SYLLABUS

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)

VISAKHAPATNAM-13

(Affiliated To Andhra University, Visakhapatnam)

DEPARTMENT OF MICROBIOLOGY

SEMESTER – V

COURSE – 12A: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (24MICM51A)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION

The objective of the course is to make the student aware of

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understanding the key concepts in Immunology and how the immune system is able to discriminate self vs. non-self	Level 2 (Understanding)
CO 2	Understand and analyze how the innate and adaptive immune systems work together to generate an effective immune response against a specific pathogen.	Level 2 (Understanding) Level 4 (Analyzing)
CO 3	Understand and apply how the immune system is able to respond to so many diverse antigens	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understand the importance of pathogenic microorganisms and analyse in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract etc	Level 2 (Understanding Level 4 (Analyzing)
CO 5	Assess to understand and able to correlate disease symptoms with causative agent, isolate and identify pathogens.	Level 5 (Evaluate)
CO-PO Mapping		
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation		

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**1**	**–**	**–**	**–**	**–**	**-**	**1**	**1**	**1**	**2**

CO 2	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**1**	**2**	**2**
CO 3	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**1**	**3**	**2**
CO 4	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**1**	**3**	**2**
CO 5	**3**	**–**	**–**	**–**	**–**	**-**	**2**	**1**	**3**	**2**

CO – PSO MAPPING

"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**2**	**1**	**1**	**-**	**1**
CO 2	**2**	**2**	**2**	**-**	**2**
CO 3	**2**	**2**	**3**	**-**	**2**
CO 4	**2**	**2**	**3**	**-**	**2**
CO 5	**2**	**2**	**3**	**-**	**2**

Unit - 1: Immune System No. of Hours:9

1. Introduction: History and Scope of Immunology, Types of Immunity: Innate and Adaptive immunity, Active and Passive immunity, Cell mediated immunity, MHC, Phagocytosis.
2. Primary and secondary organs of immune system - thymus, Bursa Fabricius, bone marrow, spleen, lymph nodes and lymphoid tissues.
3. Cells of immune system- B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils. Complement system (in brief).

Unit - 2: Immune response No. of Hours 9

1. Antigens, antigenic determinants, Factors affecting antigenicity, haptens.
2. Antibodies - basic structure and types.
3. Generation of Immune Response – Primary and Secondary, Humoral Immune Response, Hypersensitivity- definition and types (in brief)

Unit - 3: Microbes in Health and Disease No. of Hours:9

1. Normal microflora of human body.
2. Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence,Toxigenicity, Opportunistic Infections, Nosocomial infections.
3. General account on microbial diseases - causal organism, pathogenesis,epidemiology, diagnosis, prevention and control of the following

Bacterial diseases - Tuberculosis, Typhoid,
Fungal diseases – Candidiasis, Aspergillosis
Viral Diseases –Hepatitis- A and AIDS
Protozoan Diseases – Entamoeba histolytica, Plasmodium

Unit - 4: Principles of DiagnosisNo. of Hours: 9

1. General principles of diagnostic microbiology- Collection, transport of clinical Samples, Identification by culturing
2. Identification by biochemical/physiological properties
3. Identification by molecular assays (PCR, DNA probes) and serological tests (ELISA, Immunofluorescence, Agglutination, Precipitation), complement fixation

Unit - 5: Prevention and Treatment No. of Hours: 9

1. Vaccines - Active (Natural and recombinant) and passive, Interferons.
2. Antimicrobial agents- General modes of action of antibacterial (Penicillin, Streptomycin), antifungal (Amphotericin and Griseofulvin), antiviral (Amantadine, Acyclovir) agents
3. Antibiotic resistance -Tests for antimicrobial susceptibility (Disc diffusion), Double dilution method.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**
1.	**UNIT I-** History and Scope of Immunology, Cell mediated immunity, MHC, Phagocytosis.	This topic is moved from unit II to unit I as studying this topic lays the foundation for Immunology.
2.	**UNIT II-** Antigenic determinants, Factors affecting antigenicity, haptens.	Understanding the clear picture about antigens.
3.	**UNIT III-** Protozoan Diseases – Entamoeba histolytica, Plasmodium	Understanding the Protozoan Diseases also.

4.	**UNIT V-** Double dilution method.	Knowing the method of Double dilution is crucial for every microbiologist as this is the most important method.

II Skill Outcomes:

By the completion of the course the learner should able to–

1. Perform some of the ag-ab reactions
2. Carry out the biochemical tests useful for identification of bacteria
3. Perform antibiotic sensitivity test
4. Identify some common symptoms and relate them to etiology
5. Prepare some differential media routinely used for identification of bacteria

SEMESTER V

PRACTICAL COURSE 12A: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Credits – 1

LIST OF EXPERIMENTS

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (E. coli, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of
6. bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Isolation of bacterial flora of skin by swab method.
7. Antibacterial sensitivity by Kirby-Bauer method
8. Determination of minimal inhibitory concentration of an antibiotic
9. Study symptoms of the diseases with the help of photographs: Anthrax,Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
10. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.

SKILL OUTCOMES:

1. Implement safety protocols, handling hazardous materials, and practicing personal protective measures.
2. Identify microscope parts, adjusting focus and diaphragm, and accurately observing and documenting microscopic images.
3. Prepare smears, identifying different microorganisms, and interpreting microscopic characteristics.
4. Operate Autoclave, Hot Air Oven, and Laminar Air Flow Chamber for sterilization and decontamination purposes.

VI. Co-Curricular Activities:

1. Screening of Blood groups
2. Visit to Diagnostic /Laboratory
3. Competition on composition and sterile media preparation
4. Competition on Isolation and Identification of bacteria from a sample

III References

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
6. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
7. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill.
8. M.N.Reddy Microbiology: a laboratory manual / James G. Cappuccino, Natalie.
9. Plant pathology and Microbiology- K.R.Aneja
10. Mackie &Mccartney Practical Medical Microbiology,

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COURSE – 12A: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (24MICM51A)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	**Immune System**	1 out of 2	2	12 M
2.	Unit – II	**Immune response**	1 out of 2	2	12 M
3.	Unit – III	**Microbes in Health and Disease**	1 out of 2	2	12 M
4.	Unit – IV	**Principles of Diagnosis**	1 out of 2	2	12 M
5.	Unit – V	**Prevention and Treatment**	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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DEPARTMENT OF MICROBIOLOGY
SEMESTER – V
COURSE – 12B: PHARMACEUTICAL MICROBIOLOGY (24MICM51B)
HOURS PER WEEK: 3 **CREDITS – 3**
COURSE DESCRIPTION
The objective of the course is to make the student aware of
COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand the key concepts in principles of bio-safety cabinets and biological waste management	Level 2 (Understanding)
CO 2	Understand and apply the methods of detection of microorganisms in pharmaceuticals	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understand and apply the molecular methods of detection of pathogens for quality control	Level 2 (Understanding) Level 3 (Applying)
CO 4	Categorise the Design/select and analyze specific media for identification of microbes in pharmaceutical products	Level 4 (Analyzing)
CO 5	Apply and assess Practice safety principles	Level 3 (Applying) Level 5 (Evaluate)

CO-PO Mapping
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**1**	**–**	**–**	**–**	**–**	**-**	**1**	**–**	**–**	**2**
CO 2	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**–**	**–**	**2**
CO 3	**2**	**–**	**–**	**–**	**–**	**–**	**3**	**–**	**–**	**2**

CO 4	**3**	**–**	**–**	**–**	**–**	**–**	**3**	**–**	**2**	**2**
CO 5	**3**	**–**	**–**	**–**	**2**	**-**	**3**	**–**	**3**	**2**
CO – PSO MAPPING										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**2**	**1**	**1**	**3**	**1**
CO 2	**3**	**2**	**1**	**3**	**2**
CO 3	**3**	**1**	**1**	**3**	**3**
CO 4	**3**	**2**	**1**	**3**	**3**
CO 5	**3**	**3**	**2**	**1**	**2**

Unit 1: Introduction to Pharmaceutical Microbiology No. of Hours: 9

1. Types of Antibiotics-β-lactam antibiotics, tetracycline group Rifamycin, aminoglycoside antibiotics, macrolides, polypeptide antibiotics, glycopeptide antibiotics, miscellaneous antibacterial antibiotics and antifungal antibiotics.
2. Mechanism of action of antibiotics – the bacterial cell wall, protein synthesis, chromosome function & replication, folate antagonist, the cytoplasmic membrane.
3. Significance of microbiology in the pharmaceutical industry; Microbial contamination and spoilage of pharmaceutical products.

Unit 2: Microbial Control in Pharmaceuticals No. of Hours: 9

1. Sterilization methods: physical and chemical sterilization techniques. Disinfection methods: types of disinfectants, their modes of action, and applications.
2. Microbial preservation of pharmaceutical products: antimicrobial agents and their efficacy.
3. Principles of aseptic techniques and clean rooms, BSL

Unit 3: Microorganisms of Pharmaceutical Importance No. of Hours: 9

1. Identification and characteristics of microorganisms commonly found in pharmaceutical environments.
2. Environmental monitoring and microbial enumeration techniques; Bioburden testing and its importance
3. Overview of current Good Manufacturing Practices (cGMP) and regulatory requirements

Unit 4: Microbial Quality Control **No. of Hours: 9**

1. Ecology of Microorganisms as it effects the pharmaceutical industry; Microbial spoilage & preservation of medicines using antimicrobial agents;
2. Quality assurance and the control of microbial risk in medicines. Contamination of non-sterile pharmaceuticals in hospital & community environments.
3. Validation and qualification of manufacturing processes and equipment and Environmental monitoring and trend analysis in pharmaceutical facilities.

Unit 5: Microbiology in Product Development **No. of Hours: 9**

1. Microbial aspects of product development and formulation.
2. Microbial stability testing of pharmaceutical products.
3. Microbial quality control in vaccine production.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**
1.	**UNIT I-**Types of Antibiotics-β-lactam antibiotics, tetracycline group Rifamycin, aminoglycoside antibiotics, macrolides, polypeptide antibiotics, glycopeptide antibiotics, miscellaneous antibacterial antibiotics and antifungal antibiotics	Understanding about different types of Antibiotics used in our daily lives.
2.	**UNIT II-**Principles of aseptic techniques and clean rooms, BSL	This topic is shifted from Unit-1
3.	**UNIT III-** Overview of current Good Manufacturing Practices (cGMP) and regulatory requirements	This topic is shifted from Unit-1
4.	**UNIT IV-** Contamination of non-sterile pharmaceuticals in hospital & community environments.	Understanding the pharmaceuticals in hospital & community environments is necessary for microbiology student.
Topics Deleted		

1.	**UNIT III-** Pathogenic microorganisms and their significance in pharmaceutical products	These topics were already covered in Unit-5. Hence the repetitive topics were omitted.
2.	**UNIT V** -Microbial assays for antibiotics and other Pharmaceutical substances	These topics were already covered in Unit-1. Hence the repetitive topics were omitted as these topics were more relevant there.

Skill Outcomes: By the completion of the course the learner should able to–
1. Perform sterility tests for equipment.
2. Employ disinfection methods of selected instruments
3. Perform sterility test of air in the lab
4. Test the sterility of microbiological media
5. Test the sterility of pharmaceutical products

SEMESTER V
PRACTICAL COURSE 12B: PHARMACEUTICAL MICROBIOLOGY
Credits – 1

LIST OF EXPERIMENT
1. Sterility tests for Instruments – Autoclave & Hot Air Oven
2. Disinfection of selected instruments &Equipment
3. Sterility test of Air in Laboratory.
4. Sterility testing of Microbiological media
5. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
6. Standard qualitative analysis of water.
7. Analysis of food samples for Mycotoxins

III. References
1. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition.Springer
4. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
5. Microbiology - A laboratory manual, Cappuccino &Sherman , 6 th Ed, Pearson Education
6. Manual of diagnostic microbiology, Dr.B.J.Wadher&Dr.G.L.Bhoosreddy, First Ed ., Himalaya publishing house, Nagpur.
8. Pharmaceutical Microbiology – W.B. Hugo
9. Pharmaceutical Microbiology – Purohit
10. Laboratory Exercises in Microbiology, George.A.Wistreich&Max.D.Lechtman, 3rd Ed, Glencoe press, London.

IV. Co-Curricular Activities:
1. Visit to pharmaceutical Company

2. Project on QC and QA methods in pharma
3. Assignments on collecting SoPs from Pharma labs

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COURSE – 12B: PHARMACEUTICAL MICROBIOLOGY (24MICM51B)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Introduction to Pharmaceutical Microbiology	1 out of 2	2	12 M
2.	Unit – II	Microbial Control in Pharmaceuticals	1 out of 2	2	12 M

3.	Unit – III	Microorganisms of Pharmaceutical Importance	1 out of 2	2	12 M
4.	Unit – IV	Microbial Quality Control	1 out of 2	2	12 M
5.	Unit – V	Microbiology in Product Development	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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SEMESTER – V
COURSE – 13A: APPLIED MICROBIOLOGY (24MICM52A)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION

The objective of the course is to make the student aware of

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand and assess the areas of entrepreneurship, and assess the scope for establishment.	Level 2 (Understanding) Level 5 (Evaluate)
CO 2	Understand and apply the production of fermentation products and economics	Level 2 (Understanding) Level 5 (Evaluate)
CO 3	Understand, apply and analyse the production method of biofertilizers and mushrooms	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analyzing)
CO 4	Understand and apply the process of baking and brewing	Level 2 (Understanding) Level 3 (Applying)
CO 5	Understand and Assess DPR and patenting	Level 2 (Understanding) Level 5 (Evaluate)

CO-PO Mapping
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**1**	**–**	**–**	**–**	**–**	**-**	**3**	**1**	**1**	**2**
CO 2	**3**	**–**	**–**	**–**	**–**	**3**	**3**	**2**	**2**	**2**
CO 3	**3**	**–**	**–**	**–**	**–**	**3**	**3**	**2**	**3**	**2**
CO 4	**3**	**–**	**–**	**–**	**–**	**–**	**3**	**3**	**3**	**2**
CO 5	**3**	**–**	**–**	**–**	**3**	**-**	**2**	**2**	**3**	**2**
CO – PSO MAPPING										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	**1**	**1**	**1**	**-**	**3**
CO 2	**2**	**2**	**2**	**-**	**3**
CO 3	**3**	**2**	**3**	**-**	**3**
CO 4	**3**	**2**	**3**	**-**	**3**
CO 5	**2**	**2**	**1**	**-**	**3**

Unit–I: Entrepreneurial skill No of Hours: 9

1. Scope and importance of applied microbiology
2. Entrepreneurial skills– Institutes involved, Government support to entrepreneurs, Incubation Centers, risk assessment.
3. Scope for small, medium and large scale industries in Applied Microbiology

Unit–II: Fermentation Products No of Hours: 9

1. Microbial cells as fermentation products: Yeast, (bakers, food and feed), Bacterial Insecticide (Bacillus thurungensis), Legume Inoculants, Algae (SCP).
2. Enzymes as fermentation products– Amylases, Proteolytic Enzymes, Pectinases, Invertases
3. Fermentation Economics

Unit–III: Bio-fertilisers and Mushrooms No of Hours: 9

1. Mushroom cultivation–Cultivation ofAgaricusbisporus, and Volvariella volvaciae; Preparation of compost, filling tray, beds, spawning, maintaing optimal temperature, casing, watering, harvesting,storage.
2. Biofertilizers –Chemical fertilizers versus biofertilizers, organic farming. Production of biofertilizers-Rhizobium sp, Azospirillumsp, Azotobacter sp.
3. Microbial consortia for composting and as biofertilisers

Unit–IV: Baking and Brewing processes No of Hours: 9

1, Brewing–Media composition and preparation of medium, Microorganisms involved in preparation of wine and beer
2. Bakery –Microorganisms involved in making of bread - Yeast
3. Carbonation, packaging, keeping quality, contamination, by products.

Unit–V:DPR and Patents No of Hours: 9

1. Preparation of DPR (Detailed Project Report)
2. Patents and secret processes –History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**
1.	**Unit–I:** Scope and importance of applied microbiology	Understanding and assess the scope for establishment of applied microbiology.
2.	**Unit–II:**Bacterial Insecticide- *Bacillus thurungensis*	Understanding the benefits of *Bacillus thurungensis*.
3.	**UNIT IV:** Media composition and preparation of wine and beer	Understanding the preparation and process of wine and beer is important to learn.
Topics Deleted		
1.	**Unit–III:** Cultivation of Calocyba indica and Agaricus bisporus	Focused on two examples of Mushroom cultivation. Hence the topics were omitted.

Skill Outcomes:

By the completion of the course the learner should able to–

1. Prepare Microbial consortia for composting
2. Prepare a report on the working of production unit of mushrooms/biofertiliser
3. Prepare sample DPR

SEMESTER V

PRACTICAL COURSE 13A: APPLIED MICROBIOLOGY

Credits – 1

LIST OF EXPERIMENTS

1. Preparation of Microbial consortia for composting
2. Field visit and report preparation of Mushroom cultivation unit/ Biofertiliser production centre/or any other
3. Preparation of sample DPR

References:

1. Entrepreneurial Development in India -ByArora.
2. Sathyanarayana.U, Biotechnology.(2005)1stEd.BooksandAllied(P)Ltd.
3. Casida, LEJR, (2019). Industrial Microbiology.NewAge International Publishers
4. K.R.Aneja, Experiments in Microbiology,Plantpathology,Tissue culture and Mushroom production technology, 6thEd.S Chand Publication
5. Nduka O kafor.ModernIndustrialMicrobiology and Biotechnology, 2007. CRC Press
6. Michael J. Waites, Neil L.Morgan, John S. Rockey, Gary Higton. Industrial Microbiology: An Introduction, 2013. Wiley Blackwell Publishers.
7. A.H.Patel. IndustrialMicrobiology.2016. 2ndEd.Laxmi Publications, NewDelhi.
8. Dubey RC. A Text book of Biotechnology.(2014). S Chand Publishers.
9. Robert D.Hisrich, Michael P.Peters,"Entrepreneurship Development",TataMcGraw Hill.

II. Co-Curricular Activities:

1. Prepare fermented foods
2. Workshop on project report preparation of mushroom cultivation unit
3. Visit to industry producing microbial products

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COURSE 13A: APPLIED MICROBIOLOGY (24MICM52A)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Entrepreneurial skills	1 out of 2	2	12 M
2.	Unit – II	Fermentation Products	1 out of 2	2	12 M
3.	Unit – III	Bio-fertilisers and Mushrooms	1 out of 2	2	12 M
4.	Unit – IV	Baking and Brewing processes	1 out of 2	2	12 M
5.	Unit – V	DPR and Patents	1 out of 2	2	12 M

SUMMARY	**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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DEPARTMENT OF MICROBIOLOGY
SEMESTER – V
COURSE – 13B: DIAGNOSTIC MICROBIOLOGY (24MICM52B)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION

The objective of the course is to make the student aware of

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand and apply the key concepts to differentiate and explain various methods of staining and media preparation	Level 2 (Understanding) Level 3 (Applying)
CO 2	Understand and apply the principles of serological and molecular methods of Diagnosis	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understand and Evaluate how to Safeguard oneself and community from antibiotic misuse	Level 2 (Understanding) Level 5 (Evaluate)
CO 4	Understand and Analyse the incidence, distribution and determinants of diseases	Level 2 (Understanding) Level 4 (Analyzing)
CO 5	Understand and Assess to execute the methods of prevention of various infectious diseases	Level 2 (Understanding) Level 5 (Evaluate)

CO-PO Mapping
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10

CO 1	**2**	**–**	**–**	**–**	**–**	**-**	**2**	**1**	**2**	**1**
CO 2	**2**	**–**	**–**	**–**	**–**	**–**	**3**	**2**	**3**	**2**
CO 3	**3**	**–**	**–**	**–**	**2**	**–**	**1**	**2**	**1**	**2**
CO 4	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**2**	**2**	**2**
CO 5	**3**	**–**	**–**	**–**	**–**	**-**	**2**	**2**	**2**	**2**
CO – PSO MAPPING										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**1**	**1**	**1**	**-**	**1**
CO 2	**2**	**2**	**2**	**-**	**2**
CO 3	**2**	**2**	**3**	**-**	**2**
CO 4	**2**	**2**	**3**	**-**	**2**
CO 5	**2**	**2**	**2**	**-**	**2**

UNIT- I: Collection of Clinical Samples No. of hours: 9

1. Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and Faeces) and precautions required.
2. Method of transport of clinical samples to laboratory and storage.
3. Laboratory acquired infections, safety of laboratory workers.

UNIT- II: Microscopic and culture methods of Diagnosis No. of hours: 9

1. Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria, Lactophenol cotton blue staining
2. Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein Jensen medium, MacConkey agar, Mannitol salt agar, Saborauds dextrose agar.
3. Distinct colony properties of various bacterial pathogens.

UNIT- III: Serological and molecular methods of DiagnosisNo. of hours: 9

1. Agglutination, ELISA, immunofluorescence, Radio immune assay
2. PCR and Its Variations Real-Time and Digital PCR for Nucleic Acid Quantification;
3. Nonamplified Probe-Based Microbial Detection and Identification

UNIT- IV: Antimicrobials- sensitivity and resistance No. of hours: 9

1. Importance and its mechanisms of drug resistance.
2. Determination of resistance/sensitivity of bacteria using disc diffusion method.
3. Determination of minimal inhibitory concentration (MIC) of an antibiotic.

UNIT- V: Advances in Diagnostic Microbiology No. of hours: 9

1. Metagenomic studies for Pathogen Detection and Identification.
2. Transcriptomic Techniques in Diagnostic Microbiology.
3. Developments in molecular tests for detecting TB and anti-TB drug resistance.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**
1.	**UNIT- II:** Mannitol salt agar, Saborauds dextrose agar.	Understanding the Preparation and use of culture media is important for microbiology students
2.	**UNIT- III:** Radio immune assay	Understanding the technique of Radio immune assay is necessary for microbiology students.
Topics Deleted		
1.	**UNIT- III:** Multiplex PCR for detection and identification of microbial pathogens	These topics were already covered in this unit. Hence the repetitive topics were omitted.

Skill Outcomes:

1. Collect, label and transport clinical specimens
2. Isolate pure culture of bacteria
3. To identify common bacteria
4. To maintain and preserve stock culture

SEMESTER V
PRACTICAL COURSE 13B: DIAGNOSTIC MICROBIOLOGY(24MICM52B)

Credits – 1

LIST OF EXPERIMENTS

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum).
2. Receipts, Labeling, recording and dispatching clinical specimens.
3. Isolation ofbacteria in pure culture and Antibiotic sensitivity.
4. Identification of common bacteria by studying their morphology, cultural characters, Biochemical reactions, slide agglutination and other tests.
5. Maintenance and preservation of stock culture.

References

1. Ananthanarayan R and Paniker CKJ (2009). Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.
5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

Co-Curricular Activities:

1. Hands-on training in techniques such as sample collection, microbial culture, staining, identification methods (e.g., biochemical tests), and antimicrobial susceptibility testing.
2. Case Study Analysis individually or in groups to evaluate patient histories, laboratory test results, and diagnostic data to reach a diagnosis.
3. Project work on comparing reports from different diagnostic lab

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COURSE 13B: DIAGNOSTIC MICROBIOLOGY (24MICM52B)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Collection of Clinical Samples	1 out of 2	2	12 M
2.	Unit – II	Microscopic and culture methods of Diagnosis	1 out of 2	2	12 M
3.	Unit – III	Serological and molecular methods of Diagnosis	1 out of 2	2	12 M

4.	Unit – IV	Antimicrobials-sensitivity and resistance	1 out of 2	2	12 M
5.	Unit – V	Advances in Diagnostic Microbiology	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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DEPARTMENT OF MICROBIOLOGY
SEMESTER – V
COURSE – 14A: INDUSTRIAL MICROBIOLOGY (24MICM53A)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION

The objective of the course is to make the student aware of

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand and apply various industrially important microorganisms	Level 2 (Understanding) Level 3 (Applying)
CO 2	Understand and apply the methods of screening of required microorganisms	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understand and apply the appropriate methods of fermentation to be adapted for productions	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understand and Analyse the basic concepts in industrial microbiology, industrially important microbes and metabolites	Level 2 (Understanding) Level 4 (Analyzing)
CO 5	Understand and Assess the components of upstream and downstream bioprocessing	Level 2 (Understanding) Level 5 (Evaluate)

CO-PO Mapping
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**2**	**–**	**–**	**–**	**–**	**-**	**1**	**1**	**2**	**1**

CO 2	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**1**	**2**	**2**
CO 3	**2**	**–**	**–**	**–**	**–**	**3**	**2**	**2**	**2**	**2**
CO 4	**3**	**–**	**–**	**–**	**2**	**–**	**2**	**1**	**2**	**2**
CO 5	**3**	**–**	**–**	**–**	**–**	**-**	**1**	**1**	**2**	**2**
CO – PSO MAPPING										
“1” – Low; “2” – Moderate; “3” – High; “–” – No Correlation										

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**1**	**2**	**1**	**-**	**2**
CO 2	**2**	**2**	**2**	**-**	**2**
CO 3	**2**	**2**	**2**	**-**	**2**
CO 4	**2**	**2**	**2**	**-**	**2**
CO 5	**1**	**2**	**2**	**-**	**2**

UNIT I: Microorganisms of industrial importance No. of hours: 9

1. Brief history and developments in industrial microbiology.
2. Microorganisms of industrial importance -yeasts (Saccharomyces cerevisiae), molds (Aspergilusniger) bacteria (E.coli), actinomycetes (Streptomyces griseus).
3. Industrially important Primary and secondary microbial metabolites- Techniques involved in selection of industrially important metabolites from microbes.

UNIT II : Screening and Strain Improvement No. of hours: 9

1. Primary and secondary screening.Outlines of strain improvement Preservation and maintenance of industrial strains
2. Microbial growth kinetics, batch culture, continuous culture, fed batch culture and Dual or multiple fermentations.
3. Fermentation media (Crude and synthetic media; molasses, corn- steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates)

UNIT III: Bioreactors No. of hours: 9

1. Design and Components of a typical continuously stirred tank bioreactor.
2. Types of fermenters – laboratory, pilot-scale and production fermenters.
3. Types of fermentation processes- solid state, liquid state; batch, fed- batch, continuous; aerobic, anaerobic; submerged, surface

UNIT IV: Fermentation and Downstream processes No. of hours: 9

1. Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration.
2. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.Methods of immobilization, advantages and applications of immobilization
3. Computer application in fermentation technology. Recovery and purification of fermentation products.

UNIT V: Microbial Productions No. of hours: 9

1. Production of citric acid, ethanol and penicillin.
2. Production of Glutamic acid and vitamin B12
3. Enzyme probe biosensors, biochips, biofilms, biosurfactants, Biotransformation, Microbial products from genetically modified (cloned) organisms ex: insulin.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**
1.	**UNIT II :** Microbial growth kinetics, batch culture, continuous culture, fed batch culture and Dual or multiple fermentations	Knowing the Microbial growth kinetics, batch, continuous, fed batch and Dual or multiple fermentations is crucial for every microbiologist.
2.	**UNIT III:** Design of bioreactor	Understanding the Design of bioreactor is the foundation course for microbiology students.
3.	**UNIT IV:** Computer application in fermentation technology. Recovery and purification of fermentation products.	Understanding the Computer application in fermentation technology in the industrial microbiology is crucial as this is the foundation course for microbiology students. Therefore, this topic is incorporated in this unit.
4.	**UNIT V:** Enzyme probe biosensors, biochips, biofilms, biosurfactants, Biotransformation, Microbial products from genetically modified (cloned) organisms ex: insulin.	Knowing the Enzyme probe biosensors, biochips, biofilms, biosurfactants, Biotransformation, Microbial products from genetically modified organisms iscrucial for every microbiologist as these are the most important topics.
Topics Deleted		
1.	**UNIT IV:** Methods of immobilization and enzymes	These topics were already covered in this Unit. Hence the repetitive topics were omitted.
2.	**UNIT V:**Production and uses of enzymes	The contents of unit 5 were moved to Unit – 4 as these topics were more relevant there.

Skill Outcomes:

By the completion of the course the learner should able to–

1. Comprehend the significance of and demonstrate microbial diversity by isolating microorganisms from natural environments.
2. Microscopically demonstrate the microorganisms found in fermented food; prepare some of the fermented products(wine) in the laboratory to observe the associated physical and chemical changes.
3. Carry out microbial productions in small scale (citric acid) and estimate the product

SEMESTER V

PRACTICAL COURSE – 14A: INDUSTRIAL MICROBIOLOGY

Credits – 1

LIST OF EXPERIMENTS

1. Demonstration of fermenter
2. Microbial fermentation for the production and estimation of ethanol by dichromate method
3. Isolation and production of citric acid by Aspergillus niger
4. Production of glutamic acid by fermentation.
5. Asssay of vitamin B12
6. Growth curve and kinetics of any two industrially important microorganisms.
7. Preparation of model for biosensor based enzyme probe.
8. Examination of Biofilms.

References:

1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.

2. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals and Frontiers. ASM Press, Washington D.C., USA.

Co-Curricular Activities:

1. Lectures/ Seminar on current trends in industrial microbiology
2. Field visit to related industry
3. Assignments on identifying and procuring industrially important Microorganisms

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COURSE – 14A: INDUSTRIAL MICROBIOLOGY(24MICM53A)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Microorganisms of industrial importance	1 out of 2	2	12 M
2.	Unit – II	Screening and Strain Improvement	1 out of 2	2	12 M
3.	Unit – III	Bioreactors	1 out of 2	2	12 M
4.	Unit – IV	Fermentation and Downstream processes	1 out of 2	2	12 M
5.	Unit – V	Microbial Productions	1 out of 2	2	12 M

SUMMARY	**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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DEPARTMENT OF MICROBIOLOGY
SEMESTER – V

COURSE – 14B: AGRICULTURAL MICROBIOLOGY (24MICM53B)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION
The objective of the course is to make the student aware of

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand soil as a microbial habitat, diversity of microorganisms, and their interactions.	Level 2 (Understanding)
CO 2	Understand and analyze the microbial pathogenicity, virulence factors, and plant defense mechanisms	Level 2 (Understanding) Level 4 (Analyzing)
CO 3	Understand and Analyze how to Learn principles and practices for managing plant diseases, including regulatory, cultural, chemical, and biological methods.	Level 2 (Understanding) Level 4 (Analyzing)
CO 4	Understand and Analyse to Study important plant diseases caused by fungi, bacteria, viruses, and viroids, focusing on their etiology, symptoms, Epidemiology, and control.	Level 2 (Understanding) Level 4 (Analyzing)
CO 5	Understand and apply the plant growth promoting bacteria, biofertilizers, mycorrhizae, and their role in enhancing plant growth and about bioinsecticides and their advantages over synthetic pesticides.	Level 2 (Understanding) Level 3 (Applying)

CO-PO Mapping										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**
CO 1	**1**	**–**	**–**	**–**	**–**	**1**	**1**	**1**	**1**	**2**
CO 2	**2**	**–**	**–**	**–**	**–**	**-**	**1**	**1**	**2**	**2**
CO 3	**2**	**–**	**–**	**–**	**–**	**3**	**2**	**1**	**2**	**2**
CO 4	**2**	**–**	**–**	**–**	**2**	**1**	**2**	**1**	**2**	**2**
CO 5	**2**	**–**	**–**	**–**	**3**	**3**	**3**	**3**	**3**	**2**

CO – PSO MAPPING
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**1**	**2**	**2**	**-**	**2**
CO 2	**2**	**2**	**2**	**-**	**2**
CO 3	**2**	**2**	**2**	**-**	**2**
CO 4	**2**	**2**	**3**	**-**	**2**
CO 5	**2**	**2**	**3**	**-**	**2**

Unit 1: Soil Microbiology No of Hours: 9

1. Soil profile, soil structure and properties, Diversity and distribution of microorganisms in soil.
2. Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus.
3. Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbe-Plant interaction: Symbiotic and non symbiotic interactions.

Unit 2: Host Pathogen Interaction No. of Hours: 9

1. Microbial Pathogenicity Virulence factors of pathogens: enzymes, toxins (host specific and non specific) growth regulators.Virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development.
2. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).

3. Defence Mechanisms in Plants: Concepts of constitutive defense mechanisms in plants, inducible structural defences (histological cork layer, abscission layer, tyloses, gums), inducible biochemical defences [hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins, pathogenesis related (PR) proteins, plantibodies, phenolics, quinones, oxidative bursts].

Unit 3: Control of Plant Diseases No. of Hours: 9

1. Principles & practices involved in the management of plant diseases by different methods, viz. regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen free ropagative material, cultural - host eradication,
crop rotation, sanitation, polyethylene traps and mulches
2. Chemical -protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals. Biological - suppressive soils, antagonisticmicrobes- bacteria and fungi, trap plants
3. Genetic engineering of disease resistant plants- with plant derived genes and pathogen derived genes and Genetically Modified crops.

Unit: 4: Study of Plant diseases No. ofHours: 9

1. Study of some important plant diseases giving emphasis on itsetiological agent, symptoms, epidemiology and control. Important diseases caused by fungi:
a. Black stem rust of wheat – *Puccinia graminis tritici*
b. Wilt of tomato – *Fusarium oxysporumf.sp. Lycopersici*
2. Important diseases caused by phytopathogenic bacteria: Bacterial leaf blight of rice, and bacterial cankers of citrus.
3. Important diseases caused by viruses: Papaya ring spot, tomato yellow leaf curl. Important diseases caused by viroids: Potato spindle tuber, coconut cadangcadang.

Unit 5: Biofertilization, Phytostimulation, Bioinsecticides No of Hours: 9

1. Plant growth promoting bacteria, biofertilizers – symbiotic (Rhizobium, Frankia), Non Symbiotic (Azospirillum, Azotobacter, Phosphate solubilizers, algae).
2. Importance of mycorrizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.
3. General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, *Bacillus thuringiensis*- production and Field applications, Baculo Viruses – cultivation and field applications.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**

1.	**Unit 1:**soil structure	Knowing the soil structure lays the foundation for origin of soil on earth.
2.	**Unit 5:**Baculo Viruses	Understanding the beneficial impact of cultivation and field applications is most important for microbiology students.
Topics Deleted		
1.	**Unit: 4:** Early blight of potato – Alternaria solani, Angular leaf spot of cotton, crown galls	The contents of Study of some important plant diseases already covered in this unit. Hence the repetitive topics were omitted.
2.	**Unit 5**: Bradyrhizobium	This content is already covered in this unit. Hence the repetitive topics were omitted.

Skill Outcomes:

1. Understand soil composition and characteristics, measuring water activity and Ph levels, interpreting soil profiles, and recognizing the influence of these factors on soil fertility and plant growth.
2. Identifying soil microorganisms
3. Understand Rhizobium's characteristics demonstrate field application techniques, and recognize the importance of Rhizobium inoculation in enhancing plant growth and soil fertility.
4. Demonstrate field application techniques, and recognize the role of Azotobacter in promoting plant growth and soil nitrogen availability.
5. Identify cellulose-degrading microorganisms
6. Identify the plant diseases based on section cuttings

SEMESTER V

LIST OF EXPERIMENTS
COURSE 14 B: AGRICULTURAL MICROBIOLOGY **Credits – 1**

1. Study soil profile, water activity, and pH
2. Study microflora of different types of soils
3. Rhizobium as soil inoculant, characteristics and field application
4. Azotobacter as soil inoculant, characteristics and field application
5. Isolation of cellulose degrading organisms
6. Demonstration of Koch's postulates in fungal, bacterial and viral plant pathogens.
7. Study of important diseases of crop plants by cutting sections of infected plant material (microscopic observations)- Albugo, Puccinia, Ustilago, Fusarium, Colletotrichum.

References:

1. Agrios G.N. (2006). Plant Pathology. 5th edition. Academic press, SanDiego,
2. Lucas JA. (1998). Plant Pathology and PlantPathogens.3rd edition. Black well Science, Oxford.
3. Mehrotra RS. (1994).Plant Pathology. Tata McGraw-Hill Limited.
4. RangaswamiG. (2005). Diseases of Crop Plants India.4th edition.Prentice Hall India Pvt.Ltd. New Delhi.
5. Singh RS. (1998). Plant Diseases Management.7thedition.Oxford&IBH, New Delhi.

Co-Curricular Activities:

1. Project on collecting photographs of diseased plants and identification.
2. Project on collecting photographs of diseased plant parts and identification of pathogen.
3. Workshops/ Lectures on natural farming methods.

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Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Soil Microbiology	1 out of 2	2	12 M
2.	Unit – II	Host Pathogen Interaction	1 out of 2	2	12 M
3.	Unit – III	Control of Plant Diseases	1 out of 2	2	12 M
4.	Unit – IV	Study of Plant diseases	1 out of 2	2	12 M

5.	Unit – V	Biofertilization, Phyto stimulation, Bioinsecticides	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

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DEPARTMENT OF MICROBIOLOGY
SEMESTER – V
COURSE – 15A: FOOD AND DAIRY MICROBIOLOGY (24MICM54A)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION

The objective of the course is to make the student aware of

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand and Assess the factors influencing microbial growth, contamination in foods, and sources of microbial contamination.	Level 2 (Understanding) Level 5 (Evaluate)
CO 2	Understand and Assess the Microflora of milk, microbial contamination of raw milk and butter, and spoilage of various food types.	Level 2 (Understanding) Level 5 (Evaluate)
CO 3	Understand and Apply dairy starter cultures in fermented dairy products, other fermented foods, and probiotics.	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understand and Analyse to Differentiate Food borne diseases, intoxications, and infections	Level 2 (Understanding) Level 4 (Analyzing)
CO 5	Understand and Assess to adopt food sanitation, control measures, Follow HACCP; Carry out tests to detect pathogens in foods.	Level 2 (Understanding) Level 5 (Evaluate)

CO-PO Mapping

"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**2**	**–**	**–**	**–**	**–**	**-**	**1**	**1**	**2**	**2**
CO 2	**2**	**–**	**–**	**–**	**–**	**–**	**3**	**3**	**2**	**2**

CO 3	**2**	**–**	**–**	**–**	**–**	**–**	**3**	**3**	**3**	**2**
CO 4	**2**	**–**	**–**	**–**	**–**	**–**	**2**	**-**	**3**	**2**
CO 5	**2**	**–**	**–**	**–**	**2**	**-**	**2**	**-**	**2**	**2**
CO – PSO MAPPING										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	**1**	**2**	**2**	**-**	**2**
CO 2	**1**	**2**	**2**	**-**	**2**
CO 3	**2**	**2**	**3**	**-**	**2**
CO 4	**2**	**2**	**3**	**-**	**2**
CO 5	**2**	**2**	**2**	**-**	**2**

Unit 1: Microbes in Food and Dairy No. of Hours: 9

1. Intrinsic and extrinsic factors that affect growth and survival of microbes in foods. Microbial flora of fresh foods, grains, fruits, vegetables, milk, meat, eggs and fish and their infestation by bacteria, fungi and viruses.
2. Microflora associated with milk and milk products and their importance. Sources of microbial contamination of raw milk and butter
3. Sources of microbial contamination and spoilage of vegetables, fruits, meat, eggs, bread, canned Foods.

Unit 2: Food Preservation No. of Hours: 9

1. Principles of food preservation: temperature, canning, drying, irradiation, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, citrates, benzoates, nitrite and nitrates etc.
2. Microbial and chemical changes in raw milk during chilling and refrigeration.
3. Naturally occurring preservative systems in milk like LP system, Immunoglobulins, Lysozyme, Lactoferrin. Food grade Biopreservatives (GRAS), Bacteriocins of lactic acid bacteria; Nisin and other antimicrobials produced by Lactic Acid Bacteria (LAB).

Unit 3: Fermented foods No. of Hours: 9

1. Dairy starter cultures fermented dairy products: yogurt, acidophilus milk, kumiss, Kefir, dahi and cheese.
2. Other fermented foods: dosa, sauerkraut, soy sauce and tempeh, Utilization and disposal of dairy by-products – whey.
3. Probiotics: Healthbenefits, types of microorganisms used, probiotic foods available in market.

Unit 4: Food borne diseasesNo. of Hours: 9

1. Food borne diseases (causative agents, foods involved, symptoms and preventive measures) Food intoxications: Staphylococcus aureus, Clostridium botulinum and mycotoxins;
2. Food infections: Vibrio parahaemolyticus, Escherichia coli, Salmonellosis,
3. Shigellosis, Yersinia enterocolitica, Listeria monocytogenes and Campylobacter jejuni

Unit 5: Food Sanitation No. of Hours: 9

1. Food sanitation and control; HACCP; National and International microbiological standards for dairy products (BIS, ICMSF, Codex Alimentarius Standards.
2. Cultural and rapid detection methods of food borne pathogens and introduction to predictive microbiology.
3. Genetically modified foods, Nutraceuticals, Biosensors in food, Applications of microbial enzymes in dairy industry [Protease, Lipases].

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

Topics Deleted		
1.	Bacillus cereus,	This topic is already covered in this unit. Hence the repetitive topic was omitted.

Skill Outcomes:

1. Mastering the MBRT method and standard plate count technique, interpreting MPN results, assessing milk quality based on microbial load, and understanding the significance of microbial analysis in ensuring milk safety.
2. Check the efficiency of pasteurization of milk include understanding the principle of the test, performing the enzymatic reaction, interpreting results, and assessing the effectiveness of milk pasteurization in ensuring food safety.
3. Mastering aseptic techniques perform sample preparation and isolation techniques, identify potential pathogens and spoilage microorganisms, and understand the role of microorganisms in food safety and spoilage.

4. Follow yogurt fermentation protocols, controlling fermentation conditions, assessing yogurt quality, and understanding the role of microbial cultures in yogurt production.

SEMESTER V

PRACTICAL COURSE 15A: FOOD AND DAIRY MICROBIOLOGY

LIST OF EXPERIMENTS **Credits – 1**

1. MBRT of milk samples and their standard plate count.
2. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
3. Isolation of any foodborne bacteria from food products.
4. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
5. Isolation of spoilage microorganisms from bread.
6. Preparation of Yogurt/Dahi.

References

1. Stanbury, PF., Principles of Fermentation Technology. Whittaker, A and Hall, S.J 2nd Edition. Pergamon Press (1995).
2. Banwart, GJ. Basic Food Microbiology. CBS Publishers and Distributors, Delhi.(1989).
3. Hobbs BC and Roberts D.Food poisoning and Food Hygiene. Edward Arnold (A division of Hodder and Stoughton) London.
4. Joshi. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2.
5. John Garbult. Essentials of Food Microbiology. Arnold International.
6. John C. Ayres. J. Orwin Mundt. William E. Sandinee. Microbiology of Foods. W.H. Freeman and Co.
7. D. J. Bagyaraj and G. Rangaswami. AGRICULTURAL MICROBIOLOGY. Prentice Hall of India, Pvt Ltd.2005
8. N. S. Subba Rao. Soil Microbiology. Oxford and IBH publishing Company 2009
9. PhotisPapademas. Dairy Microbiology: A Practical Approach. CRC Press
10. Rao M.K.Food and Dairy Microbiology. Manglam Publishers
11. William Frazier. Food Microbiology. McGraw Hill Education
12. Jay, James M., Loessner, Martin J., Golden, David A. Modern Food Microbiology. Springer.

Co-Curricular Activities:

1. Food Microbiology Workshops
2. Assign projects or lab exercises where students analyze food and dairy products for microbial quality and safety.
3. Organize visits to food processing facilities or dairy
4. Seminars on Food Safety and Quality Assurance, food regulations, and quality management systems.

Visakhapatnam-13

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COURSE- 15A: FOOD AND DAIRY MICROBIOLOGY (24MICM54A)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
Application	20 %	1 (8 M)	4 (16 M)	24 M
Analysis	13 %		4 (16 M)	16 M
Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Microbes in Food and Dairy	1 out of 2	2	12 M
2.	Unit – II	Food Preservation	1 out of 2	2	12 M
3.	Unit – III	Fermented foods	1 out of 2	2	12 M
4.	Unit – IV	Food borne diseases	1 out of 2	2	12 M
5.	Unit – V	Food Sanitation	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)

VISAKHAPATNAM-13
(Affiliated To Andhra University, Visakhapatnam)
DEPARTMENT OF MICROBIOLOGY
SEMESTER – V

COURSE – 15B: ENVIRONMENTAL MICROBIOLOGY (24MICM54B)

HOURS PER WEEK: 3 **CREDITS – 3**

COURSE DESCRIPTION
The objective of the course is to make the student aware of

COURSE OUTCOMES:
At the end of the course, the student will be able to:

CO	CO DESCRIPTION	LEARNING LEVEL (BLOOMS TAXONOMY)
CO 1	Understand ecosystems and microflora in soil, water, atmosphere, human/animal bodies.	Level 2 (Understanding) Level 3 (Applying)
CO 2	Understand about mutualism, synergism, commensalism, competition, parasitism, predation in microbes and study plant-microbe and animal-microbe interactions.	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understand and apply how microbial involvement in carbon, nitrogen, phosphorus, and sulphur cycles, including organic degradation and nutrient processes.	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understand and Analyse to study solid waste disposal, liquid waste treatment and microbial bioremediation.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analyzing)

CO 5	Understand and apply the microorganisms in bioremediation processes.	Level 2 (Understanding) Level 3 (Applying)

CO-PO Mapping
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	**2**	**–**	**–**	**–**	**–**	**3**	**–**	**1**	**2**	**2**
CO 2	**2**	**–**	**–**	**–**	**–**	**3**	**3**	**1**	**2**	**2**
CO 3	**2**	**–**	**–**	**–**	**–**	**3**	**3**	**1**	**2**	**2**
CO 4	**2**	**–**	**–**	**–**	**2**	**3**	**–**	**2**	**2**	**2**
CO 5	**2**	**–**	**–**	**–**	**2**	**3**	**–**	**2**	**3**	**2**
CO – PSO MAPPING										
"1" – Low; "2" – Moderate; "3" – High; "–" – No Correlation										

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	**2**	**2**	**2**		**3**
CO 2	**2**	**2**	**2**		**3**
CO 3	**2**	**2**	**3**		**3**
CO 4	**2**	**2**	**3**		**3**
CO 5	**2**	**2**	**3**		**3**

Unit 1: Microorganisms and their Habitats **No. of Hours: 9**

1. Basic concepts of Ecology and Environment – Biological spectrum at levels of organization & realm of ecology. Ecosystem – Concept, components, food chains, food webs and tropic levels.
2. Terrestrial Environment: Soil microflora, Decomposition of plant organic matter.Aquatic Environment: Microflora of freshwater and marine habitats.Atmosphere: Aero microflora and dispersal of microbes
3. Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.

Unit 2: Microbial Interactions **No. of Hours: 9**

1. Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation Microbe-Plant interaction: Symbiotic and non symbiotic interactions
2. Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria.
3. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

Unit 3: Biogeochemical Cycling **No. of Hours: 9**

1. Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin
2. Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction.
3. Phosphorus cycle: Phosphate immobilization and solubilisation. Sulphur cycle: Microbes involved in sulphur cycle.

Unit 4: Waste Management **No. of Hours: 9**

1. Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill)
2. Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.
3. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

Unit 5: Microbial Bioremediation **No. of Hours: 9**

1. Bioremediation: Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.
2. Bioleaching, mineral recovery, removal of heavy metals from aqueous effluents. Biodegradable plastics.
3. Biogas production: Methane and hydrogen production using microbial culture.

Course with focus on Employability/ Entrepreneurship/ Skill Development Modules							
	Skill development		Employability		Entrepreneurship		Crosscutting issues

TOPICS MODIFIED UNDER AUTONOMOUS CATEGORY

TOPICS ADDED		
S. No.	**Title of the Topic**	**Justification**

1.	**Unit 1:** Basic concepts of Ecology and Environment – Biological spectrum at levels of organization & realm of ecology. Ecosystem – Concept, components, food chains, food webs and tropic levels.	Understanding the Basic concepts of Ecology and Environment is the foundation course for microbiology students.

Skill Outcomes:

1. Assess soil properties (pH, moisture content, water holding capacity, percolation, capillary action) and understand their impact on plant growth and soil fertility.
2. Isolate bacteria and fungi from soil samples, and comprehend the diverse microbial communities present in soil ecosystems.
3. Master techniques to isolate bacteria and fungi associated with plant roots, understand their ecological roles, and appreciate the significance of plant-microbe interactions in nutrient cycling and plant health.
4. Use the MPN method to evaluate microbial populations in water samples, and understand the importance of water quality monitoring for public health.
5. Measure BOD and COD in wastewater, and comprehend their significance in assessing pollution levels and wastewater treatment efficiency.

SEMESTER V

PRACTICAL COURSE 15B : ENVIRONMENTAL MICROBIOLOGY

LIST OF EXPERIMENTS **Credits – 1**

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria & fungi) from soil.
3. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
4. Assessment of microbiological quality of water by MPN method.
5. Determination of BOD of waste water sample.
6. Determination of COD of waste water sample
7. Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
8. Isolation of Rhizobium from root nodules.
9. Isolation of Azotobacter from soil.
10. Design and functioning of a biogas plant.

III. References

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings

3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology.2nd edition, Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems.1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts &Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
9. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
10. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities.Cambridge University Press, Cambridge, England.
11. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.
12. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

IV. Co-Curricular Activities:

1. Project work on assessment of different soil
2. Prepare a Model of Biogas plant
3. Prepare a model of sewage treatment plantypes
4. Prepare a Model of Biogas plant
5. Prepare a model of sewage treatment plant

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COURSE 15B: ENVIRONMENTAL MICROBIOLOGY (24MICM54B)

Learning Level Wise Weightage				
Bloom's Taxonomy level	**Weightage**	**No. of Essay Type Questions (8M)**	**No. of Short Answer Type Questions (4M)**	**TOTAL MARKS**
Knowledge/ Remember	33 %	5 (40 M)		40 M
Understanding/ Comprehension	27 %	4 (32 M)		32 M
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Synthesis/ Evaluate	7 %		2 (8 M)	8 M
TOTAL	**100 %**	**10 (80 M)**	**10 (40 M)**	**120 M**

CHAPTER WISE WEIGHTAGE					
S. No.	**Chapter/ Unit No.**	**Name of the chapter**	**Essay Questions (8M)**	**Short Questions (4M)**	**TOTAL CHAPTER MARKS**
1.	Unit – I	Microorganisms and their Habitats	1 out of 2	2	12 M
2.	Unit – II	Microbial Interactions	1 out of 2	2	12 M
3.	Unit – III	Biogeochemical Cycling	1 out of 2	2	12 M
4.	Unit – IV	Waste Management	1 out of 2	2	12 M
5.	Unit – V	Microbial Bioremediation	1 out of 2	2	12 M
SUMMARY			**5 (40 M)**	**Any 5 (20 M)**	**60 M**

Dr. V.S. Krishna Govt. Degree College (A), Visakhapatnam

DEPARTMENT OF MICROBIOLOGY
ADD ON COURSE IN FOOD, NUTRITION AND HEALTH EDUCATION
(W.E.F. 2016 – 17)

(Theory – 52 hours; Practical – 18 Hours; Activity – 10 Hours = Total 80 Hours)

COURSE OUTCOMES

At the end of the course, the student will be able to

I. Provide nutrition counselling and education to individuals, groups, and communities throughout the lifespan using a variety of communication strategies.
II. Describe food toxicants, adulteration and food additives and explain prevention strategies of food contamination.
III. Obtain knowledge about malnutrition, related deficiencies, methods of assessing nutritional status, nutritional policies and National programmes.

Module – I: Nutrition for the community

1. Unit: Basic concepts in nutrition
2. Unit: Meal planning
3. Unit: Food storage, preservation and safety
4. Unit: Nutrition related disorders
5. Unit: Nutrient deficiency control and supplementary feeding programme.

Module – II: Public Health and Hygiene

1. Unit: Health indicators
2. Unit: Environmental sanitation and safety
3. Unit: Dietary management of disease
4. Unit: Foodborne diseases, infections and intoxications
5. Unit: Common infections and infectious diseases

Module III: Nutrition and Health Education

1. Unit: Primary health care
2. Unit: Health programmes
3. Unit: Nutrition and health status of the community
4. Unit: Themes, messages and their communication in nutrition and health education.
5. Unit: Nutrition programmes

PRACTICAL – 18 Hours

1. Finding Nutritive value of food stuffs
2. Methods of cooking
3. Planning Diets – I
4. Planning Diets – II
5. Isolation of bacteria and fungi from contaminated foods
6. Methods of food preservation