

**MICROBIOLOGY**  
**PROPOSED SCHEME FOR CHOICE BASED CREDIT**  
**SYSTEM IN B.Sc.**

**MICROBIOLOGY (2020-21)**

Code	Course Title	Course Type	HPW	Credits
<b>FIRST YEAR - SEMESTER-1</b>				
BS	AEC-1			2
BS	English			4
BS	Second Language			4
BS	<b>General Microbiology</b>	DSC-1A	4+2	5
BS	<b>Optional-II</b>			5
BS	<b>Optional-III</b>			5
<b>SEMESTER-2</b>				
BS	AEC-2			2
BS	English			4
BS	Second Language			4
BS	<b>Microbial Diversity</b>	DSC-1B	4+2	5
BS	<b>Optional-II</b>			5
BS	<b>Optional-I II</b>			5
<b>SECOND YEAR-SEMESTER-3</b>				
BS	<b>Haematology</b>	SEC-1	2	2
BS	<b>Food Fermentation Techniques</b>	SEC-2	2	2
BS	English			3
BS	Second Language			3
BS	<b>Food &amp; Environmental Microbiology</b>	DSC-1C	4+2	5
BS	<b>Optional-II</b>			5
BS	<b>Optional-III</b>			5

<b>SEMESTER-4</b>				
BS	Mushroom Cultivation	SEC-3	2	2
	Biofertilizers and Biopesticides	SEC-4	2	2
	English			3
BS	Second Language			3
BS	Medical Microbiology & Immunology	DSC-1 D	4+2	5
BS	Optional-II			5
BS	Optional-III			5
<b>THIRD YEAR-SEMESTER-5</b>				
BS501	Mushroom cultivation	SEC-3	2	2
BS502	Microbiology and Human health	GE-1	2	2
BS503	APPLIED MICROBIOLOGY	DSC-1E	3+2	4
BS506	A-IMMUNOLOGY B- PHARMACEUTICAL MICROBIOLOGY	DSE-1E	3+2	4
<b>THIRD YEAR-SEMESTER-6</b>				
BS601	G/H HOSPITAL WASTE MANAGEMENT	SEC-4	2	2
BS602	CONTAGIOUS DISEASES AND IMMUNISATION	GE-2	2	2
BS603	MEDICAL MICROBIOLOGY	DSC-1F	3+2	4
BS606	A-FOOD MICROBIOLOGY B- INDUSTRIAL MICROBIOLOGY	DSE-1F	3+2	4

## 1. Program Name: B.SC. (MBC) - Microbiology-Chemistry-Biotechnology

DSC-1A Semester – I

Course Title :- General Microbiology

Credits: 4+1=5

**CO1:** Can learn about history of microbiology, contributions of different scientists in the field of Microbiology and also applications related to this field.

**CO2:** Can learn about different types of microscopic techniques, measurement/calibration of microbes

**CO3:** Can learn about how to stain micro organisms using different staining techniques (dyes). By staining students can observe the shape and arrangement of cells. Students can also see the motility of bacteria by hanging drop method.

**CO4:** Can learn about classification of micro organisms. They can also learn about general characters of prokaryotic microorganisms.

**CO5:** Can learn about ultra structure of bacteria and viruses in detail. In addition students are also exposed to general characters and classification of eukaryotic micro organisms.

**CO6:** Can learn about different nutritional types in microorganisms and biochemical pathways underlying their mechanism.

**CO7:** Can learn about different sterilization techniques and mechanism of growth and facto

**CO6:** In practicals students will learn microscope handling, calibration, staining and morphology of some micro organisms.

**DSC-1 Title: GENERAL MICROBIOLOGY**

**4HPW -Credits-4**

**Theory: 60 Lectures**

**UNIT-1: INTRODUCTION TO MICROBIOLOGY**

**No. of hours: 15**

Meaning, definition and scope. History of microbiology: Contribution of Louis Pasteur and Robert Koch, Edward Jenner, Antonie Van Leeuwenhoek, Alexander Flemming. Importance and application of Microbiology.

Principles of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Principles and types of stains-simple stain, differential stain, negative stain, structural stain-spore, capsule, flagella, Acid fast staining. Bacterial motility - Hanging drop method.

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

**No. of hours: 15**

Prokaryotes — Ultra structure of eubacteria. - General characteristics of viruses, differences between bacteria and viruses. Classification of viruses

Morphology and structure of TMV and HIV. Structure and multiplication of lambda bacteriophage.

Isolation of pure culture techniques- Enrichment culturing, Dilution plating, streak plate, spread plate, pour plate method, Micromanipulator. Preservation of Microbial cultures — Sub culturing, overlaying cultures with minerals oils, lyophilization, glycerol stocks, sand cultures, storage at low temperature,

**UNIT-3: MICROBIAL NUTRITION AND METABOLISM**

**No. of hours: 15**

Microbial Nutrition — Nutritional requirement, Uptake of nutrients by cell. Nutritional groups of microorganisms — Autotrophs, Heterotrophs, Mixotrophs. Components and types of bacterial growth media — simple and complex media, algal Medium, mineral salts medium, nutrient agar medium, MacConkey agar and blood agar.

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

#### **UNIT-4: STERILIZATION TECHNIQUES AND MICROBIAL GROWTH**

**No. of hours: 15**

Sterilization and disinfection techniques - Physical methods- Autoclave, Hot air oven, Laminas air flow, **ultrasonication**, Filter sterilization. Radiation methods - U. V rays, Gamma rays, Ultrasonic methods. Chemical methods - Alcohols, Aldehydes, Phenol, Halogens and Hypochlorides.

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.

#### **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 2nd Edition, WCB McGrawHill, New York.
3. Madigan, M.T., Martinkl, I.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 Panicker, Medical Microbiology.

#### **I Semester**

#### **DSC-1A General Microbiology**

#### **PRACTICALS**

**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*, *Penicillium*, *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, MacConkey 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:

- Experiments in Microbiology by K.R. Aneja.
- Gopa1Reddy.M., Reddy. M.N., SaiGopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
- Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
- Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers. USA.

## Semester – II

### Course Title :- MICROBIAL DIVERSITY

CO1: Concept of Biodiversity– Can learn about elements of biodiversity, its economic value. Students can also learn about classification of living organisms and get an idea about Bergey's manual.

CO2: Prokaryotic Microbial Diversity– Here students will learn about diversity of prokaryotic microorganisms such as Archaeobacteria, Cyanobacteria etc.

CO3: Eukaryotic Microbial Diversity – Students will learn about diversity of eukaryotic microorganisms such as fungi, algae, protozoa etc.

CO4: Microbial Ecosystems – Students can learn about interactions between microorganisms in addition to understanding about microbiome and other ecosystems.

CO5: PRACTICALS - In practicals students are made to learn isolation of methanogens, halophiles, cyanobacteria etc.

CO6: PRACTICALS – Students can learn about how to observe algae, protozoa, making of winogradsky column that shows microbial diversity.

## DSC-1B

### B.Sc. I Year: II Semester

Title: MICROBIAL DIVERSITY

4HPW - Credits-4

#### UNIT 1: CONCEPT OF BIODIVERSITY

Basic concept of Biodiversity and Conservation. Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity. Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity.

Classification of living organisms; Haeckel, Whittaker and Carl Woese systems. Differentiation of prokaryotes and eukaryotes. Classification of bacteria as per the second edition of Bergey's manual of systematic bacteriology.

#### UNIT 2: PROKARYOTIC MICROBIAL DIVERSITY

General characteristics of eubacteria. Rickettsia and Mycoplasma. Microbial richness: Exploration, significance, conservation and applications. Structural and physiological diversity of Archaea bacteria, Metabolic characteristics of extremophiles (Methanogens. Halophiles, thermoacidophiles).

Gram negatives: Cyanobacteria and Proteobacteria, Gram positives and heterogenous members including Firmicutes, Actinobacteria, Bacteroidetes, Acidobacteria and Planctomycetes.

### UNIT 3: EUKAROTYIC MICROBIAL DIVERSITY

Eukaryotic microbial diversity. Structural, physiological and metabolic characteristics of Algae - Cyanophyta, Chlorophyta, Bacillariophyta, Phacophyta, Rhodophyta; Fungi -Phycomycetes, Basidiomycetes, Zygomycetes, Oomycetes, Ascomycetes, Deuteromycetes (imperfect and perfect stages) and Protozoa - Giardia, Entamoeba and Plasmodium.

### UNIT 4: MICROBIAL ECOSYSTEMS

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

Understanding microbial diversity with cultivated vs uncultivated microorganisms.

The Great Plate count anomaly. Cultivation independent methods to assess microbial diversity.

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

#### References:

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 (1986). "General Microbiology" - Mac Milan Education Ltd. London.
  - 4.Brown J. W. (2015) Principles of Microbial Diversity, ASM PFCSS
  - 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, 15<sup>th</sup> Edition

### MICROBIAL DIVERSITY PRACTICALS

2HPW-Credits-1

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

## References:

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

Course Code :- BS304                      Program :- B.Sc.                      Semester – III

Course Title :- Haematology                      HPW :- 2                      Credits – 2

Course type: SEC-1

CO1: students can learn about different concepts such as composition of blood (RBC, WBC, Plasma, Serum, Platelet cells).

CO2: Staining of blood films, Total blood picture, Differential count, Blood grouping, Rh-typing, Blood haemoglobin, Anticoagulants.

CO3: Here students can learn about Blood transfusion (Principles), Blood preservation, Precautions of handling blood and its products.

CO4: students are made aware of diseases related to blood such as Hemophilia, Anaemia and ESR technique.

**Title: HAEMATOLOGY**

**III SEMESTER**

**Code: BS, SEC-1**

**UNIT-1: INTRODUCTION TO BLOOD**

Blood: definition, characters, composition. Collection of blood — capillary blood: from adults and infants, examinations employed. Venous blood: from adults and infants, examinations employed composition of blood (RBC, WBC, Plasma, Serum, Platelet cells), Staining of blood films. Total blood picture, Differential count. Blood grouping, Rh-typing. Haemoglobin: composition and normal values, haemoglobin estimation Anti-coagulants.

**UNIT-2: BLOOD TRANSFUSION**

Principles of blood transfusion, Donor screening — cross matching, collection of blood, preservation and storage. Precautions of handling blood and its products. Challenges in management of Hemophilia and Anaemia. General account on spread of diseases through blood and blood products. Coagulation mechanism: factors, bleeding time, clotting time. Haematological indices: packed cell

volume. Erythrocyte sedimentation: principle — determination.

References :

1. Kawthalbar.Essentials of Haematology Paperback — 2013
2. Lokwani.D.P.The ABC of CBC Interpretation of Complete Blood Count and Histograms Paperback 2013
3. RamnikSood . Medical Laboratory technology Methods and Interpretation Jaypee Publications.
4. ShirishMKawthalkar. Essential Of Hematology. Jaypee Publication

## **SEC-2: FOOD FERMENTATION TECHNIQUES**

Semester – III Course Title :- **Haematology** HPW :- 2 Credits – 2  
Course type: SEC-2

CO1: Students can learn about different fermented foods such as milk based products and grain based products.

CO2: Students can understand the concept of probiotics

CO3: Can learn about various food products made from fermented vegetables.

CO4: Can study about fermented fish and meat products.

**B.Sc. II Year, III semester**

**Title: FOOD FERMENTATION TECHNIQUES**

**2HPW-Credits-2**

### **Unit 1 Fermented Foods**

Definition, types, advantages and health benefits, **Milk Based Fermented Foods** - Dahi, Yogurt, Buttermilk (Chach) and cheese: Preparation of inoculums, types of microorganisms and production process, **Grain Based Fermented Foods** - Soy sauce, Bread, Idli and Dosa: Microorganisms and production process

### **Unit 2 Probiotics & Fermented Foods**

**Vegetable Based Fermented Foods** -Pickels, Saeurkraut: Microorganisms and production process

**Fermented Meat and Fish-** Types, microorganisms involved, fermentation process, **Probiotic Foods-**

Definition, types, microorganisms and health benefits

### **Suggested Readings**

1. Hui YH, Meunier-Goddik L, Josephsen J, Nip WK, Stanfield PS (2004) Handbook of food and fermentation technology, CRC Press
2. Holzapfel W (2014) Advances in Fermented Foods and Beverages, Woodhead Publishing.
3. Yadav JS, Grover, S and Batish VK (1993) A comprehensive dairy microbiology, Metropolitan



Code: BS, DSC-IC  
Semester

B.Sc II year: III

Title: FOOD AND ENVIRONMENTAL MICROBIOLOGY

4 HPW-Credits-4

Course Outcomes:

CO1: Can gain knowledge about the concept of fermented foods such as pickles, Idly, etc.

CO2: Can learn about role of microorganisms in milk products.

CO3: Can understand what are probiotics and prebiotics.

CO4: Can understand why and how foods are spoiled

CO5: Can gain knowledge about various food preservation methods

CO6: Study about how food quality is assessed and screened.

CO7: Can learn about microorganisms present in air, water.

CO8: Can understand how sewage is being treated under aerobic and anaerobic conditions.

CO9: Can learn about soil and its properties, type of microorganisms present in soil

CO10: Can study about interactions between plants and microorganisms

CO11: Can understand the importance of bioremediation.

CO12: Can study about the microorganisms role in operation of carbon and nitrogen cycle in the atmosphere.

## **Title: FOOD AND ENVIRONMENTAL MICROBIOLOGY**

### UNIT 1: FERMENTED FOODS

Introduction to fermented foods; Health aspects of fermented foods; Fermented vegetables: Processing and fermentation of Sauerkraut and pickles, idly. Dairy Microbiology - Types of microorganisms in milk, significance of microorganisms in milk, Microbial products of milk- Bulgarian milk, Kefir, cheese, yogurt; Microorganisms as food; Probiotics and Prebiotics.

### UNIT 2: MICROBIAL FOOD SPOILAGE AND POISONING

Microbial Spoilage of foods; Microbial Food poisoning, risks and hazards; Mycotoxins and their poisoning/toxicity; Food preservation methods and food safety issues. Food Quality: Importance and functions of quality control. Methods of quality assessment of foods; Screening and Enumeration of spoilage microorganisms, Detection of pathogens in food.

### UNIT 3: AIR AND WATER MICROBIOLOGY

Microorganisms in air and their importance (brief account); Microorganisms and water pollution Water-borne pathogenic microorganisms and their transmission; Sanitary quality of water; Water pollution due to degradation of organic matter; Aerobic and Anaerobic sewage treatment,

### UNIT 4: SOIL MICROBIOLOGY

Soil properties (physical, chemical and biological), Soil microorganisms, Methods of enumeration and activity of microbes in environment/soil; Microbes and plant interactions — Rhizosphere, Phyllosphere and Mycorrhizae; Introduction to Microbial Bioremediation, Microbial degradation of organic pollutants; Carbon and Nitrogen cycle.

### **References:**

1. Stanbiiry, 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, McGraw-Hill, New York.
4. Jay, J.M. (1996). Modern Food Microbiology, Chapmand Has, New York.
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 Banha, 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.

## FOOD AND ENVIRONMENT MICROBIOLOGY PRACTICALS

2HPW-Credits-1

- Determination of microbiological quality of milk by MBRT method.
- Isolation of fungi & bacteria from spoiled fruits/vegetables/Milk/Meat products.
- Isolation of microorganisms from air by impingement method.
- Microbiological examination of water by coliform test.
- Determination of biological Oxygen demand.
- Extraction of Mycotoxins from contaminated grains/foods.
- Detection of Mycotoxins
- Isolation and identification of probiotic bacteria
- Isolation and identification of probiotic yeast

### References:

1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
  0. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals and Frontiers. ASM Press, Washington D.C., USA.
  0. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, McGraw-Hill, New York.
  1. Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.
  2. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.
- Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA

**IV Semester**

**Title: MUSHROOM CULTIVATION**

**Code: BS SEC-3**

**2HPW**

**Credits: 2**

### Course Outcomes:

**CO1:** Can learn about mushrooms and their history.

**CO2:** Can gain knowledge about edible mushrooms and their global status of production

**CO3:** Can know about nutritional and health benefits of mushrooms

**CO4:** can learn in detail about steps involved in mushroom production.

**CO5:** Can learn about pests and pathogens of mushrooms and post harvest handling and care of mushroom production.

**Title: MUSHROOM CULTIVATION**

**Code: BS SEC-3**

UNIT-I

Introduction to mushroom cultivation. Importance and history of mushroom cultivation in India. Global status of mushroom production. Edible mushrooms (white button oyster, Paddy straw). Nutritional value and health benefits of mushrooms

## 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
- g. Entrepreneurship development in Mushroom cultivation

Pests and pathogens of mushrooms

Post harvest handling and preservation of mushrooms

### Reference:

- Mushroom cultivation in india by B.C.Suman and V.P. Sharma Published by Daya publishing house New Delhi.
- Mushrooms Cultivation, Marketing and Consumption Manjit Singh Bhuvnesh Vijay Shvet Kama I G.C. Wakchaure Directorate of Mushroom Research (Indian Council Of Agricultural Research) Chambaghat. Solan —17321 3 (HP)

## SKILL ENHANCEMENT COURSE IV – (SEC-IV)

Code: BS, SEC-4

BSc III year: IV Semester

Title: Biofertilizers and Biopesticides

2HPW-Credits-2

### Course outcomes:

**CO1:** Students can learn about different biofertilizers and bioinsecticides.

**CO2:** Can learn about Rhizobium biofertilizer production and applications.

**CO3:** Can learn about microbes used as bioinsecticides and their advantages.

**CO4:** Can learn about isolation, characters of Azospirillum and Azotobacter.

**CO5:** Can study about phosphate solubilizers.

**CO6:** Can gain knowledge about mycorrhizae and their importance.

**Biofertilizers and Biopesticides**

**SEC-4**

**Unit 1 Biofertilizers and Bioinsecticides**

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N<sub>2</sub> fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants Frankia - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis. Cyanobacteria, Azolla - Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application. General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, Bacillus thuringiensis, production, Field applications.

### **Unit 2 Non symbiotic Nitrogen Fixation and phosphate solubilization**

Free living Azospirillum, Azotobacter - free isolation, characteristics, mass inoculums, production and field application. Phosphate Solubilizers- Phosphate solubilizing microbes - Isolation, characterization, Mass inoculum production, field application. Mycorrhizal Biofertilizers-

Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

### **Suggested Readings**

1. Kannaiyan, S. (2003). Bioethnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.
5. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG 6. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.

**Code: BS, DSC-ID**

**4 HPW**

**Credits-4**

**Title: MEDICAL MICROBIOLOGY & IMMUNOLOGY**

**CO1: Can learn about concepts of normal flora, bacterial toxins and antimicrobial resistance.**

**CO2: Can get knowledge about air borne, food and water borne, and sexually transmitted diseases.**

**CO3: Can learn about zoonotic diseases and nosocomial infections.**

**CO4: Can learn about cells and organs of immune system.**

**CO5: Can get knowledge about concepts of antigen and antibody.**

**CO6: Can learn about antigen-antibody reactions and immunoflouresence techniques.**

**Title: MEDICAL MICROBIOLOGY & IMMUNOLOGY**

**UNIT-1: MEDICAL BACTERIOLOGY**

History of Medical Microbiology. Normal flora of human body, Host pathogen interactions. Bacterial toxins, virulence and attenuation. Antimicrobial resistance.

Air borne diseases - Tuberculosis.

Food and waterborne diseases- Cholera, Typhoid.

Contact diseases - Syphilis. Gonorrhoea. General account of nosocomial infections.

## **UNIT-2: MEDICAL VIROLOGY AND PARASITOLOGY**

Food and waterborne diseases - Poliomyelitis. Amoebiasis.

Insect borne diseases- Malaria, Dengue fever.

Zoonotic diseases — Rabies

Viral diseases- Hepatitis B, HIV, SARS, MERS: Air borne diseases- *Influenza*.

## **UNIT-3: INTRODUCTION TO IMMUNOLOGY**

History of immunology. Cells and organs of immune system- Primary and Secondary lymphoid organs. Functions of B&T Lymphocytes, Natural killer cells, Polymorphonuclear cells. Structure and classification of Antigens, Factors affecting antigenicity.

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

Types of immunity- Innate and Acquired; Humoral and cell mediated immune response. Major Histocompatibility Complex- Class I and II

## **UNIT-4: IMMUNOLOGICAL DISORDERS AND AG-AB REACTIONS**

Types of hypersensitivity - Immediate and delayed. Systemic and localized autoimmune disorders  
Complement pathways — Classical and Alternate.

Types of Antigen-Antibody reactions- Agglutination, blood groups, precipitation, neutralization, complement fixation test. Labeled antibody based techniques- ELISA, RIA and

Immunofluorescence: Polyclonal and monoclonal antibodies production and application

### **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. 2<sup>nd</sup> Edition. CBS Publishers and Distributors, New Delhi.
7. Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2<sup>nd</sup> Edition, Oxford University Press, U.S.A.

## **MEDICAL MICROBIOLOGY & IMMUNOLOGY PRACTICALS**

### **2HPW- Credits-1**

Determination of blood grouping and RH typing.

Total count of RBC and WBC.

Differential count of blood leucocytes.

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

IMViC test - Indole test, Methyl red test, Voges-Proskauer test, Citrate utilization test.

Oxidase test.

Catalase test.

Antibiotic sensitivity testing — Disc diffusion method

### **References:**

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, Himalaya Publishing House, Mumbai.
- Experiments in Microbiology by K.R. Aneja.

**Code: BS 503, DSC-1E**

**B.Sc III year, SEMESTER-V**

**Title: APPLIED MICROBIOLOGY**

**3 HPW**

**Credits-3**

**CO 1 – Students made to learn about Physical and chemical characteristics of soil; Rhizosphere and phyllosphere, Plant growth promoting microorganisms; Biofertilizers**

**CO 2 Plant Diseases & Biocontrol**

**Students learn about diseases in plants and advantages and making of biopesticides**

**CO 3 Microbial ecology**

**Students are made to understand concept of nitrogen fixation (symbiotic, non symbiotic); Role of microorganisms in nutrient cycles and Microbial interactions.**

**CO 4 Role of microbes in environmental Pollution**

**Students can learn about microbiology of potable and polluted water, Sanitation of potable water and Sewage treatment. In addition to this they can also learn about Solid waste disposal and biodegradation of environmental pollutants –pesticides**

**SEMESTER-V Title: APPLIED MICROBIOLOGY**

**UNIT-1 - Microbes in Agriculture**

Physical and chemical characteristics of soil; Rhizosphere and phyllosphere

Plant growth promoting microorganisms;

(*mycorrhizae, rhizobium, azospirillum, azatobacter, cyanobacteria, 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.

**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.

**SEC-3**

**5th semester**

**Title: Mushroom cultivation**

CO 1· Students are made to learn about importance of mushrooms, their cultivation method and its status in India.

CO 2 · Students can learn about Steps in mushroom cultivation

**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)

**GE-1 5th semester**

**Title: Microbiology and Human health**

**CO 1:** Non-microbiology students are made to learn about history of microbiology, contributions of different scientists, basic culture techniques such as staining, and cultivation methods.

**CO 2:** In this students are made to learn about Microorganisms related to human health i.e. Normal microbial flora, and some pathogens.

**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.

**5th semester**

**Title: IMMUNOLOGY**

**CO 1 HISTORY OF IMMUNOLOGY AND IMMUNITY**

Students are made to learn about concepts of immunology such as antigens, antibodies, complement and types of immunity.

**CO 2 CELLS AND ORGANS OF IMMUNE SYSTEM**

Students can learn about Primary and secondary organs of immune system and cells of immune system.

**CO 3 ANTIGENS AND ANTIBODY REACTION**

Students can learn about Components of complement and activation of complement,

types of antigens-Antibody reactions, Labeled antibody based techniques

#### CO 4 IMMUNOLOGICAL PROCESSES AND APPLICATIONS

In this section students can learn about types of hypersensitivity, autoimmunity, monoclonal antibodies and vaccines.

### DISCIPLINE SPECIFIC ELECTIVE-(DSE-IE) - A

**Title: IMMUNOLOGY**

**3 HPW-credits-4**

#### UNIT-1 HISTORY OF IMMUNOLOGY AND IMMUNITY

Development of immunology; Antigen – types, chemical nature, Molecular size, Heterogeneity, Antigenic determinants, Haptens, Factors affecting antigenicity.; Antibodies-Basic structure, Types, properties and functions of immunoglobulins.; Complement, components of complement and activation of complement-Classical, alternative and lectin pathways.

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 lymph nodes, mucus associated lymphoid tissue (MALT).

Cells of immune system, Identification and functions of B & T Lymphocytes, NK cells, Null cells, Mast cells, Monocytes, Dendritic cells, Macrophages, Neutrophils, Basophils and Eosinophils.

#### 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 Immuno fluorescence

#### 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, University 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.
7. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
8. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
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). Immunology – 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.
13. Gupta, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

### **IMMUNOLOGY Practicals**

### **B.Sc III year: 5<sup>th</sup> semester**

- 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.

5. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai.

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.

**(DSC-IF) BSc III year: 6th semester**

**Title: MEDICAL MICROBIOLOGY**

**CO 1 INTRODUCTION TO MEDICAL MICROBIOLOGY**

Students can learn about basic concepts of medical microbiology such as normal flora, infections, antibacterial substances. Etc.

**CO 2 DIAGNOSTIC AND THERAPEUTICAL MICROBIOLOGY**

In this section students can learn about general principles of diagnostic microbiology, lab diagnosis methods and chemotherapy concepts.

**CO 3 MEDICAL BACTERIOLOGY**

Students are made to study in detail about air borne, food and water borne diseases.

**CO 4 MEDICAL VIROLOGY AND PARASITOLOGY**

Students can learn about some other diseases such as influenza, hepatitis, polio, amoebiasis, rabies, malaria, hepatitis, AIDS etc.

**Title: MEDICAL MICROBIOLOGY 3HPW-credits-3**

**UNIT-I: INTRODUCTION TO MEDICAL MICROBIOLOGY**

Histry 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 & processing of clinical samples.

General methods of lab diagnosis-cultural, biochemical, serological & molecular methods, Test for antimicrobial susceptibility. Elements of chemotherapy-Therapeutic drugs, Mode of action of Penicillin & sulpha drugs & their clinical use. Drug resistance.

Antiviral agents- Interferon, Base analogues.

Preventive control of diseases- active & passive immunization.

## **UNIT-III MEDICAL BACTERIOLOGY**

General account of following diseases, casual organisms, pathogenesis, epidemiology, diagnosis, prevention & control; Air born diseases-Tuberculosis.; Food & 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 & control

Air born diseases- Influenza.; Food & 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

**PRACTICALS Title: MEDICAL MICROBIOLOGY 2 HPW-credits-1**

- Biochemical tests for identification members of enterobacteriaceae.
- IMVIC test-indole test, methyl red test, Voges-Proskauer test, citrate utilization test. Oxidase test, Catalase test.
- Study of medically important microorganisms-E. coli, Klebsiella, Staphylococcus,
- Pseudomonas, 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). Immunology – Introductory Textbook. New Age International Pvt. Ltd., New Delhi.



## **Title: HOSPITAL WASTE MANAGEMENT**

CO 1 · students can learn about types of Hospital waste and its Management. Guidelines of Central Pollution Control Board (CPCB), Safe disposal of the Radioactive waste rules.

CO 2 · in this section students are made to learn about Basic steps in health care waste management such as Segregation, Disinfection, Storage and Transportation.

## **Title: HOSPITAL WASTE MANAGEMENT**

### **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.

**Code: BS 602**

**GE-2**

**6th semester**

## **Title: CONTAGIOUS DISEASES AND IMMUNISATION**

CO 1 Contagious diseases

Students are made to learn about Types of Infections, their sources, types of infections.

CO 2 Immunization

Students can learn about concepts of Immunity such as types of immunity, and vaccines.

**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.

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

**Title: FOOD MICROBIOLOGY**

**2HPW-credits-1**

**6th semester**

**CO 1**

Students can learn about Microorganisms of food materials and their sources. In this section students are made aware of microbes responsible for spoilage of foods.

#### CO 2

Students can learn about Microbiological production of fermented foods, Biochemical activities of microbes in milk. Microorganisms as food i.e. SCP, Edible mushrooms, Probiotics.

#### CO 3

Students can learn about Methods of Food preservation, food poisoning and Food intoxication.

#### CO 4

Students can learn about Microbiology of potable and polluted water, Solid waste disposal and Outline of biodegradation of environmental pollution –pesticides

**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: Physical methods - high temperature, low temperature, irradiation, aseptic packaging Chemical methods - salt, sugar, benzoates, citric acid, ethylene oxide, nitrate and nitrite, 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.
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.

**Title: FOOD MICROBIOLOGY 2HPW-credits-1**

**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. 15

5. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.