

(2020 - 2023)



**BHAVAN'S VIVEKANANDA COLLEGE
OF SCIENCE, HUMANITIES & COMMERCE**

Sainikpuri, Secunderabad - 500094

(Accredited with 'A' grade by NAAC)

Autonomous College - Affiliated to Osmania University

Department of Microbiology


Template for BSc Microbiology under CBCS
(With effect from academic year 2020-21)


FIRST YEAR - SEMESTER-I				
Course Code	Course title	Course Type	HPW	CREDITS
	Environmental Science/Computer Skills	AECC-1	2	2
	English	CC-1A	4	4
	Second Language	CC-2A	4	4
	Optional 1	DSC-1A	4T+2P=6	4+1=5
MB131	General Microbiology -I	DSC-2A	4T+2P=6	4+1=5
	Optional 3	DSC-3A	4T+2P=6	4+1=5
	TOTAL			25
SEMESTER-II				
	Environmental Science/Computer Skills	AECC-2	2	2
	English	CC-1B	4	4
	Second Language	CC-2B	4	4
	Optional 1	DSC-1B	4T+2P=6	4+1=5
MB 231	Microbial Diversity II	DSC-2B	4T+2P=6	4+1=5
	Optional 3	DSC-3B	4T+2P=6	4+1=5
	TOTAL			25
SECOND YEAR -SEMESTER-III				
	English	CC-1C	3	3
	Second Language	CC-2C	3	3
	Optional 1	DSC-1C	4T+2P=6	4+1=5
MB331	Microbiology Paper III	DSC-2C	4T+2P=6	4+1=5
	Optional 3	DSC-3C	4T+2P=6	4+1=5
MB	Food Adulteration	SEC 1	2	2
MB	Fundamentals of Bioinformatics	SEC 2	2	2
	TOTAL			25
SEMESTER-IV				
	English	CC-1D	3	3
	Second Language	CC-2D	3	3
	Optional 1	DSC-1D	4T+2P=6	4+1=5
MB431	Microbiology Paper IV	DSC-2D	4T+2P=6	4+1=5
	Optional 3	DSC-3D	4T+2P=6	4+1=5

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MB	Clinical Microbiology	SEC-3	2	2
MB	Mushroom Cultivation	SEC-4	2	2
	TOTAL			25
THIRD YEAR –SEMESTER-V				3
	English	CC-1E	3	3
	Second Language	CC-2E	3	4+1=5
	Optional 1	DSE-1E	4T+2P=6	
MB531/ MB531A	A. Microbiology Paper V/B.Optional paper	DSE-2E	4T+2P=6	4+1=5
	Optional 3	DSE-3E	4T+2P=6	4+1=5
MB	Microbes for Human Welfare	GE	4T	4
	TOTAL			25
SEMESTER-VI				
	English	CC-1F	3	3
	Second Language	CC-2F	3	3
	Optional 1	DSE-1F	4T+2P=6	4+1=5
MB631/ MB631A	A. Microbiology Paper VI (or)	DSE-2F	4T+2P=6	4+1=5
	B. Optional paper			
	Optional 3	DSE-3F	4T+2P=6	4+1=5
	Project work / Optional		4	4
	TOTAL			25
	TOTAL CREDITS			150


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Course Code	Course title	Course Type	HPW	CREDITS
MB131	General Microbiology -I	DSC-2A	4T+2P=6	4+1=5
MB 231	Microbial Diversity II	DSC-2B	4T+2P=6	4+1=5
MB331	Microbiology Paper III	DSC-2C	4T+2P=6	4+1=5
MB	Food Adulteration	SEC 1	2	2
MB	Fundamentals of Bioinformatics	SEC 2	2	2
MB431	Microbiology Paper IV	DSC-2D	4T+2P=6	4+1=5
MB	Clinical Microbiology	SEC-3	2	2
MB	Mushroom Cultivation	SEC-4	2	2
MB531/ MB531A	A. Microbiology Paper V/ B. Optional paper	DSE-2E	4T+2P=6	4+1=5
MB	Microbes for Human Welfare	GE	4T	4
MB631/ MB631A	A. Microbiology Paper VI/ B. Optional paper	DSE-2F	4T+2P=6	4+1=5
	Project work / Optional		4	4


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. I YEAR SYLLABUS (2020 onwards)
SUBJECT -MICROBIOLOGY
I SEMESTER (4 HPW-4Credits)
MB131 Paper I GENERAL MICROBIOLOGY

Overall course objective: To familiarize the students with the concepts of microscopy staining, general characters of microorganisms and microbial growth & nutrition.

Unit Wise Course Objectives:

Cob1 Gives insight to the world of microorganisms in the aspect of historical developments and familiarize with the concepts of microscopy, staining and motility.

Cob2 Discuss the characteristics of various bacteria and illustrate structure of viruses

Cob3 Discuss the nutritional requirements and familiarize with the concepts of bacterial Metabolism

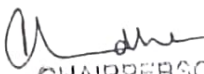
Cob4 Basics on sterilization, isolation and preservation of microorganism along with the growth of bacteria.


UNIT-1: INTRODUCTION TO MICROBIOLOGY

Meaning, definition and scope. History of microbiology: Contribution of Louis Pasteur and Robert Koch. Importance and application of Microbiology	15 Hrs
Principles of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM)	5 Hrs
Principles and types of stains-simple stain, differential stain, negative stain.	5Hrs
Structural stain-spore, capsule, flagella	4 Hrs
Bacterial motility - Hanging drop method	1 Hr

UNIT-2:STRUCTURE OF BACTERIA, VIRUSES & PURE CULTURE CONCEPT

Prokaryotes—Ultra structure of eubacteria-Invariant components - Cell Wall, Cell Membrane, Ribosomes, Nucleoid. Variant components - Capsule, Flagella, Fimbriae, Endospore and Inclusion bodies	15 Hrs
Morphology and structure of TMV and HIV. Structure and multiplication of lambda bacteriophage	5 Hrs
Isolation of Pure culture techniques- Enrichment culturing, Dilution plating, streak plate, spread plate, Pour plate and Micromanipulator. Preservation of Microbial cultures – Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures, storage at low temperature	4 Hrs
	6 Hrs


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UNIT-3: MICROBIAL NUTRITION AND METABOLISM 15 Hrs
 Microbial Nutrition – Nutritional requirement, Uptake of nutrients by cell. 7 Hrs
 Nutritional groups of microorganisms – Autotrophs, Heterotrophs, Mixotrophs.
 Components and types of bacterial growth media – simple and complex media
 Respiration – Glycolysis, HMP Pathway, ED Pathway, TCA Cycle and Anaplerotic reaction, Electron Transport, Oxidative and substrate level phosphorylation 8 Hrs

UNIT-4: STERILIZATION TECHNIQUES AND MICROBIAL GROWTH 15 Hrs
 Sterilization and disinfection techniques. Physical methods – Autoclave, Hot-air oven, Pressure cooker, Tyndallization, Laminar air flow, Filter sterilization 4 Hrs
 Radiation methods – UV rays, gamma rays, Ultra sonic methods, Microwave. 4 Hrs
 Chemical methods – Use of Alcohols, Aldehydes, Fumigants, Phenols, Halogens, and Hypochlorites.
 Microbial growth – Different Phases of Growth in Batch culture. Factors influencing microbial growth. Synchronous, Continuous, Biphasic Growth. Methods for measuring microbial growth – Direct Microscopic, Viable count, Turbidometry, Biomass 7 Hrs

References:

1. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB McGrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker, J. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Anthanarayan and Panicker, Medical Microbiology.

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General Microbiology practicals

Paper I : MB131P

2HPW-Credits-1

1. Handling and calibration of light microscope.
2. Simple and differential staining (Gram staining), Spore staining.
3. Microscopic observation of cyanobacteria (*Nostoc, Spirulina*), algae and fungi (*Saccharomyces, Rhizopus, Aspergillus, Pencillium, Fusarium*).
4. Isolation of T2 bacteriophage from sewage sample.
5. Preparation of media for culturing autotrophic and heterotrophic microorganisms – algal medium, mineral salts medium, nutrient agar medium, McConkey agar and blood agar.
6. Sterilization techniques: Autoclave, Hot air oven and filtration.
- ✓ 7. Enumeration of bacterial numbers by serial dilution and plating (viable count)
8. Isolation of pure cultures by streak, spread and pour plate techniques
9. Preservation of microbial cultures- Slant, Stab, Sand cultures, mineral oil overlay and glycerol stocks
10. Turbidometric measurement of bacterial growth and plotting growth curve.

References:

1. Experiments in Microbiology by K.R. Aneja.
2. GopalReddy.M., Reddy. M.N., SaiGopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.

Course Outcomes:


At the end of the course student will be able to

MB131.CO1 Acquaint with historical account and apply microscopy and staining techniques.


MB131.CO2 Able to classify microorganisms based on salient characteristics and summarize characteristics of various bacteria and compare different types of viruses.

MB131.CO3 Understand the nutritional requirements of different types of bacteria and importance of various metabolic pathways in food and energy production.

MB131.CO4 Able to identify, isolate, and preserve the microorganisms.


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. I YEAR SYLLABUS (2020 Onwards)
SUBJECT -MICROBIOLOGY
II SEMESTER (4 HPW-4Credits)
MB 231 PaperII MICROBIAL DIVERSITY

Overall Course Objective:To explain the relevance of the microbial biodiversity concepts and ecosystems.

Unit wise Course Objectives:

Cob1. Discuss about diversification of microorganisms

Cob2. Explain about the physiological diversity of bacteria

Cob3. Basic insights into few unique characteristics of protozoa, fungi and algae.

Cob4. Discuss various microbial ecosystems and their interactions

UNIT 1: CONCEPT OF BIODIVERSITY

Basic concept of Biodiversity and Conservation –Elements of Biodiversity- Ecosystem	15 Hrs
Diversity, Genetic Diversity, Species Abundance & Diversity. Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity	6 Hrs
Classification of living organisms; Haeckel, Whittaker and Carl Woese systems	4 Hrs
Differentiation of prokaryotes and eukaryotes	1Hr
Classification of bacteria as per the second edition of Bergey's manual of systematic bacteriology	4 Hrs

UNIT 2: PROKARYOTIC MICROBIAL DIVERSITY

General characteristics of eubacteria, Rickettsia, Mycoplasma	15 Hrs
Microbial richness: exploration, significance, conservation and applications	4 Hrs
Structural and physiological diversity of Archaea bacteria, Metabolic characteristics of extremophiles (Methanogens, Halophiles, Thermoacidophiles)	3 Hrs
Gram negatives: Cyanobacteria and Proteobacteria, Gram positives and heterogenous members including Firmicutes, Actinobacteria, Bacteroidetes, Acidobacteria and Planctomycetes	4 Hrs

UNIT 3: EUKAROTIC MICROBIAL DIVERSITY

Eukaryotic microbial diversity. Structural, physiological and metabolic characteristics of Algae - Cyanophyta, Chlorophyta Bacillariophyta, Phacophyta, Rhodophyta	15 Hrs
Fungi -Phycomycetis, Basidiomycetis, Zygomycetes, Oomycetes, Ascomycetes,	6 Hrs
Deuteromycetes (imperfect and perfect stages)	5 Hrs

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Protozoa - Giardia, Entamoeba and Plasmodium

4 Hrs

UNIT 4: MICROBIAL ECOSYSTEMS

15 Hrs

Microbial interactions: Symbiosis, neutralism, commensalism, competition, antagonism, synergism, parasitism

6 Hrs

Understanding microbial diversity with Cultivated vs Uncultivated microorganisms.
The Great Plate count anomaly

2 Hrs

Cultivation independent methods to assess microbial diversity

2 Hrs

Preserved and perturbed microbial ecosystems, microbiome for sustainable agroecosystems, Human microbiome

5 Hrs

Suggested Books


1. Pelczar Jr. M.J. Chan. E.C.S and Kreig.N.R (2006). "Microbiology" - 5th Edition McGraw Hill Inc. New York.
2. David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" - Mac Milan Education Ltd. London.
4. Brown J.W. (2015) Principles of Microbial Diversity, ASM Press
5. Epstein S.S. (2009) Uncultivated microorganisms, Springer-Verlag Publishers
6. Madigan M.T., Bender K.S., Buckley D.H., Sattley W.M. and Stahl D.A. (2017) Brock Biology of Microorganisms, 15th Edn. (Global Edn.) Pearson Education

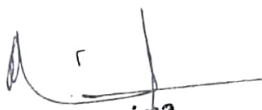
MICROBIAL DIVERSITY PRACTICALS

Paper-II MB231P

2HPW-Credits-1

1. Isolation of Methanogenic bacteria from manure by anaerobic culturing
2. Isolation and enumeration of halophiles from saline environment
3. Isolation of bacteria from diversified habitats to demonstrate antagonism, commensalism and synergism
4. Isolation of *Cyanobacteria* and fungi from different habitats
5. Identification of fungi by staining techniques
6. Microscopic observation of soil algae and Protozoa
7. Winogradsky's column to demonstrate microbial diversity
8. Visit and observe any nearby unique ecosystems to understand the role of microorganisms
9. Demonstration of the great plate count anomaly


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References:

1. Anuja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Burns, R.G. and Slater, J.H. (1982). Experimental Microbiology and Ecology. Blackwell Scientific Publications, USA.
4. Pepler, I.L. and Gerba, C.P. (2004). Environmental Microbiology – A Laboratory Manual. Academic Press. New York.
5. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.
6. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi.
7. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
8. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, SriPadmavathi Publications, Hyderabad

Course Outcomes:


The student will be able to

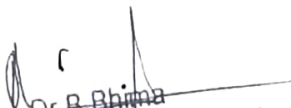
MB231.CO1 Understand and appreciate the diversity of microorganism and conservation, for the Sustenance of life on Earth in general.

MB231.CO2 Able to classify and compare various bacteria

MB231.CO3 Aware of general characteristics of protozoa, fungi, algae and their economic importance

MB231.CO4 Appreciate the microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. II YEAR SYLLABUS
SUBJECT -MICROBIOLOGY
III SEMESTER (4 IIPW-4Credits)
MB 331 Paper III MICROBIAL PHYSIOLOGY

Overall Course Objective: To summarize microbial nutrition and microbial metabolism.

UNIT WISE COURSE OBJECTIVES:

The student will be able to

- Cob1. To categorize microbes basing on their nutritional requirements and summarize various phases of bacterial growth.
- Cob2. Classify enzymes and describe different factors influencing enzyme activity.
- Cob3. Explain various pathways of aerobic respiration and interpret their importance in cellular energy yield.
- Cob4. Describe Anaerobic respiration, fermentation and photosynthetic pathways.

UNIT-I – Nutrition and Growth

1	Microbial Nutrition - Nutritional requirements and uptake of nutrients by cells	15 hrs
2	Nutritional groups of microorganisms - Autotrophs, Heterotrophs, Phototrophs Chemotrophs, Organotrophs, Lithotrophs, Mixotrophs, Methylophs. With example of each	4 hrs 3 hrs
3	Growth media - Synthetic, Nonsynthetic, Selective, Enrichment and Differential media.	2 hrs
4	Microbial growth - Different phases of growth in batch cultures	2 hrs
5	Synchronous, continuous, biphasic growth	1 hr
6	Factors influencing microbial growth	1 hr
7	Methods for measuring microbial growth – Direct microscopy, Viable Count estimates, Turbidometry, Biomass. (DNA, Protein, Nitrogen content- Kjeldal method)	2 hrs

UNIT-II - Enzymes

1	Enzymes - properties and classification, enzyme unit, enzyme assay methods	15 hrs
2	Biocatalysis - Induced fit, Lock and key model, Types of catalysis, Coenzymes, Cofactors, Factors affecting catalytic activity of enzymes	5 hrs 5 hrs
3	Inhibition of enzyme activity –Reversible, Competitive, Non competitive, uncompetitive and Irreversible, Allosteric.	5 hrs

UNIT-III – Microbial Metabolism 1

1	Aerobic respiration - Glycolysis, HMP pathway, ED pathway, TCA cycle	7
2	Electron transport, Oxidative and Substrate-level Phosphorylation..	5
3	β -Oxidation of fatty acids	2
4	Glyoxylate cycle	1

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UNIT-IV - Microbial Metabolism 2

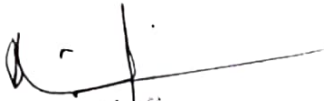
15 hrs

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|---|---|-------|
| 1 | Anaerobic respiration (nitrate, sulphate respiration). | 2 hrs |
| 2 | Fermentation - Common microbial fermentations with special reference to Ethyl alcohol, Butanol and lactic acid fermentations. | 6 hrs |
| 3 | Photosynthetic apparatus in prokaryotes | 2 hrs |
| 4 | Outlines of oxygenic and anoxygenic photosynthesis in bacteria. | 5 hrs |

TEXT AND REFERENCE BOOKS:

1. Gottschalk, G. (1986). Bacterial Metabolism, Springer-Verlag, New-York.
2. Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA.
3. Moat, A.G. and Foster, J.W. (1995). Microbial Physiology, John-Wiley, New York.
4. Trevor Palmer, Enzymes, Biotechnology, Biochemistry and Clinical Chemistry, Eastwest Press private limited.
5. Reddy, S.R. and Reddy, S.M. (2004). Microbial Physiology, Scientific Publishers, Jodhpur, India.
6. Reddy, S.M. and Reddy, S.R. (2005). A Text Book of Microbiology Vol-II. Metabolism and Molecular Biology. Himalaya Publishing House, Mumbai.
7. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
8. Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2nd edition.
9. Applied Microbiology, W.H. Freeman and company, New York.
10. Gopal Reddy, M., Naga Padma, P., Anuradha, K., Madhsudhan Reddy, D. (2013). Microbial Physiology, Genetics, Telugu Akademy


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III SEMESTER PRACTICALS (2 HPW-1Credits)

MB 331P Paper III MICROBIAL PHYSIOLOGY

- 1 Preparation of media for culturing Autotrophic and Heterotrophic microorganisms - Algal medium, Mineral salts medium, Nutrient agar medium, McConkey agar, and Blood agar
- 2 Enrichment culturing and isolation of Phototrophs and Chemoautotrophs
- 3 Setting and observation of Winogradsky Column
- 4 Determination of viable count of bacteria
- 5 Turbidometric measurement of bacterial growth
- 6 Bacterial growth curve
- 7 Factors affecting bacterial growth – pH, temperature, salts
- 8 Sugar fermentation
- 9 Starch hydrolysis and amylase assay (Quantitative method).

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology. S. Chand & Co. Ltd., New Delhi.
3. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
4. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi
5. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

COURSE OUTCOME:


Students will be able to

MB331.CO1 List growth media ingredients based on nutritional requirement of microbes.


MB331.CO2 Apply enzyme assay methods to determine the enzyme activity.

MB331.CO3 Sketch and summarize metabolic pathways in microbes.

MB331.CO4 Analyse fermentative abilities of various microbes


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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SEC-1: MB 301: FOOD ADULTERATION
III SEMESTER (2 HPW-2Credits)

Overall Course objective: To describe the methods in detection of food adulterants

UNIT WISE COURSE OBJECTIVES

The student will be able to

Cob1 Discuss different food adulterants and their harmful effects

Cob2 Hands on training to analyse food adulteration and discuss Concept of Food Safety Act and FSSAI in preventing and punishing adulteration.

Unit 1:

1. Definition and Introduction to food adulteration.
2. Types of Food Adulteration
3. Common Food adulterants
4. Causes of Food adulteration
5. Analysis of food

Unit 2:

1. Effects of Food Adulteration
2. Prevention of Food adulteration
3. Detection of Common food Adulterants.
4. Food Adulteration act-1954

REFERENCES:


1. Jesse Park Battershall. Food adulteration and its detection. Published by Book on Demand, Miami, 2015
2. R. B. Sethi's Prevention of food adulteration act.
3. Dr. Sheela.S. Prevention of Food Adulteration.

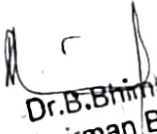
Outcomes

Students will be able to

MB301.CO1 Differentiate adulterated and unadulterated food products.

MB301.CO2 Apply simple methods to detect food adulterants.


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. II YEAR SYLLABUS
SUBJECT -MICROBIOLOGY
IV SEMESTER (4 HPW-4Credits)
MB 431 Paper IV MOLECULAR BIOLOGY

Overall Course Objective: Discuss DNA replication, transcription, translation and recombinant DNA technology

UNIT WISE COURSE OBJECTIVES:

The student will be able to:

- Cob1. Describe the structure of DNA and explain mechanisms of DNA replication, Transcription and Translation.
- Cob2. Categorize types of mutagens and summarize DNA repair mechanisms.
- Cob3. Discuss gene expression and regulation.
- Cob4. Explain various steps involved in Recombinant DNA technology.

UNIT-I - Fundamentals of Microbial Genetics 15 hrs

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|---|--|-------|
| 1 | DNA and RNA as genetic materials | 3 hrs |
| 2 | Structure of DNA – Watson and Crick model (B), A and Z forms of DNA, | 1 hr |
| 3 | Super coiling of DNA (positive and negative coiling, Topoisomerases /Gyrase) | 1hr |
| 4 | Replication of DNA – Semi conservative mechanism | 2 hrs |
| 5 | Types of RNA and their functions | 2 hrs |
| 6 | Outlines of RNA biosynthesis in prokaryotes. | 3 hrs |
| 7 | Genetic code. Structure of ribosomes and a brief account of protein synthesis. | 3 hrs |

UNIT-II - Mutation and Genetic variation 15 hrs

- | | | |
|---|--|-------|
| 1 | Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions | 3 hrs |
| 2 | Various physical and chemical mutagens, Biological agents, Overview of Site directed Mutagenesis | 4 hrs |
| 3 | Outlines of DNA damage and repair mechanisms | 4 hrs |
| 4 | Genetic recombination in bacteria – Transformation, Transduction and Conjugation. | 4 hrs |

UNIT-III - Microbial Gene Expression 15 hrs

- | | | |
|---|--|-------|
| 1 | Concept of gene and its product.
gene structure -Muton, Recon and Cistron | 2 hr |
| 2 | Operon concept. Regulation of gene expression in bacteria – lac operon | 3 hrs |

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 Sainikpuri

Dr. B. Bhima
 Chairman, BOS
 Dept. of Microbiology
 Osmania University, Hyd.

3	Extra chromosomal Genetic elements:	5 hrs
	a. Plasmids: Types F, R, Col Ti, Degradative etc, Properties and Functions	5 hrs
	b. Transposons: IS, Composite, DNA , RNA and Retro transposons - Structure and Functions	
UNIT-IV - Recombinant DNA Technology		15 hrs
1	Basic principles of genetic engineering	2 hrs
2	Enzymes in Genetic engineering, restriction endonucleases, DNA polymerases, ligases S1 nuclease ,Reverse transcriptase, Alkaline phosphatase, Methylase	4 hrs
3	Outlines of gene cloning methods-random cloning, shot gun, PCR and cDNA	3hrs
4	Genomic and cDNA libraries.- construction and applications	3 hrs
5	General account on application of genetic engineering in industry, agriculture Medicine, Environment.	3 hrs

TEXT AND REFERENCE BOOKS:

1. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.
2. Reddy, S.M. and Reddy, S.R. (2005). A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology. Himalaya Publishing House, Mumbai.
3. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
4. Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2nd Edition, Oxford University Press, U.S.A. Verma, P.S. and Agarwal, V.K. (2004).
5. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.
6. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
7. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
8. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
9. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
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11. Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, Blackwell Science Publication, New York.
12. Smith, J.E. (1996). Biotechnology, Cambridge University Press.
13. Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press, Washington, D.C., USA.
14. Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
15. Lewin, B. (2000). Genes VIII. Oxford University Press, England
16. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. (1998).
17. Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
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19. Nicholl, D.S.T. (2004). An Introduction to Genetic Engineering. 2nd Edition. Cambridge University Press, London.
20. Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) A text Book of Molecular Biotechnology. Himalaya Publishers, Hyderabad.
21. Gopal Reddy, M., Naga Padma, P., Anuradha, K., Madhsudhan Reddy, D. (2013). Microbial Physiology, Genetics, Telugu Akademy

IV SEMESTER PRACTICALS (2 HPW-1Credits)
MB 431P Paper IV MOLECULAR BIOLOGY

- 1 Colorimetric estimation DNA by diphenylamine method.
- 2 Colorimetric estimation RNA by orcinol method
- 3 Colorimetric estimation of proteins by Biuret method
- 4 Paper chromatographic separation of sugars or amino acids
- 5 Extraction of Genomic DNA
- 6 Agarose gel Electrophoresis
- 7 Problems related to DNA and RNA characteristics, Transcription and Translation

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology. Himalaya Publishing House, Mumbai.
2. Wilson, K. and Walker, J. (1994). Practical Biochemistry. 4th Edition, Cambridge University Press, England.
3. Sawhney, S.K. and Singh, R. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
4. Plummer, D.T. (1988). An Introduction to Practical Biochemistry. 3rd Edition, Tata Mc GrawHill, New Delhi.
5. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
6. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
7. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.

COURSE OUTCOME:

Students will be able to

MB431.CO1 Solve problems related to DNA basing on Chargaff's rule and determine the concentration of DNA and RNA.

MB431.CO2 Prepare a mind map of types of Mutagens and their mechanism of action.

MB431.CO3 Extract DNA from bacteria and estimate the molecular weight of isolated DNA.

MB431.CO4 Prepare a pictorial representation of various steps involved in Recombinant DNA technology and present applications of Recombinant DNA technology in various fields.

B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SEC-2: MB 401: FUNDAMENTALS OF BIOINFORMATICS
IV SEMESTER (2 HPW-2Credits)

Overall Course Objective: Explain the basics of bioinformatics.

UNIT WISE COURSE OBJECTIVES

The student will be able to

- Cob1. Discuss about human genome project and Biology behind gene editing technologies.
- Cob2. Hands on training on searching databases, pairwise alignment and multiple sequence alignment.

Unit 1: Introduction to Bioinformatics and Biological Databases

1. Human Genome Project.
2. Bioinformatics and overview of genomics, transcriptomics, and proteomics
3. Biological Databases: primary and secondary, knowledgebases, databases for sequence, structure, metabolic pathways. interactions
4. Searching databases with text and sequence queries (BLAST)
5. Pair-wise and multiple sequence alignment

Unit 2: Technologies for HTS

1. Methods to characterize the genome: first, second and third generation sequencing techniques for DNA
2. Methods to characterize the transcriptome: PCR and RNA sequencing
3. Methods to characterize the proteome: peptide sequencing and MS methods
4. Analytical methods: Microarrays to study the genome and transcriptome
5. Genome engineering using ZFN, TALENs, and CRISPR

REFERENCES:

1. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
2. Pradeep and Sinha Preeti (2007) Foundations of Computing, 4th ed., BPB Publications
3. Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell
6. Ghosh, Z. and Mallick, V. (2008) Bioinformatics- Principles and Applications. Oxford University Press.

COURSE OUTCOMES

Students will be able to

MB401.CO1 Sketch phylogenetic tree using NCBI

MB401.CO2 Perform pairwise alignment and multiple sequence alignment

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

V SEMESTER (3 HPW-3Credits)

MB 531 Paper V AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Course Objectives:

This paper provides:

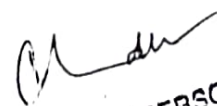
- Overview on characteristics of soil, Microorganisms of rhizosphere and Phyllosphere and role of Microbes in promoting plant growth.
- Outlines on biological nitrogen fixation process.
- Concepts on plant diseases caused by bacteria and viruses, symptoms and prevention.
- Study on control of plant diseases by biopesticides
- Role of microorganisms in biogeochemical cycles.
- An account on Microbial interactions. Air microflora and air sampling methods.
- Concepts on Microbiology of potable and polluted water.
- Learning on sewage treatment and solid waste disposal methods.


UNIT - I Agricultural Microbiology 12 Hrs

1	Physical and chemical characteristics of soil	1 hr
2	Microorganisms of Soil	1hr
3	Rhizosphere and phyllosphere	2 hr
4	Plant growth-promoting microorganisms -Mycorrhizae, <i>Rhizobia</i> , <i>Azospirillum</i> , <i>Azotobacter</i> , <i>Cyanobacteria</i> , <i>Frankia</i> and Phosphate-solubilizing microorganisms	5 hr
5	Outlines of biological nitrogen fixation (symbiotic, non-symbiotic).	2hr
6	Biofertilizers - Production and application of Biofertilizers - <i>Rhizobium</i> and <i>Cyanobacteria</i> .	1 hr

UNIT - II Plant Diseases and Biocontrol 11 Hrs

1	Concept of disease in plants	1 hr
2	Symptoms of plant diseases caused by fungi, bacteria, and viruses	3hr
3	Plant diseases caused by fungi (Groundnut rust), bacteria (Angular Leaf Spot of Cotton) and viruses (Tomato Leaf Curl).	3 hr
4	Principles of plant disease control	1hr
5	Biological control of plant diseases. Biopesticides - <i>Bacillus thuringiensis</i> , <i>Nuclear Polyhedrosis Virus</i> (NPV), <i>Trichoderma</i>	3 hr


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 Associate Professor
 Department of Microbiology, U.C.S.,
 OSMANIA UNIVERSITY, HYD-7.

UNIT - III Environmental Microbiology

		11 H
1	Role of microorganisms in nutrient cycling - carbon, nitrogen, sulphur, phosphorus .	6 hr
2	Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.	2 hr
3	Microorganisms in Air	1 hr
4	Air sampling methods	2 hr

UNIT - IV Environmental Pollution and Bioremediation

		11 Hrs
1	Microorganisms in water	1 hr
2	Microbiology of potable and polluted waters. <i>E. coli</i> and <i>Streptococcus faecalis</i> as indicators of water pollution, Sanitation of potable water	3 hr
3	Sewage treatment (primary, secondary and tertiary).	3 hr
4	Outlines of biodegradation of environmental pollutants– pesticides	2 hr
5	Solid waste disposal – sanitary landfills, composting	2 hr

REFERENCE BOOKS

1. Subba Rao, N.S. (1993). Biofertilizers in Agriculture and Forestry, 3rd Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
3. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA
4. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.
5. Lynch, J.M. and Poole, N.J. (1979). Microbial Ecology – A Conceptual Approach, Blackwell Scientific Publications, USA
6. Alexander Martin. Soil Microbiology (2001).
7. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M.(2012) Applied Microbiology, Telugu Akademy.

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U.C.
HYD.

Dr. B. BHIMA, M.Sc., Ph.D.
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OSMANIA UNIVERSITY, HYD.

Dr. B. BHIMA
Depto
OSM
CBSC SYLLABUS/MB/NEW/2017

V SEMESTER PRACTICALS (2 HPW-1Credits)

MB 531P Paper V AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

- 1 Isolation and enumeration of major groups of microorganisms from rhizosphere and non rhizosphere
- 2 Isolation and enumeration of major groups of microorganisms from phyllosphere.
- 3 Study of root nodules and isolation of *Rhizobium* from legume root nodules
- 4 Isolation of *Azospirillum* / *Azotobacter*
- 5 Staining and observation of vesicular-arbuscular mycorrhizal (VAM) fungi
- 6 Observation of plant diseases of local importance – Rusts, smuts, powdery mildews, tikka disease of groundnut, citrus canker, bhendi yellow vein mosaic, tomato leaf curl, little leaf of brinjal
- 7 Isolation of microorganisms of air by Petri plate exposure method
- 8 Determination of biological oxygen demand (BOD) of polluted water
- 9 Microbial testing of water by coliform test (Multiple Tube Fermentation method).

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad
3. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
4. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
5. Burns, R.G. and Slater, J.H. (1982). Experimental Microbiology and Ecology. Blackwell Scientific Publications, USA.
6. Peppler, I.L. and Gerba, C.P. (2004). Environmental Microbiology – A Laboratory Manual. Academic Press. New York.

Course outcome:

- Knowledge on role of plant growth promoting rhizobacteria
- Understand the mechanism of biological nitrogen fixation and applications of biofertilisers.
- Awareness on different plant diseases and measures to prevent them.
- Understand the importance and applications of biopesticides like *Bacillus thuringensis*, *Trichoderma* etc.
- Able to understand the recycling of carbon, sulphur, phosphorus and Nitrogen in the environment.
- Practical skills on trapping air microorganisms.
- Gain practical knowledge on testing water samples by MPN technique.

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 Saintipuri

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 DR. M. DHINA, M.Sc., Ph.D.
 Associate Professor
 Department of Microbiology, U.O.S.
 JYOTI UNIVERSITY, HYD-7.

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- Understand methods of solid and liquid waste disposal methods.

**SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY**

**V SEMESTER (3 HPW-3Credits)
MB 532/A Paper VI IMMUNOLOGY**

Objectives:

This paper provides:

- Overview on history and recent developments of immunology
- Introduction to types of immunity and role of natural and recombinant vaccines in protecting against infections.
- Insight into process of Hematopoiesis for formation of different cells and their role in immunity.
- Study on structure and functions of primary and secondary lymphoid organs in inducing immune responses.
- Basic fundamental concepts on types of antigens and antibodies, properties and their functions.
- Detailed account on complement pathways and role of cytokines in Immune system.
- Learning on different types of antigen and antibody reactions. Production and applications of Monoclonal antibodies.
- Outlines on Hypersensitive reactions, Autoimmune disorders and role of MHC

UNIT – I History and types of Immunity

1	History of Immunology	1
2	Recent developments of immunology	1
3	Types of immunity – innate and acquired; active and passive	6
4	Humoral and Cell-mediated immunity	1
5	Vaccines – natural and recombinant	2

11hrs

UNIT-II Components of Immune system

1	Process of Hematopoiesis	1
2	Cells of immune system - Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils, eosinophils, Mast cells and Dendritic cells	4
3	Process of Phagocytosis	1
4	Primary organs of immune system- Thymus, Bursa fabricus, Bone marrow	2
5	Secondary organs of immune system –, Spleen, Lymph nodes, Mucous Associated Lymphoid Tissue (MALT).	3

11 Hr

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DR. B. BHISHA, M.Sc., Ph.D.,
Associate Professor
Department of Microbiology, U.C.S,
OPMANIA UNIVERSITY, HYD-7.

UNIT-III Basics of Immunology

- Antigen - types, chemical nature, antigenic determinants, epitopes
- Factors affecting antigenicity
- Antibodies - basic structure, types, properties and functions of immunoglobulins
- Complement: Components of complement and activation of complement
- Role of Cytokines in Immune system

UNIT-IV Immunological processes

- Types of antigen-antibody reactions - agglutination, precipitation, neutralization, complement fixation
- Labeled antibody based techniques - ELISA, RIA and Immunofluorescence, Western Blotting
- Polyclonal and monoclonal antibodies - production (Hybridoma Technology) and applications
- Types of hypersensitivity - immediate and delayed
- MHC and its role in graft rejection
- Autoimmunity and its significance

REFERENCE BOOKS:

1. Bailey, S.R. and Bailey, K.R. (2016). A Text Book of Microbiology - Immunology and Medical Microbiology, Himalaya Publishing House, Mumbai
2. Ezzi, I.R. (1995). Immunology - An Introduction, WB Saunders, Philadelphia, USA
3. Joffe, L.M. (1998). Essentials of Immunology, ELBS and Black Well Scientific Publishers, England
4. Gellistry, Smith, T.J. and Osborne, B.A. (2014). Kuby Immunology, 8th Edition, W.H. Freeman and Company, New York
5. Laskyari, P.M., Whelan, A. and Finger, M.W. (2000). Immune Notes in Immunology, Viva Books Pvt. Ltd., New Delhi
6. Chakrabarty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

VI SEMESTER (3 HPW-3Credits)
MB 631 Paper VII MEDICAL MICROBIOLOGY

Course Objectives:

This paper provides:

- Description of the Normal flora of human body and its significance.
- An account on the role of non specific defence mechanisms of human body.
- Study of general principles and methods of diagnostic microbiology.
- Study of important bacterial and viral pathogens, epidemiology, diagnosis, prevention and their control.
- An introduction to nosocomial infections and its control measures.
- An overview of superficial and systemic fungal infections.
- Fundamentals in use of therapeutic drugs and their mode of actions.
- Detailed study of methods for evaluation of antimicrobial agents.
- Study of mechanisms in antimicrobial drug resistance.

UNIT-I Basics of Medical microbiology

11 hr

1	History of Medical microbiology	1
2	Normal flora of human body-Definition, Effects of Antibiotics, Distribution of normal flora	3
3	Definition and process of infection, non-specific defense mechanisms, mechanical barriers	2
4	Host-pathogen interactions. Bacterial toxins, virulence and attenuation	3
5	Anti-microbial substances of host – lysozyme, complement, properdin, antiviral substances, Phagocytosis, beta lysine, leukin, lactoperoxidase	2

UNIT-II Diagnostic Microbiology & Medical Bacteriology

12hrs

1	General principles of diagnostic microbiology	1 hr
2	Collection, transport and processing of clinical samples	2 hr
3	General methods of laboratory diagnosis – cultural, biochemical, serological and molecular methods	2 hrs
4	General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of:	1 hr
	Air-borne diseases - Tuberculosis	1 hr
	Food and water-borne diseases - Cholera, Typhoid.	2 hr
	Contact diseases - Syphilis, Gonorrhoea	2hr

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 Asst. Prof. of
 Dept. of Microbiology, U
 O. S. S. UNIVERSITY, HYD

- 5 Zoonotic diseases – Anthrax
 6 General account of nosocomial infections-*Staphylococcus* and *Pseudomonas* 1 hr

UNIT-III Virology and Parasitology 11 hrs

- 1 General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of:
 Air-borne diseases - Influenza 2 hr
 2 Food and water-borne diseases - Hepatitis- A, Poliomyelitis, Amoebiasis 3 hrs
 3 Zoonotic diseases – Rabies 2 hrs
 4 Blood-borne diseases - Serum hepatitis, AIDS 2 hrs
 6 Insect Borne: Malaria, Dengue 2 hrs

UNIT-IV Chemotherapy 11 hrs

- 1 Elements of chemotherapy – therapeutic drugs 2 hrs
 2 Mode of action of cell wall inhibitors(penicillin), antimetabolites (sulpha drugs), and their clinical use 4 hrs
 3 Drug resistance 3 hrs
 4 Tests for antimicrobial susceptibility 1 hrs
 5 General account of antiviral drugs 1 hrs

REFERENCES:

1. Jawetz. Medical Microbiology and Immunology(2000), 6th Edition. Mc Graw Hill, New York.
2. Greenwood,David. Medical Microbiology (1997).15th Edition.Churchill Livingstone, New Delhi.
3. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.
4. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
5. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
6. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical
7. Zaman, Hand book of Medical Parasitology 2nd Edition, K.C.publishers,Singapore.
8. Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
9. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, NewDelhi.
10. Franklin,DJ. and Snow GA. Biochemistry of antimicrobial action.Pub:Chapman & Hall.
11. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Antibiotics and Chemotherapy. Publ:Churchill Livingstone.
12. Williams, RAD., Lambart, PA. & Singleton, P. Antimicrobial Drug action. Pub:Bios Sci

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~~11 SEMESTER PRACTICAL COURSE~~
11th SEMESTER PRACTICAL COURSE IN MEDICAL MICROBIOLOGY

- 1. Antibiotic sensitivity of bacterial pathogens: McCooky, Mannitol Salt agar, Penicillin, Bacitracin, Oxidase Media
- 2. Isolation and identification of medically important bacteria (*E. coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*) by cultural, microscopic and biochemical tests.
- 3. Antibiotic sensitivity testing - disc diffusion method
- 4. Parasitology - Malaria parasite, *Entamoeba* (study of permanent slides).
- 5. Observation of fungal pathogen (*Candida*).
- 6. Test for disinfectant (Phenol coefficient).

REFERENCES:

- 1. Choudhary, M., Reddy, M.N., Saigopal, DVR and Mallaiyah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
- 2. Gulley, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
- 3. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyer & Son Publishers, Chennai.
- 4. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai.
- 5. Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.
- 6. Cappuccino (2000). Microbiology Lab manual, Oxford University Press

Learning outcomes:

- 1. Understand the importance normal flora and its health benefits.
- 2. Understanding the different types of diagnostic methods for identifying the pathogens and the principles of diagnosis.
- 3. Understanding the control, prevention and pathogenesis of bacterial and viral infections.
- 4. Understand the toxocytosis infections and their control.
- 5. Understand the virulence of systemic and superficial mycotic infections.
- 6. Understand understanding of Drug resistance.
- 7. Understand mode of action of antimicrobial agents and evaluation of the drugs.
- 8. Understand the mechanisms of antibiotic agents.

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B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

VI SEMESTER (3 HPW-3Credits)

MB 632/A Paper VIII FOOD AND INDUSTRIAL MICROBIOLOGY

Course Objectives:
This paper provides:

- Description of different microbes involved in food spoilage and detailed study of various spoiled food materials.
- An account on the food poisoning and important food borne infections.
- Study of general principles and methods of food preservation and account on biochemical activities of microbes in milk.
- Detailed study of production of fermented foods.
- An overview on the Single Cell Proteins and production of edible mushrooms.
- General account on concept of probiotics and its production.
- Detailed study on screening of microorganisms used in industry, strain improvement and types of fermentations.
- Description of fermentor, types of raw materials in microbial fermentation.
- Basic outlines of industrial production of alcohol, beverages, enzymes, antibiotics, amino acids, organic acids, vitamins, biofuels and Insulin.

UNIT - I Food Microbiology		12 hrs
1	Microorganisms of food spoilage and their sources	1
2	Spoilage of different food materials - fruits, vegetables, meat, fish. Canned foods	5
3	Food poisoning (botulism and staph poisoning), Food borne diseases (Salmonellosis, Shigellosis, Listeria) and their detection	4
4	General methods of food preservation	2
UNIT- II Applied Food Microbiology		11 hrs
1	Microbiological production of fermented foods – bread, cheese, yogurt	3
2	Biochemical activities of microbes in milk	2
3	Microorganisms as food – SCP, edible mushrooms.	4
4	Concept of probiotics and its production	2
UNIT - III Industrial Microbiology		11 Hrs
1	Microorganisms of industrial importance – yeasts, molds, bacteria; actinomycetes	3
2	Screening and isolation of industrially-important microorganisms	2
3	Outlines of strain improvement	2

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 OSmania University, HYD-7.

CHAIRMAN
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4 Types of fermentation – aerobic, anaerobic, batch, fed batch continuous, surface, submerged and solid state 4



UNIT – IV Microbial Biotechnology

11 Hrs

- 1 Design of a stirred tank reactor fermentor 1
- 2 Fermentation media. Raw materials used in fermentation industry 2
- 3 Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane). 8

REFERENCES:

1. Casida, L.E. Industrial Microbiology (1999). 10th edition. New Age International Publication, New Delhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
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VI SEMESTER PRACTICALS (2 HPW-1Credit)
MB 632P/A Paper VIII FOOD AND INDUSTRIAL MICROBIOLOGY

- 1 Observation and Isolation of fungi and bacteria from spoiled fruits and vegetables
- 2 MBRT -Test for microbiological quality of milk
- 3 Isolation of antagonistic microorganisms by crowded plate technique
- 4 Isolation of amylase-producing organisms
- 5 Alcohol production and estimation; Calculation of fermentation efficiency
- 6 Citric acid production and estimation
- 7 Preparation of fermented food- Yoghurt

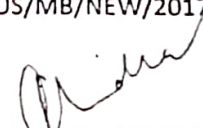
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Course outcome:

- Knowledge of various microbes involved in the food spoilage and properties of spoiled foods.
- Awareness of food borne diseases , food poisoning and their detection.
- Understanding the general methods food preservation.
- Learn the basic principles in production of fermented foods like bread, cheese, youghurt.
- A brief understanding of biochemical activities of microbes in milk.
- Understand the processes in production of SCP ,edible mushrooms and probiotics.
- Acquire broad understanding in strain improvement and screening of industrially important microbes.
- Understand basic design of fermentor.
- Acquire knowledge in various microbial fermentation procedures involved in production of ethyl alcohol, glutamic acid, Beer, penicillin, citric acid, Vitamin B12, Biogas and Insulin.

CBCS SYLLABUS/MB/NEW/2017


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CHAIRPERSON
 BOS in Microbiology
 Ananda College

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

VI SEMESTER (3 HPW- 3Credits)
MB 632/B Paper VIII MICROBIAL TECHNOLOGY

Overall Course Objective: Detailed account on the applications of microbiology in the industry

UNIT WISE COURSE OBJECTIVES:

The student will be able to

- Cob1. Explain importance of production strains and strain development strategies.
- Cob2. Describe bioreactor, fermentation media and process economics.
- Cob3. Elaborate on fermentative production of microbial enzymes, beverages, probiotics and food additives
- Cob4. Outline the concept of GMP, GLP, SOP, QC and QA.

UNIT -I Bioprocessing and Process economics

11Hrs

- 1. An overview of industrially important microorganisms 1 hr
- 2. Characterization of industrial strains and their strain development strategies. 2 hr
- 3. Raw materials: Preparation of conventional and non-conventional substrates for microbial fermentation. Optimization of fermentation media 3 hr
- 4. Bioreactors: Designing and development of a bioreactor. 3 hr
- 5. An overview of process economics: 2 hr
 - a. Cost estimates b. Process Design optimization c. Operating Cost Estimates.
 - d. Marketing Potential

UNIT -II Fermentation Technology

12Hrs

- 1. Types of fermentation 1 hr
- 2. Microbial Enzymes: a. Amylases b. Proteases 2 hr
- 3. Beverages : a. Wine b. Beer 3 hr
- 4. Food Additives and Supplements : a. Exopolysaccharide b. vitamin (B12) 2 hr
- 5. Health Care Products : a. Antibiotic (Streptomycin) b. Recombinant therapeutic product (Humulin) 2 hr
- 6. Industrial Chemicals : a. Ethanol b. Citric acid 2 hr

UNIT -III Food biotechnology

11Hrs

- 1. Fermented foods: Bread, Idli, Cheese, Yoghurt 3 hr
- 2. Concept of probiotics and prebiotics. 2 hr

3. Overview of microbial biomass for food and feed: Algal, bacterial, fungal and yeast biomass, Technologies for the production of SCP 2 hr
4. Mushrooms: Types of Mushrooms; Cultivation of White button and Oyster Mushrooms. 2 hr
5. Foods of increasing sophistication: Functional/bioactive foods, Nutraceuticals, GM foods. 2 hr

UNIT -IV QC and QA in Microbial Technology

11 Hrs

1. Concept of Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP) and Standard Operating Practices (SOP) 2 hr
2. Overview of Quality Control (QC) in fermentation processes: Principles of validation for pharmaceutical industry 1 hr
3. Tests used for quality assurance (QA) of finished product. 3 hr
 - i. Sterility testing ii. Pyrogen testing iii. Ames test and modified Ames test iv. Toxicity testing v. Shelf life testing
4. An introduction to indicators of food safety, food quality and assurance. 2 hr
5. Quality assurance: Microbiological quality standards of food. 3 hr

Government regulatory practices and policies. FDA, EPA, HACCP, ISI.

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15. Brian McNeill, Linda Harvey, Wiley, Practical Fermentation Technology.
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VI SEMESTER PRACTICALS (2 HPW-1 Credit)
MB 632P/B Paper VIII MICROBIAL TECHNOLOGY

1. Microscopic observation of industrially important Microorganisms.
2. Preparation of different fermentation media.
3. Industrial production of Amylase.
4. Industrial production of Wine.
5. Industrial production of Alcohol.
6. Industrial production of Citric acid.
7. Preparation of Yoghurt.
8. Microbial examination of idli batter.
9. Good Lab Practices and procedure of writing SOPs for instruments.
10. Quality assurance of Fermentation procedure by sterility testing.

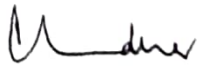
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COURSE OUTCOME:

Student will be able to

- MB632/B.CO1 Summarize industrially important microorganisms and strain manipulation techniques.
- MB632/B.CO2 Elaborate concepts on bioreactor and process economics
- MB632/B.CO3 Illustrate the process of fermentations and steps involved in purification.
- MB632/B.CO4 Review on QC and QA in microbial technology


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CBCS/B.SC/2019ONWARDS

B. Sc MICROBIOLOGY (CBCS STRUCTURE)

SEC-4: MB 601: MUSHROOM CULTIVATION

VI SEMESTER (2 HPW-2Credits)

Overall Course Objective: To provide theoretical and practical details of mushroom cultivation.

UNIT WISE COURSE OBJECTIVE:

Student will be able to

- Cob1. Explain mushroom cultivation method
- Cob2. Outline methods of mushrooms preservation

Unit-1

1. Introduction to mushroom cultivation
2. Importance and history of mushroom cultivation in India
3. Global status of mushroom production
4. Food value of mushroom

Unit-2

1. Steps in mushroom cultivation
2. Selection of site and types of mushroom
3. Mushroom farm structure, design layout
4. Principle and techniques of compost and composting
5. Principle of spawn production
6. Casing and crop production
7. Harvesting and marketing
8. Pest and pathogens of mushrooms
9. Post-harvest handling and preservation of mushrooms


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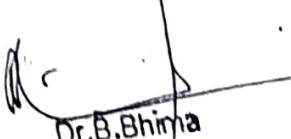
1. Mushroom cultivation in India by B.C. Suman and V.P. Sharma. Published by Daya Publishing House, New Delhi.
2. Mushrooms Cultivation, Marketing and Consumption by Manjit Singh Bhuvnesh Vijay Shwet Kamal G.C. Wakchaure Directorate of Mushroom Research (Indian Council of Agricultural Research) Chambaghat, Solan -173213 (HP)

COURSE OUTCOME:

The student will be able to

- MB601.CO1 Summarize mushroom cultivation in methods.
- MB601.CO2 Tabulate the nutritional value of mushrooms


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CBCS/B.SC/2019ONWARDS

B. Sc MICROBIOLOGY (CBCS STRUCTURE)
GE-2: MB 602: CONTAGIOUS DISEASES AND IMMUNIZATION
VI SEMESTER (2 HPW-2Credits)

UNIT WISE COURSE OBJECTIVE:

This paper provides

- Cob1. Overview of various kinds of infection.
- Cob2. Introduction to sources of microbial infections.

Unit-1: Contagious diseases

1. Types of Infections.
2. Sources of infections.
3. Mode of infections.
4. Overview of bacterial diseases.
5. Overview of Viral Diseases.

Unit-2: Immunization

1. Immunity.
2. Types of Immunity.
3. Immunization.
4. Types of immunization.
5. Vaccines- Live and killed vaccines.
6. Vaccination schedule.

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5. Shetty, N. (1994). Immunology – Introductory Textbook. New Age International Pvt. Ltd., New Delhi.
6. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, New Delhi.

COURSE OUTCOME:

The student will be able to

MB602.CO1 Awareness on bacterial and viral diseases

MB602.CO2 Understand about mode of infections

