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MARATHWADA UNIVERSITY,  
AURANGABAD.**



Syllabus of  
B.Sc. Second Year  
[ Microbiology ]  
Semester- III & IV

( Effective from June-2010 - 2011 & onwards )

**B.Sc. Second Year [ Microbiology ] Semester III**  
**Paper IX Environmental Microbiology.**

**Credit 1 :****Microbiology of air : (15)**

Composition of air.  
Number and kinds of microorganisms in air ( indoor, outdoor)  
Distribution and sources of air borne microorganisms.  
Air as a carrier of microorganisms.  
Droplet, droplet nuclei, **Dispersal of Microorganisms in air.**  
Techniques for microbiological analysis of air.  
Significance of air flora in human health, hospitals , industries.  
Air borne diseases - list of diseases caused by bacteria, fungi, viruses.  
Air pollution.  
Air sanitation – dust control, UV radiation, bactericidal vapors, filtration, laminar air flow system ( HEPA filters )

**Credit 2.****Microbiology of Water and Waste water management : (15)**

Water zonation – upwelling, eutrophication  
Microbial communities in natural water  
Determining sanitary quality of water : bacteriological evidence of faecal pollution, indicators of faecal pollution.  
Significance of index organisms. Faecal and non faecal coliforms ( IMViC & elevated temperature tests. ).  
Bacteriological examination of water.  
Presumptive, confirmed, completed test, SPC, MPN, Membrane filter technique.  
Water pollution : causes hazards & control of human water borne diseases ( list ).  
Water purification methods.  
Disinfection of potable water supplies.

**Credit 3. (15)****Microbiology of Sewage :**

Definition of sewage, chemical composition.  
Microbiology of sewage treatment.: septic tank, evapotranspiration, Imhoff's tank  
Municipal sewage treatment process : Primary, Secondary, ( aerobic and anaerobic process ), chemical treatment : chlorination.  
Disposal of treated sewage. ( sludge as fertilizer ; irrigation and dilution )

**B.Sc. Second Year Semester III****Paper X Immunology****Credit 1.**

Host parasite relationship. (15)  
 Normal flora of human body.  
 Defensive mechanism of the host  
 Non specific factors : physiological barriers, natural cellular & humoral factors.  
 Infection:  
 Definitions: (primary infection, secondary infection, cross infection )  
 Sources of infection.  
 Modes of transmission of infectious diseases.  
 Process of infection : entry and spread of infection in host body  
 Determining factors in infection  
 Aggressive factors and mechanisms.

**Credit 2.****Immunity :****(15)**

Definition and classification  
 Innate / Acquired , Active/Passive, Cellular/Humoral , specific / non specific humoral factors of immunity : complement, interferon.  
 General methods of prophylaxis.  
 Toxoid & immune sera, Principle involved in preparation use of adjuvants.  
 Vaccines : types , administration of vaccines, Immunization schedule.  
 Antigen:  
 Definition, determination of antigenicity , size, chemical nature, susceptibility to tissue enzymes, foreignness, specificity .  
 Types of antigens : species specific antigen, Isoantigen, autoantigen, organ specific antigen , MHC antigen , Heterogenetic ( Heterophile ) antigen , antigens in relation to bacterial cell.  
 Antibody :  
 Immunoglobulins : structure & classes,  
 Types of antibodies : antitoxin , precipitin, agglutinin, bacteriolysin, bacteriocidin, bacteriotropin, complement fixing, neutralizing.

**Credit 3.****(15)**

Immune responses :  
 Primary & secondary responses.  
 Fate of antigens in tissues  
 Production of antibodies : organs & cells involved, monoclonal Antibodies, Regulation of antibody production (genetic control).  
 Factors influencing antibody production:  
 Cellular immune response – organs & cells involved, characteristics & types of T cells.  
 Antigen – Antibody reactions:  
 General features of Antigen- Antibody reactions  
 Mechanisms , methods & applications of:  
 i) Agglutination:  
 ii) Precipitation  
 iii) Complement fixation  
 iv) Neutralization  
 v) Immunofluorescence  
 vi) ELISA

**B.Sc. Second Year Semester IV****Paper XIII Applied Microbiology.****Credit 1.****Microbiology of milk : (13)**

Definition of and composition of milk  
Sources of microorganisms in milk  
Desirable and undesirable changes carried out by microorganism in milk  
Types of microorganisms – Biochemical types, temperature characteristic types and pathogens ( of bovine and human origin ) ,  
Changes in the flora of raw milk stored at room temp,  
Microbiological examination of milk – SPC, DMC reductase tests.  
Pasteurization, phosphatase test , sterilization of milk.  
Cheese – microbiology and production .

**Credit 2.****Microbiology of Soil : (15)**

Soil as an environment as a culture medium  
Microbiota of soil-their activities  
Brief account of microbial interactions :  
Definition with examples :  
Symbiosis, mutualism, commensalism, competition, synergism, satellitism, predation, parasitism with two examples each :  
i) Microbe-microbe interactions (Protozoa-Algae; Lichen)  
ii) Plant-microbe interactions (Phyllosphere; leg-plant-Rhizobium)  
iii) Animal-microbe interactions(Rumen; Bioluminescence)  
Microbiological examination of soil.  
Major biogeochemical cycles :  
Carbon ( degradation of cellulose, starch, lignin, pectin )  
nitrogen, phosphorus, sulphur cycle.  
General account of microbes used as biofertilizers, phosphate solubilizers.  
Rhizosphere : definition, rhizosphere and non rhizosphere microflora,  
R: S ratio, interactions between plant and rhizosphere flora .

**Credit 3.****Microbiology of Food : (18)**

Food as a substrate for microorganisms.  
Major groups of bacteria, fungi, yeasts important in food microbiology.  
Sources of contamination of food, factors affecting kind and number of microorganisms in food.  
Microbiological examination of food: general and specific methods of examination.  
Principles of food preservation :  
Microbiostatic and microbicidal methods : Asepsis, removal of microorganisms, anaerobic conditions, high temp, low temp, drying, chemical preservatives, high osmotic pressure, radiation, smoking.  
Microbial spoilage of foods.  
Classification of foods by ease of spoilage, chemical changes caused by microorganisms in food.  
Types of spoilage of canned and non canned foods with organisms involved. (tabular form).  
Food borne diseases: Food infections, indicators of food pathogens associated with food, food intoxication – Staphylococcal, Clostridial Samonella and Mycotoxins..

**B.Sc. Second Year Semester IV**  
**Paper XIV Clinical Microbiology**

**Credit 1.****Human Diseases****(18)**

Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis. Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy wrt. Diseases caused by:

**Bacteria**

- i) *Staphylococcus aureus*
- ii) *Pneumococcus*
- iii) *Mycobacterium tuberculosis*
- iv) *Salmonella typhi*
- v) *Vibrio cholerae*
- vi) *Treponema pallidum*
- vii) *Leptospirillum*
- viii) *Leishmania*.

**Credit 2****(16)****Viruses**

- i) HIV
- ii) Hepatitis virus
- iii) H1N1
- iv) SARS
- v) Chikun guniya
- vi) Oncogenic viruses.

**Credit 3.****(13)****(a) Protozoa**

- i) *Entamoeba histolytica*
- ii) *Plasmodium spp*

**(b) Fungi**

- i) *Candida albicans*

**(c) Typhus fever.**

**B.Sc. Second year Semester III****Paper XI. Practical**

- 1) Microbial sampling of air from various sources – indoor , outdoor , hospital . Assessment of air quality by solid , liquid impingement techniques and enumeration using plating and turbidimetry..
- 2) Bacteriological examination of water for potability:: MPN,SPC.
- 3) Presumptive, confirmed, completed test.
- 4) Measurement of chloride, phosphate and nitrate in water.
- 5) Testing (water/ sewage) for physicochemical parameters including BOD, COD.
- 6) Isolation of coliphages from sewage and estimation of phage titre.
  - i) Isolation of *E coli* & identification by IMVIC
  - ii) Cultivation of phages
  - iii) Preparation of phage stocks
  - iv) Estimation of phages w.r.t. time.
- 7) Enumeration and isolation of soil microorganisms : Enrichment culture technique for isolation of bacteria, fungi, protozoa, actinomycetes & algae from soil.

**B.Sc. Second Year Semester III****Paper XII Practical**

- 1) Preparation of media for cultivation of pathogenic bacteria.
  - i) Mannitol salt agar.
  - ii) Wilson and Blair's medium
  - iii) Monsur's medium
  - iv) Lowenstein- Jenson's medium
  - v) Corn- meal agar.
- 2) Staining techniques
  - i) Acid fast staining
  - ii) Blood stainingWBC count- total & differential .
- 3) RBC count by haemocytometer.
- 4) Isolation & study of normal flora of skin, nose, throat.
- 5) Agglutination tests: ( slide tests )
  - i) Blood grouping
  - ii) Widal test
  - iii) RPR test.
- 6) Precipitation test:
  - i) Single radial immunodiffusion
  - ii) Immuno electrophoresis.

**B. Sc. Second year Semester IV**  
**Paper XV Practical**

- 1) Determination of R: S ratio.
- 2) Demonstration of IAA production using soil fungi.
  - i) Extraction from filtrate.
  - ii) qualitative tests.
  - iii) quantitative estimation.
- 3) Demonstration of : i ) Ammonification, ii) Nitrification, iii) Denitrification, iv) Nitrate reduction, v) Sulfate reduction.
- 4) Isolation & study of *Rhizobium* sp from root nodules of leguminous plants.
  
- 5) Isolation & study of *Azotobacter* sp. from soil.
- 6) Bacteriological analysis of milk:
  - i) SPC
  - ii) DMC
  - iii) Reductase test.
- 7) Determination of efficiency of pasteurization by phosphatase test.
- 8) Isolation of microorganisms from common food items; curd, bread, pickles, spoilt food.
- 9) Bacteriological examination of food: ( SPC, DMC )
- 10) Visit to waste treatment plants, dairies , food industries, agricultural universities.

**B.Sc. Second year Semester IV**  
**Paper XVI. Practical**

- 1) Study of pathogens:
  - i) *Staphylococcus aureus*
  - ii) *Salmonella typhi*
  - iii) *Vibrio cholerae*
- 2) Isolation & Identification of *Candida albicans*
- 3) Demonstration of haemolysin & coagulase tests.
- 4) Determination of antibiotic resistance of bacteria.
- 5) Detection of specific antigen by ELISA (demonstration – Viral Disease)
- 6) Visits to related labs, hospitals & institutes.