Colour Coding
Global GREEN
Regional BLUE
National ORANGE
Local (State) PINK

Sanjay Gandhi Postgraduate Institute of Medical Science (SGPGIMS), Lucknow, India
Department of Microbiology
Course curriculum

**Program** MD. Clinical Microbiology

**Program duration** Three academic years

**Program objective** Objective of the training program is to train the medical graduate as "Clinical Microbiologists" who have skills and in-depth understanding about the origin, etiology, pathogenesis, laboratory diagnosis and management of common and rare infectious diseases. They shall also have intellectual and technical capabilities to contribute in the growth of 'Clinical Microbiology' field by imparting training, teaching and contributing towards research.

**Program outcomes** Outcomes of the 'MD Medical Microbiology program', as enumerated below, are to enable the students to acquire thefollowing skills after the successful completion of three years training program:

1. To develop competence as a clinical microbiologist
2. Demonstrate application of microbiology in a variety of clinical settings to solve diagnostic and therapeutic problems along with preventive measures
3. Play a pivotal role in hospital infection control, including formulation of antibiotic policy and management of biomedical waste
4. Demonstrate communication skills required for safe & effective laboratory practice
5. Demonstrate skills in conducting collaborative research in the field of Clinical Microbiology and allied sciences which has significant bearing on human health and patient care.
6. Demonstrate ability to plan, execute and evaluate teaching and training assignments efficiently and effectively in Microbiology for undergraduate students as per Competency Based Medical Education (CBME).
7. Identify public health epidemiology, global health patterns of infectious diseases and effectively participate in community outreach and public health programs for investigation, prevention and control of infectious diseases.
8. Demonstrate ability to work as a member of the rapid response team and contribute to investigations of outbreaks of infectious diseases in the hospital and outbreak/epidemic/pandemic in the community.
9. Demonstrate self-directed learning skills and keep updated with recent advances in the field of clinical

microbiology.

10. To advance the field of Microbiology by promoting the research in terms of identification of research gap, conducting research, promoting research, and imparting guidance/training to those who wish to pursue research
11. Demonstrate administrative and organizational skills to establish good clinical microbiological services in a hospital and in the community in the field of clinical microbiology
12. Demonstrate effective leadership and teamwork skills while working with other members of the health care team in hospital, laboratory and community settings.
13. Demonstrate attributes of professional behavior and uphold the prestige of the discipline amongst the fraternity of doctors

Needs: Local : Pink, National : Orange, Regional: light blue, International : green

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**Courses offered in the program**

Course I: **General Microbiology (GM) & Immunology (IG)**
Course II: **Clinical / Systemic Microbiology - I (CM -I)**
Course III: **Clinical / Systemic Microbiology - II (CM-II)**
Course IV: **Applied Microbiology (AM) & Recent Advances**

**Course I: General Microbiology (GM) & Immunology (IG)**

**Course objective:** Student shall have an in-depth understanding about the nomenclature, classification, morphology, growth requirements, pathogenesis and laboratory diagnosis of different bacteria, viruses, parasites and fungi.

**Course outcomes** Students shall have acquired in depth knowledge about the following

1. The epidemiology of common infectious diseases, host-parasite relationship and their significance.
2. To explain various methods of isolation, identification and preservation of microbes in laboratory.
3. To explain the concept & application of various biosafety and biosecurity issues in laboratory and patient care including physical, biological containment and standard precautions.
4. The various methods of sterilization and disinfection and apply them in the laboratory and in patient care.
5. To explain the concept and application of quality assurance, quality control and accreditation in diagnostic microbiology.
6. To describe the principles & implementation of animal and human ethics involved in diagnostics and research in Microbiology
7. To explain the principles and application of recent technological advances, automation, and application of Artificial Intelligence, nanotechnology, biosensors, bioinformatics, etc. in diagnosis & research in Microbiology.
8. To describe types and applications of Bacteriophages in diagnostic and therapeutic of infections
9. To describe the mechanism/s in immunological disorders (hypersensitivity, autoimmune disorders and immunodeficiency states) and discuss the laboratory methods used in their diagnosis including measurement of immunological parameters
10. To describe the types & principles of antigen and antibody reactions and immunological techniques used in diagnostic microbiology as well as in research.

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## Course II: Clinical / Systemic Microbiology - I (CM-I)

**Course objective:** Student shall have acquired necessary skill, understanding, and knowledge about etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national and international guidelines for Infections of various organs and systems of the human body.

**Course outcomes:** Students shall have acquired the following knowledge and skills at the end of the course.

Microbiological basis of infective syndromes of various organs and systems of human body viz. CVS and blood, Respiratory Tract Infections, Urinary Tract Infections, Central Nervous System infections, Reproductive Tract Infections, Gastrointestinal Tract infections, Hepatobiliary System, Skin and Soft tissue infections, Musculoskeletal system, infections of Eye, Ear and Nose etc.

## Course III: Clinical / Systemic Microbiology - II (CM-II)

**Course objective:** This course aims at enabling the students to achieve the competency about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines for Infectious diseases as per the source/risk, Opportunistic Infections in special and high-risk host, Infections in special situations/ scenario.

**Course outcomes:** Students shall have acquired the following knowledge and skills at the end of the course

1. Ability to identify Blood borne, sexually transmitted infections congenital, vector borne, food, air & water borne, zoonotic, laboratory acquired, occupational infections etc.
2. Opportunistic Infections in special and high-risk host i.e., Pregnancy, neonates, geriatrics, diabetics, immunocompromised host due to any reason, patients with Implants/Devices, dialysis etc.
3. Infections in special situations/ scenario -Tropical, Travel related, Emerging/ Remerging Infectious diseases seen commonly, agents of bioterrorism etc.
4. Elicit relevant history, interpret laboratory results with clinic-microbiological correlation and develop diagnostic and treatment algorithms.

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## Course IV: Applied Microbiology (AM) & Recent Advances:

**Course objectives:** The students should be able to learn various applied and advanced aspects of Clinical Microbiology related to vaccines, antibiotics, biomedical waste management, hospital infection control.

**Course outcomes:**

i. **Biomedical waste and its management.**

a. **Role of microbes in non-communicable diseases** - infectious agents in origin and progression of non-communicable diseases like cancer, diabetes, musculoskeletal disorder and influence of these microbes on mental health.

b. **Antimicrobial Resistance Detection and Prevention:** classification, mechanism of action, detection and reporting drug resistance to antimicrobials (antibacterial, antiviral, antifungal, antimycobacterial and antiparasitic agents).

c. Investigation of an infectious disease outbreak in hospital and outbreak/epidemic/pandemic in community.

d. Information technology (computers) in microbiology.

e. Automation in Microbiology.olecular techniques in the laboratory diagnosis of infectious diseases.

f. Statistical analysis of microbiological data and research methodology.

g. Animal and human ethics involved in microbiological work.

h. Laboratory safety and management.

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## Method for computing program outcome

### Method for computing course outcomes

### Course I: General Microbiology (GM) & Immunology (IG)

Assessment of the student will be done on his/her performance in the following academic activities

1. Seminars presentation
2. Short topic presentation
3. Journal clubs
4. Group discussion during the rounds and during teaching hours
5. Didactic lectures
6. Invited faculty lectures to elaborate upon specific topics

### Course II: Clinical / Systemic Microbiology - I (CM -I)

Assessment of the student will be done on his/her performance in the following academic activities

1. Early identification of causative organisms
2. Seminars on clinical topics
3. Short seminars on clinical topics
4. Case discussion during academic hours
5. Case presentation and discussion
6. Discussion on consultations sought by other departments

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**Course III: Clinical / Systemic Microbiology - II (CM-II)**

**Assessment of the student will be done on his/her performance in the following academic activities**

1. Seminars presentation, short topic presentation
2. Journal clubs
3. Skill demonstrated in isolation and identification of causative organisms/Culture seminars.
4. Group discussion during the teaching hours
5. Updated knowledge in the field of automation, advance technology and molecular diagnosis.

**Course IV: Applied Microbiology (AM) & Recent Advances**

Assessment of the student will be done on his/her performance in the following academic activities

1. Journal club presentation
2. Number of journals followed by the student on regular basis
3. Knowledge on most recent guidelines or recommendations, laid for the diagnosis and management of emerging diseases
4. Level of knowledge about the new drugs, diagnostic tests, and diagnostic procedures
5. Critical analysis of the new information's before its application in patient Cre
6. Application of new information in patient care
7. Hypothesis generation and planning new research ideas and proposal based on new information's

## The summative assessment examination shall include two heads:

**A. Theory examination.**

**B. Practical and Viva-voce.**

**Theory examination** shall comprise of four papers, each representing four courses included in the program. Passing percentage shall be cumulatively 50% with minimum of 40% marks in each theory paper.

**Practical /Clinical** examination consisting of (i) Clinical and laboratory exercise consisting of one mixed culture and one pure culture. (ii) culture identification and laboratory exercise of mycology, serology, virology and parasitology (iii) OSCEs (iv) infection control scenario (v)

Passing percentage is 50%

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**Two external examiners and two internal examiners assess the students in the above parameters**

Passing shall be separate for each head and failing shall be common, meaning thereby that clearance at theory and failure at practical / clinicalshall amount to failure at Summative examination and vice versa

In addition to the above-mentioned formal examination, each student will also be evaluated on day to day basis based on the following activities

1. Willingness to accept the responsibility by a student
2. Level of confidence while performing laboratory procedures
3. Depth of knowledge about the procedure while performing it
4. Willingness to learn new skill and acquire new knowledge
5. Self-motivated reading and learning
6. Involvement in extracurricular activities
7. Punctuality to work
8. Involvement in research and departmental data management
9. Willingness to teach and train
10. Skill to teach and train others
11. Interpersonal relationship

## Revision of the syllabus for MD Clinical Microbiology

Syllabus for the MD Clinical Microbiology program is revised. This revision is based on the inputs obtained from the students, faculty, alumni, and thesubject expert. In revision, we attempted to make our syllabus more comprehensive

We attempted to revise our syllabus while ensuring the minimum syllabus defined by National Medical Council to meet the requirements of the MD program

**Over all, almost 25% of syllabus was revised**

Syllabus before revision and additions after revision: 25% of the syllabus has been updated

1. **Bacteriology:**
   Theory: General microbiology, Introduction and History, Bacterial Taxonomy, Classification, structure of bacteria, Growth and nutrition, Bacterial metabolism, Bacterial genetics, Mode of action of antibiotics, Antibiotic resistance, Sterilization and disinfection, Healthcare

associated infections: surveillance and prevention, Methods of Anaerobiosis, Bacterial vaccines, Normal flora, Staphylococci, Streptococci, Corynebacterium, Classification, antigenic structure, laboratory diagnosis of Enterobacteriaceae, Salmonella, Shigella, Non-fermenters, Mycobacteria, non-tuberculous mycobacteria Listeriosis, Pertussis, Brucellosis, Yersiniosis, Plague, Anthrax, Treponemal infections, Mycoplasma, Chlamydia, Rickettsial diseases, Urinary tract infections, Respiratory tract infections, Meningitis, Leprosy, Air, water and milk bacteriology, sexually transmitted Infections, Rapid diagnostic methods and automation in microbiology.

**Practical:** Methods of collection and transportation of specimens and techniques used in processing of samples, serialization and disinfection, media preparation and standardization, bacterial staining techniques, study of morphological, cultural, biochemical and serological characters of bacteria, quantitative bacteriology and viable counts, antibiotic sensitivity tests and bioassay, MIC, MBC, serological identification of bacteria, Lancefield grouping of streptococci, maintenance of stock culture and lyophilization. In vivo and in vitro tests for enteropathogenicity of bacteria. Milk, water, air bacteriology, testing of disinfectants, Principles, practice of fluorescent microscopy, dark ground microscopy, phase contrast microscopy and electron microscopy, working of Central Sterile supply Department, laboratory safety and handling of infections material, techniques of hospital surveillance, use of laminar flow & biosafety hoods, anaerobic hood, safety procedures in Microbiology. Use of lab animals for isolation and pathogenicity testing of bacteria, Gas Liquid Chromatography, BACTEC, automatic microbial system, Western blot & Southern blot, modern techniques for plasmid analysis.

**Revisions:** Basics of antimicrobial stewardship and Antibiotic policy.

**Mycobacteria including Mycobacterium tuberculosis complex (MTBC), Mycobacteria other than tuberculosis (MOTT) and Mycobacterium leprae**

**Theory**. Classification, cell wall structure, pathogenesis of infection, source of infection, transmission, drugs for treatment, classification of agents, their mechanism of action and resistance, regimens, National Program-NTEP, DOTs.

**Practical Laboratory skills**

- **Laboratory biosafety and infection control** – The main purpose of learning laboratory biosafety and infection control is to prevent aerosol generation while collection, transport and processing of pulmonary and extra pulmonary samples which can lead to transmission of infections. Knowledge of Class II biosafety cabinet or Biosafety level 3 with negative pressure facility and HEPA filter, provision of N95 appropriate respirators, glove, gown, appropriate biomedical waste management, appropriate disinfectant for *Mycobacterium tuberculosis*, along with laboratory equipment compliant to maintain biosafety which includes appropriate centrifuge and incubator.
- **Specimen Collection, transportation and labeling-Knowledge of** leak proof container, at least two sputum samples are recommended by the National Tuberculosis Elimination Program, transport of samples, receipt of samples in laboratory at 2-8 °C. After inspecting for

adequate sample volume, requisition form and appropriate tests raised the sample is labeled with laboratory identification number. Sterile scalpel, N95 respirator and gloves to be used for **slit skin sampling** for *M. leprae* with sites.

- **Sample processing of both pulmonary and extra pulmonary samples-** Sample processing starts with decontamination at optimal recovery though it is not applicable to sterile fluids like cerebrospinal fluid. After decontamination preparation of smear and separating sample for culture and other molecular assays.
- **Microscopy**-Ziehl- Neelsen (ZN) stain, Fluorescent stain (using acridine orange), knowledge of both solid and liquid culture which include Lowenstein Jensen (LJ) medium and BACTEC MGIT and BacT/ALERT liquid culture. With routine microscopy of acid-fast stained slides for *M. tuberculosis* there should be knowledge of grading pulmonary samples according to the National TB Elimination Programme, there should be knowledge about all culture methods employed in the laboratory, interpretation of results of solid and liquid culture, weekly reading of colonies on LJ medium, liquid culture drug susceptibility testing (DST) -using MGIT 960 SIRE kit and inoculum preparation for DST.
- **Identification or lab diagnosis** - Its purpose is to correctly detect both *Mycobacteria tuberculosis* (MTBC) and Atypical mycobacteria for effective treatment. It includes,
  - Use of Immunochromatographic assays (like MPT-64) and phenotypic tests, which helps differentiate between MTBC and Atypical mycobacteria.
  - Molecular tests like CBNAAT (GeneXpert MTB/RIF assay), Line probe assay (LPA) and Polymerase chain reaction (PCR).
- **Supplementary knowledge-** Whole genome sequencing (WGS) and targeted next genome sequencing (NGS).

2. **Immunology:** Structure and function of the immune system, immunological mechanisms in health and response of the host immune system to infections. (Innate and acquired immunity. Cells involved in immune response. Antigens. Immunoglobulins. Hypersensitivity. Cell mediated immunity, Cytokines. MHC complex. Immune tolerance etc, complement system and describe its role in health and disease. antigen-antibody reactions. Immunology of malignant disease.

   **Practical:** Antigen & antibody detection by ELISA, rapid immunochromatography method, Latex agglutination method, PCR

3. **Parasitology:**

   **Theory:** Introduction and history of parasitology, classification of parasites, General characters and life cycle and pathogenesis of different parasites, laboratory diagnosis including immunodiagnostic methods in parasitic diseases, epidemiology of parasitic diseases especially in relation to India- Amoebiasis, Intestinal flagellates, Leishmaniasis, Toxoplasmosis, Malaria, Hydatid diseases, Protozoa causing human diarrhea, Filariasis, Cysticercosis, Schistosomiasis, Flukes other than schistosomes, soil transmitted helminths, Prevention

Allergic reaction in parasitic disease. Vaccines in parasitic diseases, clinical manifestation of parasitic diseases, Arthropods of human importance, hematological disorders in Nematodes.

**Practical:** collection and transportation of specimens, processing of stool/blood and other specimens for parasites by direct smears, microscopy, concentration and staining methods. Quantitative egg and cyst count methods, preparation of culture media for parasites and processing of samples for culture purposes, maintenance of strains in India (harvesting of cultures and preparation of different antigen and antisera for serological tests, preparation and maintaining of adult parasites and arthropods, Inoculation of laboratory animals by different routes and harvesting of infected organs, In vitro cultivation of helminthic larvae and preparation of various reagents and serum specimens for different tests, parasitic serology: Immobilization, agglutination, precipitation, indirect hemagglutination CIEOP, fluorescence, Latex and bentonite flocculation, intradermal tests, identification of different parasites and arthropods in smears, tissue section and laboratory safety and handling of infections material.

**Revised syllabus in Parasitology:**

**Theory:**

Point of care testing for important parasitic infections
Drug resistance in malaria
Emerging parasites: epidemiology, agents, life cycle and clinical spectrum,
Transplant associated parasitic infections
Neglected tropical diseases
One Health concept

**Practical:**

Sample collection by NIH swab
Calculation of Parasite index for malaria
Modified Kinyoun staining for coccidian parasites like Cryptosporidium, Cyclospora, Cystoisospora,
ELISA for detection of antibodies against Entamoeba histolytica and Echinococcus, students must be able to diagnose tropical infections and discuss common clinical cases of amoebic liver abscess, malaria, Kala-azar, filariasis.

4. **Virology:**

Introduction of virology, structure and classification of animal viruses, physical and chemical methods of purification of viruses, replication of animal viruses, cell virus interaction, pathogenesis of viral infections, latent and persistent virus infection, Immunology in viral

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Arbo viruses in India & viral hemorrhagic fevers, viral vaccines, Interferon, Rabies, viral hepatitis, viral gastroenteritis, cell cultures uses in virology, viral genetics, epidemiology of viral infection.

**Revised virology syllabus theory:** DNA viruses of medical importance including Pox viruses, Herpes viruses, Adenoviruses, Hepadna virus, Papova and Parvo viruses, RNA viruses of medical importance including Picorna viruses, Toga viruses, Flavi viruses, Orthomyxo viruses, Paramyxo viruses, Reo viruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human immunodeficiency virus, Arbo viruses, Corona viruses, Calci viruses etc., Oncogenic viruses, Bacteriophages, Slow viruses including prions, Unclassified viruses, Viroids, Newly emerging viruses.

**Revised Virology syllabus Practical:** Preparation of glass wares for tissue cultures (washing, sterilization), Preparation of media like Hanks, MEM etc. Preparation of clinical specimens for isolation of viruses, Maintenance of continuous cell lines by subcultures viz. Vero, MDCK, L20B, RD, Preservation of cell line in liquid nitrogen, Recognition of CPE producing viruses, Collection and visualization of Tzank smear, Serological tests-ELISA for Dengue, Japanese encephalitis etc. Collection of specimens for Swine Flu/ COVID -19, RNA extraction from VTM, Blood, CSF, DNA Extraction from blood, solid tissue, sterile body fluids, Conventional PCR Measles and Rubella, RT PCR for Swine Flu, CMV, Herpes, arbovirus, B K virus etc. Multiplex PCR, TrueNat RT-PCR, Gel electrophoresis, Nucleic acid quantification on Nano drop spectrophotometer, Maintenance of biosafety cabinet, Use of Real time thermocycler, Culture of Enterovirus from urine sample, Immuno assay using Chorus autoanalyzer, Programming of conventional thermocycler, Maintenance of Hela and Vero cell lines, IQC sample Preparation for ELISA, Dengue serotyping, Nucleic acid sequencing

5. **Mycology**

**Theory:** Structure and classification of fungi, laboratory diagnosis of fungal diseases, tissue reaction to fungi, chemotherapy for fungal infection, immunity to fungal diseases, Candidiasis, Histoplasmosis, Aspergillosis, Mucormycosis, Entomophthoramycosis and S/C Phaeohyphomycosis, Cryptococcosis, Sporotrichosis and Rhinosporidiosis, Blastomycosis, Lobomycosis, African Histoplasmosis, Chromomycosis, Cladosporiosis, Mycetoma-Maduromycotic, Dermatophytosis, Mycotoxins, Opportunistic fungal infections, Mycotic infection of the lungs, Mycotic infection of the eye and ear, Superficial mycotic infection- Pityriasis, Piedrosis, Serodiagnosis of fungal infections.

**Practical:** Preparation and techniques of staining, 10% KOH wet mount, Lactophenol cotton blue, Gram's stain, Kinyoun's stain, Mucicarmine stain, Gridley fungal stain Periodic Acid Schiff's stain (PAS), Giemsa and Leishman's staining, Grocoff's Gomori [illegible] (GMS) staining, Cryptococcus Antigen detection by CALAS test, slide culture technique, Paraffin/ hair baiting [illegible] testing for yeasts and molds by disc diffusion

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Preparation of special media for fungal culture: Sabouraud's dextrose agar and is various modification. Corn meal agar, Rice starch agar, Brain heart infusion agar, Caffeic acid agar, Potato dextrose agar, Malt extract agar, Czpek's Dox agar, DTM, Yeast nitrogen base (YNB), RPMI 1640 with glutamine without sodium bicarbonate (sigma), Muller Hinton agar with 2% glucose and Methylene blue, Lowenstein Jensen medium, Thioglycolate medium, Antigen broths, Fermentation and assimilation media. Study of various common laboratory contaminants. Aspergillus, Penicillium, Rhizopus, Mucor, Alternaria, Hormodendrum, Fusarium, Cephalosporium, Helminhosporium, Ustilago-zae. Study of the morphological, colonial and biochemical characters, of various human pathogenic fungi e.g., Candida, Histoplasma, Cryptococci, Dermatophytes, Blastomyces, Sporothrix-schenckii.

**Myco-serological test:** Agglutination for candida, cryptococcus, gel diffusion for aspergillus candida, histoplasma and Blastomyces and farmers lung, CIEP for aspergillus, candida, HA (Hemagglutination), Latex agglutination for cryptococci, Histological sections with fungal infections, skin test for: Aspergillosis, Candidiasis, Histoplasmosis. Animal pathogenicity of various pathogenic fungus e.g. cryptococcus, histoplasma, Sporothrix-schenckii, Candida auris.

**Mycobacteria including Mycobacterium tuberculosis complex (MTBC), Mycobacteria other than tuberculosis (MOTT) and Mycobacterium leprae**

A. **Theory**. Classification, cell wall structure, pathogenesis of infection, source of infection, transmission, drugs for treatment, classification of agents, their mechanism of action and resistance, regimens, National Program-NTEP, DOTs.

**B. Lab skills**

- **Laboratory biosafety and infection control** – The main purpose of learning laboratory biosafety and infection control is to prevent aerosol generation while collection, transport and processing of pulmonary and extra pulmonary samples which can lead to transmission of infections. Knowledge of Class II biosafety cabinet or Biosafety level 3 with negative pressure facility and HEPA filter, provision of N95 appropriate respirators, glove, gown, appropriate biomedical waste management, appropriate disinfectant for *Mycobacterium tuberculosis*, along with laboratory equipment compliant to maintain biosafety which includes appropriate centrifuge and incubator.
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  - Molecular tests like CBNAAT (GeneXpert MTB/RIF assay), Line probe assay (LPA) and Polymerase chain reaction (PCR).
- **Supplementary knowledge-** Whole genome sequencing (WGS) and targeted next genome sequencing (tNGS).

## Credit based compulsory modules for MD Clinical Microbiology

In addition to the four mandatory courses, defined above, each student has to complete the following modules available to them. Each of these is of 1 week duration:

1. Biomedical Research
2. Clinical Pathology
3. Transfusion Medicine
4. Community medicine

## Academic flexibility offered to the students in MD Clinical Microbiology

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Our syllabus and duration of courses, offered under our programs are regulated, controlled and guided by national medical council. Hence, we cannot change the course duration at the institute level. Though, we offer the following academic flexibility to the students:

1. Being a tertiary care institute, we see and practice few advanced techniques apart from those mentioned in syllabus. Students can learn those techniques.
2. Student can choose their duration of rotation in department apart from mandatory duration in various courses.
3. Depending upon the interest of the student and their research need, the duration of their rotation may be extended or shortened as permitted with in the NMC norms
4. Additional rotation may be completed during off-duty hours, leaves, or vacations
5. Apart from the thesis work of course, he/she can do research work in their field of interest.
6. During interdepartmental posting, they are permitted extension in other departments.
7. Students are permitted to mutually exchange their rotations but each of them has to complete the entire set of rotatory postings

## Credit based optional modules for MD Clinical Microbiology

In addition to the four mandatory courses, and credit based compulsory modules, defined above, each student will have to options to choose additional optional modules as described below

1. Patient safety
2. Hospital infection control
3. Prevention of Needle stick injury to the health care workers
4. Environmental safety
5. Biomedical waste management

6. Antibiotic Stewardship program
7. Gender safety
8. Health equity
9. One Health
10. Biomedical statistics
11. Basic Life Support and Advanced Trauma Life Support (ALS BLS) Course

## Posting of II-year PG Trainee under "District Residency Programme" (DRP) at the District Hospital

- All postgraduate students pursuing MD/MS in broad specialties in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020).
- Such rotation shall take place in the 2nd year of Postgraduate programme during the 3rd week of May to 3rd week of August and the rotation shall be termed as "*District Residency Programme*" and the PG medical student undergoing training shall be termed as "*District Resident*".

## District hospital postings (mandatory) for 3 months

- The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.
- A tabular attendance record will be maintained during the posting by the PG student and signed by the Doctor In-charge at the end of each posting at the District Hospital.

## Clinical Postings in District Hospital

**Schedule of Rotation**

6. Antibiotic Stewardship program
7. Gender safety
8. Health equity
9. One Health
10. Biomedical statistics
11. Basic Life Support and Advanced Trauma Life Support (ALS BLS) Course

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## Clinical Postings in District Hospital

**Schedule of Rotation**

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i. **Medicine & Allied (14 Days)**
(General Medicine, Respiratory Disease, Skin & Venereal Disease)

ii. **Pediatrics (14 Days)**

iii. **Surgery & Allied (14 Days)**
(General Surgery, Orthopedic)

iv. **Obstetrics and Gynaecology (14 Days)**

## Recommended Reading

### Books (latest edition)


1. Forbes B, Sahm D, Weissfeld A. Bailey and Scott's Diagnostic Microbiology, Mosby, St. Louis.
2. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. Color Atlas and Textbook of Diagnostic Microbiology, J.B. Lippincott, Philadelphia.
3. Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH. Manual of Clinical Microbiology, American Society for Microbiology.
4. Garcia LS, Bruckner DA. Diagnostic Medical Parasitology, American Society for Microbiology.
5. Mackie & McCartney Practical Medical Microbiology by J.G. Collee, A.G. Fraser
6. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases: by John E. Bennett, Raphael Dolin, Martin J. Blaser
7. Manson's Tropical Diseases by Jeremy Farrar; Peter J. Hotez; Thomas Junghanss; Gagandeep Kang; David Lalloo; Nicholas J. Wh
8. Harrison's Infectious Diseases, by Dennis L. Kasper; Anthony S. Fauci
9. Hunter's Tropical Medicine and emerging infectious disease by Edward T. Ryan, David R. Hill, Timothy P. Endy
10. Clinical Immunology Principles and Practices by Robert Rich
11. Anaerobic Bacteriology, Clinical and Laboratory practice by A. Trevorwillis
12. Topley & Wilson, Principles of Bacteriology, Virology and Immunity by M.T. Parker and L.H. Collier
13. Topley and Wilson's Microbiology and Microbial infection by Brian W. J. Mahy, Graham Selby Wilson, and William Whiteman Carlton Topley
14. Text book of Medical Mycology by Jagadish Chander
15. Atlas of Fungal infection by Carol A. Kauffman
16. Bennett and Brachman's Hospital Infection, 6th edition, William R Jarvis.

## Journals:

1. Indian Journal of Medical Research
2. Indian journal of Medical Microbiology
3. Journal of Clinical Microbiology
4. Lancet Infectious disease
5. Antimicrobial Agents and Chemotherapy.
6. J Medical Mycology
7. Mycoses
8. New England Journal of Medicine (NEJM)
9. Nature Review s Microbiology
10. Clin Microbiol Reviews

## E-learning resources & links: Important websites suggested to MD Microbiology students

1. Clinical key access to various Microbiology journals https://www.clinicalkey.com
2. UpToDate.http//www.uptodate.com
3. https://www.ncdc.in/
4. https://main.icmr.nic.in/
5. https://www.who.int/
6. https://www.cdc.gov/
7. https://idsp.mohfw.gov.in/
8. https://ncvbdc.mohfw.gov.in/
9. http://www.cst.up.gov.in/
10. https://dst.gov.in/
11. https://www.mohfw.gov.in/
12. http://ethicalguidelines.gov.in/

Needs: Local : Pink, National : Orange, Regional: light blue, International : green

## Curriculum priorities included in M.D. Microbiology

Uttar Pradesh is one of the largest states in the country, out state has high burden of infectious diseases (Bacteria/ TB/ fungi/ viruses/parasites etc. Therefore, the course curriculum is designed to meet these specific needs of infections prevalent in the state.

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|---|---|
| Local Level | Bacterial/ Mycobacterial/ Leprosy/ Enteric pathogens/Fungal/ Viral/ Parasitic and Opportunistic pathogen are prevalent in hospitalized patients, Diabetes mellitus, Solid organ / Bone marrow transplantation. Transplant Infections. |
| Regional Level | Bacterial/ Mycobacterial/ Leprosy/ Enteric pathogens, Fungal/ Viral/ Parasitic and Opportunistic pathogen are prevalent in Diabetes mellitus, HIV, Solid organ / Bone marrow transplantation. Rickettsial diseases are prevalent which are included. |
| National Level | High burden of tropical diseases. Increased number of Diabetes patient population/ organ transplantation, those on high dose steroid / monoclonal abs increases the risk of infections. The course teaches the students to recognise infections in this group of patients. |
| Global Level | All infectious diseases present locally/endemic and imported are taught during the course. The laboratory diagnosis of these agents and special techniques required for the diagnosis are covered in the course of MD Microbiology as relevant to global health scenario. |