

# Microbiology

**B.Sc. A]WcV]c`c[ mSyllabus (CBCS)**  
( w.e.f. 201Ī - 201Ī )



Faculty of Science

**PALAMURU UNIVERSITY**

Mahabubnagar - 509 001, Telangana

201Ī

**Telangana State Council of Higher Education, Govt. of Telangana**  
**PRAPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc.**  
**MICROBIOLOGY (2017-18)**

<b>FIRST YEAR - SEMISTER-1</b>				
Code	Course Title	Course Type	HPW	Credits
BS101	Communication			
BS102	English			
BS103	Second Language			
BS104	<b>General Microbiology</b>	DSC-1A	4+2	5
BS105	Optional-II			
BS106	Optional-III			
<b>SEMISTER-2</b>				
BS201	Environmental studies			
BS202	English			
BS203	Second Language			
BS204	<b>General Microbiology-II</b>	DSC-1B	4+2	5
BS205	Optional-II			
BS206	Optional-III			
<b>SECOND YEAR-SEMISTER-3</b>				
BS301	<b>A/B HAEMATOTOLOGY</b>	SEC-1	2	2
BS302	English			
BS303	Second Language			
BS304	<b>Microbial Physiology and Enzymology</b>	DSC-1C	4+2	5
BS305	Optional-II			
BS306	Optional-III			
<b>SEMISTER-4</b>				
BS401	<b>C/D-FOOD ADULTERATION</b>	SEC-2	2	2
BS402	English			
BS403	Second Language			
BS404	<b>Microbial Genetics and Molecular biology</b>	DSC-1D	4+2	5
BS405	Optional-II			
BS406	Optional-III			
<b>THERD YEAR-SEMISTER-5</b>				
BS501	<b>Mushroom cultivation</b>	SEC-3	2	2
BS502	<b>Microbiology and Human health</b>	GE-1	2	2
BS503	<b>APPLIED MICROBIOLOGY</b>	DSC-1E	3+2	4
BS504	Optional-II			
BS505	Optional-III			
BS506	<b>A-IMMUNOLOGY</b>	DSE-1E	3+2	4

	<b>B- PHARMACEUTICAL MICROBIOLOGY</b>			
BS507	Optional-II-A/B/C			
BS508	Optional-III-A/B/C			
<b>SEMISTER-6</b>				
BS601	<b>G/H HOSPITAL WAST MANAGEMENT</b>	SEC-4	2	2
BS602	<b>CONTAGIOUS DISEASES AND IMMUNISATION</b>	GE-2	2	2
BS603	<b>MEDICAL MICROBIOLOGY</b>	DSC-1F	3+2	4
BS604	Optional-II			
BS605	Optional-III			
BS606	<b>A-FOOD MICROBIOLOGY B- INDUSTRIAL MICROBIOLOGY</b>	DSE-1F	3+2	4
	Optional-II-A/B/C			
	Optional-III-A/B/C			
				164

**Dept. Microbiology: Palamuru University**

**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)  
With effect from 2017-18**

**Syllabus for B.Sc Microbiology**

**Code: BS 104, DSC- 1A**

**B.Sc I year: 1<sup>st</sup> semester**

**Title: General Microbiology-I**

**4HPW -credits-4**

**UNIT-1: HISTROY OF MICROBIOLOGY**

Meaning, definition and scope. History of microbiology: Contribution of Antony Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert, Koch, Iwanoswky, Beijernik, Winogradsky and Alexander Fleming. Importance and application of Microbiology.

**UNIT-2: MICROSCOPY**

Principles of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Ocular and stage micrometry. Size determination of microorganisms. Principles and types of stains-simple stain, differential stain, negative stain. Structural stain-spore, capsule, flagella. Bacterial motility-Hanging drop method.

**Unit-3; BIOLOGY OF MICROORGANISMS**

Classification of living organisms; Heckel, Whittaker and Carl Woese systems. Place of microorganisms in the living world. Differentiation of prokaryotes and eukaryotes. Prokaryotes—General characteristics of bacteria, Archea bacteria. Rickettsiasis, Mycoplasma, cyanobacteria and Actinomycetes. Classification of bacteria as per the second edition of Bergy's manual of systematic bacteriology

**UNIT-4 STRUCTURE OF MICROORGANISMS**

Ultra structure of bacteria cell; invariant components-cell wall, cell membrane, Ribosomes, nucleoid. Variant components-Capsule, flagella, fimbriae, endospores & storage granules. General characteristics and classification of virus. Morphology and structure of TMV and HIV. Structure and multiplication of lambda bacteriophage. Eukaryotes- General characteristics and classification. Eukaryotic microorganism- protozoa, microalgae, molds and yeast.

**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 5<sup>th</sup> Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker, J. Broch Biology of Microorganism, 9<sup>th</sup> Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.

**Dept. Microbiology: Palamuru University**  
**CHOICE BASED CREDIT SYSTEM-2017-18 (CBCS)**  
**B.Sc I year –I-semester Practical Syllabus**

**General Microbiology-I**

**2HPW-Credits-1**

- Light compound microscope and its handling.
- Calibration of microscopic measurements( ocular, stage micrometer)
- Measuring dimensions of microorganisms ( Bacteria and fungal spores)
- Simple and differential staining (Gram staining), Spore staining, capsule staining and negative staining.
- Microscopic observation of bacteria (Gram positive bacilli and cocci:Gram negative bacilli),cyanobacteria (nostoc,spirulina).
- Microscopic observation of algae
- Microscopic observation of fungi (sacharomyces, Rhizopus, Aspergillus, Pencillium, Fusarium)
- Electron Microscopic pictures of TMV and HIV

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiiah 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.

**Dept. Microbiology: Palamuru University**  
**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**  
**With effect from 2017-18**

Syllabus for B.Sc Microbiology

Code: BS 204, DSC-1B

B.Sc I year: 2<sup>nd</sup> semester

Title: General Microbiology-II

4HPW-creditd-4

**UNIT-1-MICROBIOLOGICAL TECHNIQUES**

Sterilization and disinfection techniques. Principles and methods of sterilization. Physical methods-Autoclave, Hot air oven, pressure cooker, Laminar air flow, Filter sterilization. Radiation methods-U.V rays, Gamma rays, Ultrasonic methods. Chemical methods-use of Alcohols, Aldehydes, Fumigants, Phenol, Halogens and Hypochlorides, Phenol coefficient.

**UNIT-2-PURE CULTURE TECHNIQUES**

Isolation of Pure cultural techniques- Enrichment culturing, Dilution plating, streak plate, spread plate, Micromanipulator. Preservation of Microbial cultures – Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures, storage at low temperature

**UNIT-3 BIOMOLECULES**

Outline classification and general characteristics of carbohydrate (Monosaccharides, disaccharides and polysaccharides). General characteristics of Amino acids and proteins, Fatty acids(saturated and unsaturated) and lipids (sphingo lipids,sterols and phospholipids). Structure of nitrogenous bases, nucleotides and nucleic acids.

**UNIT-4 BIOCHEMICAL TECHNIQUES**

Hydrgen ion concentration in biological fluids. PH measurement. Types of buffers and their uses in biological reactions. Principles and application of colorimetry and chromatography (paper and thin layer). Principles and applications of Electrophoretic techniques.

## 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 5<sup>th</sup> Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker,j. Broch Biology of Microorganism, 9<sup>th</sup> Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.

5. Voet, D Biochemistry WCB. Mc GrawHill, Iowa.
6. N.J. Dimmock, A.J Easton, and K.N. Leppard. Introduction to Modern Virology. Blackwell Publishing.

## **CHOICE BASED CREDIT SYSTEM (CBCS)-2017-18**

### **B.Sc I year –II-semester Practical Syllabus**

#### **GENERAL MICROBIOLOGY-II**

**2 HPW- CREDITS-1**

- Preparation of culture media: Solid/Liquid.
- Sterilization techniques: Autoclave, Hot air oven and filtration.
- Enumeration of bacterial numbers by serial dilution and plating.
- Isolation of pure cultures by streak, spread and pour plate techniques
- Preservation of microbial cultures- Slant, Stab, Sand cultures, mineral oil overlay and glycerol stocks
- Qualitative tests for carbohydrates and amino acids
- Paper chromatography-separation of sugars/amino acids
- Determination of pH
- Preparation of Buffers
- Colorimetry- Principles, laws, determination of absorption maximum.

#### References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, 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.
5. Mahy, B.W.J. and Kangro, H.O. Virology – Methods Manual Academic Press, USA.
6. Burleson et al Virology – A Laboratory Manual. Academic Press, USA.

**SKILL ENHANCEMENT COURSE-I (SEC-I)****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 301, SEC-1****B.Sc II year: 3<sup>rd</sup> semester****Title: HAEMATOLOGY****2 HPW-credits-2****Unit-I:**

Composition of blood (RBC, WBC, Plasma, Serum, Platelet cells), Staining of blood films. Total blood picture, Differential count. Blood grouping, Rh-typing, Blood hemoglobin. Anti-coagulants.

**Unit-II**

Blood transfusion (Principles). Blood preservation. Precautions of handling blood and its products. Hemophilia. Anaemia. General account on spread of diseases through blood and blood products. ESR.

**References:**

1. Kawthalkar. Essentials of Haematology Paperback – 2013
2. Lokwani. D.P. The ABC of CBC Interpretation of Complete Blood Count and Histograms Paperback – 2013
3. Ramnik Sood . Medical Laboratory technology Methods and Interpretation Jaypee Publications.
4. Shirish M Kawthalkar. Essential Of Hematology. Jaypee Publications.



**Dept. Microbiology , Palamuru University**  
**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**  
**With effect from 2017-18**

Syllabus for B.Sc Microbiology

Code: BS 304, DSC-1C

B.Sc II year: 3<sup>rd</sup> Semester

Title: Microbial Physiology and Enzymology

4 HPW-credits-4

**UNIT-1: MICROBIAL NUTRITION AND PHOTOSYNTHESIS -**

Microbial Nutrition – Nutritional Requirement, Uptake of nutrients by cell. Nutritional group of microorganism – Autotrophs , Heterotrophs , Mixotrophs , Methylophs. Photosynthetic Apparatus in Prokaryotes. Outline of oxygenic and Anoxygenic photosynthesis in bacteria.

**UNIT-2: MICROBIAL GROWTH -**

Growth media – Synthetic , Non Synthetic , Selective , Enrichment and Differential media. 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

**UNIT-3- MICROBIAL METBOLISM-**

Aerobic : Respiration – Glycolysis , HMP Pathway , ED Pathway , TCA Cycle and Anaplerotic reaction, Electron Transport , Oxidative and substrate level phosphorylation.

β-Oxidation of Fatty acids. Glyoxylate cycle , Anaerobic respiration (Nitrate , Sulphate respiration)

Fermentation – Common Microbial fermentation with special reference alcohol and lactic acid fermentation.

**UNIT-4-ENZYMES-**

Properties and Classifications of Enzymes , Enzymes unit. Biocatalysis – Induced fit and Lock & Key Model , Coenzymes , Co-Factors. Factors effecting catalytic reaction activity of enzymes. Inhibition of Enzymes activity – Competitive non Competitive , Un competitive and Allosteric

## References:

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. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.
5. Reddy, S.R. and Reddy, S.M. (2004). Microbial Physiology, Scientific Publishers, Jodhpur, India.
6. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
7. Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2nd Edition, Oxford University Press, U.S.A.

**Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****II Year B.Sc III SEMESTER MICROBIOLOGY -2017-18****Title: MICROBIAL PHYSIOLOGY & ENZYMOLOGY****Practical syllabus****2HPW- credits-1**

- Preparation of media for culturing autotrophic and heterotrophic microorganisms – algal medium, mineral salts medium, nutrient agar medium, McConkey agar and Blood agar.
- Setting and observation of Winogradsky column
- Methods of pure culture isolation
- Enrichment culturing and isolation of phototrophs and chemoautotrophs.
- Determination of viable count of bacteria.
- Turbidometric measurement of bacterial growth.
- Factors affecting bacterial growth – pH, temperature, salts.
- Starch hydrolysis, Catalase test and sugar fermentation test

## References:

1. Wilson, K. and Walker, J. (1994). Practical Biochemistry. 4th Edition, Cambridge University Press, England.
2. Sawhney, S.K. and Singh, R. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology. S. Chand & Co. Ltd., 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.
8. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiyah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.

**Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 404, DSC-ID****B.Sc II year: 4<sup>th</sup> semester****Title: Microbial Genetics and Molecular Biology****4 HPW-credits-4****UNIT-1 : MICROBIAL GENETICS**

Fundamentals of Genetics – Mendellin laws , Alleles , Crossing over and Linkage

DNA and RNA as Genetic material

Structure of DNA – Watson and Crick model

Extra Chromosomal genetic elements – Plasmids and Transposons

Replication of DNA- Semi Conservative mechanism

**UNIT-2: MUTATIONS**

Mutations – Spontaneous and induced , Base pair changes , Frameshift , Deletion , Inversion , Tandem duplication , Insertion

Various physical and chemical mutagens

Outline of DNA Damage and repair mechanism

Brief account on gene transfer among bacteria – Transformation , Transduction and Conjugation

**UNIT-3-GENE EXPRESSION**

Concept of gene – Muton , Recon and Cistron.

One gene – One enzyme , One gene – One Poly peptide , One gene – One product hypothesis

Types of RNA and their function

Outline of RNA Biosynthesis in Prokaryotes

Genetic Code , Structure of Ribosomes and Brief account on Protein synthesis

Type of Genes – Structural , Constitutive , Regulatory

Operon Concept. Regulation of Genes expression in bacteria – Lac Operon

**UNIT-4-RECOMBIANT DNA TECHNOLOGY**

Basic principles of genetic engineering –Restriction endonucleases ,

DNA polymerases and Ligases, vectors

Outline of gene cloning methods.

Genomic and c DNA libraries

General account on application of genetic engineering in industry , agriculture and medicine.

## References:

1. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
2. Crueger, W. and Crueger, A. (2000). Biotechnology: A Text Book of Industrial Microbiology, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
4. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
5. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
6. Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5th Edition. McGraw Hill, New York.
7. Glazer, A.N. and Nikaido, H. (1995). Microbial Biotechnology – Fundamentals of Applied Microbiology, W.H. Freeman and company, New York.
8. Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, Blackwell Science Publication, New York.
9. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.

**II Year B.Sc IV SEMESTER; MICROBIOLOGY -2017-18  
CHOICE BASED CREDIT SYSTEM (CBCS)**

**Microbial Genetics and Molecular biology**

**Practical syllabus**

**2 HPW-Credits-1**

- Colorimetric estimation of proteins by Biuret / Lowery method.
- Colorimetric estimation of DNA by Diphenyl amine method.
- Colorimetric estimation of RNA by Orcinol method
- Extraction of genomic DNA
- Agarose gel Electrophoresis
- Problems related to DNA and RNA characteristics, Transcription and Translation

References:

1. Wilson, K. and Walker, J. (1994). Practical Biochemistry. 4th Edition, Cambridge University Press, England.
2. Sawhney, S.K. and Singh, R. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology. S. Chand & Co. Ltd., 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.
8. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.

**SKILL ENHANCEMENT COURSE-II (SEC-2)**

**Dept.of Microbiology: Palamuru University**

**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**

**With effect from 2017-18**

**Syllabus for B.Sc Microbiology**

**Code: BS 401, SEC-2**

**B.Sc II year: 4<sup>th</sup> semester**

**Title: FOOD ADULTERATION**

**2 HPW-credits-2**

**Unit-I**

Definition and Introduction to food adulteration.

Types of Food Adulteration

Common Food adulterants

Causes of Food adulteration

Analysis of food

**Unit-II**

Effects of Food Adulteration

Prevention of Food adulteration

Detection of Common food Adulterants.

Food Adulteration act-1954

Reference:

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

**Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****Syllabus for B.Sc Microbiology****Code: BS 503, DSC-1E****CHOICE BASED CREDIT SYSTEM---2017-18****B.Sc III year, SEMESTER-V****THEORY****Title: APPLIED MICROBIOLOGY****3 HPW- Credits-3****UNIT-1 - Microbes in Agriculture**

Physical and chemical characteristics of soil

Rhizosphere and phyllosphere

Plant growth promoting microorganisms

*(mycorrhizae, rhizobium, azospirillum, azatobacter, cynobacteria, frankia* and phosphate solubilising microorganisms)Biofertilizers- *Rhizobium & Cyanobacteria***UNIT-2 Plant Diseases & Biocontrol**

Concept of disease in plant

Symptoms of plant diseases caused by fungi (ground nut rust), bacteria (angular Leaf spot cotton) and viruses (tomato leaf curl) Principles of plant disease control

Biological control of plant diseases, Biopesticides-*Bacillus thuringensis*, Nuclear polyhedrosis virus (NPV), *Trichoderma***UNIT-3 Microbial ecology**

Outline classification of nitrogen fixation (symbiotic, non symbiotic)

Microorganisms of environment soil, water, air

Role of microorganisms in nutrient cycles (carbon, nitrogen, sulphur)

Microbial interaction-mutualism, commensalism, antagonism, competition, parasitism, predation

**UNIT-4 Role of microbes in environmental Pollution**Microbiology of potable and polluted water. *E.coli* and *Streptococcus faecalis* as indicators of water pollution. Sanitation of potable water. Sewage treatment (primary, secondary and tertiary)

Solid waste disposal-sanitary landfills composting

Outline of biodegradation of environmental pollutants –pesticides

**References:**

1. Alexander, M. (1985). Introduction to Soil Microbiology, 3rd Edition. Wiley Eastern Ltd., New Delhi.
2. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.
3. Subba Rao, N.S. (1993). Biofertilizers in Agriculture and Forestry, 3rd Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.



4. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
5. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA
6. Lynch, J.M. and Poole, N.J. (1979). Microbial Ecology – A Conceptual Approach, Blackwell Scientific Publications, USA
7. Subba Rao, N.S. (1999). Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Reddy, S.R. and Singara Charya, M.A. (2007). A Text Book of Microbiology - Applied Microbiology. Himalaya Publishing House, Mumbai.
9. Singh, R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.

**B.Sc III year –V-semester Practical Syllabus-2017-18****APPLIED MICROBIOLOGY****Practical syllabus****2 HPW-CREDITS-1**

- Isolation & enumeration of Rhizosphere microorganisms.
- Isolation & identification of Phyllosphere microorganisms.
- Study of root nodules of leguminous plants.
- Isolation of Rhizobium from leguminous root nodules.
- Isolation of *Azospirillum* and *Azotobacter*.
- Staining & observation of VAM fungi.
- Isolation of microorganisms in air by solid/liquid impingement method.
- Plant diseases-Rust, Smuts, Powdery mildews, Tikka disease of ground nut, citrus canker, bhendi yellow vein mosaic, tomato leaf curl, little leaf of brinjal.
- Microbial quality testing of water by coliform test
- Determination of Biological oxygen demand (BOD) of water

## References:

1. Aneja, 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, Sri Padmavathi Publications, Hyderabad

**SKILL ENHANCEMENT COURSE-III (SEC-3)****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 501, SEC-3****B.Sc III year: 5<sup>th</sup> semester****Title: Mushroom cultivation****2 HPW-credits-2****Unit-1**

- Introduction to mushroom cultivation
- Importance and history of mushroom cultivation in India
- Global status of mushroom production
- Food value of mushroom

**Unit-2**

- Steps in mushroom cultivation
  - a. Selection of site and types of mushroom
  - b. Mushroom farm structure, design layout
  - c. Principle and techniques of compost and composting
  - d. Principle of spawn production
  - e. Casing and crop production
  - f. Harvesting and marketing
- Pest and pathogens of mushrooms
- Post harvest handling and preservation of mushrooms

**Reference:**

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 Manjit Singh Bhuvnesh Vijay Shwet Kamal G.C. Wakchaure Directorate of Mushroom Research (Indian Council of Agricultural Research) Chambaghat, Solan –173213 (HP)

**GENERIC ELECTIVE-I (GE-1)****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 502, GE-1****B.Sc III year: 5<sup>th</sup> semester****Title: Microbiology and Human health****2 HPW-credits-2****Unit-1:**

Historic developments of Microbiology, contributions of Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch.

Types of microorganisms, Morphological characteristics of bacteria, Staining, cultivation methods of bacteria, Culture Media.

**Unit-II:**

Microorganisms related to human health. Normal microbial flora, Pathogenic microbes and their diseases - typhoid, T.B, syphilis, AIDS, Influenza.

**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 5<sup>th</sup> Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker,j. Broch Biology of Microorganism, 9<sup>th</sup> Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Ananthanarayan and Panikar. Text book of Microbiology. Universities Press.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IE) - A****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 506, DSE-1E-A****B.Sc III year: 5<sup>th</sup> semester****Title: IMMUNOLOGY****3 HPW-credits-3****UNIT-1 HISTORY OF IMMUNOLOGY AND IMMUNITY**

Development of immunology.

Antigen –types,chemical nature,Antigenic determinants,Haptens

Factors affecting antigenicity.

Antibodies-Basic structure,Types,properties and functions of immunoglobulins.

Complement, components of complement and activation of complement.

Types of immunity-Innate, Acquired; Active and passive, humoral and cell mediated immunity.

**UNIT-2 CELLS AND ORGANS OF IMMUNE SYSTEM**

Primary and secondary organs of immune system- Thymus, bursa of fabrica, bone marrow, spleen and lymphnodes, mucus associated lymphoid tissue (MALT).

Cells of immune system, Identification and functions of B &amp;T Lymphocytes, Null cells, Monocytes. Macrophages, Neutrophills, Basophills &amp; Eosinophills.

**UNIT-3 ANTIGENS AND ANTIBODY REACTION**

Components of complement and activation of complement.

Types of antigens-Antibody reactions- Agglutination, blood groups, precipitation, neutralization, complement fixation.

Labeled antibody based techniques-ELISA, RIA and Immunofluorescence

**UNIT-4 IMMUNOLOGICAL PROCESSES AND APPLICATIONS**

Types of hypersensitivity immediate and delayed.

Autoimmunity and its significance.

Polyclonal and monoclonal antibodies production and application

Vaccines-Natural and recombinants

## References:

1. Sudha Gangal. Shubhangi Sontakke. Text book of Basic and Clinical Immunology, Universitie Press.
2. Tizard, I.R. (1995). Immunology : An Introduction, WB Saunders, Philadelphia, USA.
3. Riott, I.M. (1998). Essentials of Immunology, ELBS and Black Well Scientific Publishers, England.
4. Goldsby, Kindt, T.J. and Osborne, B.A. (2004). Kuby Immunology, 6th Edition, W.H.Freeman and Company, New York.
5. Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). Instant Notes in Immunology, Viva Books Pvt. Ltd., New Delhi.
6. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India. 12
7. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
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9. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
10. Shetty, N. (1994). Imuunology – Introductory Textbook. New Age International Pvt. Ltd., New Delhi.
11. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, New Delhi.
12. Reddy, S.R. and Reddy, K.R. (2006). A Text Book of Microbiology - Immunology and Medical Microbiology, Himalaya Publishing House, Mumbai.
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**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IE) - A****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology Practicals****B.Sc III year: 5<sup>th</sup> semester****Title: IMMUNOLOGY****2HPW-credits-1**

- Determination of blood grouping and RH typing.
- Total count of RBC and WBC.
- Differential count of blood leucocytes.
- Estimation of blood Haemoglobin.
- WIDAL test for typhoid(slide test)by Ag-Ab reactions
- VDRL test for syphilis (slide test) by Ag-Ab reactions.
- Ouchterlony double diffusion test
- Separation of serum and plasma

## References:

1. Talwar, G.P. and Gupta, S.K. (1992). A Hand Book of Practical and Clinical Immunology. CBS Publications, New Delhi.
2. Baren, E.J. (1994). Bailey and Scott's Diagnostic Microbiology, 9th Edition, Mosby Publishers.
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.13
4. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer & Son Publishers, Chennai.
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6. Dey, N.C., Dey, T.K., Dey, M. and Sinha, D. (1998). Practical Microbiology, Protozoology, and Parasitology. New Central Book Agency (P) Ltd. Calcutta.
7. Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.
8. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-1E) - B****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 506, DSE-1E-B****B.Sc III year: 5<sup>th</sup> semester****Title: PHARMACEUTICAL MICROBIOLOGY****3 HPW-credits-3****UNIT-I:**

Principles of chemotherapy – Clinical and lab diagnosis, sensitivity testing, choice of drug, dosage, route of administration, combined/mixed multi drug therapy, control of antibiotic/drug usage.

**Unit-II:**

History of chemotherapy – plants and arsenicals as therapeutics, Paul Ehrlich and his contributions, selective toxicity and target sites of drug action in microbes.

Over view of development of synthetic drugs.

Antibiotics - The origin, development and definition of antibiotics as drugs, types of antibiotics and their classification.

**UNIT-III**

Mode of action of important drugs – Cell wall inhibitors (Betalactam – eg. Penicillin), membrane inhibitors (polymyxins), macromolecular synthesis inhibitors (streptomycin), antifungal antibiotics (nystatin)

**UNIT-IV:**

Anti Microbial Assays: Assay for growth inhibiting substances – Assay for non-medicinal antimicrobials (Phenol coefficient/RWC). Drug sensitivity testing methods and their importance. Assay for antibiotics – Determination of MIC, the liquid tube assay, solid agar tube assay, agar plate assay (disc diffusion, agar well and cylinders cup method).

**References:**

1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
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.
7. Reddy, S.R. and Reddy, K.R. (2006). A Text Book of Microbiology - Immunology and Medical Microbiology, Himalaya Publishing House, Mumbai.
8. Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). Instant Notes in Immunology, Viva Books Pvt. Ltd., New Delhi.
9. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India. 12

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-2E) - B****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology  
B.Sc III year: 5<sup>th</sup> semester****PRACTICALS****Title: PHARMACEUTICAL MICROBIOLOGY****2HPW-credits-1**

- Tests for disinfectants (Phenol coefficient)
- Determination of antibacterial spectrum of drugs/antibiotics Chemical assays for antimicrobial drugs
- Testing for antibiotic/drug sensitivity/resistance.
- Determination of MIC value for antimicrobial chemicals
- Microbiological assays for antibiotics (Liquid tube assay, agar tube assay, agar well assays)

**References:**

1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
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.
7. Reddy, S.R. and Reddy, K.R. (2006). A Text Book of Microbiology - Immunology and Medical Microbiology, Himalaya Publishing House, Mumbai.
8. Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). Instant Notes in Immunology, Viva Books Pvt. Ltd., New Delhi.
9. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India. 12

**DISCIPLINE SPECIFIC ELECTIVE-(DSC-1F)****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 603, DSC-1F****B.Sc III year: 6<sup>th</sup> semester****Title: MEDICAL MICROBIOLOGY****3HPW-credits-3****UNIT-I: INTRODUCTION TO MEDICAL MICROBIOLOGY**

History of medical Microbiology.

Normal flora of human body. Definition of infection.

Non specific defence mechanism- Mechanical barriers.

Antibacterial substance- Lysozyme, Complement, Properdin, Antiviral substances, Phagocytosis.

Host pathogen interactions. Bacterial toxins, Virulence and Attenuation.

**UNIT-II- DIAGNOSTIC AND THERAPEUTICAL MICROBIOLOGY**

General principles of diagnostic microbiology

Collections, transport &amp; processing of clinical samples.

General methods of lab diagnosis-cultural, biochemical, serological &amp; molecular methods

Test for antimicrobial susceptibility.

Elements of chemotherapy-Therapeutic drugs, Mode of action of Penicillin &amp; sulpha drugs &amp; their clinical use. Drug resistance.

Antiviral agents- Interferon, Nucleoside analogues.

Preventive control of diseases- active &amp; passive immunization.

**UNIT-III MEDICAL BACTERIOLOGY**

General account of following diseases, casual organisms, pathogenesis, epidemiology, diagnosis, prevention &amp; control

Air born diseases-Tuberculosis.

Food &amp; waterborn diseases- Cholera, Typhoid.

Contact diseases- Syphilis, Gonorrhoea. General account of Nosocomial infections.

Zoonotic diseases - Anthrax.

**UNIT-IV MEDICAL VIROLOGY AND PARASITOLOGY**

General account of following diseases, casual organisms, pathogenesis, epidemiology, diagnosis, prevention &amp; control

Air born diseases- Influenza.

Food &amp; waterborn diseases- Hepatitis-A, Poliomyelitis, Amoebiasis.

Insect born diseases-Malaria, Filariasis, Dengue fever.

Zoonotic diseases -Rabies. Blood born diseases- Serum hepatitis, AIDS.

References:

1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
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.

**DISCIPLINE SPECIFIC ELECTIVE-(DSC-IF)****Dept.of Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****B.Sc III year: 6<sup>th</sup> semester****PRACTICALS****Title: MEDICAL MICROBIOLOGY****2 HPW-credits-1**

- Biochemical tests for identification members of enterobacteriaceae.
- IMVIC test-indole test,methyl red test,voages proskeures test,citrate utilization test.
- Oxidase test.
- Catalase test.
- Study of medically important microorganisms-Ecoli, Klebsiella, Staphylococcus, Psedomonus.
- Test for disinfectant (Phenol coefficient)
- Antibiotic sensitivity testing – Disc diffusion method

**Slides**

Mycobacterium  
Candida albicans  
Entamoeba histolytica  
plasmodium

**References:**

1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
5. Shetty, N. (1994). Imuunology – Introductory Textbook. New Age International Pvt. Ltd., New Delhi.

**SKILL ENHANCEMENT COURSE-IV (SEC-4)**

**Dept. Microbiology: Palamuru University**

**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**

**With effect from 2017-18**

**Syllabus for B.Sc Microbiology**

**Code: BS 601, SEC-4**

**B.Sc III year: 6<sup>th</sup> semester**

**Title: HOSPITAL WASTE MANAGEMENT**

**2 HPW-credits-2**

**Unit-I**

- Types of Hospital waste and its Management.
- General , Hazardous , Health care waste, Infectious waste, Genotoxic Waste.
- Specification of Materials and colour coding for Identification.
- Biomedical waste management and handling rules.
- Guidelines of Central Pollution Control Board (CPCB).
- Safe disposal of the Radioactive waste rules.

**Unit-II**

- Basic steps in health care waste management- Segregation, Decontamination/Disinfection, Storage and Transportation.
- Mechanical and Chemical Treatment of the Waste.
- Liquid waste treatment-Autoclaving, Incrimination.
- Waste minimization- Recyclinf and reusing.
- Health and safety practices.
- Estimation of various items of waste management.

**References:**

1. B.D. Acharya, Meeta Singh. Hospital Waste Management and Its Monitoring.

**GENERIC ELECTIVE-II (GE-2)****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****Code: BS 602, GE-2****B.Sc III year: 6<sup>th</sup> semester****Title: CONTAGIOUS DISEASES AND IMMUNISATION****2 HPW-credits-2****Unit-1: Contagious diseases**

Types of Infections,

Sources of infections,

Mode of infections.

Bacterial diseases: Diphtheria, whooping cough, Gonorrhoea,

Viral Diseases: HSV, HIV, HBV.

**Unit-2: Immunization**

Immunity,

Types of Immunity.

Immunization,

Types of immunization,

Vaccines- Live and killed vaccines,

Vaccination schedule.

**References:**

1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
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.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IF) - A**

**Dept. Microbiology: Palamuru University**

**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**

**With effect from 2017-18**

**Syllabus for B.Sc Microbiology**

**Code: BS 606, DSE-1F-A**

**B.Sc III year: 6<sup>th</sup> semester**

**Title: FOOD MICROBIOLOGY**

**3 HPW-credits-3**

**UNIT-I**

Microorganisms of food materials and their sources.

Spoilage of different food materials (Fruits, vegetables, Meat, Fish and Canned foods).

Food born diseases (Salmonellosis & Shigellosis) and their detection.

**UNIT-II**

Microbiological production of fermented foods- Bread, Cheese, Yoghurt.

Biochemical activities of microbes in milk. Microorganisms as food – SCP, Edible mushrooms (white button oyster, Paddy straw). Concepts of Probiotics.

**Unit-3**

Methods of Food preservation, food poisoning (Staphylococci, C. botulinum)

Food intoxication.

**UNIT-4**

Microbiology of potable and polluted water

E.coli and streptococcus of water pollution Sanitation of potable water

Sewage treatment (primary, secondary And tertiary

Solid waste disposal-sanitary landfills composting

Outline of biodegradation of environmental pollution –pesticides



## 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.
3. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, Mc Graw-Hill, New York.
4. Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.  
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5. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.
6. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
7. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA
8. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IF) - A****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology Practicals****B.Sc III year: 6<sup>th</sup> semester****PRACTICALS****Title: FOOD MICROBIOLOGY****2HPW-credits-1**

- Isolation of microorganisms by crowded plate technique.
- Isolation of Amylase producing organisms.
- Isolation of microorganisms in air by petriplate exposure method.
- Determination of microbiological quality of milk by MBRT method.
- Isolation of fungi & bacteria from spoiled fruits & vegetables.
- Microbiological examination of water by coliform test.
- Determination of biological oxygen demand.
- Spoiled foods-bacterial soft rot, bread & bakery products, milk & milk products, eggs, meat and meat products, canned foods, cheese, yoghurt.
- Bacterial slides- Escherichia coli, Bacillus, Lactobacillus, Azospirillum, Azotobacter, Rhizobium, Yeast, Rhizopus, Penicillium

**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.
3. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, Mc Graw-Hill, New York.
4. Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.
5. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IF) - B**

**Dept. Microbiology: Palamuru University**

**Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)**

**With effect from 2017-18**

**Syllabus for B.Sc Microbiology**

**Code: BS 606,DSE-1F-B**

**B.Sc III year: 6<sup>th</sup> semester**

**Title: INDUSTRIAL MICROBIOLOGY**

**3 HPW-credits-3**

**UNIT-I**

Microorganisms of industrial importance-Yeast , Molds, Bacteria, Actinomycetes. Screening and isolation of industrially useful microbes. Methods of Screening and strain improvement.

**UNIT-II**

Types of fermentation- Aerobic, anaerobic , batch, continuous, submerged, surface, solid state Dual and multiple.

Design of stirred tank reactor fermentor,

**UNIT-III**

Inoculation media and fermentation media

Raw material used in fermentation industry and their processing

Downstream processing

**UNIT-IV**

Microbial products

Industrial production of alcohol (ethyl alcohol), Beverages (beer), Amylases, Antibiotics(pencillin) Aminoacids(glutamic acid), Organic acid(citric acid.) VitaminB12, Biofuels (biogas-methane)

## References:

1. Patel, A.H. (1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Crueger, W. and Crueger, A. (2000). Biotechnology – A Text Book of Industrial Microbiology, Panima Publishing Corporation, New Delhi
4. Reedy, G. (Ed.) (1987). Prescott & Dunn's Industrial Microbiology, 4th Edition, CBS Publishers & Distributors, New Delhi.
5. Reddy, S.R. and Singara Charya, M.A. (2007). A Text Book of Microbiology - Applied Microbiology. Himalaya Publishing House, Mumbai.
6. Singh, R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.
7. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology, ASM Press, Washington, D.C., USA.

**DISCIPLINE SPECIFIC ELECTIVE-(DSE-IF) - B****Dept. Microbiology: Palamuru University****Proposed scheme for B.Sc Microbiology program under choice based credit system (CBCS)****With effect from 2017-18****Syllabus for B.Sc Microbiology****B.Sc III year: 6<sup>th</sup> semester****Practicals****Title: INDUSTRIAL MICROBIOLOGY****2HPW-credits-1**

- Screening for amylase producing microorganisms
- Screening for organic acid producing microorganisms
- Production and Estimation of Ethanol by potassium dichromate method.
- Production and Estimation of Citric acid by titrimetry method.
- Estimation of streptomycin.
- Bacterial slides- Bacillus, Lactobacillus, Yeast, Aspergillus, Pencillium

References:

1. Patel, A.H. (1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Crueger, W. and Crueger, A. (2000). Biotechnology – A Text Book of Industrial Microbiology, Panima Publishing Corporation, New Delhi
4. Reedy, G. (Ed.) (1987). Prescott & Dunn's Industrial Microbiology, 4th Edition, CBS Publishers & Distributors, New Delhi.
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6. Singh, R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.
7. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology, ASM Press, Washington, D.C., USA.