIT III Control of Environment Pollution: Monitoring of air and water quality parameters - methods, equipments, standards- control of soil pollution. Role of individuals in prevention of pollution - pollution case studies. Global and regional perspectives of environmental pollution.

UNIT IV Solid Wastes: Causes, sources and types-**Municipal solid waste- organic waste-commercial wastes-Toxic waste-Recyclable-Soiled**-Hazardous wastes- -Biomedical wastes-Animal wastes- Sewage Wastes- Urban and industrial wastes.

UNIT V Solid Waste & Disaster management: Basic aspects of solid waste management; Current practices in India; Volume and strength reduction – Recycle, reuse and by-product recovery – Applications. Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal. Disaster management- Floods, Earthquake, Cyclone and landslides.

TEXT BOOKS

Atlas R. and Bartha .M (1988) Microbiology Fundamentals & Applications.2nd edn.Maxwell Macmillan International edn. UK.

Mitchell R (1992) Environmental Microbiology, Wiley – John Wiley Sons, Inc Publications, New York.

REFERENCES

1. Dave P. K. Gupta S. Parmar N. K, Kant S. (2007) Emergency Medical Services and Disaster Management: A Holistic Approach. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
2. Kumar A (2006) Disaster Management – Recent Approaches, Anmol Publications, New Delhi.
3. Eugene P. Odum (1990) Ecology – A Bridge between Science and Society.

Bloom's Taxonomy		K1: Rememberin g	K2: Understandin g	K3: Applyin g	K4: Analyzin g	K5: Evaluatin g	K6: Creatin g
Unit 1	CO1	1					
Unit 2	CO2		2				
Unit 3	CO3				4		
Unit 4	CO4			3			
Unit 5	CO5						5
							M=3