* NORTH MAHARASHTRA UNIVERSITY, JALGAON*

SYLLABUS FOR T.Y.B.Sc.

(From June, 1994)

MICROBIOLOGY

Paper – V. Medical Microbiology.

Unit – I Microorganisms & Human diseases – (10 Lectures)

1) Introduction to various human & veterinary diseases in tabular form :-

Disease	Causative agent	Host	Mode of transmission

Human diseases :-

1. Haemorrhagic enteritie
2. Recurrent fever.
3. Meningitis.
4. Gangrene.
5. Plague.
6. Whooping Cough.
7. Gonorrhoea.
8. Typhus fever.
9. Q - fever.
10 Trypanosomiasis.
11 Kala – azar.
12 Systosomiasis.
13 Herpes.
14 Measles & German Measles.
15 Small pox & Chicken pox.
16 Viral diarrhoea.
17 Mumps.
18 Common Cold.
19 AIDS.

Veterinary Diseases :-

1. Rinderpest.
2. Rota viral diarrhoea.
3. Vesicular stomatitis.
4. Brucellosis.
5. Salmonellosis.
6. Ranikhet.
7. Marek's disease.
8. Distemper.
9. Mastitis.

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2) Pattern of disease :-

Definition of terms such as signs & symptoms, disease, syndrome, acute & chronic disease & pattern of disease through stages such as incubation, prodromal period of illness, period of decline and Convalescence.

3) Portals of entry :-

1. Respiratory tract.
2. Gastrointestinal tract.
3. Genitourinary tract.
4. Skin.
5. Wounds.
6. Animal bites.

70 - Lectures.

Unit II Detailed Study of following human diseases w.r.t., Causative agent, Classification, Culture, biochemical Characteristics, Antigonic Structure.

Pathogenesis, Lab. diagnasis, Epidemiology. Chemotherapy. Prophylaxis.

A) Respiratory tract diseases :-

1. Tuberculosis.
2. Diphtheria.
3. Influenza.

B) Gastrointestinal tract diseases -

1. Bacillary dysentery.
2. Cholera.
3. Gastroenteritis caused by E. coli.
4. Typhoid.

C) Genitourinary tract & Sexually transmitted diseases -

1. UTI - Caused by Proteus & Pseudomonas
2. AIDS.

D) Diseases of the CNS. :-

1. Tetanus
2. Rabies.
3. Poliomyelitis.

E) Diseases of Cardiovascular & Lymphatic Systems -

1. Serum hepatitis.
2. Rocky Mountain spotted fever.

F) Skin & Wound Infections -

1. Wound infections -
   * Staphylococcus and
   * gas gangrene.
2. Leprosy.

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Unit-III Detailed Study of following 15-Lectures
Veterinary diseases w.r.t. causative agent-
Classification: Culture;biochemical Characteristics.
Lab.diagnosis, Epidemiology, Chemotherapy, Prophylaxis.

1. F.M.D.
2. Haemorrhagic Septicaemia in Cattle.
3. Mastitis.
4. Distemper.
5. Rinderpest.

List of Books :-

1. Ronala M. Atlas : Basic & Practical Microbiology.
(Mac Millan Publishing Company, 1986)
2. Prescott & Hartley : Microbiology , Vm.
(Brown Publishers, 1990)
3. Davis : Microbiology (Maryland; Harper & Row , 1980)
4. Dey N.C. & Dey T.K. : Medical bacteriology
(Calcutta, Allied Publishers, 1978)
5. Jawetzm Ernest, Review of Medical Microbiology
(Tokyo : Lange Medical, 1974)
6. Cruickshank K.R. Medical Microbiology
Vol I (1976) ; Vol II (1982) (Livingstone, Longman)
7. Burrows, William : Textbook of Microbiology.
(Philadelphia:W.B. Saunders, 1973)
8. Zinsser, W. : Microbiology
(Ed. W.K.Joklik New York: Appleton Century C rofts, 1976)
9. Todd, Sandford : Clinical diagnosis & management by laboratory Methods.
(Philadelphia, W.B. Saunders, 1979)
10. Dorland's Pocket Medical Dictionary
(New Delhi, Oxford & IBH, 1969)
11. Ananthanarayan, R. & C.E. Jayaram Paniner : Textbook of Microbiology.
(Bombay : Orient Longman, 1986)
12. Smith & Jones : Veterinary Pathology.
13. Smith & Shastri :Veterinary Pathology.
14. Doxey D.L. : Veterinary Clinical Pathology.
15. Pocker M. : Veterinary Bacteriology & Virology.
16. Jobb - Kennedy : Pathology of Domisticated Animals.
17. Buxton & Fraser : Animal Microbiology.
18. Smith : Veterinary Pathology.

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INDUSTRIAL MICROBIOLOGY

Paper - VI

UNIT-I) PRINCIPLES OF FERMENTATION TECHNOLOGY - (10)

a) Methods of Culture Preservation and maintainance.

b) Improvement of Strains -

i) Modification of Permeability.

ii) Isolation of mutants not producing inhibitors or repressors.

iii) Isolation of mutants not recognizing the Presence of inhibitors or repressors.

UNIT-II) QUALITY CONTROL IN FERMENTATION INDUSTRY- (15)

i) Physical, Chemical & Biological Assays.

ii) Sterility testing.

iii) Pyrogen testing.

iv) Texicity testing.

v) Carcinogenicity testing.

UNIT-III) PROCESS ECONOMICS IN FERMENTATION INDUSTRY. (06)

i) Plant and Equipment.

ii) Media

iii) Air Sterilization

iv) Heating and Cooling

v) Acration & Agitation

vi) Recovery.

vii) Effluent treatment.

viii) R & D.

UNIT-IV) FERMENTATION PROCESS:-

a) Large Scale Production of .....

i) Beer, Wine & Alcohol.

ii) Penicillin, Semisynthetic Penicillin & Streptomycin.

iii) Acetone & Butanol.

iv) Lysin and Glutamic acid.

v) Vitamin B_{12}

vi) Vinegar and Citric acid.

vii) Xanthum gum.

viii) Biofertilizers - Azo, Rizo & BGA fertilizers.

b) Bioinsecticides.

LIST OF BOOKS:-

1. Casida L.E. :Industrial Microbiology (New Delhi) Wiley easter, 1984)

2. Miller, Irinton, H :Industrial Microbiology (New York) Mc Graw Hill, 1976)

3. Peppler H.J. Perlman D: Microbial Technology Vol.I & II
(New York: Academic Precess 1979)
4. Stanbury, Peter F, Whitakar Allen: Principles of fermentation technology (New York : Pergaman, 1984)
5. Aiba, Shuichi : Biochemical Engineering, (New York) Academic Press , 1973)
6. Prescott S.C. Dunn C.G.: Industrial Microbiology (New York : Mc Graw - Hill (3rd edition) 1959)
7. Prescott S.C. Dunn.C.G.: Industrial Microbiology (4th eidition) edited by Gerald Reed (Delhi: CBS Publishers; 1987)
8. Riviere Jacques: Industrial applications of Microbiology (Lond · Survey University Press; 1977)
9. Wiseman, · .len : Hand book of enzyme biotechnology (New York : Ellis Harwood; 1987)

Paper - VII MICROBIAL METABOLISM

I) Biosynthesis : (20)
Proteins, Nucleic acids, Polysaccharides, Lipids.

II) Enzymology : (06)
1. Principles of enzyme purification.
. Methods used for purification.
Criteira of enzyme purity.
2. Principles of measurment of enzyme activities. (0b)
enzyme assays with suitable examples.
3. Enzyme Kinetics : (10)
Derivation of Initial velocity equation by Michaelis-Menten approach.
- Definition and significance of Km, Ks, V max.
- Methods of Plotting Kinetic data.
- Enzyme inhibitions, Cimpetitive, Uncompetitive Noncompetitive.
4. Enzyme Regulation : (08)
- Feedback inhibition
- Feedback repression.
- Enzyme compartmentation.
- Regulation by covalent modification of enzymes.
- Isoenzymes (L.D.H.)
- Allosteric enzymes.

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5. Vitamins and Coenzymes : (06)
- N.D, FAD, TPP, Biotin
- Mettaloenzymes - Mg^{++}

III) Bioenergetics : (18)
Laws of thermodyanamics, Free enrrgy, Entoopy, Electron transport Chain, it's types and components. High energy compounds, ATP Structure and ATP formation (Substrate Level Phosphorylation, oxidative phosphorylation, theories of ATP formation.

IV) Energy Yielding Pathways : (12)
a) Detailed study of central energy yielding pathways with respect to energetics, Examples of Microorganisms and significance.
   1. E.D.
   2. Pentose Phosphate.
   3. HMP
   4. Glyoxylate bypass.

b) Concept of amphibolism & anapleurotic reactiones.

V) Photosynthesis : (10)
Photosynthetic apparatus, Bacterial photosynthesis, Cyclic and noncyclic photophosphorylation, Caluin Cycle and other Co_2 Fixation pathways, Comparative account of plant and bacterial photosynthesis.

List of books :-

1. Outlines of Biochemistry -
Conn. Erric, C. and Stumpf P.K.
(New Delhi, Wiley eastern, 1976)
2. Biochemistry -
Lehinger, Albert L,
3. Biochemistry of bacterial growth -
Mandelstam J. and Mc Quillen K.Ed,
(London : Blackwell Scientific Publication, 1976)
4. Chemical Microbiology -
Rose A.H. , Third edition.
5. Understanding enzymes -
Palmer, Trevor.
6. Enzyme Kinetics -
Engel P. (London : Chapman and Hall , 1981)
7. Control of Enzyme activity -
Cohen P.
8. Bioenergetics -
Lehninger, A.L.

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Paper - VIII

IMMUNOLOGY AND CLINICAL PATHology

UNIT-I) IMMUNOLOGY :

1. Immunogenicity and antigenic specificity (04)
   a) Requirements for immunogenicity.
   b) Antigenic determinants.
   c) Antigenic Specificity.

2) Humoral Immune Responce (08)
   a) Primary and secondary immune responce
   b) Theories of antibody production.
   c) Supresion and tollerence.
   d) Complement System.

3) Cellular Immune Responce (08)
   a) Cells involved cellular immunity with respect to Morphology, formation and function.
      i) Macrophages
      ii) Micro phages
      iii) Mast Cells
      iv) T & B Cells
      v) Plasma cells.
   b) Cell mediated immunity

4) Immunological apparatus (04)
      i) Thymus
      ii) Spleen
      iii) Lymph nodes

5) Antigen - Antibody reactions. (08)
   i) Agglutination.
   ii) Precipitation.
   iii) Complement fixation test
   iv) Opsonization
   v) Bacterilysis or hemolysis
   vi) Bactericidin.

6) Serological Methods (08)
   i) Immuno diffusion
   ii) Immuno electrophoresis
   iii) Immunofluorescence
   iv) Radioimmuno assay
   v) ELISA

7) Hypersensitivity - (04)
   Type I to type V

8) Immuno prophylaxis (04)
   i) Vaccines and Toxoids.
      - Types and Production.
   ii) Immune Sera.
      - Types, Production & Uses.
   iii) Immunization Schedule in India.

9) Recent advances in Immunology (06)

i) Interferon

- Types, Mechanism, Significance.

ii) Monoclonal antibody Technique

- Concept, Production, Significance.

UNIT-II) CLINICAL PATHOLOGY : (15)

1. Haematology

i) Formation & Cytology of blood cell
ii) Biochemistry of Haemoglobin.
iii) Haematological disorders.
  a) Anaemia.
  b) Leukemia c) Abnormal Haemoglobin
  d) Haemophilia.
iv) Blood Grouping.
  a) Introduction to blood grouping systems.
  b) ABO & Rh grouping
  c) Forensic application of blood grouping
  d) Cross reactions and Incompatibility.
    - ABO
    - Rh

2. Structure and functions of Organs.

i) Kidney

a) formation of Urine
b) Routine examination of Urine
c) Disorders of kindney
  - Nephritis

ii) Liver

a) Bilirubin Metabolism
b) Disorders of Liver
  - Hepatitis
c) Liver function tests
  - SGOT
  - SGPT
  - Acid Phosphatase
  - Alkaline Phosphatase

iii) Meninges

a) Formation & function of CSF
b) CSF Examination

3) Biochemical Disorders & their Diagnosis

a) Diabetis Mellitus
  Introduction, diagnosis, treatment
b) Thalassamia
  Introduction, Diagnosis, Treatment
c) Phenyl Ketonurea

LIST OF BOOKS :

1. Roitt, Evan M. : Essential immunology (New Delhi, PPG, Publishing, 1984)
2. Weir D.M. : Immunology (Livingston: ELBS & Churchill, 1983)
3. Stites, Daniel P. & Feudenberg : Basic & Clinical immunology (California : Lange medical 1982)

4. Bowry, T.R. Immunology simplified (London : ELBS & Oxford University Press, 1984)
5. Bellanti, Joseph, Immunology.
6. Humphery, J. & White : Immunology for students of Medicine.
7. Hyde & Patnodes Immunology.
8. Zilva, clinical chemistry in Diagnosis & treatment.
9. D.D. Banker, Modern Practice in Immunization.
10 Livolsis, Merino, Brooks, Saul, Tomaszewali, Pathology (NMS, 1989)

MB - IX Microbial Genetics

I. DNA replication - Mechanism in detail (03)

II. Genetic Recombination - (16)

a) General features.
b) Bacterial transformation & transinfection
c) Bacterial Conjugation-Physiology, mechanism, Fplasmial, Hfr, F' genote.
d) Transduction - Generalized, Specialized, abortive, and Phage conversion.
e) Fate of exogenote in bacterial recombination.
f) Molecular basis of crossing over : Breakage.-reunion and copy choice model.
g) Bacterial chromosome mapping- concepts of genetic map, interrupted mating expt., contransformation cotransduction and deletion mapping.

III) Mutation (14)

1) Methods of detecting mutants.
2) Genetic complementation.
3) Mutation rate.
4) Genetic suppression (Intergenic and Intragenic)
5) Transposable elements in bacteria.

IV) Bacteriophage genetics (15)

1) Bacteriophage growth cycle (lytic and lysogenic)
2) Kinetics of viral multiplication -
   a) One step growth curve - Ellis and Delbriick.
   b) Doerman's experiment for eclipse period.
3) T_4 phage mutants : - Plaque morphology, host range, conditional lethal mutants, cofactor requiring and defective lysoryme.
4) Detection and Enumeration of Virnses - Plaque assay.

V) Genetic aspects of regulation -
Lac operon - Role of mutants in understanding the concept - Positive and negative operon.
arabinose operon.

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VI. Cytoplasmic Inheritance (10)

1) Basic concepts - Criteria.

2) Plasmid - Nomenclature, Types and properties, Detection and Isolation of plasmid

3) Kappa particle in Paramecium.

4) Petite mutants.

VII. Outline of recombinant DNA technology and its applications in brief. (06)

VIII. Genetics of Fungi (20)

1) Review of mitosis and meiosis.

2) Mendel's laws of inheritance

3) Tetrad analysis in Neurospora.

4) Parasexual cycle in Aspergillus.

5) Protoplast fusion and polyploidy in yeast.

LIST OF BOOKS :

1. Stanier, Rogeretal : General Microbiology (London: Macmillan, 1976)
2. Hayes, William : Genetics of bacteria and their viruses Delhi : CBS, 1984)
3. Luria, S.Estal : General virology (New York: John Wiley, 1978)
4. Bainbridge, Biran A.: Genetics of microbes (London: Blackie, 1980)
5. Fincham, J.R.S.: Microbial and molecular genetics (London) English University Press, 1965),
6. Finclam. : Fungal Genetics.
7. Stsickberger, Monroe, W.: Genetics (New York: Macmillan, 1977).
8. Esser, K.: Genetics of Fungi.
9. Hersk.owits, Irwin H,: Principles of genetics (New York: Macmillan, 1977).
10. King : Handbook of genetics.
11. Norris and Ribbons, Ed.: Methods in Microbiology. Vol.78 (London : Academic Press, 1972).
12. Levy,J. and Campbell, J.: Companion to microbiology Vol. I and II.
13. Stent, Gunther S.: Molecular Genetics (San Fransico:

Paper X — Applied & Environmental

- Microbiology -

Unit-I) 1. Fermented Milk and Food Products. (10)

1.. Fermented Milk.

a) Yoghurt.

b) Pumiss

c) Kefir

d) Acidophilus milk.

2. Cheeses. (10)

a) Classification.

b) Microflora.

c) Processing.

d) Spoilage.

e) Common defects.

f) Control.

3. Fermented foods. (10)

a) Bread making

- Microflora

- Dough making.

b) Oriental fermented foods.

Idli

Saurkraut.

Soya sauce.

4. Microbial food posoning & food infection. (15)

a) Clostridium botulinum

b) Clostridium perfringens.

c) Aflatoxin (B1, B2, G1, G2)

d) Food infections (Salmonella, Vibrio)

e) Staphylococcal food poisoning.

Unit-II) 1. Concept of Microbial associations. (30)

Microbial Interactions.

a) Commensialism.

b) Parasitism.

c) Synergism.

d) Antiniosis.

2. Symbiosis.

(As per Stanier 5th edition)

Unit-III) Plant Pathology. (10)

a) Classification of plant diseases based on sym.- ptoms-canker, Mildew (Powdery & downy), Rust, Smuts, Wilts, Spots, Mosaic, Galls, Rots.

b) Epidemiology of plant diseases.

c) General methods of plant disease control :- Eradication chemical & Biological control.

d) Study of plant diseases w.r. to causative agent, symptoms, mode of transmission, prevention & control :-

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i) Citrus canker.
ii) Head smut of jowar.
iii) Whipsmut of sugarcane.
iv) Wilt of cotton.

UNIT-IV Environmental Microbiology - (12)

1. Geomicrobiology.
   a) Scope of geomicrobiology.
   b) Microbial leaching & beneficiation of ore.
   c) Copper & Manganese leaching.
   d) Laboratory process.
   e) In situ leaching.
2. Sewage & waste water -
   a) Domestic & Industrial waste.
   b) Composition, COD & BOD- determination & their significance.
   c) Different Methods of sewage treatment.

LIST OF BOOKS:-

1. Dey, S.: Dairy bacteriology. & Milk
2. Eckles, C.H. & Macy, Combes : Milk/products (Bombay: Tata McGraw Hill, 1979)
3. Frozier, W.C. & Westhoff, D.C.: Food microbiology (3rd ed, New Delhi, Tata McGraw Hill, 1978)
4. Jay, James M : Modern food microbiology (New York: D. Van Nostrne, 1978).
5. Benawart: Basic food Microbiology.
6. Dube, H.G. & Vilgrami, K.S.:Text book of modern plant pathology (New Delhi: Vikas Pub. House, 1976)
7. Mundkar, B.B.: Fungi & Plant disease (London: Mac Millan, 1949)
8. Mitchell, Ralph : Introduction to environmental microbiology. (New Jeresy, Prentice Hall, 1974)
9. Hammer : Sewage & waste treatment.
10. R.Y. Stanier, General Microbiology, 5th edition (London : Mac Millan, 1949)

MICROBIOLOGY

MICROBIOLOGY PRACTICAL COURSE - III

CLINICAL PATHOLOGY AND BIOCHEMISTRY

1) Urine Examination :- Microscopic, Chemical & Physical examination, & Pregnancy test-

II)Stool Examination :- Macroscopic, Microscopic examination and Occult Blood test.

III)Blood Examination :- 1) Haematology
- a) Haemoglobin estimation
- b) Total leucocyte count
- c) Total erythrocyte count
- d) ESR, PCV Indices.

2) Blood smear examination
- Differential LDC count

3) Clinic biochemistry
- a)Blood urea estimation.
- b)Blood Sugar estimation.
- c)Serum Cholesterol extination
- d)Serum bilirubin extimation
- e)SGPT estionation
- f)SGOT estimation
- g)Serum Protein estimation.

IV) SEROLOGICAL TECHNIQUES:-
- a)Blood grouping & Cross matching.
- b)VORL test
- c) Widal agglutination test (Double dilution technique)

V) ELISA TECHNIQUE (USE ONLY KIT)

VI) A my lase array

VII) Determination of molar extinction coefficient

VIII) Electrophoresis - Tube gel electrophoresis
- PAGE.

MICROBIOLOGY PRACTICAL COURSE IV (enerak Microbiology)

I) Clinical bacteriology

Isolation and identification of following microorganisms from respective pathological sample.

a) Staphylococcus aureus
b) Salmonella typhi, S Paratyphi A, S paratyphi B.
c) Escherichia coli
d) Proteus vulgaris
e) Shigella spp

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f) Candida albicans

g) Pseudomonas aerucinosa

II) Agricultural Microbiology:

1) Isolation and identification of the following - microorgansisms from respective samples.

a) Azotobacter spp

b) Rhizobium spp

c) Xanthomones citrii

2) Preparation of biofertilizers

3) Cultivation of fungi and growth measurement

4) Cultivation of actinomycetes

5) Slide culture technique

III) Effect of anti-bacterial agents.

1) Determination of MIC by tube dilution technique using Antibiotics & Heavy Metal salts

2) Antibiotic sensitivity test.

IV) Measurement of cell size by micrometry.

MICROBIOLOGY PRACTICAL COURSE-V.

A) Applied Microbiology:

I) Estimation of DO & BOD

II) Isolation & enumeration of bacteriophage

III) U. V. Survival Curve.

IV) Isolation of mutants by replica plate technique

V) Anaerobic Cultivation Technique

VI) Production, recovery & estimation of fermentation products

a) Alcohol

b) Citric acid

VII) Microbiological assays of .....

a) Penicllin

b) Streptomycin

c) Vitamin B12.

VIII) Total Viable count of bacteria, yeast and Molds from

a) Soil

b) Food

IX) Isolation & Identification of lactic cultures from fermented food samples (genus level only)

X) Determination of DR.

B) PROJECT:- Review article comprising not more than 25-30 pages in double Space on thesis size paper. For 50 marks

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