CURRICULUM MD

Chemical Pathology

Rawalpindi Medical University

Programme

MD Chemical Pathology

WMA DECLARATION OF GENEVA

Adopted by the 2nd General Assembly of the World Medical Association, Geneva, Switzerland, September 1948 and amended by the 22nd World Medical Assembly, Sydney, Australia, August 1968 and the 35th World Medical Assembly, Venice, Italy, October 1983 and the 46th WMA General Assembly, Stockholm, Sweden, September 1994 and editorially revised by the 170th WMA Council Session, Divonne-les- Bains, France, May 2005 and the 173rd WMA Council Session, Divonne-les-Bains, France, May 2006.

AT THE TIME OF BEING ADMITTED AS A MEMBER OF THE MEDICAL PROFESSION:

I SOLEMNLY PLEDGE to consecrate my life to the service of humanity;
I WILL GIVE to my teachers the respect and gratitude that is their due;
I WILL PRACTISE my profession with conscience and dignity;

THE HEALTH OF MY PATIENT will be my first consideration;
I WILL RESPECT the secrets that are confided in me, even after the patient has died;

I WILL MAINTAIN by all the means in my power, the honor and the noble traditions of the medical profession;

MY COLLEAGUES will be my sisters and brothers;

I WILL NOT PERMIT considerations of age, disease or disability, creed, ethnic origin, gender, nationality, political affiliation, race, sexual orientation, social standing or any other factor to intervene between my duty and my patient;

I WILL MAINTAIN the utmost respect for human life;

I WILL NOT USE my medical knowledge to violate human rights and civil liberties, even under threat;

I MAKE THESE PROMISES solemnly, freely and upon my honor.

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 Chemical Pathology.

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 Chemical Pathology program at RMU. Curriculum is incorporated in the book for convenience of supervisors and residents. MD 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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(Sitara-e-Imtiaz)
(MBBS, MCPS, FCPS, FACG, FRCP (Lon),
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Vice Chancellor
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COMPILED BY

SR No	Name & Designation	
1.		**Prof. Dr. Wafa Omer** MBBS, MPhil, PhD, Post-Doc (UK), CHPE, ICMT(UK) Associated Professor / HOD Chemical Pathology, Rawalpindi Medical University Rawalpindi

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SECTION 1:

1 Introduction

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

2 MISSION STATEMENT:

The mission of MD Diagnostic Chemical Pathology program must be,

1. That the student accepts Chemical Pathology 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 Chemical Pathology; 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 Chemical Pathology.
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 Chemical Pathology in Health / rehabilitation / welfare teams and his/her willingness to work cooperatively within such teams.
6. The awareness that he/she has to create his/her own professional impact as a capable specialist/ Teacher / Scholar of Chemical Pathology in the world.
7. To pursue and develop the basic scientific pursuits and guideline for scientific discoveries to strengthen knowledge further about human body requirements.
8. To set and pursue the highest goals for ourselves as we learn the science, craft, and art of Chemical Pathology.
9. To passionately teach our junior colleagues and students as we have been taught by those who preceded us.
10. To treat our colleagues and hospital staff with kindness, respect, generosity of spirit, and patience.
11. To foster the excellence and well-being of our residency program by generously offering our time, talent, and energy on its behalf.
12. 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.
13. To serve as proud ambassadors for the mission of the Rawalpindi Medical University MD Diagnostic Chemical Pathology Residency Program for the remainder of our professional lives.

INTRODUCTION TO THE DEPARTMENT OF PATHOLOGY

A dynamic and rapidly evolving field, Pathology is the study of disease, or more generally, the study of the biological response to adverse conditions. As an intellectual discipline, Pathology bridges basic and clinical sciences. The Department of Pathology at Rawalpindi Medical University is a large multi-disciplinary department. Our diverse faculty teaches in different phases of MBBS and BSc undergraduate programs as well as engaged in post-graduate training in various specialties of pathology. Our goal is to advance our fundamental understanding of the pathology and the patho-physiologic mechanisms of disease, and to bring this knowledge to others through teaching and publication.

Department of Microbiology, Rawalpindi Medical University is well established and is offering an ongoing M. Phil Program in Microbiology in affiliation with University of Health Sciences, Lahore since 2007. Apart from post graduate institutes, RMC was the first Government Medical College in Punjab to have started an ongoing M. Phil program in affiliation with University of Health Sciences.

We have three well established diagnostic Microbiology Laboratories in three RMU allied hospitals i.e. Holy Family Hospital, Benazir Bhutto Hospital and District Headquarters Hospital. Infection control program is well established in three allied hospital setups of RMU which is headed by expert infection control committees under supervision of Prof. Dr. Naeem Akhtar and are very fruitful for M. Phil students and all staff members of hospitals and the patients at large.

Our post graduate multipurpose research laboratory which includes Anatomy, Physiology, Pharmacology, Forensic Medicine, Hematology, Chemical Pathology, Microbiology, Molecular Biology, Histopathology and skill laboratories is under process. It's PC1 has been submitted to Health Department.

Keeping in view the persistent demand from students and urgent need for experts in the field of laboratory sciences, it is highly imperative to initiate our own M. Phil program in this field. To establish this program, the main areas to be focused are:

- Faculty
- Research Laboratory
- Specialized Equipment

Faculty in Pathology

Sr. #	Name	Designation	Qualification
1	Prof. Mobina Ahsan Dodhy	Professor of Pathology	MBBS, FCPS (Haem)
2	Prof. Naeem Akhtar	Professor of Pathology	MBBS, PhD (Micro)
3	Prof. Wafa Omer	Professor of Pathology	MBBS, PhD (Chem Path)
4	Dr. Mudassira Zahid	Associate Professor	MBBS, FCPS (Histo)
8	Dr. Rabia Anjum	Pathologist	MBBS, M. Phil (Micro)
9	Dr. Ambar Habib	Pathologist	MBBS, M. Phil (Micro)
10	Dr. Abid Hassan	APMO	MBBS
11	Dr. Saeed Lehrasab	Sr. Demonstrator	MBBS
12	Dr. Syed Muhammad Ali	Sr. Demonstrator	MBBS, CMT, MHPE
13	Dr. Fariha Sardar	Sr. Demonstrator	MBBS, FCPS (Haem)
14	Dr. Syeda Fatima Sughra Rizvi	Sr. Demonstrator	MBBS.M. Phil (Micro)
15	Dr. Iqbal Haider	Sr. Demonstrator	MBBS
16	Dr. Mehreen Fatima	Demonstrator	MBBS, M. Phil (Histo)
17	Dr. Syeda Ayesha	Demonstrator	MBBS
18	Dr. Nida Fatima	Demonstrator	MBBS
19	Dr. Unaiza Aslam	Demonstrator	MBBS

FACULTY IN CHEMICAL PATHOLOGY

Faculty Available

We have the following worthy experts in Chemical Pathology

1. **Prof. Dr. Wafa Omer**
   Professor of Pathology,
   Head of Department Pathology Benazir Bhutto Hospital.
   She did MPhil in Chemical Pathology (2011) and PhD in Chemical Pathology (2016) from Army Medical College, NUST and Post-doc Training from UK in 2017 and has over 10 years of experience in the field

2. **Dr. Fatima-tuz-zuhra**
   Assistant Professor Pathology
   District head Quarter Hospital, Rawalpindi
   She did her MPhil in chemical pathology from NUST University, Islamabad in 2009 and has over four years of experience in the field.

3. **Dr. Naureen Aitizaz**
   Medical Officer
   Benazir Bhutto Hospital
   She did her M. Phil in Chemical Pathology from SZAB University, Islamabad in 2018 and MCPS in 2022.

4. **Dr. Asma Nafeesa**
   Bio Chemist
   Benazir Bhutto Hospital
   She did her M. Phil in Bio Chemistry from University of Agriculture Faisalabad, in 1997. And finished PhD Bio Chemistry from Arid Agriculture University Rawalpindi in 2020.

3 Rationale of curriculum:

The Diagnostic Chemical Pathology 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 curriculumare integral parts of the syllabus to describe the professional tasks within the scope of specialty practice.

4 Training pathway and duration of training:

Trainees enter Diagnostic Chemical Pathology training via a Central Induction Process. Program has 2 phases. Phase 1 consists of 2 years training in Diagnostic Chemical Pathology with mandatory rotations in Hematology, Blood Bank, Microbiology and Clinical Pathology followed by Mid-term Assessment. Phase 2 also consists of 2 years training in Diagnostic Chemical Pathology with rotation in ICU/CCU and ER followed by Final Assessment and Defense of Thesis.

Table 1: TRAINING PATHWAY & ROTATIONS

Year of training	Rotations			Assessment
Year 1	10 months+ Chemical Pathology	6 weeks Hematology		MCQs
Year 2	9 months Chemical Pathology	Microbiology - 1 month	Blood Bank 2 months	MCQs OSCE
Year 3	11 months+ Chemical Pathology	Histopathology/Clinical Pathology 2 weeks		MCQs
Year 4	8 1/2 months Chemical Pathology	• ER 1 month • NICU 2 weeks	ICU/CCU 2 month	MCQs OSCE VIVA VOCE

SECTION 2: GENERAL

1. STATUTES

1. Nomenclature:

The name of degree programme shall be MD Diagnostic Chemical Pathology. This name is well Recognized and established for the last many decades worldwide.

2. Course Title:

MD Diagnostic Chemical Pathology

3. Training Centers:

Departments of Diagnostic Chemical Pathology at Rawalpindi Medical University (RMU).

Infrastructure

The department of Pathology, RMU occupies 2 laboratories(Experimental lab & Research Lab), 2 lecture halls with seating capacity of300 students per hall and 06 rooms for offices with the following details:

Chairperson's Room	01 ROOM
Female Staff Room	01
Male Staff Room	01
Conference Room	01
Support Staff Room	01

Departmental library present with 750 books approximately & 1000 microscopic slides approximately

We have well equipped diagnostic laboratories in all of our RMU Allied Hospitals where M. Phil students of Microbiology are getting their training for the last 10 years. There are two well-established diagnostic microbiology laboratories in Rawalpindi Medical University allied hospitals

1. Holy Family Hospital.
2. Benazir Bhutto Hospital.

Each microbiology department has a collection point, well-equipped bacteriology section, sterilization room, urine R/E section, serology section, PCR lab, TB section, reporting room and classroom for postgraduate students, along with modern teaching facilities e.g. multimedia and microscope projection on LCD.

4.**Duration of Course:**
The duration of MD Diagnostic Chemical Pathology 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 Chemical Pathology Programme the resident will spend first 12 Months in the relevant Department of Chemical Pathology, during which resident will get orientation about 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 100 clinical/applied basics MCQs. Pass marks will be 50%.
The resident will continue formal training in the Basic Principals of Diagnostic Chemical Pathology for further 12 Months, during this period the resident must get the research synopsis approved by AS&RB of the university.
At the end of second year, trainee will undergo Midterm Examination. This Examination will comprise of written and clinical components. Pass percentage in this examination is 60%.
During the 3rd "& 4"years of the programme, there are two components of the training: -
1. Clinical Training in Diagnostic Chemical Pathology.
2. Research and Thesis writing.
The candidate shall undergo clinical training to achieve educational objectives of M.D. Diagnostic Chemical Pathology (knowledge and skills) along with rotations in the relevant fields. The clinical training shall be competency based. There shall be generic and specialty specific competencies and shall be assessed by continuous Internal Assessment.
Thesis writing will be started in the third year.
At the end of third year, again In-training assessment will be conducted consisting of MCQs based examination in which pass marks will be 50%.
In Fourth year 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 Assessment at the end of fourth year training that will comprise written and clinical components. Pass marks in this examination will be 60%.

2. 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.
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

3. 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 FOR MD DIAGNOSTIC CHEMICAL PATHOLOGY PROGRAM AT RAWALPINDI MEDICAL UNIVERSITY

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 Chemical Pathology 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 Chemical Pathology is below:

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

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**

Table 2: Milestones levels

Milestones for high level outcome	**Milestones Level (end of** Year 1**)**	**Milestones Level (end of** Year 2**)**	**Milestones Level (end of** Year 3**)**	**Milestones Level (end of** Year 4**)**
Patient care and technical skills	L2	L3	L4	**L5**
Medical knowledge	L 2	L 3	L 4	**L 5**

professionalism	L 1	L 2	L 3	**L 4**
Interpersonal and communication skills	L 2	L 2	L 3	**L 5**
System based practice	L 2	L 2	L 3	**L 4**
Practice based learning and improvement	**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.

1) AIMS AND OBJECTIVES OF THE PROGRAM:

AIM

The aim of four years MD programme in Diagnostic Chemical Pathology is to train residents to acquire the competency of a specialist in the field of Diagnostic Chemical Pathology 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 Diagnostic Chemical Pathology, including its inter relationship with other disciplines.
2. To enhance medical knowledge, clinical skills, and competence in diagnostic procedures and interpretation.
3. To cultivate the correct professional attitude and enhance communication skill towards patients, their families
4. and other healthcare professionals.
5. To enhance sensitivity and responsiveness to community needs and the economics of health care delivery.
6. To enhance critical thinking, self-learning, and interest in research and development of patient service.
7. To cultivate the practice of evidence-based medicine and critical appraisal skills.
8. To inculcate a commitment to continuous medical education and professional development.
9. To provide a broad training and in-depth experience at a level for trainees to acquire competence and professionalism of a specialist in Diagnostic Chemical Pathology especially in the diagnosis, investigation and towards the delivery of holistic patient care.
10. To acquire competence in advising the correct and judicious investigations in acute emergencies referred by other doctors.
11. To encourage the development of skills in communication and collaboration with the community towards healthcare delivery.
12. To foster the development of skills in the critical appraisal of new methods of investigation and/or treatment.
13. To reinforce self-learning and commitment to continued updating in all aspects of Diagnostic Chemical Pathology.
14. To encourage contributions aiming at advancement of knowledge and innovation in Chemical Pathology through basicand/or clinical research and teaching of junior trainees and other health related professionals.
15. To acquire professional competence in training future trainees in Diagnostic Chemical Pathology at Rawalpindi Medical University.

2. SPECIFIC OBJECTIVES:

6 CORE COMPETENCIES OF CURRICULUM

Curriculum of MD Diagnostic Chemical Pathology 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 Chemical Pathology. Curriculum is based on 6 core competencies. Detail of these competencies is as follows

Detail of these competencies is as follows

COMPETENCYNO.1

PATIENT CARE:

Provide patient care that is compassionate, appropriate and effective.

Skills

- Gather essential and accurate information about patients
- Develop a diagnostic plan based upon the clinical question/s and relevant clinical and pathological/ investigation based information
- Oversee diagnostic testing to ensure adequacy of studies performed
- Counsel patients concerning preparation for diagnostic testing
- Demonstrate a basic understanding of electronic patient information systems
- Demonstrate the ability to use the Internet as an educational instrument to expand medical knowledge
- Demonstrate knowledge of the levels of ionizing biohazard related procedures and employ measures to minimize biohazard exposure to the patient
- Perform pathological investigations appropriately and safely, assuring that the correct examination is ordered and performed

Education (with graduated faculty supervision and feedback)

- Practical experience in developing a differential diagnosis and investigations plan based upon clinical data, testing findings and other medical test results
- Active participation in journal reviews to determine the effectiveness of
- Investigative tests for specific diagnostic questions
- Graduated responsibility in performing pathology related procedures
- Didactic instruction in biohazard safety
- Preparation and presentation of rare cases to other members of the healthcare team

Assessment

- Global ratings by faculty
- 360 degree examination
- Procedure log
- Objective structured clinical examination

COMPETENCYNO.2

MEDICAL KNOWLEDGE:

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

Skills

- Demonstrate sufficient knowledge of medicine and apply this knowledge to pathological/investigation based studies in a clinical context to generate meaningful differential diagnoses
- Demonstrate progressive acquisition of pathological/investigation based knowledge
- Demonstrate knowledge of the principles of research design and implementation
- Generate a clinically appropriate diagnostic plan
- Demonstrate the ability to use all relevant information resources to acquire evidence-based data
- Understand how pathologyinvestigation equipment can be used to generate appropriate and diagnostic images

Education

- Didactic lectures and self-directed learning on the science and practice of Chemical Pathology
- Participation in departmental and inter-departmental case conferences
- Participation in the clinical activities of the Chemical Pathology department
- Departmental or institutional training programs on research design and implementation

Assessment

- Global ratings by faculty
- Program-developed written examinations
- CAP in-training examination
- Written examination
- Oral examination

COMPETENCYNO.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.

Skills

- Provide a clear and informative written pathology report including a precise diagnosis whenever possible, a differential diagnosis when appropriate, and recommended follow-up or additional studies when appropriate
- Provide direct communication to the referring physician or appropriate clinical personnel when interpretation reveals an urgent or unexpected finding and document this communication in the pathology report
- Demonstrate effective skills of face-to-face listening and speaking with
- physicians, patients, patient's families and support personnel
- Demonstrate appropriate telephone communication skills
- Demonstrate skills in obtaining informed consent, including effective
- communication to patients of the procedure, alternatives and possible complications

Education (with graduated faculty supervision and feedback)

- Participation as an active member of the Chemical Pathology team by communicating face to-face with clinicians, answering the telephone, providing consults, problem solving and decision-making
- Act as the contact person for technologists and nurses in managing patient and testing issues
- Active participation in preparing and moderating multi-disciplinary conferences
- Practical experience in dictating pathological/investigation based reports

Assessment

- Global ratings by faculty
- 360 degree evaluations
- Oral ABR examination
- Record review (systematic evaluation of resident dictations)

COMPETENCYNO.4

PROFESSIONALISM:

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

Skills

- Demonstrate altruism (putting the interests of patients and others above own self interest)
- Demonstrate compassion: be understanding and respectful of the patients, patient families, and staff and physicians caring for patients
- Demonstrate excellence: perform responsibilities at the highest level and continue active learning throughout one's career
- Be honest with patients and all members of the health care team
- Demonstrate honor and integrity: avoid conflicts of interest when accepting gifts from patients or vendors
- Interact with others without discriminating on the basis of religious, ethnic, sexual or educational differences and without employing sexual or other types of harassment
- Demonstrate knowledge of issues of impairment (i.e. physical, mental and alcohol and substance abuse), obligations for impaired physician reporting, and resources and options for care of self-impairment or impaired colleagues
- Demonstrate positive work habits, including punctuality and professional Appearance Demonstrate an understanding of broad principles of biomedical ethics
- Demonstrate principles of confidentiality with all information transmitted during a patient encounter
- Demonstrate knowledge of regulatory issues pertaining to the use of human subjects in research

Education

- Discussion of conflicts of interest and the ethics of conducting research during departmental or institutional conferences and daily clinical work
- Training programs (i.e. videotapes) on the issues of harassment and
- discrimination.
- Didactic presentations on the recognition and management of the "impaired physician"
- Participation in hospital-sponsored core curriculum educational activities (i.e.lectures, web-based programs)
- Didactic lecture/training program on the broad principles of medical ethics
- Institutional web-based self-directed learning and assessment programs on human subjects research guidelines

Assessment

- Global ratings by faculty
- 360 degree evaluations
- Conference attendance logs
- Resident self-assessment
- Written ABR examination

COMPETENCYNO.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 pathology investigation practices.

Skills

- Analyze practice experience and perform practice-based improvement in cognitive knowledge, observational skills, formulating a synthesis and impression, and procedural skills
- Demonstrate critical assessment of the scientific literature
- Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
- Use multiple sources, including information technology to optimize life-long learning and support patient care decisions
- Facilitate the learning of students, peers and other health care professionals

Education

- Participate in critical assessment of the scientific literature through journal clubs, clinical conferences and independent learning
- Didactic lectures on the assessment of scientific literature, study designs and statistical methods
- Teaching students, peers and other health care professionals, with graduated supervision and feedback from supervising faculty
- Active participation in departmental or institutional quality assurance
- (QA)/quality improvement (QI) activities with faculty supervision

Assessment

- Global ratings by faculty
- CAP in-service examination
- Written ABR examination
- QA/QI conference attendance logs
- Global ratings by students
- Procedure log

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.

Skills

- Demonstrate the ability to design cost-effective care plans based on knowledge ofbest practices
- Demonstrate knowledge of the sources of financing for National health care including
- Demonstrate knowledge of basic health care reimbursement methods
- Demonstrate knowledge of the regulatory environment including state licensing authority, state and local public health rules and regulations, and regulatory agencies.
- Demonstrate knowledge of basic practice management principles such as budgeting, record keeping, medical records, and the recruitment, hiring,supervision and management of staff

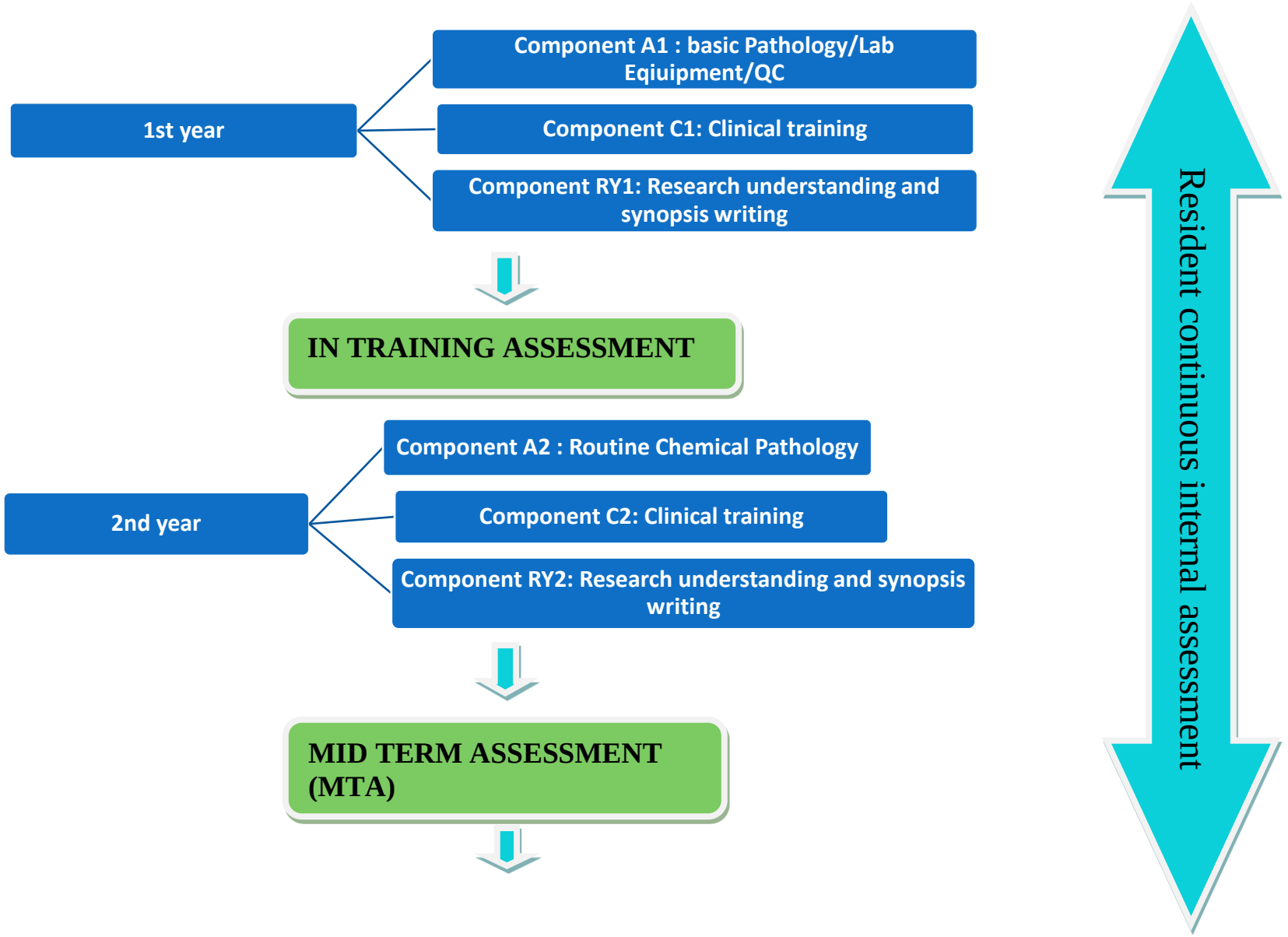
Education

- Systematic review of appropriate literature, including current American College of Pathology (CAP) Appropriateness Criteria, to develop knowledge of evidence based indications for testing procedures
- Attendance and active participation in departmental and multi-disciplinary conferences where there is discussion of the testing evaluation of specific diseases and most appropriate and cost-effective methods for establishing a diagnosis
- Interaction with department administrators and knowledgeable faculty to gain an understanding of the costs of diagnostic examinations and the influence of the type of payer system on reimbursement
- Membership and active participation in local and national pathological/investigation based societies
- Departmental or institutional presentations on health care funding and regulation

Assessment

- Global ratings by faculty
- Written ABR examination
- CAP in-training examination
- Multi-disciplinary conference attendance logs
- Documented membership and participation in pathology investigation societies and other health care organization.

ROAD MAP OF MD TRAINING DIAGNOSTIC CHEMICAL PATHOLOGY:



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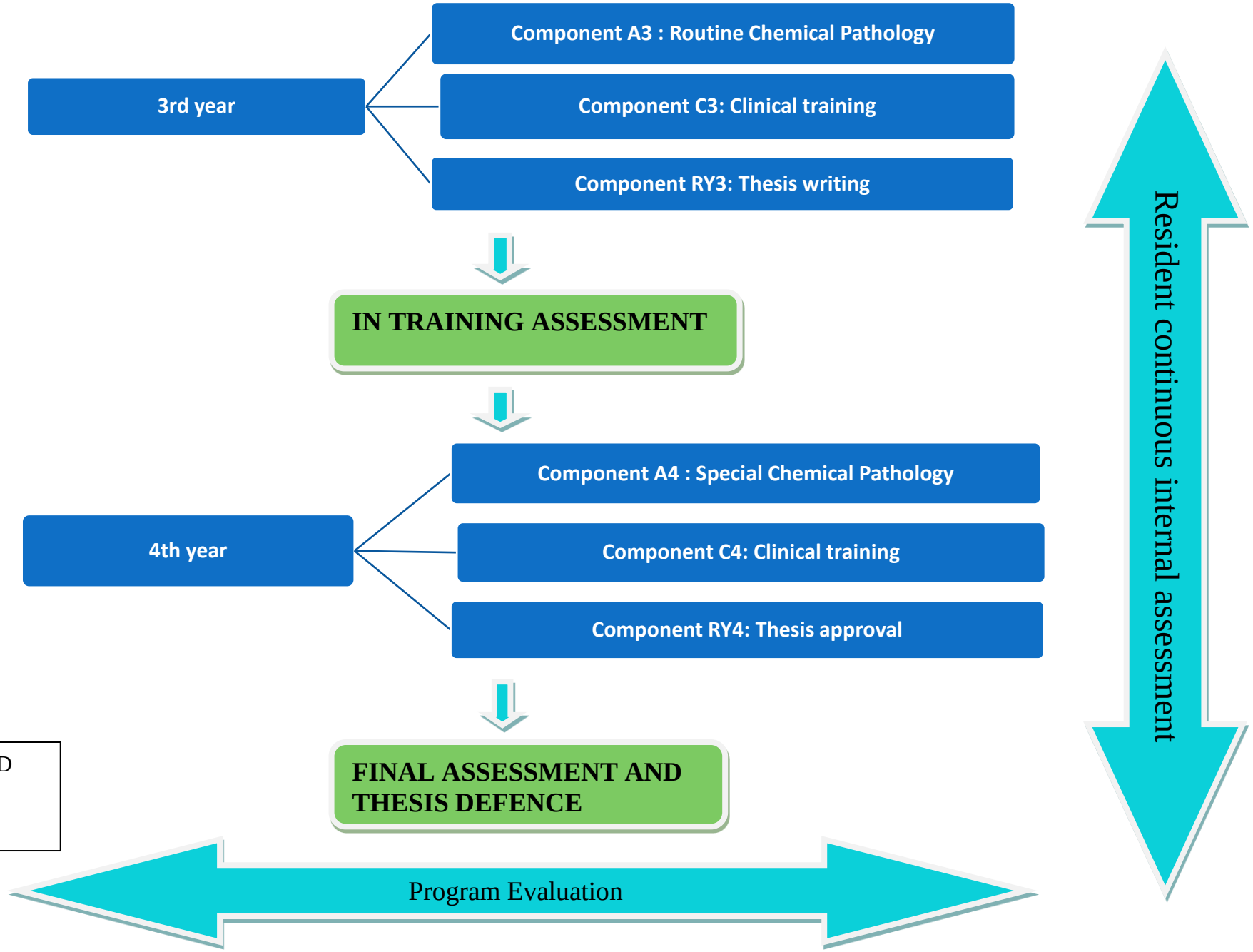


FIG:1 Road Map MD Diagnostic Chemical Pathology Program

3. LEARNING OPPORTUNITIES/ MITs:

LEARNING OUTCOMES		M.I.T (1)	M.I.T (2)
1.	Describe and correlate various principles of Clinical Chemistry	Structured Lectures	Small group discussion (SGD), Journal Club Meetings (JCM)
2.	Differentiate characteristics of various laboratory techniques	Hospital lab	SGD, JCM
3.	Describe Quality Assurance and Lab Statistics	Hospital lab/CCU/NICU /PICU/ER	SGD
4.	Describe methods of various analytes e.g. glucose, Hb and Staining	Hospital lab/CCU/NICU /PICU/ER	JCM, Clinico-Pathological Conference (CPC)
5.	Analyze and interpret laboratory data in various systems	Hospital lab/CCU/NICU /PICU/ER	JCM, CPC On the job training (OJT).

6.	Able to use and maintain basic laboratory instruments	Hospital lab/CCU/NICU /PICU/ER	SGD
6.	Students should be able to perform various laboratory tests e.g. estimation of drugs	Hospital lab/CCU/NICU /PICU/ER	OJT i.e. performing tests on patient samples after they have been reported.
7.	Perform basic statistical tests used in Chemical Path lab in routine e.g. Calculation of mean, SD and CV	SGD	OJT i.e. assisting in routine statistics under supervision.
8.	Use of computer and IT skills in laboratory	Laboratory Skill Session	OJT under supervision.
9.	Carry out counseling, showing professionalism and following principles of laboratory safety	PAL, Role Play	OJT under supervision, video clips (especially for lab safety)
10	Describe basic aspects of molecular Diagnostics.	Structured Lectures	Small group discussion (SGD), Journal Club Meetings (JCM)

1. **Journal Club Meeting (JC):**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

2. **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.
3. **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.
4. **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.
5. **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.
6. **Directly Supervised Procedures - (DSP):** Residents learn procedures under the direct supervision of an attending or fellow during

some rotations.

7. **Self-directed learning *s***elf-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.
8. **Audio visual laboratory*:*** audio visual material for teaching skills to the residents is used specifically in teaching endocrine challenge and suppression testing and procedure details.
9. **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.
10. **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:

1 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 judgements. The program of assessment comprises an integrated framework of examinations, assessments in the workplace and judgements 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 ownperformance and identify areas for development.
- Drive learning and enhance the training process by making it clear what is required of traineesand 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 requirementsduring the training programme.
- 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.

2 Assessment Methods:

Workplace-based assessment (WBA):

Each individual WBA is designed to assess a range of important aspects of performance in differenttraining 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. Traineescan 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 anindication of competence in areas such as clinical judgement, decision-making and application of medical knowledge in relation to patient care. The CBD process is a structured, in-depth discussionbetween the trainee and a consultant supervisor. The method is particularly designed to test higherorder 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 isa 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 clinicsand 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 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 and special chemistry testing.

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 offormalized 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 Clinical Examination (OSCE)

Objective Structured Clinical 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, x-rays, clinical history & laboratory findings, instruments, cross sectional testing 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:

l. Observed /Interactive

II. Unobserved / Static.

b) MCQ:

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 questions, 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) Viva Voce

3 Assessment Scheme:

FIRST IN TRAINING ASSESSMENT **At the end of 1st Year Training**	MID-TERM ASSESSMENT **At the end of 2nd year Training**	THIRD IN TRAINING ASSESSMENT **At the end of 3rd year Training**	FINAL ASSESSMENT **At the end of 4th year Training**
• **Written Paper** • **(conducted in house)**	• **Written & OSCE**	• **Written Paper**	• **Written, Clinical, And Thesis –** • Thesis submision 06 months before completion of training. • Internal assessment = 75% for legibility to sit in FTA
Total Marks= 100	**Total Marks =300**	**Total Marks= 100**	**Total Marks= 800**
MCQ=100 clinically based	**a) Written- Two papers** Two papers each of 75 scenario based MCQs 75+75=150 marks **(Pass%=60%)-eligibility for clinical assessment** **b) OSCE** - 150 marks	**MCQs**=100 clinically based	**a) Written- Two papers** • 1st paper- 100 MCQs-100 marks • 2nd paper- 100 MCQs-100 marks **(Pass%=60%)-eligibility for clinical assessment** **b) Clinical** • OSCE – 300 marks • Viva Voce- 200 marks **(Pass%=60%)** **c) Thesis- 100 marks**
Pass Percentage = 50%	**Pass percentage = 60%**	**Pass percentage = 50%**	**Pass percentage = 60%**

4 Eligibility Criteria:

First In Training Assessment	Mid-Term Assessment	Third In Training Assessment	Final Assessment
Certificate of Completion of 1st year training. **Rotations completion:** Hematology-6 weeks Workshops completion: • Communication skills- 3 days • Computer & IT skills- 3 days • Synopsis writing -3 days • Research methodology & Biostatistics-3 days **Research:** • Allotment of Synopsis topic by supervisor • Publication of one article in Resident Research Journal OR Statistical report of one disease **CIA:** Minimum 75% marks Certification by DME and Supervisor/s	**Certificate of completion of 2nd year training.** **Passed First In Training Assessment** **Rotations completion:** Microbiology -1 month Blood Bank – 2 months **Research:** Formulation of research Synopsis with approval of IRF & BASR by the end of 2nd year. **CIA:** Minimum 75% marks Certification by DME and Supervisor/s	**Certificate of completion of 3rd year training.** **Passed Mid-term Assessment** **Rotations completion:** Histopath/Clinical Path- 2 weeks ICU/CCU- 2 months **Research:** Data collection Data analysis & interpretation Start writing Thesis **CIA**: Minimum 75% marks Certification by DME and Supervisor/s	**Certificate of completion of 4th year training** **Passed Third In Training Assessment** **Rotations completion:** ER-1 month NICU= 2 weeks **Research/Thesis**: • Completion & submission of Thesis 6 months before completion of training • Defense & Approval of Thesis in BASR •Publication of one article in Resident Research Journal OR Statistical report of one disease **CIA:** Minimum 75% marks Certification by DME and Supervisor/s **FEE:** Evidence of submission of examination fee **No dues certificate:** submitted from all relevant departments including

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

Clinical Examination: TOACS & ORAL:

MID TERM EVALUATION

a. The OSCE part of MID term evaluation will consist of 15 Stations with 50 percent stations being static and 50% being interactive. Each station carrying 10 marks and of 05 minute duration.

FINAL EVALUATION

a) The OSCE of final evaluation will consist of 30 stations for 5 minutes each.
b) The oral viva stations to be taken by examiners as decided by examiners panel.
c) Viva will be 03 stations (2 units each). Each viva station will be of **20 minutes** duration.

b. 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. ln case of difficulty in finding an Internal examiner arrange given subject, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person with appropriate qualification and experience, outside the University as an examiner.
c. The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
d. The candidates scoring 50% marks In each component of the Clinical & 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 clinical & oral and then calculating its percentage.
3. The MS 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 2nd 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 O6 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 defence 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 100 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%.

l. 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.

Award of MD DIAGNOSTIC CHEMICAL PATHOLOGY Degree

After successful completion of the structured course of MD DIAGNOSTIC CHEMICAL PATHOLOGY and qualifying Mid-term, Final Assessment (Written, Clinical: ORAL and Thesis), the degree with title MD DIAGNOSTIC CHEMICAL PATHOLOGY Degree shall be awarded.

SECTION 7: CURRICULUM EVALUATION:

Curriculum evaluation is an important part of curriculum development. Two basic stages of curriculum evaluation are process evaluation and product evaluation. Most important aim is to evaluate if the main goals or objective have been met in order to understand and make further improvements to the curriculum.

APPENDIX-1

Medical Knowledge

- Develop and maintain knowledge in the basic and clinical sciences necessary for effective consultation in laboratory medicine.
- Demonstrate sufficient knowledge to determine clinically optimal cost-effective testing and laboratory-based strategies, including issues of turn around time, test menu construction, and in-house vs referral diagnostic testing.
- Recognize the unique aspects of laboratory medicine practice as modified by patient age and other patient population characteristics, especially of pediatric and geriatric practice.
- Demonstrate awareness and understanding of general and test-specific standards for method development and evaluation.

- Employ mathematics and statistics as appropriate to laboratory testing; understand and implement quality control (QC) and quality assurance procedures as required.
- Demonstrate awareness and understanding of proficiency programs.
- Demonstrate knowledge of the principles of clinical research design, implementation, and interpretation.
- Be able to design a study that can be used to validate methodologies and parameters of clinical utility for the implementation and continuing use of new evidence- based analytes in the local setting.

❖ **Evidence-based Medicine**

- Demonstrate knowledge of evidence-based medicine and apply its principles in practice.
- Use multiple sources, including information technology, to optimize lifelong learning and support patient care decisions.
- Develop personally effective strategies for the identification and remediation of gaps in medical knowledge needed for effective practice.
- Use laboratory problems and clinical inquiries to identify process improvements to increase patient safety.
- Demonstrate the ability to critically assess the scientific literature.

❖ **Patient Care**

- Gather essential and accurate information about patients using all relevant available modalities.

- Act as a skilled consultant to other clinicians to develop a diagnostic plan based on specific clinical questions and relevant clinical and pathologic information.
- Provide expert consultation on the interpretation and follow-up of unusual or unexpected test results.

❖ **Point-of-Care Testing**

- Understand definitions of POC and the range of analytes available in devices used at the point of care.
- Understand the principles of performance for common POC tests such as glucose, urine drugs of abuse, rapid microbial antigen, and activated clotting time. Under stand the performance characteristics of the common POC devices used for these tests. Know the issues surrounding specimen collection and preparation and the limitations and interpretation of results
- Understand the differences in reference ranges and test performance characteristics between POCT and laboratory assays.
- Be able to assess economic, workflow, human resources, and clinical factors driving the decision to perform testing at the point of care vs the central laboratory.

❖ **Communication Skills**

- Demonstrate the ability to write an articulate, legible, and comprehensive consultation note. Provide a clear and informative report, including a precise diagnosis whenever possible, a differential diagnosis when appropriate, and recommended follow-up or additional studies as appropriate.

- Demonstrate the ability to provide direct communication to the referring physician when interpretation of a laboratory assay reveals an urgent, critical, or unexpected finding.
- Conduct both individual consultations and presentations at multidisciplinary conferences.
- Choose effective modes of communication (listening, explanatory, questioning) and mechanisms of communication (face-to-face, telephone, e-mail, written), as appropriate.
- Demonstrate skills in obtaining informed consent, including effective communication to patients about procedures and possible complications.
- Demonstrate skills in educating colleagues and other healthcare professionals:
- Demonstrate the ability to present laboratory medicine concepts effectively in continuing education settings and in the day-to-day laboratory environment.
- Demonstrate an understanding of the principles one must follow when educating other practicing pathologists through publications or seminars on new testing and research discoveries.

❖ **Professionalism**

- Demonstrate positive work habits, including punctuality, dependability, and professional appearance.
- Demonstrate a responsiveness to the needs of patients and society that supersedes self-interest.
- Demonstrate principles of confidentiality with all information transmitted both during and outside of a patient encounter.
- Demonstrate knowledge of regulatory issues pertaining to the use of human subjects in research.
- Demonstrate a commitment to excellence and ongoing professional development.

- Demonstrate interpersonal skills in functioning as a member of a multidisciplinary healthcare team.

❖ **Laboratory Management**

- Demonstrate understanding of the role of the clinical laboratory in the healthcare system.
- Demonstrate the ability to design resource-effective diagnostic plans based on knowledge of best practices in collaboration with other clinicians.
- Demonstrate knowledge of basic healthcare reimburse ment methods.
- Demonstrate knowledge of the laboratory regulatory environment, including licensing authorities.
- Understand and implement policies to continually improve patient safety as they relate to clinical laboratory testing at all levels.

APPENDIX 2: DIAGNOSTIC CHEMICAL PATHOLOGY COURSE

DETAILS OF M.D. (DIAGNOSTICCHEMICAL PATHOLOGY) COURSE

- This training represents first opportunity to learn and acquire pathological/investigation based skills.
- Be familiar with:
    - Concepts and terminology of diagnostic Chemical Pathology
    - Pathological/investigation based techniques and procedures
    - Communication, interpretation and report writing
- The specialty of clinical Chemical Pathology involves all aspects of medical testing that provide information about anatomy, function and disease states.

COURSE CONTENT

- Basic lab principles
- Analytical techniques
- Metabolic disorders
- Research methodologies
- Research Methodology and computer skills
- Selection of research topic
- Basic Lab Principles

BASIC LAB PRINCIPLES

Learning Objectives

Upon completion of course the students should be able to:

1. Understand the basic concepts related to lab safety.
2. The chemical hygiene plan and OSHA guidelines
3. Criteria for safe sampling.
4. Different controllable and uncontrollable variables affecting the lab tests.

Lab Safety

1. hazards from dangerous chemicals
2. Infection hazards, apparatus and building hazards
3. Safety guidelines procedures and first aid treatment.

Specimen Collection And Handling

1. requirements for request forms,
2. collection of blood & various body fluids,
3. description of vacuum tubes used for phlebotomy
4. effect of anticoagulants,
5. stability studies and interference studies
6. (Physiological and biological factors affecting the analytes).

Analytical Techniques

Learning Objectives

Upon completion of course the students should be able to:

- Learn the working of basic lab equipment, its maintenance and quality control.
- Understand various optical techniques and study Beer Lamberts Law.
- Perform routine lab tests on spectrophotometer
- Describe the working of analyzers based on spectrophotometry principle.
- Seminars

Course Contents

1. Components, Principles, Operation and Maintenance of Basic Laboratory Equipment including Centrifuge, balances,
2. automatic pipettes,
3. Water bath,
4. Incubators,
5. Refrigerator, freezer,
6. Glass and plastic ware, deionizer, distillation plant etc. Hospital acquired infections

7. Structure of SI Units, conversion factors from old system of units to SI Units, Units in clinical enzymology and Standardized reporting of lab results

INSTRUMENTATION (presentation topics)

1. Description of features, principles, working and maintenance of major instruments
2. Comparison of different instruments and criteria for selecting an analyzer according to work load, utilization of reagents,
3. Technologists available and labour costs
4. different techniques in Spectrophotometer

Metabolic Disorders/Pathogenesis

Upon completion of course the students should be able to:

1. Understand the water and electrolyte balance in the steady state.
2. Disorders of pH occurring in patients i-e acidosis and alkalosis
3. Use of enzymes and plasma proteins in diagnosis of different disorders

Course Contents

Plasma Proteins,

- Plasma Proteins,
- Inflammatory response, Acute phase proteins
- Immune response,
- Disorders of B-cells &T-cells
- Immunoglobulins and complement proteins
- Methods of assessing Proteins in serum, urine & other body fluids
- Indications of Protein, albumin & globulin estimation,
- Protein Electrophoresis normal pattern and changes in disease state

Enzymes

- Assessment of cell damage and proliferation

- Abnormal plasma enzyme activities, enzyme kinetics, enzyme pattern in diseases, with special emphasis on Myocardial infarction, liver and bone diseases
- Estimation of Transaminases, LDH, CK, CKMB, ALP, ACP, GGT, cholinesterase, acid phosphatase and amylase in serum and other body fluids

Intestinal Digestion And Absorption

- Normal digestion and absorption including Gastric & Pancreatic function
- Special emphasis on differential diagnosis and investigation of Malabsorption Syndrome,

Steatorrhoea and failure of absorption of specific substances

Liver And Gallstones

- Function of Liver, diseases of liver with special emphasis on Hepatitis,
- Cirrhosis, Cholestasis and liver failure,
- Bilirubin, Jaundice and metabolic disorders of liver
- Investigations of liver diseases
- Formation and detection of Bile acids and Gall stones.

Renal Function and Renal Calculi

- Renal Physiology, clinical syndromes associated with kidneys
- Acute and chronic renal failure, Uraemia and Nephrotic Syndrome with special emphasis on Pathophysiology and Investigations of renal diseases, oliguria, polyuria, renal calculi
- •Urate metabolism, Hyperuricemia, Gout, and Hypouricemia, Clearance studies, dialysis and renal transplantation.

Water and Electrolyte Metabolism

- Water and Sodium balance, hormones associated with it i.e., Aldosterone, Renin-Angiotensin and Antidiuretic hormone
- Relationship between Hydrogen and Potassium ions
- Disturbances & Investigations of water and electrolyte balance, measurement of serum electrolytes and urinary &intestinal losses

Acid Base Metabolism

- Hydrogen ion homeostasis, buffer systems
- Disturbances of hydrogen ion, acid base balance and investigations of Acidosis and Alkalosis
- Blood Gas estimations, Arterial pH and pCO2 estimations.

Course Outline

- Clinical Chemistry analytes

- Endocrine Disorders
- Medical Education and Bioethics
- Biostatistics

Synopsis writing and synopsis approval

Endocrine disorders

To understand the basic structure, general properties of pituitary hormones

- To understand the site and mechanism of action of hormones
- To understand the negative feedback loop of hormone release.
- To study the pattern various disorders resulting from excess or deficiency of hormones.
- To study the various diagnostic approaches and alogrithms for the diagnosis of endocrine disorders

Course Contents

- . General endocrine functions, hormones and their mechanism of action, regulation and receptors
- The endocrine functions and regulation of hypothalamus, pituitary gland, adrenal cortex, thyroid, parathyroid and gonadal hormones
- Assessment of pituitary, adrenal and thyroid functions by dynamic function tests
- Effects of abnormal levels of cortisol, aldosterone, rennin angiotensin, catecholamines, serotonin, thyroid hormones and gonadal hormones including infertility evaluation and assessment in male and female
- Clinical usefulness of urinary free cortisol, testosterone, DHEAS, androstenedione, sensitive TSH and free T4 and T3 tests, stimulation and suppression tests
- Laboratory investigation of patients with hypothyroidism, hyperthyroidism, Cushing's syndrome, Addison's disease, Conn's syndrome, phaeochromocytoma, hirsutism, infertility, congenital adrenal hyperplasia.

Clinical Chemistry Analytes

Learning Objectives

To understand the basic structure, general properties and classification of different lab analytes.

To understand the metabolic cycle of endogenously produced analytes.

To master the techniques and methods used in laboratory for diagnosis of disorders associated with excess or deficiency of these analytes.

To study the pattern of various disease and their symptoms associated with the abnormality of enzymes, amino acids, haem, LDL and cholesterol.

Course Contents

Lipids
Plasma lipids, lipoprotein metabolism, disorders of lipid metabolism, investigation of lipid disorders
• Analytical techniques available for estimation of Cholesterol, Triglycerides, HDL-C, LDL-C, with special emphasis on standardisation, precision and current recommendations on detection of lipemia
• Problems arising in determination of reference ranges for lipid profile
• Clinical significance of lipoproteins and hyperlipoproteinemia.

Calcium, Phosphate and Magnesium metabolism
- Factors effecting total plasma Calcium, Parathyroid hormone, Calcitonin, Vitamin D
- Disorders of Calcium Metabolism, Hypocalcaemia, Hypercalcaemia
- Tests for diagnosis of calcium disorders
- Abnormalities of Phosphate and Magnesium metabolism.

Haem and Iron Metabolism
- Biosynthesis of Haemoglobin
- Disorders of Haem synthesis, various types and investigations of Porphyrias
- Iron metabolism, absorption, excretion and transport, factors effecting plasma iron concentration

Estimation of serum iron, TIBC, Ferritin and investigation of Anaemia

(BS-01&& SW-01) Biostatistics and Synopsis Writing
2 credit hours (4 weeks)

- Special clinical chemistry
- Advance instrumentation

- Quality control and lab management
- Laboratory Technique Practices
- Research work and thesis writing
- Mandatory rotation

Special Clinical Chemistry

Learning Objectives

To understand in born errors of metabolism related to amino acid and urea cycle defects. To study the different physiological and pathological changes in pregnancy. To develop an understanding of the measuring of peak and trough level of drugs with particular emphasis on cytotoxic drugs.

Course contents

Inborn errors of metabolism

- General principles of inheritance
- Diseases due to inborn errors of metabolism
- Disorder of amino acid metabolism
- Disorders of carbohydrate & lipid metabolism
- •Disorders of transport mechanism and storage defects with special emphasis on clinical importance, diagnosis and screening of inborn errors of metabolism and neonatal screening, techniques for detection of inborn errors of metabolism

Pregnancy

- Physiological changes seen in pregnancy
- Role of lab in assessment of fetal lung maturity
- Clinical usefulness of HCG assays in normal pregnancy
- Maternal serum screening for open neural tube defects and Down syndrome including tests for amniotic fluid L/S ratio, AF, serum HCG glucose challenge tests
- Screening guidelines for different diseases.

The Cerebrospinal fluid and other body fluid

- Examination of CSF and other body fluids with special emphasis on biochemical estimations, measurement of total proteins, individual CSF protein concentration and abnormal CSF protein synthesis Basic concepts of monitoring drug treatment
- • Factors affecting plasma concentration and its relation with cellular affects

Therapeutic Drug Monitoring

- • Indications for measuring drug concentrations to monitor treatment
- • Monitoring side effects of drug treatment and investigation of known or suspected over dosage

Advance Instrumentation

Learning Objectives

To understand the working of state of the art lab equipment used in the diagnosis ofhormone testing, critically ill patients, inborn errors of metabolism, drugs of abuse, forensic toxicology and DNA testing.

Course contents

1. Mass spectrometry,
2. Fluorometry,
3. nephelometry,
4. turbidimetry,
5. Electrolyte analyzers,
6. Acid Base & Gas analyzers
7. Electrophoresis,
8. Chromatography
9. Radioimmunoassays,
10. ELISA
11. PCR**.**

Quality Control and Lab Management

To understand the basic concepts in quality control

To understand the Levey Jennings chart and west guard rules used in internal quality control

To study the different external quality control programs.

To introduce the budding pathologists to lab accreditation and proficiency testing.

Course Contents

1. Concept of Quality control (QC),
2. Explanations of terminology used in QC e.g. Accuracy, precision, specificity & sensitivity, procedures to asses QC e.g. Levy-Jenning charts, Cusum plots etc.
3. and rules applied to QC data e.g. Westgard's
4. Advantages and disadvantages of various control materials
5. Assessment of various techniques for determining reference ranges and reportable ranges
6. External quality assessment, proficiency testing programme, identification of sources of analytical and pre analytical errors.

LAB MANAGEMENT

Review of lab and hospital organisations, attendance in departmental meetings, discussions about day to day management, job description, scheduling workload, selection of procedures and instruments,trouble shooting and risk management.

Awareness of certification and accreditation programs and preparation of standard operating procedures, human resource management, financial, space and facility management.

Laboratory Techniques and Practices Practical Training in Chemical Pathology Analytical technique, advancements and application, screening procedures for detection of drugs, drugs of abuse e.g. amphetamine, barbiturates, cannabis, cocaine etc. Practical competencies in preparation of solutions, use of pipettes, balance, volumetric flasks and other standard glass ware.

- Use of PH meter, centrifuge, UV, VIS, Spectrophotometer, automated chemistry analyzer, atomic absorption spectrophotometry, chromatography, ELISA, electrophoresis and ion selective electrodes analyzer.
- Practical competence, performance, methodology and interpretation of all tests performed by semi-automated and automated analyzer.
- Calibration/Maintenance/Quality control of all laboratory procedures.
- Preparation of the standard curve.
  Mathematical calculation used in the laboratory.
- All end point estimations (all basic parameters e.g. glucose, urea, uric acid, creatinine, cholesterol, triglycerides, plasma proteins and bilirubin estimation.
- All enzyme assays in laboratory diagnostics (e.g. Serum Transaminases, Serum Phosphatases, amylase, LDH, GGT and CPK.
- Serum electrolyte estimation (e.g. K, Na, Ca and phosphate)
- Urine chemical examination.

- Estimation of other parameters by immunoassay techniques (e.g. Hepatitis B viral antigens and antibodies, Hepatitis C viral antibodies, Thyroid profile, FSH, LH etc).
- Estimation of blood gases.
  Sample Collection.
- Reference ranges and conversion factors.
- Preparation of the Standard operating procedures (SOPs).

D: NON CLINICAL ELECTIVES

RESEARCH

Residents are encouraged to engage in clinical or basic science research during their training through our Comprehensive **mentoring program**.At the beginning of this rotation, resident will be asked to identify a research topic or project and be linked with a research mentor. Resident will gain broad understanding of the fundamental principles and methods of research: developing research questions, analyzing current literature, designing studies (including statistical analysis), presenting research projects and writing them up.Residents receive close supervision by their preceptor throughout all phases of the research project, learning the process from hypothesis development to IRB (Institutional Review Board) submission through experimentation, data collection and analysis, and formal writing for presentation and publication. At the **Resident Research Forum,** residents present their work-in-progress to peers and faculty.

MANDATORY WORKSHOPS:

1. Each candidate of MD/MS/MDS program would attend the 04 mandatory workshops in first and second year of training as required by the University.
2. The four mandatory workshops will include the following:
   a) Research methodology and biostatics
   b) Basic life support
   c) Communication skills
   d) Introduction to computer / information Technology and Software programs

3. The workshops will be held on 03 monthly basis.
4. Certificates of attendance will be issued upon satisfactory completion.

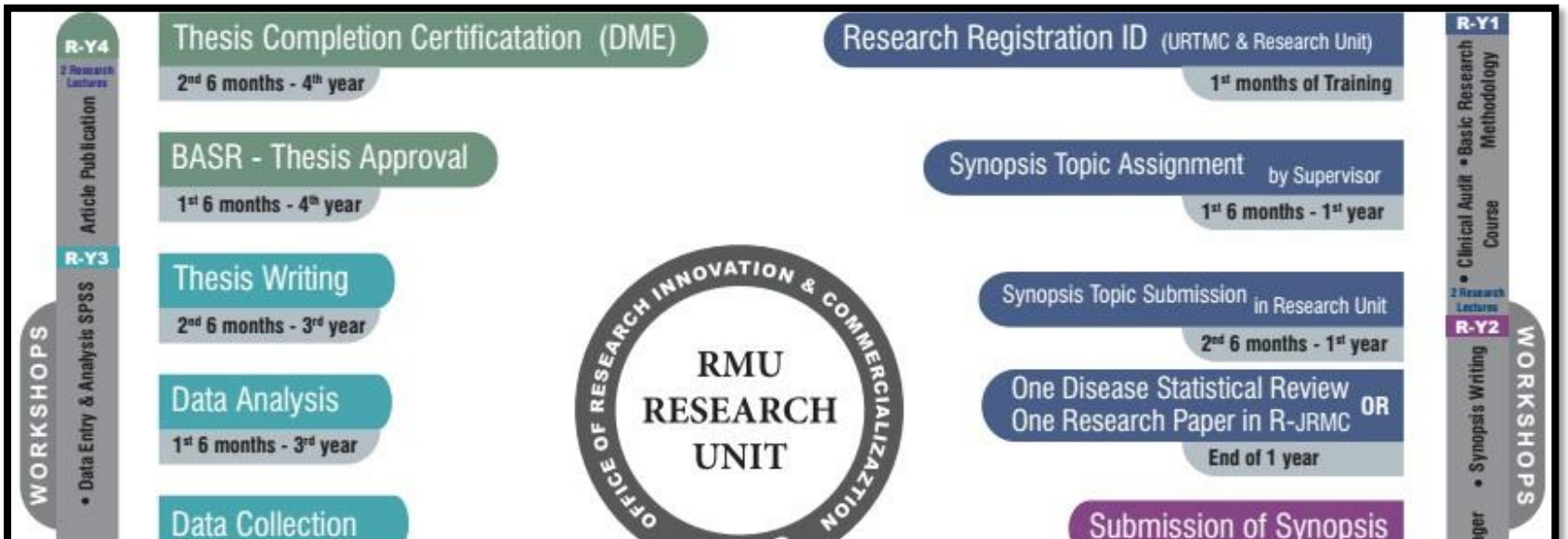
COMPULSORY ROTATIONS

The frame work for core training will consist of the rotations in

- Hematology- for 6 weeks
- Microbiology 1 month
- Blood Bank-2 months
- Histopathology and Clinical Pathology-2 weeks
- ER-1 month
- NICU-2 weeks
- ICU/CCU- 2 months

The educational objective of rotations is to give appropriate experience in relevant fields

APPENDIX 3: RESEARCH PLANNER



FTA MD CHEMICAL PATHOLOGY

S NO	COMPONENTS OF EXAM	DETAILS OF EXAM. COMPONENTS	NO. OF ITEMS	ALLOTED TIME	REMARKS	MARKS PER ITEM	TOTAL MARKS	PASS PERCENTAGE & MARKS
1	**WRITTEN THEROY PAPER (200 MARKS)**	THEORY PAPER 1	Case based 100 MCQs	1.5 min for each MCQ 2 Hours 30 Minutes	Breakup of MCQ's As per given TOS	1	100	At least 45% marks are must to acquire in each paper. Cummulative of 60% marks to pass Pass Marks = 12-/200
		THEORY PAPER 2	Case based 100 MCQs	1.5 min for each MCQ 2 Hours 30 Minutes	Breakup of MCQ's As per given TOS	1	100	
2	**CLINICAL ASSESSEMENT (450 MARKS)**	OSCE	30 STATIONS	5 min each station 150 Min Total	Breakup of MCQ's As per given TOS	15	150	60% marks required to pass from each component At least 45% from each viva station. 60% of 450 Marks = 270 Marks
		VIVA VOCE	3 STATIONS 02 UNITS EACH PER STATION	40 min each station 120 Min Total	Breakup of MCQ's As per given TOAS	100	300	

CLINICAL / OSCE (Marking Details)

COMPONENTS	TIME ALLOWED M	Maxillary. MARKS	Min. PASS MARKS
OSCE (30 STATIONS)	5 Min PER STATION	05 Marks each = 150	90
VIVA VOCE (03 STATIONS) **VIVA VOCE 1** **VIVA VOCE 2** **VIVA VOCE 3** ***20 min each examiner**	 40 Min. 40 Min. 40 Min.	100 Marks per Station = 300	 180
AGGREGATE		450	270 (60%)

SECTION 8

Reference Books:

- Tietz Textbook of Clinical Chemistry Latest Edition
- Kaplan Textbook of Clinical Chemistry Latest Edition
- Bishop Textbook of Clinical Chemistry Latest Edition
- AFIP Manual

LABORATORY DETAILS

List of equipments and facilities offered in our laboratories is attached herewith:

List of Equipment in Chemical Pathology Department RMU		
Sr. #	**Item Name**	**Qty.**
1	Microscope Micron China	06
2	Microscope Nicon Japan	14
3	Multi Media Projector	03
4	Portable Projection Screen	03
5	Air Conditioner Split Unit	01
6	Air Conditioner Window AC	01
7	Overhead Projector Portable	02
8	Slide Box wooden 200 slides	13
9	Slide Box wooden 100 slides	15
10	Camera (Microscope) China	01
11	Hot Air Oven	02

List of Equipment in Chemical Pathology Department HFH		
Sr. #	**Item Name**	**Qty.**
1	Beckman Coulter AU-480	02
2	Pictus P-500	01
3	E-Lite Plus	01
4	AFT 500 Electrolyte	01
5	CX-9	01

6	Centrifuge	07
7	Dia 710 Micro plate	01
8	Dia 810 Washer reader	01
9	Microscope	13
10	Electric weight balance	02
11	Read well touch ELISA plate reader	01
12	Deep Freezer	02
13	Refrigerator	04
14	Computer	02
15	Water Bath	03

List of Equipment in Chemical Pathology Department BBH		
Sr. #	**Item Name**	**Qty.**
1	Chemistry Analyzer **Beckman Coulter(Fully Automated)**	03
2	Electrolyte Analyzer	04
3	Blood Gas Analyzer **(Medica)**	03
4	Fully Automated Hormone Analyzer (Immulite)	01
5	Fully Automated Hormone Analyzer (Vitros)	01
6	Fully Automated Hormone Analyzer (Access 2 Beckman Coulter)	01
7	ELISA Reader / Washer Machine (Diamate)	02
8	Urine Analyzer (DIRUI)	01

List of Equipment in Chemical Pathology Department DHQ		
Sr. #	**Item Name**	**Qty.**
1	Chemistry Analyzer **Beckman Coulter(Fully Automated)**	01
2	Chemistry Analyzer **(Selectra E)**	01
3	Electrolyte Analyzer	01
4	Blood Gas Analyzer **(Medica)**	01
5	Chemistry Analyzer**(Selectra Pro M)**	01
6	ELISA Reader / Washer Machine (**Diamate)**	02
7	Centrifuge machine	03
8	Electronic balance	01
9	Water bath	01
10	Semi-automated chemistry analyzer **MICROLAB-300**	01
11	incubator	01
List of Equipment in Pathology Department HFH		
Sr. #	**Item Name**	**Qty.**
1	Multichannel Chemistry Analyser AU-480	02
3	Selectra-E	01
4	Dirui CS-400	01
5	E-Lite Plus	01
6	E-AFT	01
7	CX-9	01
8	Centrifuge	07
11	Tissue Processor (Sakura)	02

Total Equipment List

13	Embedding center (Leica)	01
14	Freezing Microtome	01
15	Knife sharpener (Shandon)	01
16	Microtome	02
18	Cytospin (Shandon)	02
20	Hot air Ovan	05
21	Dia 710 Micro plate	01
22	Dia 810 Washer reader	01
23	Incubator	05
29	Safety Cabinet	02
30	Autoclave HL-36	01
32	BATEC 960 Mgits	01
35	Bio Rad real time PCR Machine	01
36	R-Corbett SK-I Mixes	01
37	Fast Uniform	01
40	Microscope	13
41	Electric weight balance	02
44	Read well touch ELISA plate reader	01
46	Deep Freezer	02
47	Refrigerator	04
48	Computer	02

49	Multi head Microscope	02
59	Water Bath	03
64	Sysmex KX-21	01
65	Hb Electrophoresis Machine	01
66	Mindray BC-3000 Plus	04
68	Coag 4D (Diagon)	01
69	Beckman Coulter AU-480	01
74	AFT 500 Electrolyte	01
75	Micro Lab 300 analyzer	01
76	Abacus 300 Diabit	01
78	Diagon Coagulating analyzer	01
79	Water Purification system	01
80	Sysmex KX-21	02
81	Elite Plus	01

List of Equipment in Pathology Department BBH		
Sr. #	**Item Name**	**Qty.**
1	Chemistry Analyzer **Beckman Coulter(Fully Automated)**	02
2	Chemistry Analyzer **(Selectra XL)**	01
3	Electrolyte Analyzer	04
4	Blood Gas Analyzer **(Medica)**	03

5	Hormone Analyzer	02
6	Haematology Analyzer **(Sysmex)**	07
7	Hematology Analyzer 7 part (Mindray)	01
8	ELISA Reader / Washer Machine (Diamed)	02
9	Tissue Processor (HISTOTOUCH III)	01
10	Microtome (Lieca)	01
11	PCR Machine (Rotor Gene)	01
12	PCR Machine (CFX- Connect)	01
13	Urine Analyzer (DIRUI)	01

List of Equipment in Pathology Department DHQ		
Sr. #	**Item Name**	**Qty.**
1	Chemistry Analyzer **Beckman Coulter(Fully Automated)**	01
2	Chemistry Analyzer **(Selectra E)**	01
3	Chemistry Analyzer (Access 2 Beckman Coulter)	
4	Electrolyte Analyzer	01
5	Blood Gas Analyzer **(Medica)**	01
6	CHEMISTRY ANALYZER**(Selectra Pro M)**	01
7	Haematology Analyzer **(Sysmex)**	04
8	Haematology Analyzer **(Mindray)**	01
9	ELISA Reader / Washer Machine (**Diamate)**	02
10	Centrifuge machine	03
11	Electronic balance	01
12	Water bath	01
13	Semi-automated chemistry analyzer **MICROLAB-300**	01
14	Gene expert. MTB/RIF	01

15	PCR Machine (Rotor Gene)	01
16	PCR Machine (CFX- Connect)	01
17	Haematology Analyzer **(Sysmex)**	04
18	Haematology Analyzer **(Mindray)**	01
19	Safety cabinet	01
20	incubator	01
21	Hot air oven	01
22	autoclave	01

References