



Perambalur- 621 212

(For the candidates admitted from the academic year 2021-2022 onwards)

B.Sc., MICROBIOLOGY COURSE STRUCTURE UNDER CBCS

Sem	Part	Course	Course Title	Sub.Code	periods/Week	Credit	Exam Hrs	Internal	External	Total
I	I	Language course I	Cheyull (Ikkalallakiyam), Sirukathai, Ilakiyavaralaru, Hindi, French, Arabic, Sanskrit	21U1LT1/ 21U1LH1/21U1LF1/ 21U1LA1/21U1LS1	6	3	3	25	75	100
	II	English Language course I	English for Communication-I	21U1EL1	6	3	3	25	75	100
	III	Core Course-I (CC)	Fundamentals of Microbiology	21UMB1C1	6	6	3	25	75	100
		Core Course-II (CC)	Practicals –I Fundamentals of Microbiology	21UMB1C2P	4	3	3	40	60	100
		Allied Course-I	Biochemistry –I	21UMB1A1	3	3	3	25	75	100
		Allied Course-II	Lab in Biochemistry-I	21UMB1A2P	3	**	**	**	**	**
IV	Environmental Studies	Environmental Studies	21U1EVS	2	2	3	25	75	100	
					30	20				600
II	I	Language course II	Cheyull (Iddikalallakiyam), Puthinumum, Hindi, French, Arabic, Sanskrit	21U2LT2/21U2LH2/ 21U2LF2/ 21U2LA2/21U2LS2	6	3	3	25	75	100
	II	English Language course II	English for Communication-II	21U2EL2	6	3	3	25	75	100
	III	Core Course-III(CC)	Microbial Physiology	21UMB2C3	6	6	3	25	75	100
		Core Course-IV(CC)	Practicals II- Microbial physiology	21UMB2C4P	4	3	3	40	60	100
		Allied Course-III	Biochemistry-II	21UMB2A3	3	3	3	25	75	100
		Allied Course-II	Lab in Biochemistry-I &II	21UMB1A2P	3	4	3	40	60	100
		IV	Value Education	Value Education	21U2VED	2	2	3	25	75
					30	24				700
III	I	Language course III	Cheyul (Kappiyangal), Vurainadai, AluvalmuraiMadalgal, Ilakkiyavaralaru Hindi,French,Arabic,Sanskrit	21U3LT3/21U3LH3/ 21U3LF3/ 21U3LA3/21U3LS3	6	3	3	25	75	100

II	English Language Course III	English Through Literature	21U3EL3	6	3	3	25	75	100	
	Core Course – V	Immunology and Immunotechnology	21UMB3C5	6	5	3	25	75	100	
III	Core Course – VI	Practical-III Immunology and Immunotechnology	21UMB3C6P	4	3	3	40	60	100	
	Allied Course-IV	Biostatistics-I	21UMB3A4	3	2	3	25	75	100	
	Allied Course-V	Lab in Biostatistics-I	21UMB3A5P	3	**	**	**	**	**	
IV	Non-major Elective-	A) Vermi Culture	21UMB3N1A	2	2	3	25	75	100	
		B) Mushroom Technology	21UMB3N1B							
		C) Biofertilizer Technology	21UMB3N1C							
		TOTAL		30	18				600	
IV	I	Language course – IV	Cheyyl (Sangailakkiyam), Needhiilakkiyam, Nadagam, Illakiyavaralaru, Podhukatturai	21U4LT4/21U4LH4/ 21U4LF4/ 21U4LA4/21U4LS4	6	3	3	25	75	100
			Hindi,French,Arabic,Sanskrit							
	II	English Language Course – IV	English For Competitive Examinations	21U4EL4	6	3	3	25	75	100
	Core Course – VII	Clinical Microbiology	21UMB4C7	6	6	3	25	75	100	
		Core course – VIII	Practical-IV Clinical Microbiology	21UMB4C8P	4	3	3	40	60	100
	III	Allied Course-VI	Biostatistics-II	21UMB4A6	3	3	3	25	75	100
		Allied Course-V	Lab in Biostatistics I & II	21UMB3A5P	3	2	3	40	60	100
	IV	Non-major Elective-	A) Microbial metabolites	21UMB4N2A	2	2	3	25	75	100
			B) Social and preventive medicine	21UMB4N2B						
			C) Microbial Nutrition	21UMB4N2C						
		TOTAL		30	22				700	
III	Core Course – IX	Agricultural and environmental Microbiology	21UMB5C9	6	6	3	25	75	100	
	Core Course – X	Industrial microbiology	21UMB5C10	6	5	3	25	75	100	
	Core Course – XI	Food and Dairy Microbiology	21UMB5C11	5	5	3	25	75	100	
	Core Course – XII	Practical's Pertaining CCIX, CCX & CCXI	21UMB5C12P	3	3	3	40	60	100	
			A) Clinical Research	21UMB5M1A						

V	Major Based Elective-I	B) Marine microbiology	21UMB5M1B	4	4	3	25	75	100	
		C) Virology	21UMB5M1C							
IV	Skill Based Elective-I	A) Pharmacognosy	21UMB5S1A							
		B) Clinical lab Technology	21UMB5S1B	2	2	3	25	75	100	
		C) Diagnostic Microbiology	21UMB5S1C							
	Skill Based Elective-II	A) Cell biology	21UMB5S2A							
		B) Endocrinology	21UMB5S2B	2	2	3	25	75	100	
		C) Principles of Bioinstrumentation	21UMB5S2C							
	Soft Skill Development	Soft Skill Development	21U5SS	2	2	3	25	75	100	
		TOTAL		30	29				800	
VI	Core course – XIII	Microbial Genetics	21UMB6C13	6	6	3	25	75	100	
		Core course – XIV	Molecular biology	21UMB6C14	6	6	3	25	75	100
		Core Course- XV	Practical's Pertaining CCXIII & CCXIV	21UMB6C15P	6	5	3	40	60	100
	Major Based Elective-II	A) Forensic Biology	21UMB6M2A							
		B) Mycology	21UMB6M2B	6	4	3	25	75	100	
		C) rDNA Technology	21UMB6M2C							
	Major Based Elective-III	A) Genetic Engineering	21UMB6M3A							
		B) Microbial Technology	21UMB6M3B							
		C) Microbial Taxonomy and bioinformatics	21UMB6M3C	5	4	3	25	75	100	
	IV	Gender Studies	Gender Studies	21U6GS	1	1	3	25	75	100
V	Extension activity	NCC, NSS, Rotaract, YRC			1					
		TOTAL		30	27	18	150	450	600	
		Grand Total		180	140				4000	



Dhanalakshmi Srinivasan College of Arts & Science for Women (Autonomous)
(Affiliated to Bharathidasan University, Trichirappalli) (Nationally Re-accredited with 'A' Grade by NAAC)



Course title Perambalur- 621 212

(For the candidates admitted from the academic year 2021-2022 onwards)

B.Sc., MICROBIOLOGY COURSE STRUCTURE UNDER CBCS

Sem	Part	Course	Course Title	Sub.Code	periods/ Week	Credit	Exam Hrs	Internal	External	Total
I	III	Allied Course-I	Food Microbiology	21UND1A1	4	3	3	25	75	100
I	III	Allied Practical-II	Lab in Food Microbiology	21UND1A2P	3	-	-	-	-	-
II	III	Allied Practical-II	Lab in Food Microbiology & Nutritional Chemistry	21UND1A2P	3	3	3	40	60	100
III	III	Allied Course-IV	Basics of Microbiology-I	21UHA3A4	3	3	3	25	75	100
III	III	Allied Practical-V	Lab in Basics of Microbiology	21UHA3A5P	3	-	-	-	-	-
IV	III	Allied Course-VI	Clinical Microbiology	21UHA3A6	3	3	3	25	75	100
IV	III	Allied Course-V	Lab in Basics of Microbiology & Clinical Microbiology	21UHA3A5P	3	3	3	40	60	100

PROGRAMME OUTCOMES

1. Enable students to acquire expertise in the use and application of various methods used in microbiology
2. Provide learning opportunity to be reflective about their role as are searcher
3. Handle and independently work on lab protocols involving molecular techniques
4. Awareness of ethical issues in Microbiology research and career options.
5. Production of substantial original research of significance and quality sufficient for publications.

The course is reasoning and application based, making the students eligible for higher studies, jobs in various sectors and Entrepreneurship abilities. Applied papers are advanced, making the students updated in the field. More number of practical is there in the course making the students well worse with the subject.

CORE COURSE: I
FUNDAMENTALS OF MICROBIOLOGY

Semester :I

Max Marks: 75

Course Code :21UMB1C1

Credit :6*

Total Period : 75h

Exam Hrs:3

Objectives

To understand the historical landmarks in the development of microbiology. To gain knowledge on the classification and grouping of living organisms

UNIT I Introduction to Microbiology (15 Period)

Scope and application of Microbiology. Contributions of Antonyvonleeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iiwanowsky, Beijerinck, Winogradsky and Alexander Fleming. Theory of Spontaneous generation and germ theory of disease.

UNIT II Grouping and Classification of Bacteria (15 Period)

Outline classification of kingdom system: Heckle, Whittaker and Carl Woese systems. The universal phylogenetic tree and 16srDNA. Bergeys systematic classification. Archaeobacterial classification.

Unit III Microscopy (15 Period)

Principles of Microscopy- bright field, dark field, phase Contrast, Fluorescent, and Electron Microscopy (SEM and TEM).

UNIT IV Ultra structure of Prokaryotic and Eukaryotic Cell (15 Period)

Structure, composition and function of Cell wall, cell membrane, outer membrane, cytoplasmic matrix, ribosome, ER, golgi complex, nucleus, mitochondria, chloroplast, chlorophyll and flagella.

UNIT V Fungi and Cyanobacteria (15 Period)

Yeast and mold- nutrient, growth characters, classification (Alexopoulos) and general life cycle- sexual and asexual. Characteristics and ultrastructure of cyanobacteria

REFERENCES

Noel, R. Krieg, Michael, J., Pelzar, Jr. and Chan, E.C.S. 1993. Microbiology. 5th Edition. *Tata Mc Craw Hill*, New Delhi.

Dubey, R.C. and Maheswari, D.K. 2012. A text of Microbiology. Revised Edition.

S. Chand and Company Ltd., New Delhi.

Prescott, Harly, Klein'S. 2008. Microbiology, 7th International edition. *McGraw Hill*.

Michael, T. Madigan, John, M. Martinko, Paul V. Dunlap, David, P. Clark. 2009. Brock Biology of Microorganisms. 12th Edition. *Pearson*.

Atlas, R.A. Principals of Microbiology. 2nd Edition, 1997. *W.M.C. Brown Publishers*, Iowa.

Tortora, G. J., Funke, B.R. and Case, C.L. 2005. Microbiology an Introduction. 8th Edition. *LPE-*

Course Outcomes:

By the end of this course, the students will be able to:

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the contributions of eminent scientists in the development of microbiology	K1
CO 2	Understand the Grouping and Classification of Bacteria	K2
CO 3	Understand working and mechanism of different equipments and tools used in microbiology	K3
CO 4	Understand the ultra structure of bacterial cell	K4
CO 5	Understand the Classification of Fungi and Cyanobacteria	K4

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	M	S	S
CO 2	M	S	S	M	S
CO 3	S	S	S	M	S
CO 4	S	S	M	S	S
CO 5	S	S	S	M	S

S- Strong, M- Medium, L- Low

CORE COURSE : II

PRACTICAL – I: FUNDAMENTALS OF MICROBIOLOGY

Semester I

Max Marks :60

Course Code :21UMB1C2

Credit :3*

Total Period : 45h

Exam Hrs :3

Objective: To impart hands on training on fundamentals of microbiology.

1. Lab safety and precautionary measures (4 Period)
2. Sterilization Techniques: cleaning of glasswares, autoclaving and fumigation (6 Period)
3. Media Preparation: Liquid media, solid media and slant preparation (6Period)
4. Pure Culture Technique: Streak plate, pour plate, spread plate, decimal dilution. (9 Period)
5. Motility Demonstration: Hanging drop preparation, wetmount. (5 Period)
6. Staining Techniques: Simple staining, Gram staining, Capsule staining, lactophenol cotton blue staining (9Period)
7. Morphology of Microorganisms: Morphological variations in algae. Morphology of fungi, yeast, slide culture techniques. (6Period)

REFERENCE

Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 1986. General Microbiology. *Mac Millan Education Ltd.* London.

Kanai, L. Mukherjee. 2010. Medical Laboratory Technology. *Tata McGrawHill.*

Aneja, K.R. 2003. Experiments in Microbiology, Plant pathology and Biochemistry. 4th Edition. *New age International publishers*, India.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Recall the safety practice in microbiological laboratory	K1
CO 2	Explain the ubiquitous nature of microorganisms	K2
CO 3	Prepare various culture media, cleaning of glasswares and sterilization of media	K2
CO 4	Understand the Morphology of Microorganisms	K3
CO 5	Compute various pure culture techniques	K3

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	M	S
CO 2	M	S	M	M	M
CO 3	S	S	S	S	M
CO 4	S	S	S	M	S
CO 5	S	S	S	M	S

S- Strong, M- Medium, L- Low

FIRST ALLIED COURSE : I
FOOD MICROBIOLOGY

Semester I

CourseCode :21UND1A1

TotalPeriod : 60h

Max Marks :75

Credit :3*

ExamHrs :3

Objective

To enable the students to gain knowledge about the role of microorganism in health and disease.

UNIT I Food factors and Microbes (15 Period)

Growth and multiplication - Factor influencing the growth - Intrinsic factors, nutrient content, pH, redox potential, antimicrobial barrier and water activity. Extrinsic factors - Relative humidity, temperature and gaseous atmosphere.

UNIT II Microbiology of Perishable Food (15 Period)

Outline of contamination - Spoilage and intoxication. Preservation of vegetables and fruits, milk and milk products and canned food, meat and meat Products, egg and poultry. HACCP and Food regulations

UNIT III Microbiology of Non -Perishable Food (10 Period)

Outlines of contamination – spoilage and preservation of cereal and cereal, Pulses and Pulses product, sugar and sugar products.

UNIT IV Food Borne Disease (10 Period)

Food poisoning and intoxication. Causes and symptoms of the following food borne diseases - *Salmonellosis*, *Botulism*, Cholera and Typhoid. Water borne disease - Gastro enteritis, Diarrhea: *Campylobacter* and *Giardia lamblia*.

UNIT V Fermented Food from Microorganisms (10 Period)

Fermented food - curd, cheese, sauerkraut, meat, soy based foods, alcoholic beverages, vinegar and organic acids.

REFERENCES

Adams, M.R. and Moss, M.O. 2005. *Food Microbiology, Newage International (P) Ltd.*

New Delhi.

Vijaya Ramesh, K. 2007. *Food Microbiology. MJP Publishers, Chennai.*

James G. Cappuccino and Natalie Sherman. 2008. *Microbiology – A Laboratory manual,*

Pearson education publishers, USA.

James M. Jay. 2005. *Modern Food Microbiology, 4th Edition, CBS Publishers and Distributors, New Delhi.*

Adams Tamine. 2005. *Probiotic Dairy Products, Blackwell Publishing, USA.*

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the Food factors and Microbes	K3
CO 2	Outline of contamination	K2
CO 3	Understand the Microbiology of Non -Perishable Food	K4
CO 4	Understand the Food poisoning and intoxication	K3
CO 5	Understand the Fermented food	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	M	S
CO 3	S	S	M	S	S
CO 4	M	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

FIRST ALLIED COURSE:II
FOOD MICROBIOLOGY PRACTICALS

Semester I

Max Marks :60

CourseCode :21UND1A2P

Credit :3*

TotalPeriod : 45h

ExamHrs :3

Objective

To gain knowledge on food spoilage and quality control aspects

- | | |
|---|-----------|
| 1. Isolation of pathogens from spoiled food | (6Period) |
| 2. Identification of fungi from spoiled bread by LPCB | (3Period) |
| 3. A differential stain: Gram's staining method using spoiled vegetable | (6Period) |
| 4. Methylene blue reduction test | (6Period) |
| 5. Water quality by MPN technique | (9Period) |
| 6. Preparation of wine using yeast | (9Period) |
| 7. Preparation of paneer and cheese | (6Period) |

REFERENCES

Adams, M.R. and Moss M.O. 1995. Food Microbiology. *The Royal Society of Chemistry*.Cambridge.

Banwart, G.J. 1989. Basic Food Microbiology. *Chapman & Hall*, NewYork.

Basic Practical Microbiology Published by the Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG,UK

Frazier, W.C, Westhoff, D.C. 1988. Food Microbiology, *TATA McGrawHill*.

Course Outcomes:

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Isolate of pathogens from spoiled food	K5
CO 2	Perform the Methylene blue reduction test	K4
CO 3	Perform Water quality by MPN technique	K3
CO 4	Preparation of wine using yeast	K4
CO 5	Preparation of paneer and cheese	K4

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	S	S	S
CO 2	S	S	S	M	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : III
MICROBIAL PHYSIOLOGY

Semester II

CourseCode :21UMB2C3

TotalPeriod : 75h

Max Marks :75

Credit :6*

ExamHrs :3

Objectives

To understand the nutrients needed to sustain a microbe. To learn growth and physiological pattern of microbes

UNIT I Microbial Nutrition (15 Period)

Classification of bacteria based on nutrition- Phototroph, autotroph, chemotroph, Heterotroph. Source of energy and electron acceptors. Transport of nutrients- active, passive and grouptranslocation.

UNIT II Microbiological Media (18 Period)

Types of media- complex and synthetic media, basal medium, enriched media, enrichment media, selective media, differential media, anaerobic agar, transport media. Media for cultivation of fungi and microalgae.

UNIT III Metabolic Pathway (12 Period)

Energy production by catabolism of glycolysis (EMP, HMP and ED) pathways, TCA cycle and its integration. Biological membrane structure and functions electron transport, oxidative phosphorylation and theirmechanism.

UNIT IV Microbial Growth (20 Period)

Factors affecting microbial growth. Growth phases of bacteria - lag phase, exponential (Logarithmic) phase, stationary (ideo) Phase, decline and survival of microbial cells. generation time. Synchronous cultures - methods of synchronous culturing, continuous culturing methods. Methods of growth measurements.

UNIT V Survival of Bacteria under Starvation (10 Period)

Bacterial endospore structure, composition, phenomenon of sporulation, biochemistry and genetics of sporulation. Induction of sporulation phenenan. Germination of spores.

OUTCOME OF THIS PAPER:

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

REFERENCES

Review of Medical Microbiology by Jawitz, Melnick and Adelberg; bacterial and Mycotic infections of man. Ed. Dubos and HirstLipnicott; Principles of Microbiology and Immunology byDavis Dulbecco, Eison, Ginsberg and wood; Text Book of Microbiology by Anathanarayanan Microbiology by Pelczar M.J., Ried, RD and Chan, ECS, Microbial Physiology by Moat, brocks biology of Microorganisms by Madigan, MT etal Biochemistry of bacterial growth by Mandelstum, McQuillon and dawes, Bacterial metabolism byDwellely Photosynthesis by Dewlin and Barker, Laboratory Experiments in Microbiology by Gopalreddy etal., Microbes in Action by Seoley HW and Van-Demark, PJ

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	State the Nutritional requirements of microorganisms	K1
CO 2	Explain the microbiological media	K2
CO 3	Describe the Metabolic pathway	K2
CO 4	Illustrate the microbial growth	K2
CO 5	Compute the view of Survival of Bacteria under Starvation	K3

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	S	S	M	S
CO 3	M	S	S	M	S
CO 4	S	S	S	M	S
CO 5	S	S	M	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : IV
PRACTICAL – II MICROBIAL PHYSIOLOGY

Semester II

Max Marks : 60

CourseCode :21UMB2C4P

Credit :3*

TotalPeriod : 45h

ExamHrs :3

Objective

To understand and analyses the growth of Microbes.

1. Cultural Characteristics of Microorganisms: Growth curve and generationtime. (6 Period)
2. Physiological Characteristics:IMViCtest (10 Period)
3. TSItest (4 Period)
4. Oxidase and Catalase production test (5 Period)
5. Effect of high salt concentration (5Period)
6. Endo spore staining (5Period)
7. Casein hydrolysis (5Period)
8. Starch hydrolysis (5Period)

REFERENCE

Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R.1986. General Microbiology. *Mac Millan Education Ltd.* London

Aneja, K.R. 2003. Experiments in Microbiology, Plant pathology and Biochemistry. 4th Edition. New age International publishers,India.

Cappuccino and James. 1996. Microbiology a laboratory manual. 4th Edition. *Addison Wesley Publishing Company Inc.* England,California.

Holt. J.S., Kreig, N.R., Sneath, P.H.A and Williams, S.T. 1994. Bergey's Manual of Systematic Bacteriology. 9th Edition, *Williams and Wilkins*,Baltimore.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand and analyses Growth curve and generation time	K3
CO 2	Understand Physiological Characteristics of microbes	K4
CO 3	Outline the Effect of high salt concentration	K4
CO 4	Understand the hydrolysis process	K5
CO 5	Outline the spore staining	K5

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	M	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	M
CO 5	M	S	M	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : V
IMMUNOLOGY AND IMMUNOTECHNOLOGY

Semester III

Max Marks : 75

CourseCode :21UMB3C5

Credit :5*

TotalPeriod : 75h

ExamHrs :3

Objective:

This course aims to develop the skills in immunology and immunotechnology, and to introduce immunological foundations

Course Outcomes:

UNIT I –Concepts of Immunology

(15 Periods)

Introduction to immune system- History and developments. Types of Immunity- innate, acquired and herd immunity. Structure, Composition and types of cells and organs involved in immune system. Humoral and cell mediated immune responses. Immunization – Modern methods of vaccine production.

UNIT II Antigens Antibodies and Complement

(15 Periods)

Antigen, Haptans and Adjuvants- types and properties. Immunoglobulins: Structure, Types, Properties and their functions. Complement system. Nature of Antigen-Antibody interactions. Affinity, avidity and titre values.

UNIT III Allergic Reactions

(15 Periods)

Introduction to allergy. Types of allergens- Hypersensitivity- type I: asthma, type II: Blood transfusion reaction. Type III: Arthus reaction and type IV: tuberculin reaction.

UNITIV Immunotechnology

(15Periods)

Preparation and Purification of antigens. Extraction of antigens from pathogens, Parasites and other biological materials, fractionation and Purification: Preparation of synthetic antigens, recombinant antigens and whole organism vaccines. Hybridomatechnology.

UNITV Immunotechniques

(15 Periods)

Immunotechniques and its applications - precipitation, agglutination, complement fixation and radiology in immunotechniques. Enzyme-linked immune sorbent assay (ELISA), Western blotting, immune fluorescence (FAT). RT PCR indiagnosis

REFERENCES

Ivan M. Roit (1994) essential immunology- Blackwell scientific publications, oxford kuby J (2001).

Abbas A.K. Lichtman, A.M. And Pober, J.S. (1997) Cellular and molecular immunology 3rd edition Philadelphia: W.B. Saunders.

Richard A Golds, Thomas J.K (2000). Immunology. W.H. Freeman & compares.

Chakravarthy, Ashim K. (2000). Immunology & immunotechnology. Oxford university press,
 Julius cruse, Robert Lewis (2000). Atlas of immunology. CrcPress.

Ivan Roitt. Jonathan Brostoff and David Male.(2002). Immunology 6thedition.

Leffel, Donnenberg, A: and Rose, W (1997). Hand book of human immunology Boca Raton
 Fla:C.R.C

William E.Paul (2012). Fundamentals of immunology 7th edition.

Kenneth Murphy (2011). Janeway's immunobiology (immunobiology: the immune system).

Immunobiology: the immune system in health and disease. 3rd edition by Travers.

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the history and types of immunity	K4
CO 2	Demonstrate the various antigen-antibody techniques.	K4
CO 3	Explain the knowledge about hypersensitivity reactions	K4
CO 4	Demonstrate the Preparation and Purification of antigens	K6
CO 5	Explain Immunotechniques and its applications	K6

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	M	S	M	M	L
CO 2	S	M	M	S	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : VI

PRACTICAL-III: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Semester III

Max Marks : 60

CourseCode :21UMB3C6P

Credit :3*

TotalPeriod : 75h

ExamHrs :3

Objectives:

To understand the concepts of immunology and principles of immunotechniques.

1. Blood grouping and Rh typing (7Periods)
2. ASOTest (7Periods)
3. Tube agglutination-WIDALtest (8Periods)
4. Differential staining –neutrophil count (7Periods)
5. Total leukocyte count (haemocytometer) (7Periods)
6. Separation of serum from the blood sample (8Periods)
7. Immuno diffusion –Ouchterlony method. (9Periods)
8. To perform immune electrophoresis. (10Periods)
9. HCG detection by Dot ELISA (12Periods)

REFERENCES

Essentials of immunology by Riott I.M. 1998. ELBS, Blackwell scientific publishers,London.

Immunology 2nd edition by Kuby J.1994.W.H. Freeman and Co.new York. Manual of clinical laboratory and immunology 6th edition. 2002 by Noel R.Rose, chief editor: Robert G. Hamilton and Barbara Detrick (Eds.), ASM Publications.

Pocket guide to clinical microbiology 2nd edition. 1998 by Patrick R.Murray, ASM Publications.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Perform ABO blood grouping	K3
CO 2	Understand the Tube agglutination	K3
CO 3	Understand the Differential staining	K4
CO 4	Perform immune electrophoresis.	K5
CO 5	Detection of HCG by Dot ELISA	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	M	S
CO 2	S	S	S	S	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

NON MAJOR ELECTIVE : I
VERMI CULTURE

Semester III

Max Marks : 75

Course Code :21UMB3N1A

Credit :2*

Total Period : 24h

ExamHrs :3

Objectives:

To learn about the processes and methods involved in vermi culture and to learn the applications of vermi culture.

UNIT I Vermiculture

(6 Periods)

Definition, scope and importance; Local and exotic species for culture; Environmental requirements; Culture methods – wormery – breeding techniques; indoor and outdoor cultures – monoculture and polyculture.

UNIT II Earthworms(spp)

(5 Periods)

Taxonomic position and diversity; types – morphological and ecological grouping – Epigenic, Anecic and Endogeneic species; Ecological role and economic importance of earthworms

UNIT III Applications of Vermiculture

(5Periods)

Vermi composting – use of vermin castings in organic farming, Earthworms for management of municipal organic solid wastes. Nutrient value of worm cast/vermicompost – Effect of Vermi compost on plants.

UNIT IV Marketing the Products of Vermiculture

(4 Periods)

Quality control, market research, marketing techniques – creating the demand by awareness and demonstration, advertisements, packaging and transport.

UNIT V Future Perspectives

(4 Periods)

Predator/ pathogen control in wormeries; Potentials and constraints for vermiculture in India.

REFERENCES

Edwards CA, Hendrix P and Arancon N (2014) Biology and Ecology of Earthworms, Springer Publishers. 2. Karaca A (2011) Soil Biology: Biology of Earthworms. Springer Publishers.

Edwards CA, Arancon NQ and Sherman RL (2011) Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management, CRC Press, USA.

Ranganathan LS (2006) Vermibiotechnology– From Soil Health to Human Health. Agrobios, India.

Ismail SA (2005) The Earthworm Book. Edition, Other India Press, Apusa, Goa, India.

Ismail SA (1997) Vermicology: The Biology of Earthworms. Orient Longman, India.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Know the scope and breeding techniques	K3
CO 2	Understand the Taxonomic position and Endogeneic species	K2
CO 3	Outline the Applications of Vermiculture	K4
CO 4	Know Quality control, market research, marketing techniques	K4
CO 5	Understand the Potentials and constraints for vermiculture	K5

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	M	S
CO 5	S	M	S	S	S

S- Strong, M- Medium, L- Low

NON –MAJOR ELECTIVE : I
MUSHROOM TECHNOLOGY

Semester III

Max Marks : 75

CourseCode :21UMB3N1B

Credit :2*

TotalPeriod : 24h

ExamHrs :3

Objectives:

To provide knowledge on application of mushroom and to promote the students to become an entrepreneur.

UNIT I Scope and development of Mushroom (4 Periods)

Classification of Edible Mushrooms- Medicinal Value of Mushrooms- Edible mushroom cultivation – Types of edible mushroom available in India – *Calocybeindica, VolvariellaVolvacea, Pleurotussp ., Agaricusbisporus*

UNIT II Nutritive value and spawn Production (5 Periods)

Protein, Vitamins, Minerals, Carbohydrates, Fibre, Fat pure Culture- Preparation of media (PDA and Oatmeal agar media) Sterilization – Preparation of test tube Slants to store Mother Culture – Culturing of Pleuretus mycelium on Petriplates – Preparation of mother Spawn in Saline Bottle and Polypropylene Bags and their Multiplication .

UNIT III Cultivation Technology (5 Periods)

Infra structure, Substrates (locally available) polythene bag, vessels, Inoculation hood –low cost stove – sieves – Cultural rack mushroom unit (Thatched house) – Mushroom bed preparation – Paddy straw, sugarcane trash, maize straw, banana leaves- post harvest technique- packing- transport-storage- short term storage- long term storage Cultivation of button mushroom.

UNIT IV Pests and Diseases of Edible Mushrooms (5 Periods)

Fungal diseases- dry bubble, wet bubble, cob web disease, green moulds, competitor moulds- bacterial diseases- bacterial blotch- viral diseases insect- sciarid flies, phorid flies, cecid files- mushroom mites- beetles nematodes.

UNIT V Economics of Mushroom (5 Periods)

Fixed assets, recurring expenditure, Labour, Economics of Cultivation throughout the year and seasonal growing formulation of Project report for getting finance from funding agencies). Precautions in mushroom cultivation. Mushroom recipes western and Indian recipes, Pickles, Powders, Jams.

REFERENCES

Arvindkumar. Vermitechnology ,Aph publishingcorporation,2005.

Marimuthu. Oyster Mushrooms, Dept. of Plant pathology, TNAU, Coimbatore,1991.

Mary violet Christy .A .Vermitechnology, Mjp publishers,2008.

Nita Bahl. Hand book of Mushrooms, II edition, Vol. I & II,1988.

Paul Stamets, J.S. and Chilton, J.S. Mushroom Cultivator: A practical guide to growing mushrooms at home, Agarikon Press,2004.

Swaminathan M. Food and Nutrition, Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore,1990.

Tewari and PankajKapoor S.C. Mushroo m cultivation, Mittal Publications, Delhi,1988.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Differentiate edible and Poisonous mushrooms	K5
CO 2	Create an nutrient profile of mushroom	K4
CO 3	Examine cultivation system of mushroom	K5
CO 4	Formulation of mushroom food preparation	K6
CO 5	Determine health benefits of mushroom	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	M	M	M	M	S
CO 2	M	M	S	M	S
CO 3	M	M	M	S	M
CO 4	S	S	S	S	S
CO 5	S	S	M	S	S

S- Strong, M- Medium, L- Low

NON MAJOR ELECTIVE: I
BIOFERTILIZER TECHNOLOGY

Semester III

Max Marks : 75

CourseCode :21UMB3N1C

Credit :2*

TotalPeriod : 24h

ExamHrs :3

Objectives:

To demonstrate the role of bacteria in agriculture

To understand the application of bacteria and fungi as biofertilizer

UNIT I Introduction to Soil Environment

(5 Periods)

Soil Environment-soil structure, soil profile, Physico-chemical conditions, Rhizosphere Microorganisms composition, Bio-geo chemical cycles –Carbon cycle, Nitrogen cycle and sulphur cycles.

UNIT II Microbial Interactions

(5 Periods)

Microbial interaction mutualism, amensalism, and commensalisms- plant microbial interactions– N₂ fixation, symbiotic and free living- genetics of N₂ fixation- Phosphate solubilization- Rhizosphere effect- Mycorrhizal association; ecto and endomycorrhizae.

UNIT III Biofertilizers

(5 Periods)

Biofertilizers – Introduction and mass cultivation biofertilizers - Rhizobium, Azotobacter, Azospirillum, Azolla; Anabaena Symbiosis, blue green algae and Vermi composting. Carrier- based inoculants, methods of Application. Commercial Production of biofertilizers.

UNIT IV Plant Diseases

(5 Periods)

Major plant disease symptoms caused by fungi, bacteria and viruses. Plant diseases – Principles, symptoms and control measures of the following diseases: Fungal –Tikka, Fusarium wilts, Bacterial –Blight of rice, citrus canker, Xanthomonas (black rot). Viral and mycoplasmal –Bud necrosis of groundnut, citrus mosaic, tomato leaf Curl.

UNIT V Biopesticides

(4 Periods)

Biopesticides –*Bacillus thuringiensis*, *B. sphaericus*, *B. popilliae*, *Pseudomonas syringae*. Biocontrol- fungi pathogens- *Trichoderma sp.*, --. Useful genes from microorganisms for agriculture (Herbicide resistant, Bt, viral). Biological Control –Use of Baculovirus, NPV virus, protozoa & fungi in biological control.

REFERENCES

Dirk J, Elias V, Trevors JT, Wellington, EMH (1997) Modern Soil Microbiology, Marcel Dekker INC, New York.

Agricultural Microbiology by G.Rangaswamy and Bagyaraj, Prentice Hall India. 3. Bio-fertilizers in

Agriculture and Forestry, 1995, by N.S. SubbaRao.

4. Microbes For Sustainable Agriculture by K.V.B.R. Tilak, K.K. Pal, Rinku Dey 5. Soil Microbiology and Plant Growth, 1995, by N.S. SubbaRao.

6. Plant Growth and Health Promoting Bacteria by Dinesh K. Maheshwari 7. Plant-microbe interactions, Volume 1 by Gary Stacey and Noel T. Keen

Biological control of crop diseases Volume 89 of Books in soils, plants, and the environment by S. S. Gnanamanickam

Plant-microbe interactions and biological control Volume 63 of Books in soils, plants, and the environment by Greg J. Boland, L. David Kuykend

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain Soil Environment	K2
CO 2	Create Knowledge about Phosphate solubilization and study the mass cultivation methods	K6
CO 3	Analyze Non- Symbiotic Biofertilizers and study the mass cultivation methods, Symbiotic Biofertilizers and study the mass cultivation methods	K4
CO 4	Expand view of Major plant disease	K2
CO 5	Expand view of Mycorrhizae and Bioinsecticides and study the mass cultivation methods	K4

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	M	M	M	S	S
CO 2	S	S	S	M	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	M
CO 5	S	M	L	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : VII
CLINICAL MICROBIOLOGY

Semester IV

Max Marks : 75

Course Code :21UMB4C7

Credit :6*

Total Period : 75h

ExamHrs :3

Objective:

This course aims to develop the skills in clinical virology like viral infections and diseases.

UNIT I Mechanism of Pathogenicity (15 Periods)

Normal flora- opportunistic pathogen.Host microbe interaction- invasion, colonization, virulence factors, pathogenicity.Physical barriers.

UNIT II Principles of Epidemiology (15 Periods)

Current epidemics (AIDS, Nosocomial, Acute respiratory Syndrome,) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.

UNIT III Bacterial Diseases (15 Periods)

Enteric diseases- cholera, dysentery, respiratory diseases- whooping cough, diphtheria, tuberculosis, zoonotic diseases- brucellosis, salmonellosis ,tetanus, sexually transmitted diseases- gonorrhoea, syphilis.

UNIT IV Viral Diseases (15 Periods)

Some common viral diseases - Pox, Herpes, polio virus, Hepatitis viruses, SARS- COVID 19, Influenza, Rabies, Rota and AIDS, pappilloma, Epstein Barr virus.SV40

UNIT V Fungal Infection (15 Periods)

Mechanism and pathogenicity of Superficial mycoses, cutaneous mycoses, subcutaneous mycoses, systemic mycoses, oppurtunistic mycoses, mycototoxicosis.

REFERENCES

Chakraborty P (2003). A Text book of Microbiology. 2nd edition published by New Central book agency (p) Ltd.,Kolkata.

Ananthnarayanan R &JayaramPanikerCK(2000). Text book of microbiology 6thedition orient longman limitedChennai

Clnical virology manual by steven,S. Adnika, R.L., Young,S.A.

Principles of virology. 2000 by EdwardArnold.

Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.

Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier.

Joklik WK, Willett HP and Amos DB (1995). Zinsser Microbiology. 19th edition. Appleton-Century-Crofts publication.

Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Describe and Classify the various pathogens and its Characterization.	K3
CO 2	Measures for prevention of epidemics	K5
CO 3	Diagnose the various bacterial pathogens	K4
CO 4	Analyze various human viral diseases	K4
CO 5	Evaluate and compare the various fungal infections and protozoan diseases	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	L	M	L	S	S
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	M	M	M	M

S- Strong, M- Medium, L- Low

CORE COURSE : VIII
PRACTICAL PERTAINING CLINICAL MICROBIOLOGY

Semester	IV	Max Marks : 60
Course Code	:21UMB4C8P	Credit :3*
Total Period	: 75h	ExamHrs :3

Objectives:

To impart hands on training on clinical Microbiology

- | | |
|---|-------------|
| 1. Isolation of pathogen from Urine | (11Periods) |
| 2. Isolation of pathogen from Pus/Wound | (11Periods) |
| 3. Cogulase test for Staphylococci | (10Periods) |
| 4. Detection of Hbs antigen by dotELISA | (12Periods) |
| 5. Quantification of HIV agbyELISA | (12Periods) |
| 6. KOH mount for Fungal dermatitis | (9 Periods) |
| 7. Germ tube test | (10Periods) |

REFERENCES

James Cappuccino. Microbiology: A Laboratory Manual (10th Edition).

Tiwari, G. S. Hoondal, Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers.2005.

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

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

Tauro P., Kapoor, K.K. Yadav, K.S. An introduction to Microbiology first Edition, New Age International Publishers.

Kannan. N. Laboratory Manual in General Microbiology. Panima Publishing Corporation. New Delhi. 2nd Edition.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Isolation of pathogen	K4
CO 2	Detection of Hbs antigen	K5
CO 3	Perform the Cogulase test	K4
CO 4	Examine the Fungal dermatitis	K5
CO 5	Examine the Germ tube test	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	M	S	S	S	S
CO 5	S	M	S	S	M

S- Strong, M- Medium, L- Low

NON MAJOR ELECTIVE: II
MICROBIAL METABOLITES

Semester IV

Max Marks : 75

Course Code :21UMB4N2A

Credit :2*

Total Period : 24h

Exam Hrs :3

Objective:

To learn and to understand about the elemental concepts of microbiology.

UNIT I Microbial products

(5 Periods)

Microbes and metabolites: primary metabolites and secondary metabolites. Major bacteria and fungi in industrial production- *Penicillium* sp, *Streptomyces* sp, *Propionibacterium*, *Aspergillus niger*, Yeast, SCP.

UNIT II Microbes in Food Processing

(5 Periods)

Fermented food and nutritive value. types of fermentation. Role of bacteria in Bread, curd, kefir, sauerkraut, cheese

UNIT III Probiotics

(4 Periods)

Role of probiotics in human intestine. Nature of *Lactobacillus*, *Streptococcus*, *Bifidobacterium*, *Bacillus* and *S.cerevisiae*

UNIT IV Eco Microbiology

(6 Periods)

Microbes and ecosystem. Decomposition, Bioremediation, Bioremediation, Bioremediation- microbial deterioration of metals, textile, paper. Biofertilizer and biopesticide (BT)

UNIT V Industrial Microbiology

(4 Periods)

Fermentor and fermenter. Structure and design of bioreactor. Basic concept on mass Production and extraction of microbial cell.

REFERENCES

Prescott L M, JPHarley and D AKlein (2005). Microbiology. Sixth edition, International edition, McGrawHill.

Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Fifth edition, Tata McGraw-Hill INC. NewYork

Kuby Immunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition, W H Freeman and company. NewYork.

Jawetz, Melnick, & Adelberg's. Medical Microbiology. 26th Edition. McGrawHill.

Patel AH (2005). Industrial Microbiology. Published by Mac Millan India Ltd., Chennai.

SubbaRao NS (2004). Soil Microbiology. Fourth edition, Oxford, IBH Publishin Co. Pvt. Ltd., New Delhi.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the Microbes metabolites and industrial production	K2
CO 2	Explain the Microbes in Food Processing	K3
CO 3	Role of probiotics	K4
CO 4	Understand the Eco Microbiology	K4
CO 5	design of bioreactor	K3

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	M	S
CO 2	S	M	S	S	S
CO 3	M	S	S	M	S
CO 4	S	S	S	S	S
CO 5	S	S	S	M	M

S- Strong, M- Medium, L- Low

NON MAJOR ELECTIVE :II
SOCIAL AND PREVENTIVE MEDICINE

Semester IV

Max Marks : 75

Course Code :21UMB4N2B

Credit :2*

Total Period : 24h

Exam Hrs :3

Objective:

To study about the concept of health, Identify threats to the environment and infection caused by microbes

UNIT I Concept inPublicHealth

(5 Periods)

Definition of health; appreciation of health as a relative concept; determinants of health. Public health events - Sanitary awakening, germ theory of disease, rise of Public health in various countries. Indices used in measurement of health. National Health Policy

UNIT II Epidemiology Concept

(5 Periods)

Epidemiology - definition, concept and role in health and disease. Modes of transmission and measures for prevention and control of communicable and non-communicable disease.Principal sources of epidemiological data- frequency, mortality, morbidity.Common samplingtechniques.

UNIT III Important Epidemiological Outbreaks

(5 Periods)

Infective hepatitis, ARI, T.B. Malaria, Filariasis, STDs & AIDS, Diarrhoeal diseases, Kala Azar, Mental Health, Non communicable diseases, Blindness, Hypertension, Leprosy, Accidents, JE, VPDs, Plague, Chickenpox etc.

UNIT IV Emerging Diseases

(5

Periods)

Epidemiology, Pathogenesis and Treatment of *Clostridium difficile*and *Pseudomembranous colitis*, Ebola and Niphavirus .

UNIT V Medical Ethics

(4 Periods)

Bioethics and Medical ethics: Historical perspectives & Introduction to Bioethics, Nuremberg Code, Declaration of Helsinki, Principle of essentiality, informed consent, confidentiality, minimisation of risk, accountability and responsibility. Ethics of clinical trials: Drug trials, vaccine trials.

REFERENCES

- 1.Oxford Text book of Public Health: Detels R, McEwen J, Beaglehold R
 - 2.Control of Communicable Diseases in Man: Benenson AS
 - 3.Manson's Tropical Diseses:Cook G, Zumla A
 - 4.Hunter's Diseases of Occupations: Baxter PJ, AdmasPH
 - 5.Hunters Tropical Medicine and emerging infectious diseases: Strickland GT
 - 6.A Dictionary of Public Health. J Kishore
 - 7.Clinical Epidemiology-the Essentials : Fletcher
- Epidemiology and Management for Health Care for all: Sathe PV, SatheAP
- Training modules of various national & international institutes and national health programmes
- MaxyRoseman John M.Last, Maxcy-Roseman Public Helathand Preventive Medicine, Appleton-Centrury-Crofts, Newyork
- Hobson W, The Theory and Practice of Public Health, OxfordMed. Publication
- Barker D J P, Practical Epidemiology, ChurchillLivingstone
- Park J E & K Park, Text Book of P & S.M., M/s BanarsidasmBhanot, Jabalpur

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand and determinants of health	K3
CO 2	Outline the Epidemiology and sources of epidemiological data	K4
CO 3	Know the Important Epidemiological Outbreaks	K5
CO 4	Understand the Pathogenesis and Treatment of some bacteria	K5
CO 5	Understand the Bioethics and Medical ethics	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	M
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	M	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

NON MAJOR ELECTIVE : II
MICROBIAL NUTRITION

Semester IV

Max Marks : 75

CourseCode :21UMB4N2C

Credit :2*

TotalPeriod : 24h

ExamHrs :3

Objective:

This study compares the microbial nutritional content, and its physical and chemical factor requirement for growth .

UNIT I Nutritional Types

(5 Periods)

Nutritional types : Requirement of Nutrients for microbes and classification of microorganisms based on carbon, energy and electron sources viz. Photoautotrophs; Photo organotrophs; Chemo-lithotrophs (ammonia, nitrate sulphur, hydrogen, iron oxidizing bacteria); Chemo-organotrophs. Primary and secondary active transport; Passive and facilitated diffusion.

UNIT II Preservation Components

(5 Periods)

Media type and Preservation Components; Criteria and role of macro and micro-nutrients. Natural, Synthetic, Complex, Selective media & Differential Media; Methods for culturing aerobic and anaerobic bacteria; Colony and broth culture characteristics; Maintenance and preservation of Microorganisms.

UNIT III Microbial Growth

(5 Periods)

Microbial Growth: Growth in Microbes (growth phases, generation time, growth curve). Measurement of cell mass and cell number; Factors affecting microbial growth; Continuous and batch cultures ; details of synchronous and Diauxic growth curve. Physical factors influencing growth: Temperature; PH ; Atmospheric Pressure; Salt Concentration.

UNIT IV Chemical Factors

(4 Periods)

Chemical factors: heavy metal (copper), surfactants. Control of Microorganisms: patterns of microbial death, control of microorganism growth by antiseptics.

UNIT V Microbial Photosynthesis

(5 Periods)

Microbial Photosynthesis: Concept of photosynthesis and associated pigments in microbes; photosynthetic apparatus in pro and eukaryotes; anoxygenic and oxygenic photosynthesis ; light and dark reaction; photorespiration and its significance.

REFERENCES

- Moat A.G. and Foster S.W. Microbial Physiology (4th Ed.)(2004). John Wiley and Sons, New York.
- Gerald Karp. Cell Biology (3rd Ed.)(2003). McGraw Hill Book Company, New York.
- Stanier RY, Ingraham JI, Wheelis ML and Painter PR. General Microbiology. (5th Ed.)(1987). McMillan Press. UK.
- Dubey RC and Maheswari DK. A Text book of Microbiology. (2005). S.Chand & Company Ltd., New Delhi.
- Nelson D.L. & Cox M.M. Lehninger's Principles of Biochemistry, 4th edition. (2005). W. H. Freeman & Co. NY.
- Pelczar Jr, M J, Chan E C S., Krieg N R, Microbiology, (5th Ed.)(2001). McGraw Hill Book Company, NY.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the Nutritional types	K3
CO 2	Know the Media type and Preservation Components	K4
CO 3	Understand the Measurement of cell mass and cell number; Factors affecting microbial growth	K5
CO 4	Outline the Chemical factors	K5
CO 5	Understand the microbial photosynthesis	K6

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	S	S	S
CO 2	S	S	S	M	S
CO 3	S	S	S	S	S
CO 4	M	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : IX
AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Semester V

Max Marks : 75

Course Code :21UMB5C9

Credit :6*

Total Period : 75h

Exam Hrs :3

Objective:

To provide the fundamental knowledge about the various scopes of soil and agricultural microbiology, their concepts and its commercial aspects.

UNIT I Soil Microbiology

(15 Periods)

Physical chemical characteristics and micro flora of various soil types- Microbial interaction mutualism, amensalism and commensalism's role of microorganisms in biological cycles - nitrogen, phosphorus, sulphur and carbon cycles.

UNIT II Biofertilizers

(15 Periods)

Biological Nitrogen fixation- nitrogenase enzyme- Nif genes. Phosphate solubilization – Rhizosphere effect –mycorrhizal association; ecto and endomycorrhizae. Soil health - crop residues, humus, mineralization, Composting - vermicomposting, green manure. Effect of crop residues on plant growth

UNIT III Biological agents

(15 Periods)

Biological control of soil-borne microbial pathogens and nematodes - microbial pesticides. interaction of synthetic pesticides with soil microorganisms. Entomopathogenic fungi. Recent trends in pest management; strategies, mass production, formulation and applications technology, constraints.

UNIT IV Environmental Protection Act

(15 Periods)

Environmental Laws, national movements, sustainable development, environmental policies, environmental economics, environmental ethics – holistic approach of environmental protection and conservation, IUCN – role in environmental protection. Concept with reference to UN – declaration, aim and objectives of human right policies with reference to India, recent north-south debate on the priorities of implementation, Environmental Protection Agency(EPA).

UNIT V Bioremediation

(15 Periods)

Bioremediation of Oil spills, Wastewater treatment, chemical degradation, heavy Metals. Microbial decomposition; Cellulose, Hemicellulose, Lignin, Pectin and Chitin.

OUTCOME THE PAPER

Upon successful completion of the course, students are expected to be able to Learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment

and also learn different methods for their detection and characterization Competently explain various aspects of environmental microbiology and microbial ecology and to become familiar with current research in environmental microbiology.

REFERENCES

- Atlas R.M.andBartha .R.1992,Microbial Ecology. Fundamental and application .3 rd edition
Bengamin andCummings
- Alexander A M 1987.I ntroduction to soil microbiology,5 th edition John Wiley and sons
- Mitchell R 1974 ,Introduction to environmental Microbiology , mrentice –Hall Inc .,
EnglewoodCliffs.
- Rengasamy, G and D J Bagyaraj , Agricultural Microbiology ,Asia Publishing house NewDelhi.
- Randasamy G&Bagyaraj D.J. Agricultural Microbiology 2/e, Prentice –hall Publications1993
- Atlas , R.& Richard ,B. Microbial ecology 2/e Benjamin – Cummings publications 1987.
- Prescott L.M,Harley J . P &K lein D. A ., Microbiology , 6 /e , McGraw Hill Publishers,2006.,
- Madigan M.T.M Martinko J.M.& Brock P.J. Biology of Microorganisms8/e

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Define the basic view of soil Microorganisms	K1
CO 2	Understand the production of Biofertilizer	K4
CO 3	Explain the Microbial association in soil & organic forming	K3
CO 4	Discuss about Biogeochemical cycles	K4
CO 5	Discuss about Bioremediation and microbial decomposition	K5

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	M	S	S	S	M
CO 2	S	S	S	S	S
CO 3	S	S	M	S	M
CO 4	S	S	S	S	S
CO 5	S	M	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : X
INDUSTRIAL MICROBIOLOGY

Semester V

Course Code :21UMB5C10

Total Period : 75h

Max Marks : 75

Credit :6*

Exam Hrs :3

Objectives:

To train the students on bioprocess techniques so as to develop their employability skill for industry.

UNIT I Industrially Important Microorganisms (15 Periods)

Isolation of cultures – screening of new products from microorganisms- inoculum development – scale up of microbes , Primary and Secondary Screening – strain improvement – screening and selection auxotrophic mutant and revertant. Starter culture

UNITII Bioreactors (15Periods)

Bioreactions –Types of bioreactors. Bioreactors in bioprocessing of cells – enzyme bioreactors. Basis concepts in medium design – design procedure growth limiting nutrient in designed medium. Bio instrumentation and computer control of fermentation processes.

UNIT III Upstream Processing (15 Periods)

Types of fermentation- closed and open, aerobic and anaerobic, homolactic and heterolactic, fermentation media components- carbon source, nitrogen source, minerals and vitamins, growth factors, precursors, inducers, elicitors, inhibitors, anti-foaming agents, oxygen and water availability, media sterilization techniques

UNIT IV Downstream Processing (15 Periods)

Bioproducts recover – conventional recovery methods .cell disruption , foam separation , centrifugation , cell distruption – liquid – liquid extraction , counter – current distruption – chromatography. Crystallization andLyophilization.

UNIT V: Industrial Fermentation Products (15 Periods)

Biofuels – Ethanol, Hydrogen , Methane . Antibiotics – β – lactum antibiotics (synthetic penicillin) , Sterptomycin , Biopolymers – xanthan , polyhydroxyalkanotes . Thermostable enzymes – proteases .Amonoacids – Lysine Vitamins – Riboflavin , vitamins B12 Biosurfactants : a comparative account.

REFERENCES

- Mukhopadhyay , S.N., 2001 Process – biotechnology fundamentals . viva books(P) Ltd. Arnold.
L.Demain and Nadine A.Soloman .1986.Manual of industrial and biotechnology. Americal society for Microbiology ,WasgigtonDC
Stanbury , P.F., A .Whitaker and S .J .Hall .1995. principles of fermentation technology- second edition – Elsevier Publications.
Bioprocess Technology ; Fundamentals and Applications . stockholmKTH

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand Isolation of culture, inoculums development and strain improvement	K3
CO 2	Demonstrate the basic design of a fermenter and its types	K4
CO 3	Discuss the steps in upstream processing	K4
CO 4	Discuss the steps in downstream processing and assess the nature	K5
CO 5	Understand utility of various fermented products	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	M	S	M
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : XI
FOOD AND DAIRY MICROBIOLOGY

Semester V

Max Marks : 75

Course Code :21UMB5C11

Credit :5*

Total Period : 75h

Exam Hrs :3

Objective:

This course aims to provide instruction in the general principles of food microbiology and to understand microbiology of processed food, significance of different foods microorganisms, their control and other related aspects of dairy and other foods products.

UNIT I Introduction

(15 Periods)

Importance of food microbiology, types of microorganisms in food spoilage, factors affecting the growth of microorganisms in food microbiology – Food preservation – principles – methods of preservations-Physical and chemical methods food spoilage.

UNIT II Microbiology of Food Products

(15 Periods)

Contamination, spoilage and preservation of cereals and cereals products, sugar and sugar products, vegetables and fruits, meat and meat products – fish and other sea foods, egg and poultry . Role of microorganisms in beverages – tea and coffee fermentations.Single cell proteins-Spirulina&mushroom.

UNIT III Food Borne Diseases

(15 Periods)

Food intoxication and infection - bacterial and non –bacterial food borne diseases. Quality standards of food – Government regulatory practices and policies FDA, EPA,HACCP,BIS and FSSAI. Food sanitation in food manufacture and in retailtrade.

UNIT IV Fermented food sand Preservation

(15 Periods)

Methods and organisms used in bread-, wine, beer, vinegar fermentations – production and application of bakers yeast – soy sauce fermentation by moulds-fermented meat –sausages. Fermented vegetables –sauerkraut.Enzymes from microorganisms – production and application of microbial enzymes in food industry and preservation of fermented food and products.

UNIT V Dairy Microbiology

(15 Periods)

Micro flora of milk- sources of contamination –methods of minimizing contamination .milk borne infection – intoxication . Milk preservation methods-pasteurization – sterilization .Fermented dairy products – microbes involved in fermentation – starter lactic acid cultures – butter milk , cream , Youhurt , Kafir , Kumis ,Acidophilus milk and cheese production and its types.

REFERENCES

Frazier WC and Westhoff DC (1988) Food Microbiology, TATA McGraw Hill Publishing Company Ltd .NewDelhi

The microbiology of milk. Elsevier Applied Science, London. 8 Edward Harth, J.T. Steele. Applied Dairy Microbiology. 1998.

Modern Food Microbiology 4th Edition, Van Nostra and Rainhokdd Co.

Milk & Milk Products – fourth Edition – Clarence Henry Eckles, Tata McGraw Hill Publishing Company.

Fundamentals of dairy microbiology prajapati.. Volume Food Microbiology. 2nd Edition by Adams

Food Microbiology : Fundamentals and Frontiers by Dolle Biotechnology : food fermentation Microbiology, Biochemistry and Technology 2 by Joshi

Course Outcomes:

On the successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Outline the sources and components of food and their preservation techniques.	K2
CO 2	Analyze the factors influencing the food spoilage.	K3
CO 3	Outline the food intoxication and infection	K3
CO 4	Design appropriate techniques for the recovery of fermented products	K4
CO 5	Compare the production processes of various fermented foods.	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	M
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	M	S	S	S
CO 5	M	S	S	S	M

S- Strong, M- Medium, L- Low

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Perform Isolation of PGPR Bacteria	K4
CO 2	Isolate the Rhizobium from root nodules	K5
CO 3	Detect indole acetic acid producing bacteria	K5
CO 4	Determine the Nitrogen fixation activity of microorganisms	K4
CO 5	Determine the BOD and COD from sewage	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	S	S	S
CO 2	S	S	S	S	S
CO 3	M	S	S	S	S
CO 4	S	S	S	S	M
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE: I
CLINICAL RESEARCH

Semester V

Course Code :21UMB5M1A

Total Period : 75h

Max Marks : 75

Credit :4*

Exam Hrs :3

Objective:

To understand the basic needs of clinical research and promote knowledge on clinical ethical guidelines and to provide Internship at Hospitals to gain knowledge .

UNIT I Introduction to Clinical Research

(15

Periods)

Basic terminology used in clinical research: Types of clinical trials, single blinding, double blinding, open access, randomized trials and their examples, interventional study, ethics committee and its members, cross over design, etc. and Institution Ethics Committee / Independent Ethics Committee Data Management in clinicalResearch.

UNIT II Drug Discovery

(15 Periods)

Clinical trials New drug discovery process- Phase-I, II, III, IV trials.Pre clinical toxicology: General principles, Systemic toxicology, Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, animal toxicity requirements.

UNIT III Standardization of Drugs

(15 Periods)

Biological standardization, general principles, Scope and limitation of bio-assay, bioassay of some official drugs.Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED50 and LD50 determination, special toxicity test like teratogenecity andmutagenecity.

UNIT IV Regulatory Guidelines

(15 Periods)

Various regulatory requirements in clinical trials, Schedule Y, ICMR guidelines etc. Documents in clinical study Investigator Brochure (IB), Protocol & Amendment in Protocol , Case Report Form (CRF), Informed Consent Form (ICF) , Content of Clinical Trial Report Essential Documents in Clinical Trial Good Clinical Practice: ICH guidelines Indian GCP guidelines (CDCSO guidelines) ICMR Guidelines

UNIT V Clinical Trials andits Applications

(15 Periods)

Study of various clinical trials (completed or ongoing) Clinical Trial Application in India Import & Export of Drug in India Investigational New Drug application (IND) Abbreviated New Drug Application (ANDA). New Drug Application(NDA).

REFERENCES

Basic and Clinical Pharmacology, Prentice hall, International, Katzung, B.G. Clinical Pharmacology, Scientific book agency, Laurence, DR and Bennet PN.

Rick NG. Drugs From Discovery To Approval. John Wiley & Sons, Inc2004

atAllen Co, Lynda Sutton Clinical Drug Trials and Tribulations Second Edition, Revised and Expanded. Marcel Dekker, Inc.2002

Deborah Rosenbaum, Michelle Dresser. Clinical Research Coordinator Handbook Second Edition Practical Clinical Trials Series GCP Tools and Techniques Interpharm/CRC New York Washington, D.C.©2002

<https://www.healthline.com/health/clinical-trial-phases>

<https://www.drugs.com/new-drug-applications.html>

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the basic concepts of clinical research	K1
CO 2	Explain Adverse drug reaction and its management	K2
CO 3	Explain the standardization of drugs	K3
CO 4	Describe Pharmacoepidemiology, pharmacoconomics and safety pharmacology	K4
CO 5	Explain the regulatory requirements for conducting clinical trial	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	M	S
CO 2	S	S	S	S	S
CO 3	S	S	M	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	M	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE: I
MARINE MICROBIOLOGY

Semester V

Course Code :21UMB5M1B

Total Period : 75h

Max Marks : 75

Credit :4*

Exam Hrs :3

Objective:

This subject aims to introduce the students to understand microbial diversity , significance , dynamics of marine environment and marine microbial products.

UNIT I Marine Environment

(15 Periods)

Sea-benthic and littoral zone , salt pan , mangroves , estuarine and lagoon microbes , microbial loop – marine microbial community – planktons , bacteria , fungi , protozoa. Influence of physical , chemical and biological factors on marine microbes

UNIT II Characteristics of Marine Environment

(15 Periods)

Methods of studying marine microorganisms – sample collection –isolation and identification : cultural , morphological , physiological , biochemical and molecular characteristics – Preservation methods of marine microbes .Role of microorganisms in carbon , nitrogen phosphorus and sulphur cycles in the sea under different environments and mangroves.

UNIT III Extremophiles

(15Periods)

Survival at extreme environments – starvation – adaptive mechanisms in thermophilic ,alkalophilic,osmophilic and barophilic , psychrophilic microorganisms - hyperthermophiles halophiles and their importance.

UNIT IV Role of Microbes in Marine Environments

(15 Periods)

Microorganisms responsible for bioluminescence in marine environment.Uses of bioluminescence . Microbial indicators of marine pollution and control ,biofouling , biocorrosion biofilms , biodegradation and bioremediation of marine pollutants . use of genetically engineered microorganisms in biodegradation.

UNIT V Marine Products

(15 Periods)

Marine natural products ,bioactive compounds from marine microorganisms , marine biosensor . Biosurfactants , biopolymers and novel enzymes from marine organisms.

REFERENCES

Karl ,D& Buckley ,M (2005) Marine MicrobialDiversity.

Mitchell ,R (2008) Microbial Ecology of the OceansWiley

Colwell ,R&Belkin (2010) Ocean & health : Pathogens of the Marine Environment Springer

Miller ,C., Wheeler ,P.A (2012) Biological Oceanography Wiley – Blackwell.

Bhakuni DS and Rawat DS. Bioactive marine natural Products .AnamayaPublishers ,New Delhi2005.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the Sea-benthic and littoral zone and marine microbial community	K3
CO 2	Know the Methods of studying marine microorganisms	K4
CO 3	Explain the Extremophiles	K4
CO 4	Outline the Role of Microbes in Marine Environments	K5
CO 5	Know more about marine products	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	S	S	S
CO 2	S	S	S	S	S
CO 3	M	S	S	S	S
CO 4	S	M	S	S	S
CO 5	S	S	M	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE: I
VIROLOGY

Semester V

Max Marks : 75

Course Code :21UMB5M1C

Credit :4*

Total Period : 75h

Exam Hrs :3

Objectives:

This course aims to develop knowledge in virology like viral and phage Structures, Infections and diseases.

UNIT I Introduction to Virology

(15 periods)

Early development of virology General Structure, Properties and Classification-Baltimore, cultivation of Viruses- virus purification and assays.

UNIT II DNA Phages

(15 periods)

Reproduction of DNA phages- DNA lytic phages- lytic cycle of T4 phage.The one step growth, adsorption to the host cell and penetration- synthesis of Phage nucleic acids and protein assembly of phage particles- release of phage particles.

UNIT III RNA Phages

(15 periods)

Lysogeny- Temperate bacteriophages- lambda phage- induction of lysogens- Generation of defective phages and their uses.Reproduction of RNA phages.

UNIT IV Viral Replication Strategies

(15 periods)

Interaction of viruses with cellular receptors, entry of viruses, replication, assembly, maturation, and release of virions.

UNIT V Prevention and Control of Viral Diseases

(15 periods)

Anti viral compounds, interferons, viral vaccines.Applications of virology; use of viral vectors in cloning and expression, gene therapy and phage display.

REFERENCES:

Dimmock NJ, and Primrose SB. (1994). Introduction to Modern Virology. 4th edition. Blackwell Science Ltd

Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology. 6th edition (First Indian reprint 2007), Blackwell Publishing Ltd.

Carter J and Saunders V (2007). Virology: Principles and Applications. John Wiley and Sons.

Flint SJ, Enquist, LW, Krug, RM, Racaniello, VR, Skalka, AM (2004). Principles of Virology, Molecular biology, Pathogenesis and Control. 2nd edition. ASM press Washington DC.

Levy JA, Conrat HF, Owens RA. (2000). Virology. 3rd edition. Prentice Hall publication, New Jersey.

Wagner EK, Hewlett MJ. (2004). Basic Virology. 2nd edition. Blackwell Publishing. 7. Mathews.

(2004). Plant Virology. Hull R. Academic Press, New York.

Nayudu MV. (2008). Plant Viruses. Tata McGraw Hill, India.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the architecture of viruses, their classification and the methods used in their study	K3
CO 2	Discern the replication strategies of representative viruses	K4
CO 3	Outline the Lysogeny and Generation of defective phages	K5
CO 4	Know the Viral Replication Strategies	K5
CO 5	Know how viruses can be used as tools to study biological processes, as cloning vectors and for gene transfer.	K6

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	M
CO 2	S	M	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	M	S	S

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE: I
PHARMACOGNOSY

Semester V

Max Marks : 75

Course Code :21UMB5S1A

Credit :2*

Total Period : 24h

Exam Hrs :3

Objective:

This is to provide knowledge and information about pharmaceutical raw materials from natural sources, traditional medicines and chemical analysis and phytochemical screening of medicinal plants, medicinal plant biotechnology and phytotherapy .

UNIT I Pharmacognosy

(4 Periods)

Definition , History , Scope of Pharmacognosy including indigenous system of medicine and various systems of classification of drugs and natural origin .

UNIT II Sources of Drugs

(4 Periods)

Natural sources - Plants , Animals ,Marine , Mineral , Microorganisms and Synthetic sources of drugs.

UNIT III Classification of Drugs

(5 Periods)

Alphabetical , Morphological ,Taxonomical , Chemical and Pharmacological classification of drugs.

UNIT IV Formulation of Drugs

(6 Periods)

Methods of collection , process and storage of medicinal and aromatic plants ; purification of raw drugs; factors causing drug contamination, methods of storage of drugs.Formulations in Ayurveda , Siddha and Unani ; classical and modern means of drug administration – Pharmacognosy of crude drugs : based on market survey including adulterants and substitutes

UNIT V Pharmacodynamics

(5periods)

Overview and Principles of Pharmacodynamics.Drug-Receptor interactions, Chemical interactions.Dose-Response relationships.

REFERENCES

NarayanaAiyer,K.andKolammal.M.1963.*PharmacognosyofAyurvedicDrugs* (12 vol.). University of kerala , Thiruvananthapuram.

Trease ,G.E. and Evans, W.C 1983. *Pharmacognosy* (12th ed). Bailliere Tindall, London.

Vaidya ,B.1982 .Some Controversial Drugs in India Medicine .ChaukambikaOrientalia ,Varanasi.

Wallis,T.E.1997.Text Book of Pharmacognosy(5th ed) CBS Publishers &Distributors, Delhi.

Anonymous 1999 .The Ayurvedic Pharmacopoeia of India .Vol I (1&2).Ministry of health and family Welfare ,Govt . India ,New Delhi.

Chauhan M.G .and Pillai ,A.P.G .2005 .Microscopic Profile of Powdered Drugs Used inindiasystemsofmedicine.InstituteofAyurvedicMedicinalPlantSciences .Jamnagar

Hughes G. Friendly pharmacokinetics: a simple introduction. Nurse Prescribing 14(1):34-43,2016.

Aymanns C, Keller F, Maus S, et al. Review of pharmacokinetics and pharmacodynamics and the aging kidney. Clin J Am SocNephrol 5(2):314-327, 2010. doi:10.2215/CJN.03960609.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Define the History , Scope of Pharmacognosy	K2
CO 2	Understand the Sources of Drugs	K3
CO 3	Know about Classification of Drugs	K4
CO 4	Outline the Formulation of Drugs	K4
CO 5	Understand the Principles of Pharmacodynamics	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	S	S	M	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE: I
CLINICAL LAB TECHNOLOGY

Semester V

Max Marks : 75

Course Code :21UMB5S1B

Credit :2*

Total Period : 24h

Exam Hrs :3

Objective:

To Provide information used in clinical decision-making. Clinical laboratory services have a direct impact on many aspects of patient care including, but not limited to, length of stay, patient safety, resource utilization, and customer satisfaction.

UNIT I Introduction to Clinical Microbiology (5 Periods)

Managing Clinical Microbiology Laboratory. Methods of Collection, transport and processing of clinical specimens - Blood, Urine, Sputum, CSF, Pus & Faeces for microbiological examination. Separation of blood and serum.

UNIT II Examination of Urine (4 Periods)

Sample collection, Physical and Chemical tests, Principles and methods, Microscopic examination - crystals, casts, Sediments, Pregnancy test.

UNIT III Blood Analysis (5 Periods)

Staining & differential WBC count - Peripheral blood analysis examination and morphological abnormalities - Reticulocyte count - absolute eosinophil count - E.S.R and P.C.V. Blood indices - Platelet count: BT, CT, CRT - Prothrombin time. A.P.P.T and FDP estimation.

UNIT IV Laboratory Methods in Basic Mycology and Virology (6 Periods)

Collection and transport of clinical specimens - Microscopy, examination of culture media and incubation, Serological test for fungi. Laboratory methods in basic Virology - Viral culture - Media and cells used - specimen processing - Isolation and identification of Viruses. Viral Serology

UNIT V Laboratory Methods for Parasitic Infection (4 Periods)

Diagnostic techniques for fecal, Gastro intestinal and genital specimen . Microscopic examination and its significance . Identification of intestinal protozoa, Blood protozoa, Intestinal and Blood helminthes.

REFERENCES

- Bailey & Scott's (2014). Diagnostic Microbiology. 13th edition, The C.V. Mosby Company.
- Abdul Khader (2003). Medical Laboratory Techniques. First edition, Frontline Publications, Hyderabad.
- Mukherjee, L. (1997). Medical Laboratory Technology. Volume I & II. Tata McGraw-Hill Publishing Company Limited, New Delhi.
- Sundararaj, T (2005). Microbiology Laboratory Perungudi, Chennai-96. Manual,
- Godkar, P.B. (2003). Textbook of Medical Laboratory Technology, 2nd Edition, Bhalani Publication.
- Seiverd, Charles, E. Hematology for Medical Technologies, 4th Edition, Lea & Febiger, US.
- Ramink Sood, (2006). A Textbook of Medical Laboratory Technology, Jaypee Brothers Medical Publishers (p). LTD, New Delhi.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the Managing Clinical Microbiology Laboratory	K3
CO 2	Outline the Examination of Urine	K4
CO 3	Understand blood analysis	K4
CO 4	Know Laboratory Methods in Basic Mycology and Virology	K5
CO 5	Know the Laboratory Methods for Parasitic Infection	K6

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	M	S	S	S
CO 2	S	S	S	M	S
CO 3	M	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE: I
DIAGNOSTIC MICROBIOLOGY

Semester V

Course Code :21UMB5S1C

Total Period : 24h

Max Marks : 75

Credit :2*

Exam Hrs :3

Objective:

To provide up to date information of laboratory methods of the diseases of various etiologies which are of serious human health threat globally .

UNIT I Laboratory Methods in Mycology (5 Periods)

Collection and transport of clinical specimens – Direct Microscopic examination, culture media and incubation, Serological tests for fungi – Antifungal susceptibility testing. Diagnosis of Dermatophytes- Microsporum – Trichophyton, Epidermophyton- Madura mycosis- Opportunistic fungal infections- Candida albicans, Aspergillus, Mucor.

UNIT II Laboratory Methods in Parasitology (5 Periods)

Laboratory diagnosis methods for parasitic infections – Diagnostic techniques for faecal, gastrointestinal and urino-genital specimen. Parasitic diseases- *Entamoeba histolytica*, *Giardia lamblia*, *Taenia solium*, *Ascaris lumbricoides*, *Enterobius*, *Trichuris trichura*, *Plasmodium vivax*, *Wuchereria bancrofti*.

UNIT III Laboratory Methods in Bacteriology (5 Periods)

Etiology and laboratory diagnosis of Urinary tract infection- Meningitis, Diarrhea, Respiratory tract infections. Pyogenic infections- Staphylococcus and Pseudomonas: Sexually Transmitted Diseases (Bacteria), Nosocomial infections - definition, sources and detection; phage typing, Bacteriocin typing.

UNIT IV Laboratory Methods in Virology (5 Periods)

Viral culture- Media and cells used – Specimen processing – isolation and identification of viruses. Detection of viral antigen (fluorescent antibody and solid phase immunoassays). Viral Serology Special consideration- Hepatitis and AIDS.

UNIT V Therapeutic Agents (4 Periods)

Antibiotics and chemotherapeutic agents- Mechanism of actions – Drug resistance – Antimicrobial susceptibility testing- Disc diffusion- Kirby Bauer method.

REFERENCES

- Diagnostic Microbiology, Bailey and Scott's., 1990. 8th edition. The C.V. Mosby Company.
- Medical laboratory techniques, Abdul Khader, 2003, First edition. Frontline Publications, Hyderabad.
- Medical laboratory manual for tropical countries. Microbiology by Monica chees brough (ELBS).
- Tropical Health Technology, Butter worths,1985.
- Manual of Clinical Microbiology, Lenetle, E., Balows, H.A., Hausler, W.J and Shadomy J., 1985.
- Bethesda American Society ofMicrobiology.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Define the Direct Microscopic examination, culture media and incubation, Serological tests	K3
CO 2	Understand the Laboratory diagnosis methods for parasitic infections	K4
CO 3	Explain the Etiology and laboratory diagnosis of Urinary tract infection	K4
CO 4	Discuss about Viral culture	K5
CO 5	Discuss about Antibiotics and chemotherapeutic agents	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	M	M	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	M	S

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE : II
CELL BIOLOGY

Semester V

Course Code :21UMB5S2A

Total Period : 24h

Objectives

To Understand the Structure and organelles functions of microbes.

Max Marks : 75

Credit :2*

Exam Hrs :3

UNIT I Introduction

(5 Periods)

History of cell biology, cell as basic unit of life, cell theory, protoplasm theory and organismal theory, broad classification of cell types, Bacteria, Archaea (prokaryotic) and Eukaryotic cells and their similarities and differences

UNIT II Cell Structure

(5 Periods)

Structure and functions of cell wall: bacterial cell wall – plant cell wall and fungal cell wall, plasma membrane – exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport. Cytoskeleton structure – microtubules, microfilaments, intermediate filament.

UNIT III Cell Organelles I

(5 Periods)

Mitochondria – organization of respiratory chain, chloroplasts – photophosphorylation, nucleus, nucleolus, nuclear membrane and organization of chromosomes, cell cycle and its check points, cell division (mitosis and meiosis).

UNIT IV Cell Organelles II

(5 Periods)

Endoplasmic reticulum (rough endoplasmic reticulum and smooth endoplasmic reticulum), golgi apparatus, lysosomes, microbodies (peroxysomes and glyoxysomes), vacuoles, ribosomes, centriole and basal bodies.

UNIT V Cell Communication

(4 Periods)

Overview – types of cell signaling – signal molecules – signal amplification – receptor types – quorum sensing.

REFERENCES

Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.

Hardin J. and Bertoni G. (2017) Becker's World of the Cell, 9 thEdn (Global Edition). Pearson Education Ltd.

Cooper G.M. and Hausman R.E. (2016) The Cell – A Molecular Approach, 7th Edn. Sinauer Associates Inc.

Mason K.A., Losos J.B. and Singer S.R. (2017) Raven Johnson's Biology, 11th Edn. McGraw-Hill Education. 3. Karp G. (2010) Cell and Molecular Biology – Concepts and Experiments, 6 thEdn. John Wiley and Sons.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Know the History of cell biology, cells and their similarities	K4
CO 2	Outline the cell structure	K5
CO 3	Outline the cell organelles	K5
CO 4	Understand the basal bodies	K4
CO 5	Overview of cell communication	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	M	S	S	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	M

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE : II
ENDOCRINOLOGY

Semester V

Course Code :21UMB5S2B

Total Period : 24h

Max Marks : 75

Credit :2*

Exam Hrs :3

Objective:

To provide the knowledge and to understand the Endocrine glands and Hormones.

UNIT I Hormones

(5Periods)

Definition, Classification, Biosynthesis and circulation in blood.Mechanism of hormone action.Mechanism of steroid hormone receptors – Mechanism of action of steroid hormone.

UNIT II Pituitary Gland

(5 Periods)

Morphology, Thyrotropin releasing hormone (TRH), Gonadotropin releasing Hormone, Control of GH Secretion, Dopamine and control of prolactin secretion.Thyroid gland : Biosynthesis of Thyroid hormone, Iodine Trapping, Incorporation of Iodine, Mechanism of thyroid hormone action, Control of thyroid function .

UNIT III Hormonal Regulation of Fuel Metabolism

(4 Periods)

Body fuels – Glucose, Glycogen, Protein and fat. Overall regulation of blood glucose concentration (Short- term regulation, Long – term regulation)

UNIT IV Hormonal Control of Pregnancy and Lactation

(5Periods)

Puperty, Menstrual cycle – Menopause.Types and functions of placenta. Human Chorionic gonadotropin (HCG), Human chorionic Somatomammotropin (HCS), Corticotropin releasing hormone (CRH), Growth and development of mammary glands, MilkProduction.

UNIT V Reproductive Health

(5 Periods)

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminologies used in family planning .

REFERENCES

Bently, P. J., Comparative Vertebrate Endocrinology, Cambridge University Press.

Chandra, S. Negi, Introduction Endocrinology, PHI Learning Pvt. Ltd., New Delhi.

William, R. H., Textbook of Endocrinology, W. B. Saunders.

Gorbman et al., Comparative Endocrinology, John Wiley & Sons.

Yadav, B. N., Mammalian Endocrinology, Vishal Publishing Co., Jalandhar.

Martin, C. R., Endocrine Physiology, Oxford University Press.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Know the Definition, Classification of hormones	K3
CO 2	Outline the Pituitary Gland	K3
CO 3	Understand the Hormonal Regulation of Fuel Metabolism	K4
CO 4	Know Hormonal Control of Pregnancy and Lactation	K5
CO 5	Outline the Reproductive Health	K3

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	M	S	S
CO 5	M	S	S	M	S

S- Strong, M- Medium, L- Low

SKILL BASED ELECTIVE : II
BIOINSTRUMENTATION

Semester V

Max Marks : 75

Course Code :21UMB5S2C

Credit :2*

Total Period : 24h

Exam Hrs :3

Objective:

To understand the Principles, Mechanism and Application of the instruments.

UNIT I Biophysical Methods

(5 Periods)

Buffers, molars and normal solutions, pH meter, pH electrodes - calomel and glass electrodes. Incubator, water bath shaker, laminar airflow.

UNITII Centrifugation

(5 Periods)

Principle - types of centrifuges - low speed, high speed, ultra centrifuge, Differential centrifugation - density gradient centrifugation. Applications of centrifuge.

UNITIII Electrophoresis

(5 Periods)

Electrophoresis - SDS - PAGE and agarose gel electrophoresis. Southern blotting - Northern blotting- Western blotting- DOTblotting.

UNITIV Chromatography

(4 Periods)

Principle - typesofchromatograpgy.Paper, Thin layer, Column, Ion exchange, Gas chromatography andHPLC.

UNIT V Quantification Methods

(5Periods)

Colorimetry, Spectrometry - UV & visible spectrophotometer, Flame photometry, FACS.Biosensors.

REFERENCES

BajpaiPK (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand& Co. Ltd., NewDelhi.

Palanivelu P(2004). Analytical Biochemistry and Separation techniques. Third edition, MKU Co- op, Press Ltd., Palkalai Nagar, Madurai.

Gurumani N (2006). Research Methodology for Biological Sciences. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.

Subramanian MA (2005). Biophysics - Principles and Techniques. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.

John G Webster (2004). Bioinstrumentation. Student edition. John Wiley and Sons, Ltd.

RavishankarS(2001). A Text Book of Pharmaceutical Analysis.Thirdedition. Rx Publications, Tirunelveli.

Upadhyay&Upadhyay. Biophysical Chemistry, (2010). Himalaya Publishing house.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the pH meter, pH electrodes	K2
CO 2	Outline the Principle - types of centrifuges	K3
CO 3	Understand the Electrophoresis	K4
CO 4	Know more about Chromatography	K5
CO 5	Outline the Quantification Methods	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : XIII
MICROBIAL GENETICS

Semester VI

Course Code :21UMB6C13

Total Period : 75h

Max Marks : 75

Credit :6*

Exam Hrs :3

Objective:

In addition to the most essential fundamentals of the subject, the paper aims to impart the current updated knowledge on molecular genetics of prokaryotes. It also endeavors to provide the required details on eukaryotic molecular genetics.

UNIT I History of Genetics (15 Periods)

Mendalin genetics, Nucleic Acids: components and properties of nucleic acid. DNA structure and types, RNA types and structure. Genetic code properties. Wobble hypothesis

UNIT II Genetic Material (15 periods)

DNA as genetic material, Experiments of Griffith; Avery, McCleod ;McCarthy and Harshey Chase. RNA as genetic material, Experiments of Fraenkel and Singer

UNIT III Mutation (15 periods)

Mutation – cause of mutation. spontaneous and induced Mutagen & Mutagenesis. Base substitution, insertion and deletion. Point, silent and frame shift mutation chemical and physical mutants

Unit IV DNA Repair Mechanism (15 periods)

mismatch repair, Nucleotide Excision Repair (NER), Direct Repair of Damaged DNA, photoreactivation, Sos repair.

Unit V Genetic Exchange (15 periods)

Genetic exchange – Transduction (specialized & generalized), Transformation, Conjugation - Hfr mapping, genetic recombination.

REFERENCES

Molecular Biology of the Gene, 4th edition by Watson J.D, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner(1987) Benjamin/Cummings.

The RNA World (2nd edition) Gestel and R, T.Cech and J.Atkins(edition) 1999 Cold Spring Harbor, New York.

Cell biology and molecular biology by EDP Robertis and EMF Robertis, Saundercollege.

Molecular cell biology 2nd edition by Darnell.J, H.Lodish and D.Baltimore(1990), Scientific American books, New York.

GENES-IX by Benjamin Lewin.

Recombinant DNA Technology by Watson.

Molecular genetics by D.N. Bharadwaj

Advanced genetics by G.S. Miglani

Molecular biology techniques by Naik.

Genetics – analysis of genes and genomes- V Edition- Daniel L- Hartl and W. Jones.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Outline the history of history of genetics	
CO 2	Understand the DNA as genetic material	
CO 3	Know about Mutation and cause of mutation	
CO 4	Outline the Direct Repair of Damaged DNA	
CO 5	Understand the genetic exchange	

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	S	S	S	S
CO 3	M	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE : XIV
MOLECULAR BIOLOGY

Semester VI

Max Marks : 75

Course Code :21UMB6C14

Credit :6*

Total Period : 75h

Exam Hrs :3

Objective:

To understand the organization , expression, replication and regulation of the gene in both prokaryotes and eukaryotes .

UNIT I Genome Organization

(15

periods)

Organization of bacterial genome; Structure of eukaryotic chromosomes; Role of nuclear matrix in chromosome organization and function; Matrix binding proteins; Heterochromatin and Euchromatin; DNA reassociation kinetics(Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions; DNA methylation &Imprinting

UNIT II DNA Replication

(15

Periods)

DNA replication in prokaryotes: Replicons – models of DNA replication – origin and termination of replication – rolling circle replication – proof for semi conservative replication (Meselson and Stahl Experiment) –

UNIT III Enzymes and Factors

(15 Periods)

Major enzymes involved in DNA replication (nucleases, polymerases, ligases, helicases, gyrases,Topoisomerase, single strand binding protein, replisome and primosome) – mechanism of semi discontinuous replication.Transcriptional factors and regulatoryelements

UNIT IV Prokaryotic Gene Expression

(15 periods)

Organization of gene: upstream and down stream region of gen. promoter, operator, regulan. One gene one enzyme concept. Transcription and translation.

UNIT V Eukaryotic Gene Expression

(15 periods)

Structure and organization of eukarytic genome. Enhancers, transcription factors. Post transcriptional modification-RNA splicing. Post translationalmodification

operon concept- Inducible operon –lactose utilization system. repressible operon- trp operon

REFERENCES

J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6th Edition, Benjamin Cummings Publishing Company Inc, 2007.

Alberts et al; Molecular Biology of the Cell, 4th edition, Garland,2002.

Rastogi S.C, V.N. Sharma, AnuradhaTanden, Concepts in molecular biology,1993

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Discuss the structure, properties and functions of nucleic acids	
CO 2	Compare the mechanisms of DNA replication and repair between prokaryotes and eukaryotes	
CO 3	Assess the concept of Enzymes and Factors	
CO 4	Explain the process of Prokaryotic Gene Expression	
CO 5	Explain the process of Eukaryotic Gene Expression	

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	M
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

CORE COURSE: XV
PRACTICAL PERTAINING MICROBIAL GENETICS, MOLECULAR BIOLOGY

Semester VI

Max Marks : 60

Course Code :21UMB6C15P

Credit :6*

Total Period : 75h

Exam Hrs :3

Objective:

Explain the relationship between genetics, inheritance, genes and genomes. Describe the structure of DNA and individual nucleotides.

1. Scoring of auxotrophic mutant by UV **(7Periods)**
2. Competent cell preparation **(7Periods)**
3. Gene transformation- blue white selection **(7Periods)**
4. Plasmid DNA Isolation **(7Periods)**
5. Chromosomal DNA isolation **(8Periods)**
6. Gelelectrophoresis **(8Periods)**
7. Protoplast generation **(7Periods)**
8. Demonstration of Southern blotting **(8Periods)**
9. Demonstration of Western blotting **(8Periods)**
10. Demonstration of Polymerase Chain Reaction **(8Periods)**

REFERENCES

Ananthanarayanan R and Paniker CKJ.(2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University press publication.

Brooks GF, Carroll KC, Butel JS and Morse SA.(2007). *Jawetz, melnick and adelbergs medical microbiology*. 24th edition. McGraw Hillpublication.

Goering R, Dockrell H, Zuckerman M and Wakelin D.(2007). *Mims' Medical Microbiology*, 4th edition. Elsevier.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Perform Scoring of auxotrophic mutant by UV	
CO 2	Perform Competent cell preparation	
CO 3	Analyze the Gene transformation	
CO 4	Protoplast generation	
CO 5	Demonstrate Southern blotting	

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	M	S	S	S
CO 4	S	S	S	S	S
CO 5	S	M	S	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE: II
FORENSIC BIOLOGY

Semester VI

Max Marks : 75

Course Code :21UMB6M2A

Credit :4*

Total Period : 75h

Exam Hrs :3

Objective :

To make the students to understand the examination of different samples of humans for forensic study.

UnitI Blood

(15 Periods)

Composition, functions and forensic significance. Tests for identification of blood – Presumptive and confirmatory tests. Species identification. Blood groups – Introduction and identification. Typing of dried blood stains.

UnitII Semen

(15 Periods)

Composition, functions and forensic significance. Morphology and lifespan of spermatozoa. Tests for identification of semen – Presumptive and confirmatory tests. Azoospermic and oligospermic conditions.

Unit III Forensic Analysis

(15 Periods)

Composition, functions and Forensic significance of saliva, sweat, urine, faecal stains, milk and vomit. Tests for their identifications. Significance and origin of hair evidence. Structure and morphology of human hair. Comparison of hair samples - human and animal hair.

Unit IV Entomology and it's significance in forensics

(15 Periods)

Forensic palynology – introduction and significance. Forensic examination of wood, seeds, leaves and diatoms. Wildlife forensics – introduction, agencies involved. IUCN red list.

Unit V Forensic Microbiology

(15

Periods)

Introduction to microbiology, types of microbes. Microbial growth and environmental factors affecting the growth. Different methods for isolation of microorganisms from forensic samples like vomit, stool, stomach wash and residual food. Introduction to bioterrorism, popular case studies of bioterrorism.

OUTCOME OF THIS PAPER

After completion of course the students will have knowledge of Principles of Forensic science. The detail study will help to understand about the basics and different branches of Forensic Sciences. Will help to know about the working and functioning of Forensic science laboratories.

REFERENCES

Lehninger, Principles of Biochemistry, 7th Edition.

Alan Gunn, Essential Forensic Biology, 2nd Edition, Wiley(2009)

L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York(1988).

R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry, APPLETON & Lange, Norwalk(1993).

R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey(1993).

G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton(1997).

G.T. Duncan and M.I. Tracey in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton(1997).

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Know more about Composition, functions and forensic significance of blood	K3
CO 2	Understand the Composition, functions and forensic significance of urine	K4
CO 3	Outline Forensic Analysis	K4
CO 4	Understand the Entomology and it's significance in forensics	K5
CO 5	Outline the Forensics microbiology	K6

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	M	S	S	S	M
CO 2	S	M	M	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	M	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE : II
MYCOLOGY

Semester VI

Max Marks : 75

Course Code :21UMB6M2B

Credit :4*

Total Period : 75h

Exam Hrs :3

Objective:

This paper deals to an explosion of knowledge relating to fungi with a traditional base.

UNIT I Historical Perspectives

(15 Periods)

History and significance of mycology in the scientific development. General characteristics of fungi - Structure and organization of fungi – The fungal body and cells, Colony, communication and signaling. Cell differentiation and reproduction. Reproduction in fungi - Vegetative, asexual and sexual reproduction in fungi with special reference to their significance.

UNIT II Taxonomy

(15 Periods)

Criteria for classification. Traditional, Chemo and molecular taxonomy and their significance. Myxomycetes, Ascomycetes, Basidiomycetes and imperfect fungi. Ecology (Fungal Lifestyle)- the way they make their living, Distribution of yeasts and fungi

UNIT III Nutrition and Metabolism in Fungi

(15 Periods)

Nutritional requirement of fungi, saprophytic, parasitic, obligatory and facultative. Culture media for fungi, Natural substrates of fungi. Biotrophic semi-biotrophic and necrotrophic mode of growth. Fungal-microbe interaction, fungal - plant interactions – symbiotic and antagonistic interactions.

UNIT IV Endophytic Fungi

(15 Periods)

Symbiotic and opportunistic associations, co evolution and loss of reproductive structures, Secondary metabolite production, toxins – importance, toxicity to herbivores and insects. Use of endophytic fungi as biocontrol agents against plant diseases, insect herbivores. Mycorrhizal associations – endo and ectomycorrhiza.

UNIT V- Significance of Fungi in Human and Livestock Health

(15 Periods)

Significance of yeasts and fungi in agricultural production – symbiotic fungi, fungi in improving plant productivity, fungi in biocontrol; Significance of fungi in biotechnology and industrial production; Fungal metabolites and their economic significance – mycotoxins, medicinal uses of fungi (antibiotics), food additives, alcohol, vinegar, enzymes, biopesticides. Fungi as food – mushrooms, Mushroom poisoning.

REFERENCES

Ainsworth (2009), Introduction to the History of Mycology, Cambridge University Press

Mehrotra RS and KR Aneja. An Introduction to Mycology, New Age Publishers

P. D. Sharma (2005), Fungi and Allied Organisms. Alpha Science International Publishers

Bennett, J. W., and M. Klich. 2003. Mycotoxins. Clin. Microbiol. Rev. 16:497-516.

P. D. Sharma (2006), Plant Pathology. Alpha Science International Publishers.

Steven L. Stephenson (2010), The Kingdom Fungi: The Biology of Mushrooms, molds and lichens.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the History and significance of mycology	K3
CO 2	Overview of Taxonomy	K4
CO 3	Outline the Nutritional requirement and metabolism of fungi	K4
CO 4	Discuss the Endophytic Fungi	K5
CO 5	Understand Significance of Fungi in Human and Livestock Health	K6

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	M	S	S	S
CO 3	S	S	S	S	S
CO 4	M	S	S	S	S
CO 5	S	S	M	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE : II
RECOMBINANT DNA TECHNOLOGY

Semester VI

Max Marks : 75

Course Code :21UMB6M2C

Credit :4*

Total Period : 75h

Exam Hrs :3

Objective:

To provide knowledge about the cloning techniques enzymes used in the r DNA technology and the techniques used for gene manipulation .

UNIT I Gene Manipulation

(15 Periods)

Definition and Application, Restriction Enzymes, Discovery, Types and Mode of Action, Ligases and Methylases, Modifying enzymes- Alkaline Phosphatase, Phosphonucleo Kinase.

UNIT II Gene Cloning

(15 Periods)

cloning strategies. Chemical Synthesis of DNA, Genomic Library and cDNA Library construction. Knockout mice.

UNIT III Vectors

(15 Periods)

Plasmid based Vectors- Natural (PSC101, RSF2124, PMB1), Artificial – pBR322 & pUC 18
Construction: Phage based Vectors- λ) Lamda phage Vectors and its Derivatives: Hybrid Vectors- Phagemid, Phasmid and Cosmid, BAC and YAC.

UNIT IV Gene Transfer Techniques

(15 Periods)

Physical – Biolistic Method, Electroporation, Microinjection. Chemical- Calcium chloride and DEAE Methods, liposomes, Biological in vitro package method .Screening and Selection of recombinants - direct and indirect method.

UNIT V Molecular Techniques

(15 Periods)

PCR and its application. DNA Sequencing (Sanger's Method AND Next gen sequencing) Blotting (Southern, Western, Northern) Techniques, RFLP and Application, - RAPD and Application - Microarray.

OUTCOME OF THIS PAPER

Upon completion of this course, students will be able to explain the mechanisms of action of restriction endonucleases and DNA modifying enzymes. Discuss the biology of cloning and expression vectors and their methods of gene transfer into bacteria, plants and animals. Evaluate the cloning strategies of genomic library & cDNA construction, PCR, blotting techniques and DNA sequencing. Compare the various methods of selection and screening of recombinants. Assess the various applications of genetic engineering

REFERENCES

Old. RW and Primrose, 1995 Principles of Gene Manipulation, 5th edition. Blackwell Scientific Publication, Boston.

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

T.A Brown 1995, 3rd edition, An introduction to Gene Cloning ,Chapman and Hall.

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

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Define the gene manipulation	K4
CO 2	Outline the gene cloning	K5
CO 3	Understand vectors and their types	K5
CO 4	Know about Gene Transfer Techniques	K6
CO 5	Understand Molecular Techniques	K5

Mapping with Programme Outcomes:

Cos/Pos	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	M	S
CO 2	S	S	S	S	S
CO 3	S	S	M	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE: III
GENETIC ENGINEERING

Semester VI

Max Marks : 75

Course Code :21UMB6M3A

Credit :4*

Total Period : 75h

Exam Hrs :3

Objective:

To make the students to understand the applications of genetic engineering technique in different fields .

UNIT I Synthesis of Commercial Products

(15Periods)

Microbial synthesis of commercial products-Proteins-Pharmaceuticals – Interferons - Human growth hormone- Antibiotics -Biopolymers.

UNITII Vaccines

(15 Periods)

Vaccines-Subunit vaccines, Edible vaccine, Recombinant vaccine – Monoclonal antibody.Gene therapy.

UNIT III Transgenic Plants

(15

Periods)

Transgenic plants-Ti plasmid – insect, virus, herbicide resistant plants – microbial insecticides – bacteria, fungi andviruses.

UNIT IV Transgenic Animals

(15

Periods)

Transgenic animals-mice – retroviral method – DNA Microinjection method – embryonic stem cell method- Application-Transgenic - sheep – Transgenic fish .

UNIT V Applications of Genetic Engineering

(15 Periods)

DNA finger printing and its Application.Human Genome Project and History and its Application.

REFERENCES

Brown T.A 1995 An Introduction to gene cloning.3rd edition. Chapman andhall

Bernard. R Glick and Jack JPasternak.1994 Molecular biotechnology, Panima
PublishingCorporation.

U.Sathyannarayana., Biotechnology Books and Allied (P) Ltd.,(2005)FirstEdition.s

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Explain the Microbial synthesis of commercial products	K3
CO 2	Explain the vaccines and types	K4
CO 3	Outline of transgenic plants	K3
CO 4	Outline the transgenic animals	K5
CO 5	Understand the application of genetic engineering	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	M	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	M	S	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE : III
MICROBIAL TECHNOLOGY

Semester VI

Max Marks : 75

Course Code :21UMB6M3B

Credit :4*

Total Period : 75h

Exam Hrs :3

Objective:

To provide information on the fundamentals of the fermentation process, strain improvement and culture, and the use of different microorganism for the production of a variety of industrial products.

UNIT I Introduction to Fermentation Technology (15 Periods)

Chronology and components of fermentation processes - A general account on microbial biomass, enzymes, metabolites and recombinant products - Range of fermentation processes -Transformation processes. Isolation, preservation, optimization and improvement of industrially important microorganisms.

UNIT II Fermentor and Media (15 Periods)

Fermentor - basic functions- body construction-aerators, agitators (impellers and spargers) - asepsis-containment-valves and steam traps- types of fermentors. Substrates for media preparation-Medium formulation–Sterilization of medium.Steps and methods in recovery of products.

UNIT III Food, dairy, Beverages (15 Periods)

Single cell proteins (SCP) - SCP as food and feed –mass cultivation of Spirulina– Mycoprotein - Yogurt and cheese production. Alcoholic beverages–Beer and wine fermentation.

UNIT IV Pharmaceutical and Related Industries (15 Periods)

Antibiotics-sources and types- production of Penicillin and Streptomycin.Production of insulin and Hep B vaccine.Transformation of steroids.Vitamins-Production of vitaminB12.

UNIT V Production of Microbial Products (15 Periods)

Microbial Enzymes-Production and application of amylase, protease, and lipase. Microbes used for amino acid production-production of L-glutamic acids- Organic acids: citric acid, acetic acid production-Bioplastics and Exopolymerproduction

OUTCOME OF THIS PAPER

By the conclusion of this course, the students Outcome Have developed a very good understanding of areas where Microbial Technology has the potential for possible commercialization.

REFERENCES

- Crueger F and AnnelieseCrueger, 2000. Biotechnology: Industrial Microbiology Panima publishing Corporation, NewDelhi.
- Stanley, P. F.,Whittaker, A. and Hall, S.J., 1995. Principles of Fermentation technology First edn, Pergamon Press,UK.
- Balasubramanian, D., Bryce, C. F. A., Dharmalingam, K., Green, J. and KunthalaJayaraman,1998.Concepts in Biotechnology, COSIST Publications,India.
- Adams, M.R. and Moss, M.O., 1995. FoodMicrobiology New Age International Publishers,NewDelhi.
- Casida, L. E. Jr. 1996. Industrial Microbiology.New Age International Publishers, NewDelhi.
- Alexander N. Glazer and Hiroshi Nikaido, 1994. Microbial Biotechnology: Fundamentals of Applied microbiology. W.H. Freeman and Co., New York.
- Satyanarayana U. 2010. Biotechnology, Books and Allied (P) Ltd.Kolkata.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand Chronology and components of fermentation processes	K3
CO 2	Know about Fermentor and Media	K3
CO 3	Outline Food, dairy, Beverages	K4
CO 4	Understand Antibiotics-sources and types	K5
CO 5	Discuss Production of Microbial Products	K5

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	M	S	M
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	M	S	S	S	S

S- Strong, M- Medium, L- Low

MAJOR BASED ELECTIVE :III
MICROBIAL TAXONOMY AND BIOINFORMATICS

Semester VI

Max Marks : 75

Course Code :21UMB6M3C

Credit :4*

Total Period : 75h

Exam Hrs :3

Objectives

To Make the students to understand the Taxonomy of microbes based on various aspects like growth , nutritional and reproduction.

UNIT I Introduction To Taxonomy (15 Periods)

Basics of microbial taxonomy- concept of species and taxa and strain. Classification systems- Numerical taxonomy or Adansonian classification, phenetic and phylogenetic Classification.

UNIT II Bacterial Taxonomy (15 Periods)

Principles and modern approaches of bacterial taxonomy. Basic idea about Hackel and Whittaker's kingdom concept and domain concept of Carl Woese. Out line classification of bacteria and archaea as per 2nd edition of Bergy's Manual.

UNIT III Molecular Characteristics (15 Periods)

Biodiversity and systematics Modern trends in taxonomy chemotaxonomy, molecular systematics, numerical taxonomy (only brief idea). Characters used in microbial taxonomy (morphological, physiological, ecological, genetics protein content, nucleic acid sequence and base composition)

UNITIV–Bioinformatics (15Periods)

Analytical tools for sequences databanks: BLAST, FASTA, Pairwise alignment- Multiple alignment- ClustalW, PRAS. Evolutionary analysis: distances – clustering methods – rooted and unrooted tree representations – bootstrapping strategies

UNITV Databases (15 Periods)

Biological databases, Importance of databases, Nucleic acid sequence databases, Protein databases and Structure database (SCOP, CATH, KEGG, OMIM).

REFERENCES

Fundamentals of Bacteriology by A.JSalle

Principles of Microbiology by RonaldAtlas.

Microbial Physiology. 4th edition. John Wiley & Sons.

Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India.

Huson DH, et al. MEGAN analysis of metagenomic data, genome -2007.

Parkhill J., Birney E, and Kersey P. (2010) Genomic information infrastructure after the deluge.

Genome Biol.

Course Outcomes:

On the Successful completion of the course the student would be able to

CO Number	CO STATEMENT	KNOWLEDGE LEVEL
CO 1	Understand the microbial taxonomy	K3
CO 2	Know the Principles and modern approaches of bacterial taxonomy	K4
CO 3	Outline Biodiversity and systematics Modern trends in taxonomy chemotaxonomy	K5
CO 4	Understand the Analytical tools for sequences databanks	K5
CO 5	Know about database	K4

Mapping with Programme Outcomes:

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	M	S	M	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	M

S- Strong, M- Medium, L- Low