1. GOAL

The goal of teaching Microbiology is to provide understanding of the natural history of infectious diseases in order to deal with the etiology, pathogenesis, pathogenicity, laboratory diagnosis, treatment, control and prevention of these infections and infectious diseases.

2. EDUCATIONAL OBJECTIVES

KNOWLEDGE

The student at the end of one and half years should be able to: -

state the etiology, pathogenesis and methods of laboratory diagnosis and apply that knowledge in the diagnosis, treatment, prevention and control of communicable diseases caused by microorganisms.

understand commensally, opportunistic and pathogenic organisms of human body and describe host parasite relationship.

know and describe the pathogenesis of diseases caused by microorganisms.

state the sources and modes of transmission of pathogenic and opportunistic micro-organisms including knowledge of insect vectors & their role in transmission of infectious diseases.

choose appropriate laboratory investigations required for clinical diagnosis.

SKILLS

plan and interpret laboratory investigations for diagnosis of infectious diseases and correlate the clinical manifestations with the etiological agent.
identify common infectious agents with the help of laboratory procedure, acquire knowledge of antimicrobial agents, use of antimicrobial sensitivity tests to select suitable antimicrobial agents for treatment.

perform simple laboratory tests, which help to arrive at rapid diagnosis.

be conversant with proper methods of collection, storage & transport of clinical material for microbiological investigations.

understand the principles of immunology and its application in the diagnosis and prevention of infectious diseases including immunization schedule, acquire knowledge of the scope of immunotherapy and different vaccines available for the prevention of communicable diseases.

understand methods of disinfection and sterilization and their application to control and prevent hospital and community acquired infections including universal biosafety precautions and waste disposal.

recommend laboratory investigations regarding bacteriological examination of food, water, milk and air.

the student should be well equipped with the knowledge of prevalent communicable diseases of national importance and of the newer emerging pathogens.

**ATTITUDE**

the student will be regular, sincere, punctual and courteous and regular in studies.
the student will follow all the rules laid down by the department and participate in all activities.

the student will understand the importance of, and practice asepsis, waste segregation and appropriate disposal.
the student will understand the importance of, and practice the best methods to prevent the development of infection in self and patient. (E.g. hand washing, using aprons for hospitals in hospitals only, regularly washing the aprons, wearing gloves (as and when required / handling specimens etc.).

the student will understand the use of the different antimicrobial agents including antibiotics to use judiciously and prevent misuse, (prescribing attitude).

the student will understand the significance of vaccinations and will receive appropriate vaccines (e.g. TT, Hepatitis B and any other as per needs).

the student will wash his/her hands with soap after each practical class.

the student will leave the area allotted for his practical neat and tidy.

the student will discard the slides in the appropriate container provided for the same.

the student will report any injury sustained in class, immediately.

the student will report any breakage occurring during class times immediately.

the student may give suggestions to improve teacher student association.

3. DURATION OF PARA-CLINICAL TEACHING

Semesters    : 03
Teaching days : 360
Teaching Hours : 250

(As per MCI guidelines 1997).
4. SYLLABUS

LEARNING METHODS

Lectures, practicals Distribution of teaching hours -
A) Theory : Lectures ..... 71
    Tutorials ..... 26
    Total ..... 97
B) Practicals and Revision ..... 120
C) Assessments ..... 33
    Total ..... 250

SEQUENTIAL ORGANISATION OF CONTENTS

The areas of study in Microbiology will include General Microbiology, Systemic Microbiology including Bacteriology, Immunology, Mycology, Virology, Rickettsia, Chlamydia, Parasitology and Applied microbiology in relation to infections and diseases of various systems of the body.

I. GENERAL MICROBIOLOGY: (n=10)

A) Introduction and Historical background.
   Definitions : Medical Microbiology, Pathogen, commensal, symbiont etc.
   In History : Anton van Leeuwenhoek, Pasteur, Lister, Koch, Flemming etc.

B) Morphology of bacteria and Classification.

Bacterial cell and its organelles, morphological classification, methods of Studying bacteria, staining methods & their principles. Grams & Ziehl Neelson staining, their Importance in presumptive diagnosis, negative staining, dark ground illumination, phase and
fluorescent, microscopes, briefly about electron microscopy. Principles and applications of all microscopes.

C) Physiology including growth requirements & metabolism.

Nutrition, respiration (anaerobic & aerobic) and growth of bacteria, growth curve, physical Factors influencing, growth. Culture media: Definition, classification and application.

D) Sterilization

Definition of sterilization, disinfections, asepsis, antiseptics. Ubiquity of bacteria, modes of killing microbes and preventing them, factors determining selection of the mode, factors adversely affecting sterilization. Enumeration of physical methods of sterilization including principle & their application.

Work and efficacy testing of autoclave, inspissator and hot air oven Central Sterile supply Department (CSSD).

E) Disinfectants

Asepsis and antisepsis, modes of Action of chemical agents on microbes, Phenols, Halogens, Aldehydes, Acids, Alcohol, heavy metals, oxidizing agents etc. Universal bio-safety precautions.

Dyes, soaps and detergents. Concentration and contact time.

F) Waste disposal

Definition of waste, classification, segregation, transport and disposal.
G) Bacterial genetics and drug resistance to antimicrobial agents.

Introductions – codon, lac operon, mutation, transformations, transductions & conjugations, R Factor, mode of action of antimicrobials on bacteria, mechanism of drug resistance and Antimicrobial susceptibility test, steps taken to minimize emergence of resistant strains (Antibiotic policy, formulations) Microorganisms as modes in Molecular Biology and Genetic engineering.

H) Host parasite relationship and bacterial infections.

Commensal, pathogenic, and opportunistic organisms, their pathogenic factors and modes of transmission.

Microbial factors: spores, capsule, toxins, enzymes, intracellular parasitism, antigenic Variation & extrinsic factors etc. leading to establishment of infection.

Type of infection: primary, secondary, general, local, natural, nosocomialiatrogenic, zoontic.

I) Normal flora

Introduction – various sites, types and role

J) Methods of identification of bacteria. Diagnosis of infections (direct and indirect)

II. IMMUNOLOGY : (n=12)

A) Introduction

- Definition of immunity, type of immunity, factors responsible, mechanism of innate immunity.
- Herd immunity.

B) Antigens, HLA

Definition, types, antigen determinants, properties of antigen. MCI – concept, class – I,II & III functions, indications, indication of typing, MHC restriction.
Nature of determinants, e.g. of haptens, e.g. of cross-reactive antigen.

C) Antibodies

Definition, nature, structure of immunoglobulin classes, physical and biological properties of immunoglobins,

Pepsin digestion, amino acid sequence, immunoglobin domain, abnormal immunoglobins.
Understand isotypic, allotypic, and idiotypic markers.

D) Serological reactions

Definition, characteristics, titre, sensitivity & specificity, antigen-antibody interaction-primary.

Secondary & tertiary, prozone phenomenon, principle, types and application of precipitation, agglutination, complement fixation, enzyme immunoassay, radioimmunoasay, immunofluorosence test, neutralization and opsonisation.
Techniques of precipitation and their uses, blocking antibodies, antiglobulin reactions, co-agglutination, on vitro test, techniques of EIA, IF & electron microscopy.

E) Immune response

Types, developments, role of thymus, bone marrow, lymph nodes & spleen, cell of lymphoreticular system, morphology and role of T subsets, NK cells, B cells, plasma cells and macrophages, B & T cell activation, antigen processing and presentation, primary and secondary immune response, principle and use of monoclonal antibodies, factors affecting antibody production, CMI –definition, type, role of T cell and macrophages, definition of immune tolerance and mechanism of tolerance.

Lymphokines and their role, clonal selections, mechanism of immunoregulation, theories of antibodies formation, techniques of monoclonal antibody formation, detection of CME, types of immunotolerance.

F) Complement

Definition, synthesis, pathways, activations, role & biological function, components, measurement. 
Complement deficiency

Regulation of complement activation,

G) Hypersensitivity

Definition, classification, difference between immediate and delayed reaction, mechanism of anaphylaxis, type V reaction, ADCC, schwartzman phenomenon.
H) Autoimmunity

Definition, mechanism, classification. Pathogenesis.

I) Transplantation & tumor immunology

Type of transplants, mechanism of transplant rejection, prevention of graft rejection GVH reaction, IR to tumors, tumor antigens, mechanism of IR to tumours.

Type of tumor antigens, immune surveillance

J) Immuno- Deficiency

Classification, examples, laboratory test for detection, manifestations.

III. SYSTEMIC BACTERIOLOGY: (n=21)

TOPIC FOR LECTURES WITH PATHOGENESIS INCLUDES:

- Infectious agent
- Habitat
- Source / Reservoir
- Mode
- Infective dose
- Multiplication, spread
- Clinical features, pathology.
- Complications
- Virulence factors
- Immunological response

Laboratory diagnosis:

- Specimen selection
- Collection
- Transport
- Primary smear, hanging drop
- Selection of media
- Pathogenicity testing
- Anti microbial drug susceptibility testing
- Serological interpretation

**Topics for Lectures:**
1) Staphylococci
2) Streptococci Pneumococci
3) Neisseria
4) C.diptheriae
5) M.Tuberculosis
6) Atypical mycobacteria
7) M.leprae
9) Clostridium welchii, tetani, botulinum
10) Enterobacteriaceae
11) Salmonella typhi, paratyphi
12) Shigella
13) Vibrio & Campylobacter
14) Pseudomonas
15) Other GNB Hemophilus, Brucella, Bordetella
16) Newer bacteria Listeria, Gardnerella
17) Spirochetes
18) Actinomycosis & Nocaria
19) Rickettsia
20) Chlamydia & Mycoplasma
21) Bacteriology of air, water, milk and food
IV. MYCOLOGY (n=4)

A) Introduction to Mycology

Nature of fungus (definition, differences with bacteria), characteristics of fungi, common terminologies, brief account of types of sporulation and morphological classification of fungi. Methods of identification, Infections produced, Lab Diagnosis, processing of skin, hair and nail. Growth requirements, ecological, medical and industrial importance of fungi.

B) Agents of Superficial mycosis

Predisposing factors, morphological features and Lab diagnosis. Colony Characteristics of common dermatophytes

C) Subcutaneous mycosis

Predisposing factors, Mycetoma, Rhinosporidiosis, Pathogenesis and Lab diagnosis

D) Systemic mycosis opportunistic fungal infections

Classification, predisposing factors, Candida, Cryptococcus, Histoplasma morphology pathogenesis, lab. Diagnosis Classification, predisposing factors, Mucor, Aspergillus, pneumocystis carinii Cultural characteristic
V. VIROLOGY: (n=12)

Morphology, pathogenesis, laboratory diagnosis, prevention and control for all viruses.

i. General Virology
   Size, shape, symmetry, structure, resistance, multiplication, properties and classification of viruses, pathogenesis, bacteriophages, concept of virons

ii. Laboratory diagnosis of viral infections
    Collection of samples, transport, cultivation and methods of diagnosis

iii. Viral immunity
    Viral immunity, interferon, viral vaccines

iv. Pox viruses
    Small pox and Molluscum

v. DNA viruses
    Papova, Adeno, Herpes viruses (Herpes simplex, Varicella zoster, CMV, EBV)

vi. Respiratory viruses
    Orthomyxo and paramxoviruses, Ag shift and drift
    Rhinoviruses

vii. Picornaviruses
    Polio, Coxsackie, Enteroviruses, Viruses causing diarrhea – Rota viruses, Immunity (polio)

viii. Hepatitis viruses
    Hepatitis viruses, immunity and laboratory diagnosis

ix. Arboviruses
    Dengue, KFD, Japanese Encephalitis – definition, classification, enumeration in India, Pathogenesis, laboratory diagnosis and control

x. Rhabdoviruses
    Rabies

xi. Slow and Oncogenic viruses
    Characteristics of slow virus infection, pathogenesis and laboratory diagnosis and viruses associated with it

xii. Retroviruses
    HIV/ADIS, Immunity USP
VI. PARASITOLOGY: (n=11)

- Geographical distribution
- Habitat
- Morphology (different stages) found in human beings
- Life cycle
- Pathogenesis
- Laboratory diagnosis
- Treatment
- Control
- Immuno-prophylaxis

A) Introduction to medical Parasitology
   Parasites: their nature, classifications, and explanation of terminologies, epidemiology, emerging parasitic infections, (pathogenicity and laboratory diagnosis)

B) E.histolytica
   Amoebic infections

C) Free living amoebae and flagellates
   Free living amoebae, PAME, Giardia and Trichomonas

D) Haemoflagellates
   L. donovani: life cycle, morphology, pathogenicity, and lab. Diagnosis etc.
   Brief account of trypanosomes.

E) Malaria
   Malaria parasites: life cycle, morphology, pathogenicity, laboratory Diagnosis etc.

F) Misc. pathogenic protozoa
   Toxoplasma, Cryptosporidium Isospora, B.coli, Cyclospora.
G) Cestodes
   Taenia saginata and solium, Ecchinococcus granulosus, life cycle, morphology, pathogenicity and laboratory diagnosis.
   Brief mention of other cestodes

H) Trematodes
   Schistosomiasis : life cycle, morphology, pathogenicity, and lab. Diagnosis
   Brief account of fasciola hepatica.

I) Intestinal Nematodes
   A. duodenale, A. lumbricoides, E. vermicularis, T. tritura, brief mention of S. stercoralis life cycle, morphology lab. Diagnosis

J) Tissue Nematodes
   W. bancrofti, D. medinensis, in brief T. spiralis.

VII. APPLIED CLINICAL MICROBIOLOGY (n=26)

   (a) Urinary tract infection
   (b) Respiratory tract infection
   (c) Gastro-intestinal tract infection & Food poisoning
   (d) Surgical site infection
   (e) Septicaemia
   (f) Acute meningitis
   (g) Healthcare associated infection
   (h) Pyrexia of unknown origin
   (i) Emerging & re-emerging infection
   (j) Bioterrorism
   (k) Sexually transmitted infections
5. EVALUATION

METHODS
Theory, Practical & Viva

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Total marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Theory (2 papers – 40 marks each)</td>
<td>80</td>
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<tr>
<td>2</td>
<td>Oral (Viva)</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Practical</td>
<td>26</td>
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<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>150</strong></td>
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**Passing:** A candidate must obtain 50% in aggregate with minimum 50% in Theory+orals, 50% in Practicals.
PATTERN OF THEORY EXAMINATION: DISTRIBUTION OF MARKS, QUESTIONS, TIME.

Nature of Question Paper
i) Total duration - 4 hrs (each paper of 2 hrs or 120 minutes)
ii) Each paper will have 2 sections

Suggested pattern and marking for each paper of 40 marks

<table>
<thead>
<tr>
<th>Sections</th>
<th>Nature of Questions</th>
<th>Total No. of Questions</th>
<th>Marks for Each Question</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>Section - A</td>
<td>(i) One line Answer questions</td>
<td>8 out of 10</td>
<td>01</td>
<td>08</td>
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<td></td>
<td>(ii) Structured Long Answer Question</td>
<td>2 out of 3</td>
<td>07</td>
<td>14</td>
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<tr>
<td>Section - B</td>
<td>Short Answer Question</td>
<td>6 out of 8</td>
<td>3</td>
<td>18</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

* One compulsory question of 7 marks on applied Microbiology in each paper.

Paper I - Related to General Microbiology & Systematic Bacteriology
Paper II – Related to Parasitology, Mycology, Virology & Immunology

a. TOPIC DISTRIBUTION

A) MICROBIOLOGY PAPER I
- General Microbiology
- Systematic bacteriology including Rickettsia, Chlamydia and Mycoplasma
- Related applied microbiology.

B) MICROBIOLOGY PAPER II
- Parasitology
- Mycology
- Virology
- Immunology
- Related applied Microbiology.
b. MARKING SCHEME

Each paper of 40 marks as shown in the above table.

c. NATURE OF PRACTICALS AND DURATION

Practical examination in MICROBIOLOGY will be of 26 marks and oral (viva) of 14 marks of THREE hours duration.

Q.1: Gram staining                      6
Q.2: Zeil – Nelson’s staining            6
Q.3: Stool examination for Ova/cyst      4
Q.4: Spot identification (Ten spots)*    10

Total- 26

(*Spots- Microscopic slides, Mounted specimen, Instruments used in laboratory, Serological tests, Inoculated culture medium, Sterile culture medium, Vaccines / serum), Lab Animal.

The journal should be scrutinized by the teacher concerned and presented during university examination."

d. VIVA (TWO TABLES)                      Marks
A: General & Systemic Microbiology       7
B: Mycology, Parasitology, Virology, Immunology 7

e. PLAN FOR INTERNAL ASSESSMENT

Marks for Internal Assessment:
Theory: 15
Practical: 15

Pattern for computation of ’ Internal Assessment ’ in the subject of Microbiology. (Applicable to the batch joining in June 2001)

THEORY:
Internal assessment shall be computed on the basis of three term ending examinations (two terminals & one preliminary examination before the university examination).
<table>
<thead>
<tr>
<th>EXAMINATION</th>
<th>No. of Papers</th>
<th>Pattern</th>
<th>Duration of each paper</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST TERMINAL</td>
<td>One – 50 Marks</td>
<td>MCQs- 20 (10 Marks) SAQs- 8/9 (24 Marks) LAQs- 2 (16 Marks)</td>
<td>2 Hours 30 Minutes</td>
<td>50</td>
</tr>
<tr>
<td>2ND TERMINAL</td>
<td>One – 50 marks</td>
<td>MCQs- 20 (10 Marks) SAQs- 8/9 (24 Marks) LAQs- 2 (16 Marks)</td>
<td>2 Hours 30 Minutes</td>
<td>50</td>
</tr>
<tr>
<td>PRELIMINARY (As per final University pattern)</td>
<td>Two – 40 marks each</td>
<td>Each paper- Sec A One line answer 8/10 (08 Marks) LAQs- 2/3 (14 Marks) Sec B SAQs- 6/8 (18 Marks) (Total- 40 Marks paper)</td>
<td>2 Hours As for find</td>
<td>80</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>180</td>
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</tbody>
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Final internal assessment in THEORY shall be computed on the basis of actual marks obtained out of 180, reduced to marks out of 15.
PRACTICAL:

Internal assessment in PRACTICALS shall be computed on the basis of three term ending examinations and the marks allotted to practical record book.

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<th>PATTERN</th>
<th>MARKS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST TERMINAL</td>
<td>Exercise (eg.Gram's Stain)</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Spotting</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viva</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2ND</td>
<td>Exercise/Exercises (egGram's &amp; Z.N. Stain)</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Spotting</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viva</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>PRILIMINARY EXAM</td>
<td>Gram's Stain</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>As per University pattern</td>
<td>Ziehl-Neelson Stain</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stool Exam.</td>
<td>5</td>
<td></td>
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<tr>
<td></td>
<td>Spotting</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viva</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>120</strong></td>
</tr>
</tbody>
</table>

There will be 03 mid-term examinations
1st Mid term examination MCQ type -15 marks
2nd Mid-term examination Practical/ MCQ -15 marks
3rd Mid term examination Journal/ MCQ -15 marks
Best two of three performances will be considered for internal assessment

Actual marks obtained out of 120 shall be reduced to out of 12. Add marks obtained out of 3 for Practical Record Book. Total internal assessment marks for Practical shall be out of (12+3) 15.

Total Internal Assessment :  
Theory --- 15
Practical --- 15
-------  
Total: 30