Department Microbiology
PG Curriculum Template

1. Goals

   TO create specialists in the field of Clinical Microbiology who would provide high quality health care and apply the latest advances in the field of Medical Microbiology for the accurate & timely diagnosis of the various infectious disease processes, do research &actively involved in the workshops/training so as to be updated with the latest trends in Medical Microbiology.

2. Programme outcomes

   A post graduate student upon successfully qualifying in the MD (Microbiology) Examination should be able to:

   1. Demonstrate competence as a Clinical Microbiologist
   2. Exhibit effective communication skills with the allied departments by rendering services in basic as well as advanced laboratory investigations and in practice of clinical microbiology
   3. Application of the knowledge of Clinical Microbiology in a variety of clinical settings to contribute in the diagnostic and therapeutic problems along with preventive measures.
   4. Play a pivotal role in hospital infection control practices, including formulation of antibiotic policy and proper management of biomedical waste.
   5. Acquire skills in conducting collaborative research in the field of Microbiology and allied sciences.
   6. Actively involved in clinical/experimental research which will significantly improve the patient care outcome.
   7. Demonstrate effective communication skills required for teaching undergraduate students
   8. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
   9. Plan, execute and evaluate teaching assignments in Medical Microbiology.
   10. Plan, execute, analyze and present the research work in Medical Microbiology.
   11. To acquire various skills for collaborative research.
   12. To participate in various workshops/seminars/journal clubs/demonstration in the allied departments.
   13. Uphold the prestige of the discipline amongst the fraternity of doctors.

3. Syllabus

   PAPER-IGENERAL MICROBIOLOGY AND IMMUNOLOGY
   PAPER-II BACTERIOLOGY + MYCOLOGY
   PAPER-IIIVIROLOGY AND PARASITOLOGY
   PAPER-IV APPLIED MICROBIOLOGY & RECENT ADVANCES

3.1 Theory

System/Section	List of topics
1. General Microbiology	1. Introduction to microbiology a. History of Microbiology b. Role of Microbiology laboratory in diagnosis of infections c. Guidelines for the Collection, Transport, Processing, Analysis and Reporting of Cultures 2. Microscopy – Types and principles 3. Bio-safety in laboratory 4. Quality control and Quality assurance 5. Sterilization and disinfection 6. Types and preparation of Culture media 7. Morphology of bacteria 8. Growth, Nutrition and requirement of bacteria 9. Normal flora of human body 10. Bacterial toxins and Bacteriocins and their role 11. Microbiology of air, milk and water 12. Host-parasite relationship including bacterial virulence factors and pathogenecity 13. Antibacterial substances and drug resistance 14. Bacterial genetics 15. Molecular diagnosis of microorganisms 16. Accreditation of laboratories 17. Bioterrorism 18. Risk management and Laboratory Safety practices 19. Laboratory diagnosis of bacteria 20. Syndromic approach 21. Hospital Acquired Infections – Types, Surveillance and prevention 22. Human Microbiome
2. Immunology	1. Structure and function of the immune system 2. Immunity – Types and features 3. Antigens 4. Immunoglobulins 5. Complement – Role in infections and diagnostics 6. Antigen & antibody reactions 7. Hypersensitivity reactions 8. Cytokines and their role 9. Immunodeficiency 10. Auto-immunity 11. MHC complex 12. Transplantation immunity 13. Tumor immunity 14. Vaccines and immunotherapy 15. Immunological techniques 16. Immunomodulation
3. Systematic bacteriology	1. Systemic classification of bacteria 2. Gram positive cocci - Staphylococcus, Micrococcus, Streptococci, Enterococci**,** anaerobic cocci etc. 3. Gram negative cocci - Neisseria, Branhamella, Moraxella etc. 4. Gram positive bacilli of medical importance including Lactobacillus, Coryneform organisms, Bacillus & aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc. 5. Gram negative bacilli of medical importance including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella,

	Brucella, Gardnerella, Pseudomonas 6. Nil- fermenters 7. Miscellaneous bacteria - Helicobacter, Campylobacter, Legionella &Spirillium 8. Enterobacteriaceae 9. Mycobacteria 10. Spirochaetes *11. Chlamydiae* *12.* Mycoplasmatales: *Mycoplasma, Ureaplasma, Acholeplasma*and other *Mycoplasmas.* 13. Rickettsiae, Coxiella, Bartonella etc. 14. Anaerobic bacteriology – a. Introduction to Anaerobic bacteria b. Human infections caused by anaerobic bacteria c. Collection, transport and handling of anaerobic specimens and cultures d. Isolation and identification of anaerobic bacteria e. Anaerobic Gram negative bacilli – Bacteroidis, Fusobacterium etc. f. Anaerobic Gram positive bacilli – Propionibacterium, Eubacterium, Lactobacillus, 15. Mobiluncus, etc a. Clostridium species 16. Anaerobic Gram positive and negative cocci
4. Virology	1. General characteristics of viruses 2. Classification of viruses 3. Morphology of viruses 4. Replication of viruses 5. Pathogenesis and host response of viral infections 6. Laboratory diagnosis of viruses 7. DNA viruses - Poxviridae, Herpesviridae, Adenoviridiae, Hepadna virus and Parvo viruses etc. 8. RNA viruses - Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridiae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Filoviruses, Arboviruses, Coronaviridae, 9. Retroviridae, Human immunodeficiency virus 10. Slow viruses including prions 11. Unclassified viruses 12. Carcinogenic viruses 13. Teratogenic viruses 14. Vaccines & anti-viral drugs 15. Recent advances in diagnosis of Viral infection
5. Parasitology	1. Introduction to parasitology 2. Taxonomical and systemic classification of parasites 3. General characteristics of parasites 4. Laboratory diagnosis of parasitic infections 5. Protozoan parasites - Entamoeba, Free living amoebae, *Giardia, Trichomonas,* 6. *Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Sarcocystis, Cryptosporidium, Microsporidium, Cyclospora. Isospora, Babesia, Balantidium* etc. 7. Helminthology – 8. Cestoda(*Diphyllobothrium,Taenia,Echinococcus,Hymenolep,Dipyllidium, Multiceps*etc.) 9. Trematoda (*Schistosomes, Fasciola. Fasciolopsis, Gastrodiscoides, Paragonimus, Clonorchis, Opisthorchis* etc.) 10. Nematoda (*Trichiuris, Trichinella, Strongyloides, Ancylostoma, Necator, Ascaris, Toxocara, Enterobius. Filarial worms, Dracunculus* etc.) 11. *Entomology:* common arthropods & other vectors

	12. Antiparasitic agents 13. Drug resistance in parasites 14. Recent advances in parasitology
5. Mycology	1. Introduction to Mycology including classification, morphology, nomenclature, reproduction and laboratory diagnosis of fungi 2. Host response to fungal infections 3. Superficial Mycoses including Dermatophytes 4. Subcutaneous Mycoses- Sporotrichosis, Chromomycosis, Mycetoma and all fungi causing these infections 5. Yeasts and yeast like fungi of medical importance including *Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces* etc. 6. Systemic fungi of medical importance including *Aspergillus, Zygomycetes, Pseudoallescheria, Fusarium, Piedra* 7. Hyphomycetes and hyalohyphomycetes 7. Dimorphic fungi including *Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffei* 8. Fungi causing mycetoma, keratomycosis, otomycosis and opportunistic infections. 9. Pneumocystis carinii infection 10. Rhinosporidium seeberi 15. Common laboratory contaminants 16. Mycetism & mycotoxicosis 17. Antifungal agents & in-vitro antifungal susceptibility tests 18. Newer fungi 19. Recent Advances in diagnosis of fungal infections
7. Applied Microbiology	1. Epidemiology of various infectious diseases 2. Hospital acquired infections – Types, Surveillance systems, prevention 3. Biomedical waste management in hospital 4. Outbreak investigation 5. Infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear & nose, septicaemia, endocarditis, haemorrhagic fever etc. 6. Opportunistic infections. 7. Sexually transmitted diseases 8. Vaccinology: principle, methods of preparation, administration of vaccines information technology (Computers) in microbiology 9. Gene cloning 10. Molecular techniques as applicable to microbiology 11. Automation in Microbiology 12. Statistical analysis of microbiological data and research methodology 13. Animal & human ethics involved in microbiological work

3.2 Practical/ Skills

1. Methods of collection and transportation of specimen and techniques used for clinical Samples:
   - Blood
   - CSF, Pus from closed cavities & open wounds
   - Urine
   - Stool
   - Semen
   - Sputum
   - Swabs (nasal, pharyngeal, rectal, conjunctival etc.)
2. Principles of Microscopy (all types)

3. Commonly used staining in Microbiology: Gram's, A.F.B, Kinyoun's, Albert's, special stains for spores, capsules, inclusion bodies, parasites & fungi
4. Culture Media: their preparation, inoculation, and uses.
5. Antibiotic sensitivity testing including automation in Microbiology and Interpretation of antibiograms
6. Immunological techniques e.g. Widal, VDRL, ID, ELISA, IFA, etc.
7. Biochemical tests for microbial diagnosis
Stereotyping of microbes
8. Human parasites including Protozoa, Nematodes, Cestodes and Trematodes and their diagnosis by gross, microscopic and serological techniques
9. Fungal infections in human and their diagnosis
10. Hospital infection surveillance
11. Counseling: Pretest and Post test counseling of the patients.

4. PG activity programme

Sr. No	Activity	Frequency
1	Seminar	Once a week
2	Journal Club	Twice a Month
3	Practical Exercise	Once a Month
4.	Thesis review	Six Monthly
5	Presentation by faculty and students : Peer review	Regional/National/International conferences/project submission

5. Rotations/postings

Sr. No.	Department (Internal/External)	Duration & timing
1	Bacteriology (Aerobic and anaerobic)	6 Months
2	Mycobacteriology	3 Months
3	Hospital infection surveillance	3 Months
4	Serology/Immunology	4 Months
5	Mycology	3 Months
6	Virology/HIV	3 Months
7	Parasitology	3 Months
8	Clinical Microbiology	3 Months
9	Molecular Diagnostics	4 Month
10	Clinical Pathology	1 Month
11	Clinical Biochemistry	15 Days
12	Skin & Venereal Disease	15 Days
13	ICTC & ART for HIV	1 Month

6. Dissertation

Activity	January admission	July admission
Selection of topic in consultation with PG Guide	March / April	September / October
Approval by Department PG Committee		
Institute Scientific Committee approval	May / June	November / December
Institute Ethics Committee approval		
Final approval letter by Academics Section	30th June	31st December

7. Assessment plan
   7.1. Six monthly report: as per standard format. Format attached as annexure –I
   7.2. List of certifiable skills

Bacteriology- Must Acquire

1. Preparation and pouring of media-nutrient agar, blood agar, MacConkey agar, sugars, serum sugars, Kligler Iron agar, Robertson‘s cooked meat, Lowenstein- Jensen‘s, Sabouraud's dextrose agar
2. Operation of autoclave, hot air oven, distillation plant, filters like Seitz and membrane and sterility tests
3. Washing and sterilization of glass wares (plugging and packing)
4. Preparation of reagents-oxidase, Kovac's, etc
5. Disposal of contaminated materials like cultures
6. Testing of disinfectants-phenol coefficient and "in use" tests
7. Quality control of media, reagents, etc
8. Biosafety precautions in lab
9. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerator, incubator, thermocycler, automated BACTEC system, Biofire, Microcentrifuge, ELISA system etc.
10. Preparation of antibiotic discs: performance antibiotic sensitivity tests by Kirby Bauer, Stokes method, etc. Estimation of minimal inhibitory/bactericidal concentration by tube/plate dilution methods, VITEK
11. Tests for beta-lactamases, ESBL, AmpC, Metallobetalactamases
12. Collection of specimens for microbiological investigations on blood, urine, throat swab, rectal swab, stool, pus (swabs), OT specimens
13. Identification of bacteria of medical importance up to species level (except anaerobes which could be up to generic level)
14. Techniques of anaerobiosis, anaerobic jars
15. Preparation of stains viz. Grams, Albert, capsule, spores, Ziehl-Neelsen etc. and performance of staining
16. Care and operation of microscopes viz. light, dark ground, phase contrast and fluorescence microscopes
17. Preparation, examination and interpretation of direct smears from clinical specimens viz. sputum for AFB-ZN, auramine O, slit smears for *M.leprae* for ZN staining, conjunctival smears for Chlamydia by Giemsa/Iodine
18. Quantitative analysis of urine by pour plate method and semiquantitative analysis by standard loop test for finding significant bacteriuria
19. Plating of clinical specimens on media for isolation, purification, identification and quantification purposes
20. Tests for motility: hanging drop, Craigie's tube, dark ground examination for Spirochaetes- Treponema and Leptospira
21. Skin tests like Mantoux, Lepromin etc.
22. Special tests-bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for Mycobacterium, satellitism, CAMP test, catalase, slide agglutination tests
23. Bacteriological test for air, water and milk.
24. Maintenance and preservation of bacterial cultures.

Bacteriology-Desirable to acquire

1. Phage typing for *Staphylococcus, S. typhi* etc.
2. Bacteriocin typing viz. Proteocin, etc.
3. Animal pathogenicity / toxigenicity tests for *C. diphtheriae, C. tetani, S. pneumoniae, S. typhimurium, K. pneumoniae* etc.
4. Serological grouping of *Streptococcus*
5. Antibiotic susceptibility tests for Mycobacteria
6. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
7. Performance of serological tests viz. Widal, Brucella tube agglutination, Weil- Felix, Cold agglutination, VDRL, Paul-Bunnel, ASO, IFA
8. Enzyme linked immunosorbent assay
9. Latex agglutination tests

Immunology-Desirable to acquire

1. Radial immunodiffusion for estimation of serum Immunoglobulins
2. Immunoelectrophoresis
3. Crossed immunoelectrophoresis
4. Immunodiffusion in gels, (Ouchterlony) counter immunoelectrophoresis
5. Haemolysis
6. Immunoblotting
7. Separation of lymphocytes by centrifugation, gravity sedimentation, etc

Mycology-Must acquire

1. Collection and transport of specimens
2. Direct examination of specimens by KOH, Gram's, Kinyoun's, Giemsa, Lacto phenol cotton blue stains or staining and examination under fluorescent microscope.
3. Calcofluor staining and examination under fluorescent microscope.
4. Isolation and identification of common laboratory contaminants, Dermatophytes and others of medical importance (yeast, dematiacious fungi)
5. Special techniques like and slide culture
6. Special techniques like wood's lamp examination and slide culture.
7. Maintenance of stock cultures

Mycology-Desirable to acquire

1. Antigen and antibody based serological test in fungal diseases including *Candida, Cryptococcosis, Aspergillus*, etc.

Parasitology-Must Acquire

1. Examination of feces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formal-ether methods)
2. Examination of blood for protozoa and helminthes by wet mount and thin and thick stained smears
3. Examination of other specimens e.g. urine, CSF, bone marrow etc. for parasites
4. Performance of stains- Leishman, Giemsa
5. Identification of common arthropods and other vectors viz., mosquito, sandfly, tick, mite, Cyclops
6. Collection of specimens
7. Preservation of parasites- mounting, fixing, staining, etc.

Parasitology-Desirable to Acquire

1. Antigen based and antibody based serological diagnostic tests such as IHA, ELISA, etc for cysticercosis, amoebiasis, hydatid disease, filariasis, etc.

Virology-Must acquire

1. Serological tests-ELISA for HIV, ELISA for HBsAg, HCV, Hepatitis virus, serological tests for arboviruses.

Molecular biology-Must acquire

1. Extraction of DNA,RNA, routine PCR protocols, gel documentation

7.3 Formative Assessment

7.3.1 Theory

S.N.	Schedule	Marks
1.	At end of First year	100 (1 Paper)
2.	At end of Second year	100 (1 Paper)
3.	Pre-professional	400 (4 Papers of 100 marks each)
	Total	600 Marks

7.3.2 Practical

S.N.	Schedule	Marks
1.	At end of First year	100
2.	At end of Second year	100
3.	Pre-professional	400 (Practical 300 + Viva 100)
	Total	600 marks

Eligibility for Professional assessment:

- Candidate should secure a minimum of 40% marks in Theory and Practical separately in formative assessments, in order to be eligible to appear for Professional Examination
- Atleast four out of six monthly progress report should be satisfactory
- Acceptance of Dissertation is mandatory
- Successful completion of Research Methodology programme at induction
- The post graduate students would be required to present one poster presentation, to read one paper at a national/state conference and to submit one research paper for publication/ during period of their postgraduate studies.

7.4 Final Professional Assessment

A	Theory	4 Papers each of 100 marks = 400 marks
B	Practical	Practical/ Clinical Case + Viva = 400 marks

Note:

(A) Minimum 40% marks in each paper and aggregate of 50% marks in order to be declared pass in theory exam

(B) Minimum 50% marks required in Theory & Practical separately, in order to be declared successful in summative exam

8. Recommended Reading

8.1 Books

1. Ananthanarayan & Paniker‘s Textbook of Microbiology, 7th edition. Orient Longsman, India; 2007.
2. Anaissie Elias J. Clinical Mycology, Churchill Livingstone 2003.
3. Bailey and Scott's Diagnostic Microbiology. 9th ed. CV Mosby, St. Louis, 2003.
4. Brooks, Geo F Jawetz Medical Microbiology 22nd ed McGraw Hill 2001. 52
5. Coller, Leslie Topley and Wilsons Microbiology and microbial infections Vol 1, 2, 3, 4, 5, 6
6. : 9th edition
7. Collee J G Mackie and Mc cartney Practical Medical Microbiology 14thed 1999.
8. Koneman EW, Allen SD, Schreckenberg PC, Winn WC (Eds): Atlas and Textbook of Diagnostic Microbiology. 4th ed. JB Lippincott, Philadelphia, 1992.
9. Murray PR, Baron EJ, Pfaller MA, Tenover PC, and Yolken RH (Eds): Manual of Clinical Microbiology. 6th ed. American Society for Microbiology, Washington, DC, 2005.
10. Parija SC. Textbook of Medical Parasitology .3rd Edition 2008. All India Publishers and Distributors, New Delhi. India
11. Parija SC. Textbook of Practical Microbiology, 1st Edition, 2007 Ahuja Publishing House , New Delhi , India .
12. Roitt Ivan M, Immunology 10th edition Blackwell Science 1994.
13. Baijainthimala Mishra. Textbook of Medical Virology,1st Edition,2018 CBS Publishers, New Delhi
14. Stites Immunolgy 10th edn, Mc Graw Hill 2001.
15. Woods GL, Washington JA: The Clinician and the Microbiology Laboratory. Mandell GL, Bennett JE, Dolin R (Eds): Principles and Practice of Infectious Diseases. 4th ed. Churchill Livingstone, New York, 2002.
16. Gradwohl’s Clinical Laboratory Methods and Diagnosis
17. Biochemical tests for the Identification of Medical BacteriaMacFaddin JF 6. Manual of Clinical Microbiology- ASM press
18. Text book of Parasitology. Chatterjee K.D
19. Immunology: Janis Kuby- 2003.
20. Mandell, Douglas and Bennett’s Principles and Practice of Infectious Diseases -2004, 6th edition
21. Control of Hospital Infection- A practical handbook (most recent edition)-2000, 4 th edition
22. Microbiology in Clinical Practice. Shanson D.C
23. Microbiology and Clinical Practice: Shanson-1999, 3rd edition
24. Topley and Wilson’s Microbiology and Microbial infections. 8 volumes 2005, 10th edition
25. Color Atlas and Textbook of Diagnostic Microbiology: Elmer W Koneman -2006, 6 th edition
26. Hospital infection control by Nizam Damani
27. Essentials of Hospital infection control by Apurba Sastry &Deepashri R
28. Mycology – Rippons
29. Virology- Clinical Virology by Rich

8.2 Journals

1. Indian Journal of Medical Microbiology
2. IP International Journal of Medical Microbiology and Tropical Diseases
3. The Indian Journal of Medical Research
4. Journal of Clinical Microbiology
5. Journal of Hospital Infection control
6. Journal of Medical Microbiology
7. Indian Journal of STD
8. Journal Clinical Diseases and Research
9. International journal of antimicrobial agents
10. International journal of Medical Microbiology
11. Current topics in Microbiology and Immunology
12. Clinical Microbiology Reviews (CMR)
13. Journal of Infectious Disease
14. Journal of global antimicrobial resistance
15. European Journal of clinical microbiology and Infectious diseases
16. Annals of Clinical Microbiology and Antimicrobials
17. PLoS Neglected tropical diseases
18. Lancet-Infectious Diseases
19. Indian Journal of Tuberculosis and Lung Diseases.

Annexure – I

सत्यमेव जयते

अखिल भारतीयआयुर्विज्ञान संस्थान, नागपुर

All India Institute of Medical Sciences, Nagpur

Six monthly Progress Report for Postgraduate Students

SECTION I

Name of the PG student: _____

Department:_____

Admitted in (Month and Year):_____

Name of the PG Guide:_____

Report for the period:_____ **to**_____

Attendance: _____**days out of days (**_____**%)**

SECTION II

Grading as per **performance**

	Grade	**Percentage**
	A	80% and above
	B	65% to 79%
	C	50% to 64%
As applicable:	D	Below 50%

1. **OPD work:**
2. **Ward work:**
3. **Lab work:**
4. **OT work:**
5. **ICU work:**
7. **Emergency work:**

6. **Teaching assignments:**

Section III

Progress of Dissertation

_____
_____
_____
_____

Section IV

1. **Case Presentations:**

Sr. No.	Title of case	Date	Faculty I/C	Marks

2. **Microteaching:**

Sr. No.	Topic	Date	Faculty I/C	Marks

3. **Seminars:**

Sr. No.	Title of presentation	Date	Faculty I/C	Marks

4. **Journal Clubs:**

Sr. No.	Journal	Title of Paper	Date	Faculty I/C	Marks

5. **Marks obtained in tests:**

Sr. No.	Date	Theory / Practical	Marks obtained

6. **Number of faculty lectures attended: _____**
7. **Number of faculty Practicals attended: _____**
8. **Number of UG classes conducted: _____**
9. **Any other academic activity conducted: _____**

Section V

1. **Papers presented**

Sr. No.	Title of Paper	Authors	Event	Date

2. **Posters presented**

Sr. No.	Title of Poster	Authors	Event	Date

3. **Publications**
   (Note: Mention only those publications that are published or are accepted for publication during the said period only)

Sr. No.	Title of Paper	Authors	Journal	Year/ Vol/ Issue	Page Nos	Indexed/ Non-Indexed	Status

Section VI

Any other significant achievement:

_____

Certificate by the PG Guide and Head of Unit

This is to certify that Dr._____, has an attendance of _____%, during the period _____to_____.

Overall Grading: _____

Date: _____

Name and Signature of PG Guide:

Name and Signature of Head of Unit:

Certificate by the Head of Department

This is to certify that the performance of Dr._____, during the period _____to_____, has been **satisfactory/ average / unsatisfactory.**

Overall Grading:_____

Date:_____

Name and Signature of HOD:
