



# Study Guide

MD MICROBIOLOGY

**Rawalpindi Medical University**

## Preface



The horizons of *Medical Education* are widening & there has been a steady rise of global interest in *Post Graduate Medical Education*, an increased awareness of the necessity for experience in education skills for all healthcare professionals and the need for some formal recognition of postgraduate training in Diagnostic Radiology.

We are seeing a rise in the uptake of places on postgraduate courses in medical education, more frequent issues of medical education journals and the further development of e-journals and other new online resources. There is therefore a need to provide active support in *Post Graduate Medical Education* for a larger, national group of colleagues in all specialties and at all stages of their personal professional development. If we were to formulate a statement of intent to explain the purpose of this curriculum we might simply say that our aim is to help clinical colleagues to teach and to help students to learn in a better and advanced way. This book is a state of the art book with representation of all activities of the MD Diagnostic Radiology program at RMU. Curriculum is incorporated in the book for convenience of supervisors and residents. MS curriculum is based on six Core Competencies of ACGME (**Accreditation Council for Graduate Medical Education**) including **Patient Care, Medical Knowledge, System Based Practice, Practice Based Learning, Professionalism, Interpersonal and Communication Skills**. The mission of Rawalpindi Medical University is to improve the health of the communities and we serve through education, biomedical research and health care. As an integral part of this mission, importance of research culture and establishment of a comprehensive research structure and research curriculum for the residents has been formulated and provided in this book.

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# Foreword

It is my great pleasure to present this comprehensive study guide for the **MD Microbiology** program. The study guide is designed to serve as a structured and organized resource for the diverse and ever-evolving discipline of microbiology.

Microbiology is a cornerstone of modern medicine, bridging fundamental scientific principles with clinical applications that impact human health worldwide. As an MD Microbiology student, you will come across world of microorganisms, from the molecular mechanisms of pathogenesis to diagnostic innovations, epidemiology, and antimicrobial resistance. This program is tailored to not only develop your theoretical knowledge but also to equip you with hands-on experience in cutting-edge research, laboratory techniques, and clinical microbiology.

In this study guide, we have meticulously outlined the curriculum, which encompasses core subjects such as bacteriology, virology, mycology, parasitology, immunology, and infection control. Along with the core subject you will be trained in Biostatistics, Research Methodology and Medical Ethics. We emphasize critical thinking, problem-solving, and the integration of microbiological knowledge into clinical practice. The goal is to prepare you for a future as a well-rounded, skilled microbiologist capable of contributing to both scientific research and improving patient outcomes.

This study guide will be your companion throughout your academic journey, and I hope it will inspire you to strive for excellence in both your studies and future contributions to medical microbiology.

Wishing you the best in your endeavors as you embark on this exciting phase of your academic and professional life.

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# SECTION 1

## Introduction

The MD Microbiology curriculum provides the framework for the training of doctors to the level of independent consultant practice in diagnostic Microbiology, addressing the requirements of patients, the population and basic health services.

## Mission Statement

The mission of MD Diagnostic Microbiology program that:

1. The student accepts Microbiology in its full sense as lifelong activity and that he/she is prepared to invest time and effort to acquire, maintain and further improve his/her own knowledge and skills.
2. A critical appreciation of techniques, procedures carried out in Microbiology; an understanding of scientific methods, reliability and validity of observations and the testing of hypothesis.
3. The ability and willingness to adopt a problem solving approach to manage clinical situations included in the definition of Microbiology.
4. The ability to plan and interpret management program with due regard to the patient's comfort and economic factors.
5. His / her awareness of the role of specialists of Microbiology in Health Care Teams.
6. The awareness that he/she has to create his/her own professional impact as a capable specialist Microbiologist, a Teacher and a researcher both nationally and internationally.
7. To pursue and develop the basic scientific pursuits and guidelines for scientific discoveries for evidence based patient management.
8. To treat our colleagues and hospital staff with kindness, respect, generosity of spirit, and patience.
9. To foster the excellence and well-being of our residency program by generously offering time, talent, and energy on its behalf.
10. To extend our talents outside the walls of our hospitals and clinics, to promote the health and well-being of communities, locally, nationally, and internationally.
11. To serve as proud ambassadors for the mission of the Rawalpindi Medical University MD Diagnostic Microbiology Residency Program for the remainder of our professional lives.

## **Rationale of curriculum**

The Diagnostic Microbiology curriculum will produce a workforce fit for the needs of patients, producing doctors who are more patient-focused, more general and who have more flexibility in their career structure. The introduction of updated standards for curricula and assessment processes laid out in Excellence by Design requires curricula to be based on high-level outcomes. The high-level outcomes in this curriculum are integral parts of the syllabus to describe the professional tasks within the scope of specialty practice.

## **Training Pathway and Duration of Training**

Trainees enter Diagnostic Microbiology training via a Central Induction Process. Program has 2 phases. Phase 1 consists of 2 years training in Diagnostic Microbiology with mandatory 3 months rotations in each Hematology, Chemical Pathology, Histopathology, , ICUs followed by Midterm Assessment. Phase 2 also consists of 2 years training in Diagnostic Microbiology having rotations in Bacteriology, Virology, Immunology, Mycology, Parasitology, Molecular Biology and Hospital Infectious Prevention and Control practices followed by Final Assessment and Defense of Thesis.

## **MD Microbiology Outcomes**

To prepare an expert in the field of Microbiology who is able to:

1. Impart evidence-based research oriented medical education to the undergraduate and postgraduate levels
2. To provide best possible patient care in Clinical Microbiology
3. To practice the values of mutual respect and ethical practice of Laboratory Medicine
4. To supervise future postgraduates in the field of Microbiology
5. He can be:

- Post Graduate Teacher
- Undergraduate Medical Teacher
- Research Supervisor
- Medical Microbiologist
- Clinical Research Microbiologist
- Microbiology Laboratory Quality Control Officer
- Infection Control Specialist



## TRAINING PATHWAY & ROTATIONS

Year of training	Training Components	Assessment Strategies	
<b>Year 1</b>	<p><b><u>Theory (Months 1-11)</u></b> Course work including:</p> <ul style="list-style-type: none"> <li>• General and Systematic Bacteriology</li> <li>• Medical Virology</li> <li>• Medical Mycology</li> <li>• Medical Parasitology</li> <li>• Immunology</li> <li>• Molecular Biology</li> </ul>	<p><b><u>Lab Techniques (Months 1-11)</u></b> Lab Bench Work including:</p> <ul style="list-style-type: none"> <li>• Specimen Collection and Transport</li> <li>• Microscopy,</li> <li>• Autoclaving, Culture Media Preparation and Storage</li> <li>• Biochemical Bacterial Identification</li> <li>• Care, maintenance and Log Book of Equipment</li> <li>• Safe use of Equipment</li> <li>• Biosafety, Biosecurity and Infection Control Practices in Lab</li> </ul>	<p><b>Month 12:</b> <b>Exam Preparation Leave:</b> Two weeks <b>Theory Exam:</b> 1 week <b>Practical/Viva Voce Exam:</b> 1 week</p> <ul style="list-style-type: none"> <li>• Assignments</li> <li>• MCQs</li> <li>• SEQs</li> <li>• OSPE</li> <li>• Practical Bench work</li> <li>• Viva Voce</li> </ul>
<b>Year 2</b>	<p><b><u>Theory</u></b> Three months full time rotations in each discipline of Hematology, Chemical Pathology, Histopathology Labs and Two months rotation in Molecular Biology having both theory and bench work training as per minor subject curricula</p>	<p><b><u>Lab Techniques</u></b> Basic and commonly used techniques in each discipline required for any hospital Pathologist in alignment with theoretical teaching</p>	<p>Assessment in each discipline at the last week of each rotation as:</p> <ul style="list-style-type: none"> <li>• Assignments</li> <li>• MCQs</li> <li>• SEQs</li> <li>• OSPE</li> <li>• Practical Bench work</li> <li>• Viva Voce</li> </ul>
<p><b>MID-TERM ASSESSMENT (MTA)-in month-12 of year-2</b> <b>This will be out of the theoretical and practical training during last two years</b></p>			

<p><b>Year 3</b></p>	<p><b><u>Theory (Months 1-11)</u></b></p> <ul style="list-style-type: none"> <li>• Clinical Microbiology including collection, transport, processing, and reporting of variety clinical samples from Respiratory Tract, GIT, Blood, Urinary Tract, Body fluids, CNS and others for Bacterial, Viral, Fungal, Parasitic pathogens and immunological reactions</li> <li>• Journal Club Discussion</li> <li>• SGIS</li> <li>• Teaching of Year-1 MD Microbiology Students, BS-MLT students and MBBS students</li> </ul> <p><b>Research:</b> Literature Review for research project</p>	<p><b><u>Lab Techniques (Months 1-11)</u></b></p> <ul style="list-style-type: none"> <li>• Lab Bench Discussions and SUPERVISED hands on training for processing and reporting of variety clinical samples from Respiratory Tract, GIT, Blood, Urinary Tract, Body fluids, CNS and others for Bacterial, Viral, Fungal and Parasitic pathogens</li> <li>• Immunological Techniques including ELISA</li> <li>• Molecular Biology Techniques including PCR</li> <li>• Practical bench training of Year-1 MD Microbiology Students, BS-MLT students and practical rotations of MBBS students</li> </ul> <p><b>Research:</b> Sample Collection, processing and data collection for research project</p>	<p><b>Month 12:</b>  <b>Exam Preparation Leave:</b> Two weeks  <b>Theory Exam:</b> 1 week  <b>Practical/Viva Voce Exam:</b> 1 week</p> <ul style="list-style-type: none"> <li>• Assignments</li> <li>• MCQs</li> <li>• SEQs</li> <li>• OSPE</li> <li>• Practical Bench work</li> </ul> <p>Viva Voce</p>
<p><b>Year 4</b></p>	<p><b><u>Theory (Months 1-10)</u></b></p> <ul style="list-style-type: none"> <li>• Continued bench discussion as during Year-3</li> <li>• Antimicrobial Resistance data planner: feedback to clinical departments</li> </ul> <p><b>Research:</b> Publication, thesis writing, submission and defense</p>	<p><b><u>Lab Techniques (Months 1-10)</u></b></p> <ul style="list-style-type: none"> <li>• Continued bench discussion and supervised hands on training and independent reporting and feedback to clinical departments as during Year3</li> </ul> <p><b>Research:</b> Publication, thesis writing, submission and approval</p>	<p><b>Month 11:</b> Exam Preparation Leave</p> <p><b>Month 12</b> (This will be out of the theoretical and practical training during FOUR YEARS)</p> <p><b>Written, Practical, Viva Voce and Thesis Defense</b></p>
<p><b>FINAL-TERM ASSESSMENT (FTA) – Months 11-12 of year-4</b>  <b>This will be out of the theoretical and practical training during FOUR YEARS</b>  <b>Month-11- Exam Preparation Leave</b>  <b>Month-12</b>  <b>Theory Exam: Week-1</b>  <b>Practical/Viva Voce Exam: Week-2 Thesis Defense: Week-4</b></p>			

## SECTION 2: GENERAL

### STATUTES

**1. Nomenclature:**

The name of degree program shall be MD Microbiology. This name is well recognized and established for the last many decades worldwide.

**2. Course Title:**

MD Diagnostic Microbiology

**3. Training Centers:**

Departments of Diagnostic Microbiology at Rawalpindi Medical University (RMU) and Allied Hospitals

**4. Duration of Course:**

The duration of MD Diagnostic Microbiology course shall be four 04 years with structured training in a recognized department under the guidance of an approved supervisor.

**5. Course structure:**

The course is structured in two parts: After admission in M.D. Diagnostic Microbiology Program as per CIP Punjab:

**Year 1:** The resident will spend first 12 Months in the relevant Hospital Clinical Microbiology Department, during which resident will get basic theoretical knowledge and hands on training in the basic techniques in the chosen discipline and will also undertake the mandatory workshops. The research project will be designed and the synopsis be prepared during this period. Resident will undergo 1st In-training Assessment at the end of 1st year. It will comprise clinical/applied basics MCQs, SAQs, LEQs, Practical and Viva Voce. Pass marks will be 50%.

**Year 2:** The resident will continue formal training in the related disciplines of Pathology. This will comprise of three months full time rotations in each discipline of Hematology, Chemical Pathology, Histopathology Labs and Two months rotation in Molecular Biology having both theory and bench work training as per minor subject curricula. During this period the resident must get the research synopsis approved by ERB and AS&RB of the university. At the end of Year-2, trainee will undergo Midterm Assessment (MTA). It will comprise of clinical/applied basics MCQs, SAQs, LEQs, Practical and Viva Voce. The course content assessed will be that taught during Year 1 and Year 2. Pass percentage in this examination is 60%.

**Years 3-4:** During these years of the program, there will be two components of the training:

1. Clinical Training in Diagnostic Microbiology.

## 2. Research and Thesis writing.

During **Year-3**, the resident shall undergo clinical training to achieve educational objectives of MD Diagnostic Microbiology (knowledge and skills). The clinical training shall be competency based. There shall be generic and specialty specific competencies and shall be assessed by continuous Internal Assessment. Research will be completed in year-3 and thesis writing will be started.

It will comprise of clinical/applied basics MCQs, SAQs, LEQs, Practical and Viva Voce. The course content assessed will be that taught during Year 3. Pass percentage in this examination is 50%.

During **Year 4**, preferably during first 6 months, thesis will be completed and approval by BASR will be taken. Following fulfillment of eligibility criteria, the trainee will appear in Final-Term Assessment (FTA) at the end of fourth year training which will be a comprehensive qualifying examination out of content taught during last four years. It will comprise of clinical/applied basics MCQs, SAQs, LEQs, Practical and Viva Voce. Pass percentage in this examination is 60%.

## ADMISSION CRITERIA

Applications for admission to MD Training Programs will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination as per CIP, Punjab.

**Eligibility:** The applicant on the last date of submission of applications for admission must possess the:

- Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical Council.
- Certificate of one year's House Job experience in institutions recognized by Pakistan Medical Council is essential at the time of interview. The applicant is required to submit Hope Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.
- Valid certificate of permanent or provisional registration with Pakistan Medical Council.
- MD entry exam pass certificate

## REGISTRATION AND ENROLMENT

As per policy of Pakistan Medical Council the number of PG Trainees/ Students per supervisor shall be maximum 05 per annum for all PG programs including minor programs (if any).

- The University will approve supervisors for MD courses.
- Candidates selected for the courses: after their enrollment at the relevant institutions shall be registered with RMU as per prescribed Registration Regulations.

## SECTION 3: PROGRAM

### DEVELOPMENTAL MILESTONES

This document presents milestones designed for programs to use in semi-annual review of resident performance and reporting to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced. They are descriptors and targets for resident performance as a resident moves from entry into diagnostic radiology residency through graduation. In the initial years of implementation, the Review Committee will examine milestone performance data for each program's residents as one element in the Next Accreditation System (NAS) to determine whether residents overall are progressing. For each reporting period, review and reporting will involve selecting the level of milestones that best describes each resident's current performance level in relation to milestones. Milestones are arranged into numbered levels. Selection of a level implies that the resident substantially demonstrates the milestones in that level, as well as those in lower levels. A general interpretation of levels for Diagnostic Microbiology is below:

**Level 1:** The resident demonstrates milestones expected of one who has had some education in diagnostic Microbiology.

**Level 2:** The resident is advancing and demonstrating additional milestones.

**Level 3:** The resident continues to advance and demonstrate additional milestones; the resident consistently demonstrates the majority of milestones targeted for residency.

**Level 4:** The resident has advanced so that he or she now substantially demonstrates the milestones targeted for residency. This level is designed as the graduation target.

**Level 5:** The resident has advanced beyond performance targets set for residency and is demonstrating "aspirational" goals which might describe the performance of someone who has been in practice for several years. It is expected that only a few exceptional residents will reach this level. These are described in **Appendix 1**

### Milestones Levels

<b>Milestones for high level outcome</b>	<b>Milestones Level (End of Year 1)</b>	<b>Milestones Level (End of Year 2)</b>	<b>Milestones Level (End of Year 3)</b>	<b>Milestones Level (End of Year 4)</b>
<b>Patient care and technical skills</b>	L2	L3	L4	L5
<b>Medical knowledge</b>	L 2	L 3	L 4	L 5
<b>Professionalism</b>	L 1	L 2	L 3	L 4
<b>Interpersonal and communication skills</b>	L 2	L 2	L 3	L 5
<b>System based practice</b>	L 2	L 2	L 3	L 4
<b>Practice based learning and improvement</b>	L 1	L 2	L 3	L 5

## SECTION 4: TEACHING & LEARNING

The curriculum is used to help design training program locally that ensure all trainees can develop the necessary skills and knowledge in a variety of settings and situations. The curriculum is designed to ensure it can be applied in a flexible manner, meeting service needs as well as supporting each trainee's own tailored learning and development plan. The requirements for curriculum delivery have not changed as a result of this new curriculum, the only difference is that this new curriculum is more structured in its delivery.

### AIMS AND OBJECTIVES OF THE PROGRAM

#### AIM

The aim of four years MD program in Microbiology is to train residents to acquire the competency of a specialist in the field of Diagnostic Microbiology so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

#### GENERAL OBJECTIVES

1. To provide a broad experience in Microbiology, including it's inter relationship with other disciplines.
2. To enhance medical knowledge, Lab skills, and competence in diagnostic procedures.
3. To cultivate the correct professional attitude and enhance communication skill towards patients, their families and other healthcare professionals.
4. To enhance sensitivity and responsiveness to community needs and the economics of health care delivery.
5. To enhance critical thinking, self-learning, and interest in research and development of patient service.
6. To cultivate the practice of evidence-based medicine and critical appraisal skills.
7. To inculcate a commitment to continuous medical education and professional development.
8. To provide a broad training and in-depth experience at a level for trainees to acquire competence and professionalism of a specialist in Diagnostic Microbiology especially in the diagnosis, investigation and treatment of medical problems towards the delivery of holistic patient care.
9. To acquire competence in managing acute Microbiological emergencies referred by other doctors, and in selecting patients for timely referral to appropriate tertiary care or the expertise of another specialty.
10. To encourage the development of skills in communication and collaboration with the community towards healthcare delivery.
11. To foster the development of skills in the critical appraisal of new methods of investigation and/or treatment.
12. To reinforce self-learning and commitment to continued updating in all aspects of Diagnostic Microbiology.
13. To encourage contributions aiming at advancement of knowledge and innovation in Microbiology through basic and/or clinical research and teaching of junior trainees and other health related professionals.
14. To acquire professional competence in training future trainees in Diagnostic Microbiology at Rawalpindi Medical University.

## **SPECIFIC OBJECTIVES**

### **6 CORE COMPETENCIES OF CURRICULUM**

Curriculum of MD Microbiology at Rawalpindi Medical University is an important document that defines the educational goals of Residency Training Program and is intended to clarify the learning objectives for all inpatient and outpatient rotations. Program requirements are based on the **ACGME (Accreditation Council for Graduate Medical Education)** standards for categorical training in Diagnostic Microbiology. Curriculum is based on 6 core competencies. Detail of these competencies is as follows

#### **Competency No. 1: Patient Care**

Provide patient care that is compassionate, appropriate and effective.

#### **Competency No.2: Medical Knowledge**

Residents must demonstrate knowledge about established and evolving biomedical and clinical sciences and the application of this knowledge to patient care.

#### **Competency No.3: Interpersonal and Communication Skills**

Residents must demonstrate interpersonal and communication skills that result in effective information exchange with patients, patient family members, medical students, other residents, supervising faculty, referring physicians, technologists, nurses and other members of the health care team.

#### **Competency No.4: Professionalism**

Demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.

#### **Competency No.5: Practice Based Learning and Improvement**

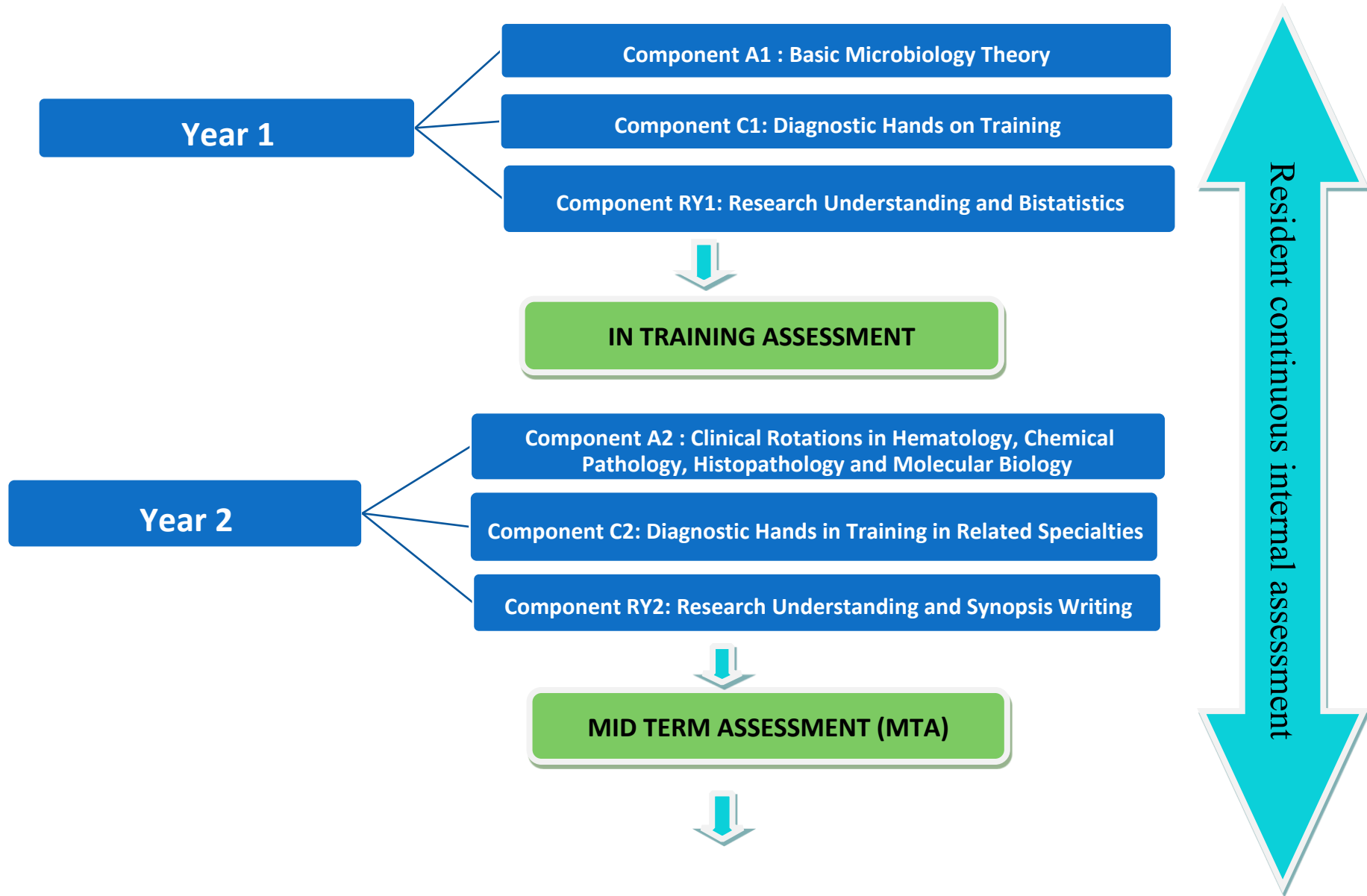
Residents must be able to investigate and evaluate their patient care practices, and appraise and assimilate scientific evidence in order to improve their radiologic practices.

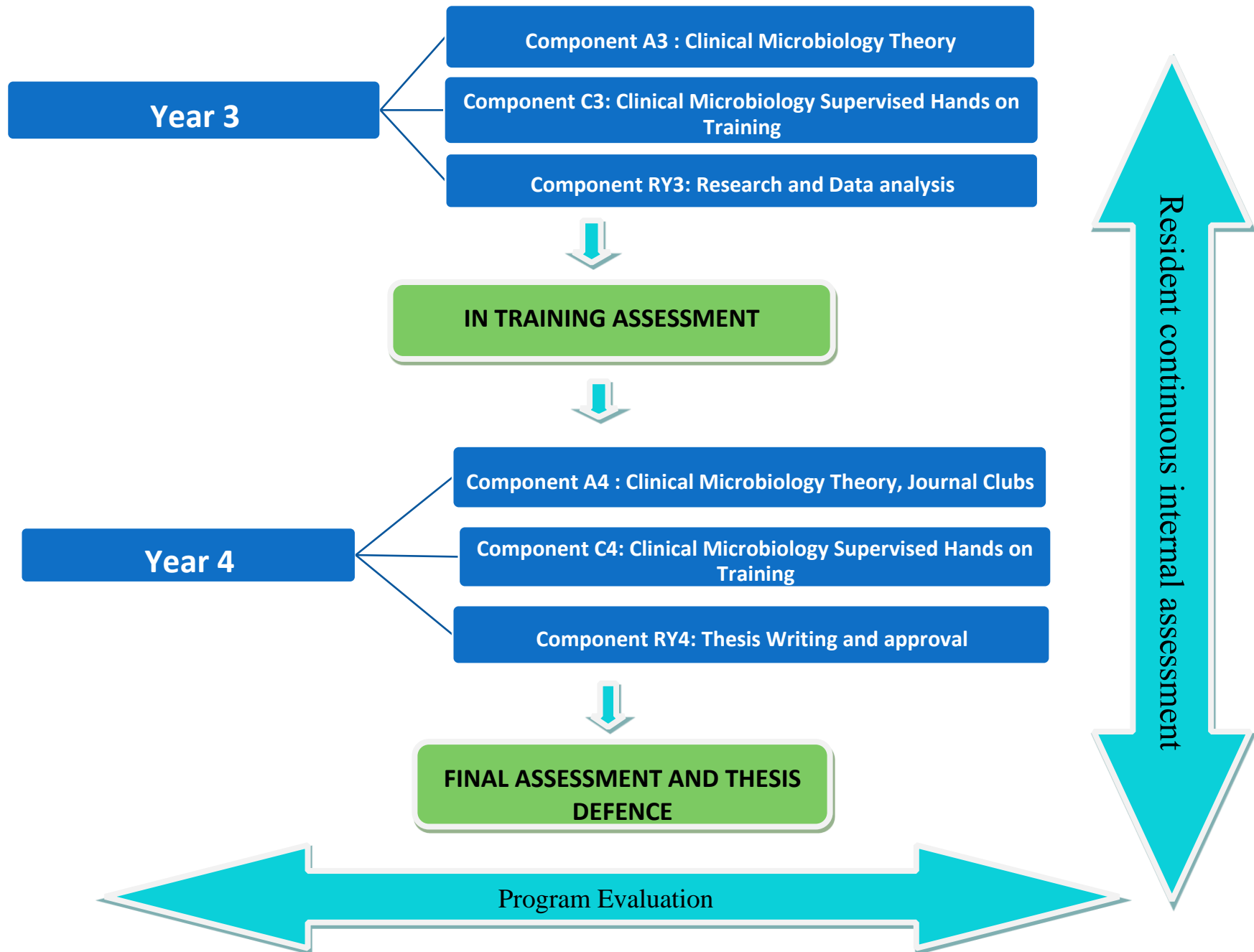
#### **Competency No.6: Systems Based Practice**

Demonstrate an awareness and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide optimal care.



## ROAD MAP OF MD TRAINING DIAGNOSTIC MICROIOLOGY





## LEARNING OPPORTUNITIES

### 1. Reporting Sessions/ Lab Bench Discussions

All residents will have rotations in Autoclaving, Media Preparation, Bacteriology, Mycology, Serology, Clinical Pathology and Parasitology sections of Diagnostic Microbiology where respective reporting session will be conducted. The required knowledge and skills pertaining to respective areas shall be demonstrated. All residents will play an active role under supervision of respective fellow.

### 2. Hands on Training

Hands on training shall be conducted for Autoclaving, Media Preparation, Bacteriology, Mycology, Serology, Clinical Pathology and Parasitology where residents shall have active participation to acquire the skills that shall play a significant role in their career ahead.

### 3. Journal Club Meeting (JCM)

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department

### 4. Small Group Discussions/ Problem Based Learning/ Case Based Learning

Traditionally small groups consist of 8-12 participants. Small groups can take on a variety of different tasks, including problem solving, role play, discussion, brainstorming, debate, workshops and presentations. Generally students prefer small group learning to other instructional methods. From the study of a problem students develop principles and rules and generalize their applicability to a variety of situations PBL is said to develop problem solving skills and an integrated body of knowledge. It is a student-centered approach to learning, in which students determine what and how they learn. Case studies help learners identify problems and solutions, compare options and decide how to handle a real situation.

### 5. Discussion/Debate

There are several types of discussion tasks which would be used as learning method for residents including: guided discussion, in which the facilitator poses a discussion question to the group and learners offer responses or questions to each other's contributions as a means of broadening the discussion's scope; inquiry-based discussion, in which learners are guided through a series of questions to discover some relationship or principle; exploratory discussion, in which learners examine their personal opinions, suppositions or assumptions and then visualize alternatives to these assumptions; and debate in which students argue opposing sides of a controversial

topic. With thoughtful and well-designed discussion tasks, learners can practice critical inquiry and reflection, developing their individual thinking, considering alternatives and negotiating meaning with other discussants to arrive at a shared understanding of the issues at hand.

**6. Case Conference (CC)/ Morning Meetings**

These sessions are held once each week; the focus of the discussion is selected by the presenting resident. For example, some cases may be presented to discuss a differential diagnosis, while others are presented to share interesting cases.

**7. Clinico-Pathological Conferences**

The clinico pathological conference, popularly known as CPC primarily relies on case method of teaching medicine. It is a teaching tool that illustrates the logical, measured consideration of a differential diagnosis used to evaluate patients. The process involves case presentation, diagnostic data, discussion of differential diagnosis, logically narrowing the list to few selected probable diagnoses and eventually reaching a final diagnosis and its brief discussion. The idea was first practiced in Boston, back in 1900 by a Harvard internist, Dr. Richard C. Cabot who practiced this as an informal discussion session in his private office. Dr. Cabot incepted this from a resident, who in turn had received the idea from a roommate, primarily a law student.

**8. Directly Supervised Procedures (DSP)**

Residents learn procedures under the direct supervision of an attending or fellow during some rotations.

**9. Self-Directed Learning**

Self-directed learning residents have primary responsibility for planning, implementing, and evaluating their effort. It is an adult learning technique that assumes that the learner knows best what their educational needs are. The facilitator's role in self-directed learning is to support learners in identifying their needs and goals for the program, to contribute to clarifying the learners' directions and objectives and to provide timely feedback. Self-directed learning can be highly motivating, especially if the learner is focusing on problems of the immediate present, a potential positive outcome is anticipated and obtained and they are not threatened by taking responsibility for their own Learning.

**10. Audio Visual Laboratory**

Audio visual material for teaching skills to the residents is used specifically in teaching ultrasound and interventional procedure details.

**11. E-learning/web-based medical education/computer-assisted instruction**

Computer technologies, including the Internet, can support a wide range of learning activities from dissemination of lectures and materials, access to live or recorded presentations, real-time discussions, self-instruction modules and virtual patient simulations. distance-independence, flexible scheduling, the creation of reusable learning materials that are easily shared and updated, the ability to individualize instruction through adaptive instruction technologies and automated record keeping for assessment purposes.

#### **12. Research Based Learning**

All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature.

## **SECTION 5: RESEARCH & THESIS WRITING**

Research and Thesis have to be completed during training period. Research topic selection is must in first year. Synopsis writing and approval from IRF & BASR are must in second year of training. In third year of training Thesis should be written, while in first six months of fourth year Thesis should be completed and after appropriate defense it should be approved by BASR.

### **Research Experience & Workshops**

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the medical literature. Residents will be advised and supervised by qualified staff members in the conduct of research To help conduction of Research and facilitate Thesis writing following workshops are mandatory during training that will be organized by RMU:

- Communication skills
- Computer & IT skills days
- Synopsis writing
- Research Methodology & Biostatistics
- Reference Manager (Endnote)

## **Clinical Research**

Each resident will participate in at least one clinical research study to become familiar with

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

## **Thesis**

The candidates shall prepare their synopsis as per guidelines provided by Institutional Research Forum/Ethical Review Board (IRF/ERB) and Board of Advanced Studies & Research (BASR). The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, collect and analyze data. Synopsis of research project should be approved in 2nd year of MS program by IRF/ERB and BASR. In 3rd year Thesis work should be completed, and in 4th year it should be approved from BASR.

## SECTION 6: ASSESSMENT

### Purpose of Assessment

Assessment of learning is an essential component of any curriculum. The focus is on good practice, based on fair and robust assessment principles and processes in order to ensure a positive educational impact on learners and to support assessors in making valid and reliable judgement. The program of assessment comprises an integrated framework of examinations, assessments in the workplace and judgement made about a learner during their approved program of training. Its purpose is to robustly evidence, ensure and clearly communicate the expected levels of performance at critical progression points in, and to demonstrate satisfactory completion of, training as required by the curriculum.

Assessments can be described as helping learning or testing learning - referred to as formative and summative respectively. There is a link between the two; some assessments are purely formative others are explicitly summative with a feedback element while others provide formative feedback while contributing to summative assessment as in Continuous Internal Assessment (CIA).

The purposes of **formative assessment** are to:

- Assess trainees' actual performance in the workplace.
- Enhance learning by enabling trainees to receive immediate feedback, understand their own performance and identify areas for development.
- Drive learning and enhance the training process by making it clear what is required of trainees and motivating them to ensure they receive suitable training and experience.
- Enable supervisors to reflect on trainee needs in order to tailor their approach accordingly.

The purposes of **summative assessment** are to:

Provide robust, summative evidence that trainees are meeting the curriculum requirements during the training program.

Ensure that trainees possess the essential underlying knowledge required for their specialty.

Identify trainees who should be advised to consider changes of career direction.

Provide information for the quality assurance of the curriculum.

## **Assessment Methods**

### **Workplace-Based Assessment (WBA)**

Each individual WBA is designed to assess a range of important aspects of performance in different training situations. Taken together the WBAs can assess the breadth of knowledge, skills and performance described in the curriculum. Each WBA is recorded on a structured form to help assessors distinguish between levels of performance and prompt areas for their verbal developmental feedback to trainees immediately after the observation. WBAs are formative and may be used to assess and provide feedback on all clinical activity. Trainees can use any of the assessments described below to gather feedback or provide evidence of their progression in a particular area. WBAs are only mandatory for the assessment of the critical conditions and index procedures.

#### **a) Case Based Discussion (CBD)**

The CBD assesses the performance of a trainee in their management of a patient case to provide an indication of competence in areas such as clinical judgment, decision-making and application of medical knowledge in relation to patient care. The CBD process is a structured, in-depth discussion between the trainee and a consultant supervisor. The method is particularly designed to test higher order thinking and synthesis as it allows the assessor to explore deeper understanding of how trainees compile, prioritize and apply knowledge. By using clinical cases that offer a challenge to trainees, rather than routine cases, trainees are able to explain the complexities involved and the reasoning behind choices they made. It also enables the discussion of the ethical and legal framework of practice. As the actual record is the focus for the discussion, the assessor can also evaluate the quality of record keeping and the presentation of cases. The CBD is important for assessing the critical conditions) Trainees are assessed against the standard for the completion of their phase of training.

#### **b) Clinical Evaluation Exercise (CEX) / CEX for Consent (CEX(C))**

The CEX or CEX(C) assesses a clinical encounter with a patient to provide an indication of competence in skills essential for good clinical care such as communication, history taking, examination and clinical reasoning. These can be used at any time and in any setting when there is a trainee and patient interaction and an assessor is available. The CEX or CEX(C) is important for assessing the critical conditions. Trainees are assessed against the standard for the completion of their phase of training.

#### **c) Direct Observation of Procedural Skills (DOPS)**

The DOPS assesses the trainee's technical, operative and professional skills in a range of basic diagnostic and interventional procedures during routine surgical practice in wards, outpatient clinics and operating theatres. The procedures reflect the common and important procedures. Trainees are assessed against the standard for the completion of core surgical training.

#### **d) Multi-source Feedback (MSF)**



The MSF assesses professional competence within a team working environment. It comprises a self- assessment and the assessments of the trainee's performance from a range of colleagues covering different grades and environments (e.g. ward, theatre, out-patients). Feedback is in the form of a peer assessment chart, enabling comparison of the self- assessment with the collated views received from the team and includes their anonymized but verbatim written comments. The supervisor should meet with the trainee to discuss the feedback on performance in the MSF. Trainees are assessed against the standard for the completion of their training level.

**e) Procedure Based Assessment (PBA)**

The PBA assesses advanced technical, operative and professional skills in a range of specialty procedures or parts of procedures during routine surgical practice in which trainees are usually scrubbed in theatre. The assessment covers pre-operative planning and preparation; exposure and closure; intra-operative elements specific to each procedure and post-operative management. The procedures reflect the routine or index procedures relevant to the specialty. The PBA is used particularly to assess the index procedures. Trainees are assessed against the standards.

**f) Logbook**

The logbook is tailored to each specialty and allows the trainee's competence as assessed by the DOPS and PBA to be placed in context. It is not a formal assessment in its own right, but trainees are required to keep a log of all operative procedures they have undertaken including the level of supervision required on each occasion using the key below. The logbook demonstrates breadth of experience which can be compared with procedural competence using the DOPS and the PBA and will be compared with the indicative numbers of index procedures defined in the curriculum.

**g) Portfolio**

A portfolio is a collection of products prepared by the resident that provides evidence of learning and achievement related to a learning plan. A portfolio typically contains written documents but can include video- or audio-recordings, photographs, and other forms of information. Reflecting upon what has been learned is an important part of constructing a portfolio. In addition to products of learning, the portfolio can include statements about what has been learned, its application, remaining learning needs, and how they can be met. In graduate medical education, a portfolio might include a log of clinical procedures performed; a summary of the research literature reviewed when selecting a treatment option; a quality improvement project plan and report of results; ethical dilemmas faced and how they were handled; a computer program that tracks patient care outcomes; or a recording or transcript of counseling provided to patients. Portfolios can be used for both formative and summative evaluation of residents. Portfolios are most useful for evaluating mastery of competencies that are difficult to evaluate in other ways such as practice-based improvement, use of scientific evidence in patient care, professional behaviors, and patient advocacy. Teaching experiences, morning report, patient rounds, individualized study or research projects are examples of learning experiences that lend themselves to using portfolios to assess residents.

### **h) Observation of Teaching (OoT)**

The OoT assesses the trainee's ability to provide formal teaching. It can be based on any instance of formalized teaching by the trainee which has been observed by the assessor. Trainees are assessed against the standard for the completion of their phase of training.

## **Written/Oral Assessments**

### **a) Objective Structured Practical Examination (OSPE)**

Objective Structured Practical Examination (OSCE) will be held on the first day of the examination, for all the candidates declared eligible for clinical part of the relevant examination. Candidates will be sent information regarding the schedule of TOACS by the Examination Department. In the TOACS the candidates will be evaluated on procedures, clinical history & laboratory findings, instruments, etc. This component of examination will consist of 15 to 20 stations, 4-8 minutes per station arranged in the examination hall and the candidates will have to rotate through all of them in turn.

The TOACS stations will be of two types:

- a) Observed /Interactive
- b) Unobserved / Static

### **b) MCQs**

A written or computer-based MCQ examination is composed of multiple-choice questions (MCQ) selected to sample medical knowledge and understanding of a defined body of knowledge, not just factual or easily recalled information. Each question or test item contains an introductory statement followed by four or five options in outline format. The examinee selects one of the options as the presumed correct answer by marking the option on a coded answer sheet. Only one option is keyed as the correct response. The introductory statement often presents a patient case, clinical findings, or displays data graphically. A separate booklet can be used to display pictures, and other relevant clinical information. In computer-based examinations the test items are displayed on a computer monitor one at a time with pictures and graphical images also displayed directly on the monitor. In a computer-adaptive test fewer test questions are needed because test items are selected based upon statistical rules programmed into the computer to quickly measure the examinee's ability. Medical knowledge and understanding can be measured by MCQ examinations. Comparing the test scores on in-training examinations with national statistics can serve to identify strengths and limitations of individual residents to help them improve. Comparing test results aggregated for residents in each year of a program can be helpful to identify residency training experiences that might be improved.

c) **Short Answer Questions**

Short-answer questions are open-ended questions that require students to create an answer. They are commonly used in examinations to assess the basic knowledge and understanding of a topic before more in-depth assessment questions are asked on the topic. It is very important that the assessor is very clear on the type of answers expected when setting the questions, because SAQ is an open-ended question, students are free to answer any way they choose, short answer questions can lead to difficulties in grading if the question is not worded carefully.

d) **Practical/Lab Techniques Assessment**

The candidate will be assessed for hands on training acquired during the period to be assessed as individual lab techniques or as processing of samples, isolation and identification of pathogens, serological technique etc

e) **Viva Voce**

Will be conducted by team of examiners/ subject specialists to assess the knowledge, competencies, interpretation of findings and training as future microbiologist and researcher.

## Assessment Scheme

1 <sup>ST</sup> IN TRAINING ASSESSMENT (ITA) At the end of 1 <sup>st</sup> Year Training (IN HOUSE)	MID-TERM ASSESSMENT (MTA) At the end of 2nd year Training (BY EXAM DEPARTMENT)	2 <sup>ND</sup> IN TRAINING ASSESSMENT (ITA) At the end of 3rd year Training (IN HOUSE)	FINAL-TERM ASSESSMENT (FTA) At the end of 4th year Training (BY EXAM DEPARTMENT)
<p><b>Written Paper</b> MCQs: 50 marks SAQs: 6x5= 30 marks LEQs: 2x10= 20 marks</p> <p><b>Practical Exam</b> Lab Techniques=40 marks OSPE: 6x5= 30 marks</p> <p><b>Viva Voce = 30 marks</b></p> <p><b>Log Book (Internal Assessment) = 100 marks</b></p>	<p><b>Written Paper</b> (Year 1=50% and Year 2=50%)</p> <p><b>Paper A</b> MCQs: 100 marks</p> <p><b>Paper B</b> SAQs: 14x5= 70 marks LEQs: 3x10= 30 marks</p> <p><b>Practical Exam</b> Lab Techniques=70 marks OSPE: 6x5= 30 marks</p> <p><b>Viva Voce: 100 marks</b></p> <p><b>Log Book (Internal Assessment) = 100 marks</b></p>	<p><b>Written Paper</b> (In house) MCQs: 50 marks SAQs: 6x5= 30 marks LEQs: 2x10= 20 marks</p> <p><b>Practical Exam</b> Lab Techniques=40 marks OSPE: 6x5= 30 marks</p> <p><b>Viva Voce: 30 marks</b></p> <p><b>Log Book (Internal Assessment) = 100 marks</b></p>	<p><b>Comprehensive Qualifying Exam</b> Written, Clinical, and Thesis Written Paper</p> <p><b>Paper A</b> MCQs: 100 marks</p> <p><b>Paper B</b> SAQs: 14x5= 70 marks LEQs: 3x10= 30 marks</p> <p><b>Practical Exam</b> Lab Techniques=100 marks OSPE: 10x5= 50 marks</p> <p><b>Viva Voce: 150 marks</b></p> <p><b>Log Book (Internal Assessment)</b> 200 marks (average of four years) = 75% marks - for legibility to sit in FTA</p> <p>Thesis Defense = 200 marks</p>
<b>Total Marks= 300</b>	<b>Total Marks = 500</b>	<b>Total Marks= 300</b>	<b>Total Marks= 900</b>
<b>Pass Percentage = 50%</b>	<b>Pass percentage = 60%</b>	<b>Pass percentage = 50%</b>	<b>Pass percentage = 60%</b>

## Eligibility Criteria

1 <sup>st</sup> in Training Assessment	Mid-Term Assessment	2 <sup>nd</sup> in Training Assessment	Final Assessment
<p><b>Certificate of Completion of:</b></p> <ol style="list-style-type: none"> <li>1. 1<sup>st</sup> year training</li> <li>2. Workshops completion: <ul style="list-style-type: none"> <li>• Communication skills- 3 days</li> <li>• Computer &amp; IT skills- 3 days</li> <li>• Synopsis writing -3 days</li> <li>• Research methodology &amp; Biostatistics-3 days</li> </ul> </li> </ol> <p><b>Research:</b></p> <ul style="list-style-type: none"> <li>• Allotment of synopsis topic by Supervisor and approval by DRB</li> <li>• Publication of one article in Resident Research Journal OR Statistical report of one disease</li> <li>• <b>CIA:</b> Minimum 75% marks certification by DME and Supervisor/s</li> </ul>	<p><b>Certificate of completion of:</b></p> <ol style="list-style-type: none"> <li>1. 2<sup>nd</sup> year training.</li> <li>2. Passed First In Training Assessment</li> <li>3. Rotations completion Hematology, Chemical Pathology, Histopathology and Molecular Biology</li> </ol> <p><b>Research:</b></p> <ul style="list-style-type: none"> <li>• Formulation of research synopsis with approval of ERB &amp; BASAR by the end of 2nd year</li> <li>• <b>CIA:</b> Minimum 75% marks Certification by DME and Supervisor/s</li> </ul>	<p><b>Certificate of completion of:</b></p> <p>3<sup>rd</sup> year training</p> <p>Passed Mid-term Assessment</p> <p>Rotations completion</p> <p><b>Research:</b></p> <ul style="list-style-type: none"> <li>• Data collection</li> <li>• Data analysis &amp; interpretation</li> <li>• Start writing thesis</li> <li>• <b>CIA:</b> Minimum 75% marks Certification by DME and Supervisor/s</li> </ul>	<p><b>Certificate of completion of:</b></p> <p>4<sup>th</sup> year training</p> <p>Passed 2<sup>nd</sup> in Training Assessment</p> <p>Rotations completion</p> <p><b>Research/Thesis:</b></p> <ul style="list-style-type: none"> <li>• Completion &amp; submission of Thesis (6 months before completion of training)</li> <li>• Approval of Thesis by BASAR</li> <li>• Publication of one article in Resident Research Journal OR Statistical report of one disease</li> <li>• <b>CIA:</b> Minimum 75% marks Certification by DME and Supervisor/s</li> <li>• <b>FEE:</b> Evidence of submission of examination fee</li> </ul> <p><b>No dues certificate:</b> submitted from all relevant departments</p>

### **Final Assessment Schedule and Fee:**

- a) Final Assessment will be held twice a year
- b) The candidates have to fulfil eligibility criteria before permission is granted to take the assessment
- c) Assessment fee will be determined and varied at periodic intervals by the University
- d) The Assessment fee once deposited cannot be refunded / carried over to the next assessment under any circumstances
- e) The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of assessment fee. This card will also show the Roll Number, date / time and venue of assessment.
- f) The written part of assessment will be valid for three consecutive attempts for appearing in the Clinical and Oral Part of the Final Assessment. After that the candidates have to re-sit the written part of the Final Assessment.
- g) The candidates will have two attempts to pass the final examination with normal fee. A special administration fee of Rs.10, 000 in addition to normal fee or the amount determined by the University from time to time shall be charged for further attempts

## **FINAL-TERM ASSESSMENT (FTA)**

- a. Panel of four examiners will be appointed by the Vice Chancellor and of these two will be from RMU whilst the other two will be the external examiners. Internal examiner will act as a coordinator.
- b. The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
- c. The candidates scoring 50% marks in each component of the Practical & Oral Examination will pass this part of the Final Examination.

### **Continuous Internal Assessments (CIA): 75%**

Continuous Internal Assessments would be submitted by the supervisor considering the following:

A. Workplace Based Assessments: These assessments will include the following:

- Generic and Specialty specific Competency Assessments
- Multisource Feedback Evaluation

B. Assessment of Residents' Training Log Book & Portfolio

### **Declaration of Result:**

For the declaration of result:

1. The Resident must get his/her Thesis accepted.
2. The Resident must have passed the final written examination with 50% marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical/ oral examination shall be 60%. Cumulative score of 60% marks to be calculated by adding up secured marks of each component of the Examination i.e., written and practical & oral and then calculating its percentage followed by calculation of Grade Points and GPA of each course and cGPA out of 4.0 as final notification of results.
3. The MD degree shall be awarded after acceptance of thesis and success in the final examination.
4. On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.

### **Submission / Evaluation of Synopsis**

- a. The Residents shall prepare their synopsis as per guidelines provided by the Board of Advanced Studies & Research, available on university website.
- b. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.

- c. Synopsis of research project shall be got approved by the end of the 2<sup>nd</sup> year of MD program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for Consideration by the Board of Advanced Studies & Research, through the Principal / Dean /Head of the institution.

### **Submission of Thesis**

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
4. The research thesis will be submitted along with the fee prescribed by the University.

### **Thesis Evaluation**

- a. The Resident will submit his/her thesis at least 06 months prior to completion of training.
- b. The Thesis along with a certificate of approval from the supervisor will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.
- c. The Controller of Examinations will submit a panel of eight assessors within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the Final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examination would bring the case personally to the Vice Chancellor.
- d. The Supervisor shall not act as an examiner of the candidate and will not take part in defense of thesis.
- e. The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.
- f. The thesis will be evaluated by the examiners within a period of 06 weeks.
- g. In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.
- h. In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.
- i. There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j. The total marks of thesis evaluation will be 200 and 60% marks will be required to pass the evaluation.
- k. The thesis will be considered accepted, if the cumulative score of all the examiners is 60%.



- I. The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.

**Research Publication**

The student preferably should publish at least one research article out of the thesis research work in a PM&DC recognized journal

**Award of MD MICROBIOLOGY Degree**

After successful completion of the structured course of MD MICROBIOLOGY and qualifying Mid-term, Final Assessment and Thesis Defense, the degree with title MD MICROBIOLOGY Degree shall be awarded.

# COURSE WORK, HANDS ON TRAINING AND RESEARCH WORK

## YEAR-WISE CREDIT HOURS DISTRIBUTION

Year of Study	Courses	Credit hours	Total Credit Hours
<b>Year 1</b>	<b>Theory:</b> Microbiology (Bacteriology, Virology, Mycology, Parasitology, Immunology) <b>Practical Hands on Training</b> Basic Lab Techniques and Use of Equipment <b>Research:</b> Literature Review and Topic Selection and Approval	30(14+14+2) CrHrs	<b>Theory: 40 CrHrs</b>  <b>Practical Hands on Training: 60 CrHrs</b>  <b>Research and Thesis: 20 CrHrs</b>
<b>Year 2</b>	<b>Rotations in Related Specialties</b> (Theory and Hands on Practical Training) Hematology Histopathology Chemical Pathology Molecular Biology <b>Research:</b> Synopsis Writing and Approval from ERB and BASAR	30(11+15+4) CrHrs 7 (3+4) 7 (3+4) 7 (3+4) 5 (2+3)	
<b>Year 3</b>	<b>Theory:</b> Clinical Microbiology discussion for sample collection, transport, processing, isolation & identification of Pathogens, Reporting of results (Bacteriology, Virology, Mycology, Parasitology, Immunology) <b>Practical Hands on Training</b> Supervised Lab Bench Work for sample collection, transport, processing, isolation& identification of Pathogens, Reporting of results <b>Research:</b> Research and Data Analysis	30(8+15+7) CrHrs	
<b>Year 4</b>	<b>Theory:</b> Recent Advances in Microbial Diagnostics (Bacteriology, Virology, Mycology, Parasitology, Immunology) <b>Practical Hands on Training</b> Lab Bench Work for sample collection, transport, processing, isolation& identification of Pathogens, Reporting of results <b>Research and Thesis</b> Publication, Thesis Writing, Approval and Defense	30(7+16+7) CrHrs	

## COURSES, COURSE CODES AND CREDIT HOURS

S #	Courses	Course Codes	Credit Hours
1	General Bacteriology	BAC-701	1
2	Microbial Genetics	MIG-702	1
3	Antimicrobials and AST	AMC-703	2
4	Systemic Bacteriology	BAC-703	5
5	Immunology	IMM-704	1
6	Virology	VIR-705	1
7	Parasitology	PAR-706	2
8	Mycology	MYC-707	1
9	Molecular Biology	MB-708	3
10	Environmental Microbiology	ENV-709	1
11	Food Microbiology	FM-710	1
12	Clinical Microbiology	CLM-711	2
13	Quality Assurance in Laboratory Medicine	QLM-712	2
14	Recent Advances in Microbiology	RAM-713	1
15	Biosafety and Biosecurity	BBS-714	1
16	Infection Prevention and Control	IPC-715	2
17	Research Methodology	RSM-716	2
18	Computer skills	CS-717	2
19	Biomedical Ethics	BME-718	1
20	Medical Education	MED-719	1
21	Biostatistics and Bioinformatics	BST-720	2
22	Workshops		2
23	Journal Clubs		2

**TABLE OF SPECIFICATIONS FOR THEORY COMPONENT AND CREDIT HOURS**

S #	Courses	Course Codes	Credit Hours	Assessment Tools		
				MCQs	SEQs	Viva
1	General Bacteriology	BAC-701	1	08	01	05
2	Microbial Genetics	MIG-702	1	08	01	05
3	Antimicrobials and AST	AMC-703	2	16	02	10
4	Systemic Bacteriology	BAC-703	5	40	05	25
5	Immunology	IMM-704	1	08	01	05
6	Virology	VIR-705	1	08	01	05
7	Parasitology	PAR-706	2	16	02	10
8	Mycology	MYC-707	1	08	01	05
9	Molecular Biology	MB-708	3	24	03	15
10	Environmental Microbiology	ENV-709	1	08	01	05
11	Food Microbiology	FM-710	1	08	01	05
12	Clinical Microbiology	CLM-711	2	16	02	10
13	Quality Assurance in Laboratory Medicine	QLM-712	2	16	02	10
14	Recent Advances in Microbiology	RAM-713	1	08	01	05
15	Biosafety and Biosecurity	BBS-714	1	08	01	05
16	Infection Prevention and Control	IPC-715	2	16	02	10
17	Research Methodology	RSM-716	2	16	02	10
18	Computer skills	CS-717	2	16	02	10
19	Biomedical Ethics	BME-718	1	08	01	05
20	Medical Education	MED-719	1	08	01	05
21	Biostatistics and Bioinformatics	BST-720	2	16	02	10

# LAB BENCH WORK

## YEAR 1

### General Bacteriology, Systemic Bacteriology and Applied Microbiology

1. Introduction to microbiology laboratory work set up, equipment and consumables.
2. Handling of laboratory equipment.
3. Maintenance of record of all consumables and equipment being used in microbiology laboratory.
4. Purchase of laboratory equipment and consumables.
5. Critical values in microbiology laboratory and their timely information to attending physician.
6. Collection / transport of specimens for microbiological investigations.
7. Preparation, examination & interpretation of direct smears from clinical specimens.
8. Plating clinical specimens on media for isolation, purification, identification and quantification purposes.
9. Preparation of stains viz., Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) Silver impregnation stain and special stains, etc.
10. Preparation and pouring of media.
11. Preparation of reagents
12. Quality control of media, reagents, etc.
13. Operation of autoclave, hot air oven, distillation plant, filters like sietz and membrane filters.
14. Infection prevention and control in clinical laboratories and hospitals.
15. Standard and expanded precautions in clinical laboratories and hospital settings.
16. Physical and biological containment
17. Hospital waste management
18. Disposal of Infectious waste in clinical laboratory.
19. Disinfection of contaminated materials like cultures.
20. CLSI guidelines; interpretation and implementation.
21. Quality control and quality assurance.

22. Microscopy techniques used in clinical and microbiology laboratory
23. Care and operation of microscopes.
24. Washing and sterilization of glassware (plugging and packing).
25. Care and maintenance of common laboratory equipment like water bath, centrifuge, refrigerators, incubators, etc.
26. Aseptic practices in laboratory and safety precautions.
27. Sterilization and disinfection of consumables and equipment and surfaces in laboratory.
28. Biosafety and biosecurity in microbiology laboratory.
29. Biosafety levels for clinical laboratories.
30. Use of various types of Biosafety cabinets and their maintenance.
31. Aseptic practices in laboratory and safety precautions.
32. Sterility tests.
33. Sample collection and handling.
34. Sample processing.
35. Plating clinical specimens on media for isolation, purification, identification, and quantification purposes.
36. Sample collection from different sites of the human body.
37. Sample transportation within hospital and outside the hospital.
38. Sample labelling, sample receiving criteria, timeline for sample reporting.
39. Sample inoculation on different culture media, biochemical reaction testing.
40. Antimicrobial sensitivity testing techniques.
41. Reporting of culture and sensitivity tests.
42. Interpretation of microbiological laboratory reports.
43. Test for Beta-lactamase production.
44. Introduction of semiautomated and automated methods used in microbiological laboratory.
45. Long term and short-term preservation of microbiological cultures. Maintenance & preservation of bacterial cultures.
46. Preparation, examination & interpretation of direct smears from clinical specimens.
47. Identification of bacteria of medical importance up to species level (except anaerobes which could be up to generic level).
48. Introduction to the techniques of anaerobiosis.

49. Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for spirochaetes.
50. In-vitro toxigenicity tests – Elek test, Naegler's reaction.
51. Special tests – Bile solubility, chick cell agglutination, sheep cell hemolysis, niacin and
52. Catalase tests for Mycobacterium, Satellitism, CAMP test, catalase, slide & tube Coagulase test.
53. Test for Beta-lactamase production.
54. Testing of disinfectants – Phenol coefficient and "in use" tests.
55. Quantitative analysis of urine by pour plate method and semiquantitative analysis by standard loop tests for finding significant bacteriuria.
56. Disposal of contaminated materials like cultures.
57. Disposal of infectious waste.
58. Bacteriological tests for water, food and air.
59. Maintenance & preservation of bacterial cultures.
60. Intradermal test like Mantoux.

### **Immunology**

1. Collection of blood by venipuncture, separation of serum and preservation of serum for short and long periods. Preparation of antigens and their standardization.
2. Performance of serological tests.
3. ELISA.
4. Latex and staphylococcal co-agglutination test separation of lymphocyte.
5. Separation of Lymphocyte and T cell rosette.
6. Immunoelectrophoretic techniques.

### **Virology**

1. Preparation of glassware for tissue cultures (washing, sterilization).
2. Preparation of media used for viruses.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests – Elisa for HIV, HBsAg, Hemagglutination inhibition and Hemadsorption for influenza virus.

5. Introduction to molecular techniques.
6. Sample collection for PCR.
7. Sample processing steps of Polymerase chain reaction techniques.
8. Pipetting techniques.

### **Mycology**

1. Collection of Specimen.
2. Direct Examination of Specimen.
3. Examination of Histopathology slides.
4. Isolation and identification of fungi & slide culture.
5. Special techniques.

### **Parasitology**

1. Collection of Specimen.
2. Examination of faeces for parasitic ova and cyst by direct and concentration method.
3. Egg counting techniques for helminths.
4. Examination of blood smears for protozoa.
5. Histopathology sections – Examination and identification of parasites.
6. Leishman and Giemsa staining.
7. Identification of common arthropods and vectors.
8. Preservation of parasites – mounting fixing & staining Maintenance of stock cultures.



## **YEAR 2**

### **Rotations in Related Specialties**

1. Histopathology: 3 months
2. Hematology: 3 months
3. Chemical Pathology: 3 months
4. Molecular Biology: 2 months

## **YEAR 3**

### **Bacteriology**

1. Multidrug resistant organism detection and reporting.
2. Isolation precautions for specific infections.
3. MRSA isolation and AST reporting
4. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing e.g., Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory / Bactericidal concentrations by tube /plate dilution methods.
5. Performance and interpretation of bacteriological tests for water, air and milk.
6. Performance of anaerobic Culture.
7. Performance and reporting of Antimicrobial Susceptibility Testing. M.I.C., M.B.C.
8. Reporting and interpretation of Automated blood culture techniques and their interpretation.
9. Reporting and Identification of various microorganisms using API techniques on different samples.

### **Clinical Microbiology and Infectious Disease**

1. Diagnostic techniques for various infectious diseases.
2. Respiratory sample collection, processing, and reporting.
3. Genitourinary sample collection, processing, and reporting.

4. Gastrointestinal sample collection, processing, and reporting.
5. Cerebrospinal fluid sample collection, processing, and reporting.
6. Multiple fluid sample collection, processing, and reporting.
7. Visit in Multiple wards and ICU of hospital.
8. Follow up of various infectious disease reports.
9. Infection control protocol applications in hospital.

### **Virology**

1. Preparation of clinical specimens for isolation of viruses.
2. Preparation of monkey kidney cells (Primary) and maintenance of continuous cell lines by subcultures. Preservation in -70°C and liquid nitrogen.
3. Preparation of monkey kidney cells (Primary) and maintenance of continuous cell lines by subcultures. Preservation in -70°C and liquid nitrogen.
4. Recognition of CPE producing viruses.
5. Performance of hemadsorption for Parainfluenza Hemagglutination for influenzas, Immunofluorescence, neutralization for Enteroviruses and Respiratory viruses' identification tests on tissue cultures and supernatants etc.
6. Performance of Serological tests – Elisa for HIV, HBsAg, Hemagglutination inhibition and Hemadsorption for influenza virus of CPE producing viruses.

### **Mycology**

1. Collection of Specimen for Mycology and their direct Examination of Specimen with their examination of Histopathology slides.
2. Isolation and identification of fungi & slide culture
3. AST for fungal species.
4. Special techniques used in mycology.
5. Maintenance of fungal stock cultures.
6. Mycobacteriology (Tuberculosis) sampling, processing and identification of Mycobacteria and their antibiotic resistance testing using various culture methods and molecular techniques like LJ medium, MGIT, and Gene expert.

7. Anaerobic culture methods.

### **Serology and Immunology**

1. Collection of blood for serological tests by venipuncture, separation of serum and preservation of serum for short and long periods.
2. Preparation and use of antigens and antisera in laboratory.
3. Performance of serological tests like Brucella agglutination, Weil Felix, cold agglutination, VDRL, Paul Bunnell, Rose Waaler, IFA, ELISA.
4. Latex and staphylococcal co-agglutination test separation of lymphocytes.
5. Immuno-electrophoretic techniques.
6. Performance and independent reporting of ELISA technique performance for Hepatitis viruses.
7. Performance of serological techniques for common pathogens independently.

### **Molecular Biology**

1. Performance of PCR method.
2. Extraction of Nucleic acid from samples.
3. Interpretation of results of real time PCR.
4. Trouble shooting in PCR.



# RESEARCH CURRICULUM MD MICROBIOLOGY 2024



Rawalpindi Medical University

R-Y4

2 Research Lectures

Article Publication

R-Y3

2 Research Lectures

Data Entry & Analysis SPSS

WORKSHOPS

Advance Research Methodology

2 Research Lectures

Thesis Completion Certificatation (DME)

2<sup>nd</sup> 6 months - 4<sup>th</sup> year

BASR - Thesis Approval

1<sup>st</sup> 6 months - 4<sup>th</sup> year

Thesis Writing

2<sup>nd</sup> 6 months - 3<sup>rd</sup> year

Data Analysis

1<sup>st</sup> 6 months - 3<sup>rd</sup> year

Data Collection

1<sup>st</sup> 6 months - 3<sup>rd</sup> year

One Disease Statistical Review  
One Research Paper in R-JRMC OR

End of 2<sup>nd</sup> Year

BASR - Synopsis Approval

2<sup>nd</sup> 6 months - 2<sup>nd</sup> year

Research Registration ID (URPMC & Research Unit)

1<sup>st</sup> months of Training

Synopsis Topic Assignment by Supervisor

1<sup>st</sup> 6 months - 1<sup>st</sup> year

Synopsis Topic Submission in Research Unit

2<sup>nd</sup> 6 months - 1<sup>st</sup> year

One Disease Statistical Review  
One Research Paper in R-JRMC OR

End of 1 year

Submission of Synopsis

1<sup>st</sup> 6 months - 2<sup>nd</sup> year

Technical Committee Evaluation

1<sup>st</sup> 6 months - 2<sup>nd</sup> year

IRF / ERB - Synopsis Approval

1<sup>st</sup> 6 months - 2<sup>nd</sup> year



R-Y1

Basic Research Methodology

Clinical Audit Course

2 Research Lectures

R-Y2

Synopsis Writing

End Note Referencing Manager

2 Research Lectures

WORKSHOPS



## Research Planner of 4 Years University Residency Program

# RESEARCH & THESIS WRITING

Research and Thesis have to be completed during training period. Research topic selection is must in first year. Synopsis writing and approval from DRB, IRF & BASR are must in second year of training. In third year of training Thesis should be written, while in first six months of fourth year Thesis should be completed and after appropriate defense it should be approved by BASR.

## RESEARCH EXPERIENCE & WORKSHOPS

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the medical literature. Residents will be advised and supervised by qualified staff members in the conduct of research

To help conduction of Research and facilitate Thesis writing following workshops are mandatory during training that will be organized by RMU: a)

Communication skills

b) Computer & IT skills days

c) Synopsis writing

d) Research Methodology & Biostatistics

e) Reference Manager (Endnote)

f) Clinical Research

Each resident will participate in at least one clinical research study to become familiar with

1. Research design

2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation

3. Data collection and data analysis

4. Research ethics and honesty

5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

### **Research Article or Statistical Report of one Disease**

Components of article writing for Resident Research Journal or Statistical Report of one disease are mandatory in First while optional in Third year.

### **Thesis**

The candidates shall prepare their synopsis as per guidelines provided by Institutional Research Forum/Ethical Review Board (IRF/ERB) and Board of Advanced Studies & Research (BASR). The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, collect and analyze data. Synopsis of research project should be approved in 2nd year of MS program by IRF/ERB and BASR. In 3rd year Thesis work should be completed, and in 4th year it should be approved from BASR.

### **Submission / Evaluation of Synopsis**

The Residents shall prepare their synopsis as per guidelines provided by the Board of Advanced Studies & Research, available on university website. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.

Synopsis of research project shall be got approved by the end of the 2<sup>nd</sup> year of MS program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for Consideration by the Board of Advanced Studies & Research, through the Principal / Dean /Head of the institution.

### **Submission of Thesis**

Thesis shall be submitted by the candidate duly recommended by the Supervisor.

The minimum duration between approval of synopsis and submission of thesis shall be one year.

The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.

The research thesis will be submitted along with the fee prescribed by the University.

### **Thesis Evaluation**

The Resident will submit his/her thesis at least 06 months prior to completion of training.

The Thesis along with a certificate of approval from the supervisor will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.

The Controller of Examinations will submit a panel of eight assessors within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the Final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examination would bring the case personally to the Vice Chancellor.

The Supervisor shall not act as an examiner of the candidate and will not take part in defense of thesis.

The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.

The thesis will be evaluated by the examiners within a period of 06 weeks.

In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.

In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.

There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.

The total marks of thesis evaluation will be 100 and 60% marks will be required to pass the evaluation.

The thesis will be considered accepted, if the cumulative score of all the examiners is 60%.

The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.



## ASSESSMENT SCHEME

4 YEARS PROGRAMME MD MICROBIOLOGY		
<b>In Training Assessment</b>	<b>(ITA-1)</b>	At the end of 1 <sup>st</sup> year training
<b>Mid Training Assessment</b>	<b>(MTA)</b>	At the end of 2 <sup>nd</sup> year training
<b>In Training Assessment</b>	<b>(ITA-2)</b>	At the end of 3 <sup>rd</sup> year training
<b>Final Training Assessment</b>	<b>(FTA)</b>	At the end of 4 <sup>th</sup> year training

## RESEARCH REQUISITES OF UNIVERSITY RESIDENT

Training year	4 years Training Program
<b>1<sup>st</sup> year</b>	ONE disease statistical report to be submitted by the end of 1 <sup>st</sup> year training to be eligible to appear in ITA-1. Submit research topic in Research and Development department
<b>2<sup>nd</sup> year</b>	Research synopsis approval from Ethical Review Board (ERB) and Board of Advance Studies and Research (BASR) is mandatory appearing in MTA
<b>3<sup>rd</sup> year</b>	Data collection
<b>4<sup>th</sup> year</b>	Thesis submission 6 months before date of completion of 4 years training to be eligible to appear in FTA

# AWARD OF MD MICROBIOLOGY DEGREE

After successful completion of the structured course of **MD Microbiology**, and qualifying In-Term, Mid-term, Final Term Assessment (Written, Clinical: OSCE & ORAL and Thesis), the degree with title **MD Microbiology**, shall be awarded by Rawalpindi Medical University.