SRI BALAJI VIDYAPEETH

(Deemed - to be - University u/s 3 of UGC Act, 1956)

Pillaiyarkuppam, Puducherry - 607 402

Mahatma Gandhi Medical College and Research Institute

COMPETENCY BASED POSTGRADUATE MEDICAL CURRICULUM

M.D. BIOCHEMISTRY

(2020 Onwards)

(As approved at the 30th Academic Council Meeting held on 28th September 2020)

Preface

Following the promulgation of the much awaited CompetencyBased Medical Education (CBME) for post graduate by the Medical Council of India (MCI)(superseded by the Board of Governors), adoption of CBME for implementing post-graduate programs is a welcome move. Sri Balaji Vidyapeeth (SBV), Puducherry, Deemed to be University, declared u/s 3 of the UGC Act. and accredited by the NAAC with A grade, takes immense privilege in preparing such an unique document in a comprehensive manner and most importantly the onus is on the Indian setting for the first time,with regard to the competency based medical education for post graduate programs that are being offered in the broad specialty departments. SBV is committed to making cardinal contributions that would be realised by exploring newer vistas.Thus, post graduate medical education in the country could be made to scale greater heights and SBV is poised to show the way in this direction.

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Preface

Following roll out of much awaited Competency-Based Medical Education (CBME) for undergraduate by the Medical Council of India (MCI)(superseded by the Board of Governors) , adoption of CBME for post-graduate by it is welcome move.

The MCI has laid down the syllabus course wise, listing competency to some extent, teaching learning methods and the assessment methods as well. The MCI describes competencies in three domains (knowledge, skill, and attitude). However, the most significant problem in competency-based training is the development of appropriate assessment tools.

The salient feature of this document is defining the program educational objectives (PEO) for its postgraduate program as a whole, defining program outcomes (PO) based on the competencies to be practiced by the specialist, course outcomes (CO) and program specific sub-competencies and their progression in the form of milestones. The compilation of the milestone description leads to the formation of the required syllabus. This allows the mentors to monitor the progress in sub-competency milestone levels. It also defines milestone in five levels, for each sub-competency. Although MCI has described three domains of competencies, the domain 'Attitude' is elaborated into 4 more competencies for ease of assessment. The six competency model (ACGME) for residency education: Medical Knowledge, Patient Care, Practice Based Learning and Improvement, Systems Based Practice, Professionalism, Inter personal and Communication Skills gives better clarity and in-depth explanation. The sub-competency and their milestone levels are mapped into the entrustable professional activities (EPA) that are specific to the individual postgraduate program. To make the program more relevant, PEO, PO, CO and EPAs are mapped with each other. EPA's which are activity based are used for formative assessment and graded. EPA assessment is based on workplace based assessment (WPBA), multisource feedback (MSF) and e-portfolio. A great emphasis is given on monitoring the progress in acquisition of knowledge, skill and attitude through various appraisal forms including e-portfolios during three years of residency period.

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Foreword

This course book for MD Biochemistry is competency based medical education introduced by Medical Council of India for post-graduate education to recognize provision of high quality in specialty health care services and advancement in the research and medical education. Biochemistry is essentially the application of chemistry to the study of biological processes at molecular and cellular level which enlightens upon the basis of a disease process.

This curriculum enlists the strategies and details of holistic approach to health care practice. This serves to ensure practical and real-time learning of theoretical concepts and their applicative aspects. There is a phased approach in the acquisition of knowledge, integration with clinical relevance and real-life practice of the learner under the supervision of experienced specialist. The methods to gauge the progress of a student and to acquire competence are carefully designed to provide a comprehensive learning experience to be an efficient clinical biochemist, teacher and a researcher.

Emphasis is laid on formative assessment where in assessments are for learning, as learning instead of traditional assessment of learning. This curriculum provides details, methods of achieving and ensuring of attainment and assessment methods in a very systematic, specific and clear manner. To facilitate this entrustable professional activities (EPAs) have been incorporated for residency completion. EPAs integrate all of the competencies, subcompetencies, and their specific milestones. Competencies and sub competencies have been formulated to equip MD Biochemistry students to achieve optimum training. There are six domains of competence: patient care, medical knowledge, systems-based practice, interpersonal and communications skills, and practice-based learning and improvement. Competencies are further divided into sub competencies and meaningful milestones to be achieved which provides vital observable behaviours of the residents.

A considerable attempt has been made in the competency driven postgraduate curriculum to provide the orientation and the skills necessary for life-long learning and that which conforms to global trends.

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This document named postgraduate curriculum for the MD Anatomy has been prepared in the accordance with the document notified by Board of Governors in suppression of MCI https://www.mciindia.org/CMS/information-desk/for-colleges/pg-curricula-2. This document has been prepared by the Department of Anatomy, MGMCRI, Puducherry, ratified by the Board of Studies on 06 May 2020 and approved by Academic Council of Sri Balaji Vidyapeeth, a deemed to be university, accredited 'A' Grade by NAAC

TABLE OF CONTENTS

1. PREAMBLE

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

The student who has obtained an MD degree in Biochemistry should be well-versed in basic concepts and recent advances in the subject and should have acquired skills and expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine and in research methodology. Training during the course should equip the student with skills to become an effective teacher, able to plan and implement teaching programmes for students in medical and allied health science courses, set up/manage a diagnostic laboratory, generate, evaluate and interpret diagnostic laboratory data, interact with clinicians to contribute to more effective patient care and carry out a research project and publish its results.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

2. PROGRAM EDUCATIONAL OBJECTIVES (PEO):

PEO1: Specialist who can provide comprehensive care related to Diagnostic services in biochemistry over and above the physician of first contact.

PEO2: Leader and team member who understands the health care system and acts to provide safe patient care with accountability and responsibility.

PEO3: Communicator possessing adequate communication skill to convey required information in an appropriate manner in various health care settings.

PEO4: Lifelong learner keen on updating oneself regarding the advancement in the health care field and able to perform the role of researcher and teacher

PEO5: Professional who understands and follows the principle of bio-ethics / ethics related to health care system.

3. PROGRAM OUTCOME (PO)

After three years of residency program postgraduate should be able to

PO1: Able to explain clearly concepts and principles of biochemistry regarding Biomolecules human nutrition, metabolism, metabolic interrelationships, metabolic homeostasis, molecular and cell biology, body Défense against xenobiotics and pathogens, including correlations of these with cellular and molecular processes involved in health and disease.

PO2: Biochemistry of principles of various laboratory estimations, instrumentations and rationale underlying biochemical laboratory investigations and interpreting the data.

PO3: To set up/supervise/manage a diagnostic laboratory in Biochemistry in a hospital including modern laboratory techniques, ensuring total quality assurance in clinical biochemistry, and providing a reliable support service.

PO4: Provide clinicians with consultation services for diagnostic tests in biochemistry and in interpretation of laboratory results.

PO5: The student should be able to effectively teach undergraduate students in medicine and allied health science courses so they become competent health care professionals and able to contribute to training of undergraduate and post graduate students.

PO6: Communicate with stake holders of the health care system

PO7: Should be able to carry out a research project from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas.

PO8: Effectual use of nutrition, lifestyle, cost of diagnostic tests and genetic counselling and exhibits shared responsibility.

4. COURSE OUTCOME

4.1 Course 1: Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry

C1.1 Explain the importance of biomolecules in sustaining the life process, describe and apply biochemical principles to explain the normal state, abnormal disease conditions pertaining to Biomolecules, cell biology

C1.2 Describe the working principle, instrumentation and uses of Analytical techniques in a clinical biochemistry laboratory including Nanotechnology and microfabrication

Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications etc.

C1.3 Demonstrate ability to apply basic concepts of biostatistics as applied to health science and to Carry out & conduct various research problems both at basic and applied level

C1.4 Perform Critical appraisal of medical literature

C1.5 Demonstrate principles of adult learning, taxonomy of learning, educational objectives, principles of assessment and question paper setting, methods of assessing knowledge, appropriate use of media, microteaching,

C1.6 Take interactive classroom lectures, prepare modules for PBL, organize and conduct PBLs, case discussions, small group teaching, Seminars, Journal club and research presentations

4.2 Course 2: Enzymes, bioenergetics, biological oxidation, metabolism of biomolecules, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

The student must be able to

C2.1 Explain the principles and mechanisms of enzymatic catalysis, enzyme kinetics, regulation of enzyme activity and principles of bioenergetics, electron transport chain and oxidative phosphorylation.

C2.2 Describe pathways of the intermediary metabolism along with their individual and integrated regulation and apply that in understanding the functioning of the body

C2.3 Describe and apply the concept of nutrition in health and disease, essential nutrients, and interlinks of nutrients with metabolism and functions of a living system.

C2.4 Apply and integrate knowledge of molecular and metabolic conditions in normal and disease states for clinica3l problem solving and research

4.3 Course 3: Molecular and cancer biology, immunology and effects of environmental pollutants on the body

The student must be able to

C3.1 Able to explain Structure and organization of chromosomes and chromatin re-modelling DNA replication, Transcription, Genetic code, mutations, Translation and Regulation of gene expression

C3.2 Describe human Genome Project, basics of bioinformatics, Principles of human genetics and stem cells in clinical medicine

C3.3 Integrate principles of immunology in biochemistry

C3.4 Perform important biochemical, immunological and molecular biology techniques.

C3.5 Acquire knowledge on application of various aspects of genetic engineering in medicine

C3.6 Application of molecular techniques in forensic investigation and medicolegal cases

4.4 Course 4: Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry

The student must be able to

C4.1 Perform sample collection, quality control methods, setting up of a clinical biochemistry laboratory, specialized assays and statistical analysis of data.

C4.2 Explain principles of basic techniques and instrumentation used in a clinical biochemistry

laboratory and to Clinically correlate these to analytical procedures

C4.3 Describe regulation of fluid and electrolyte balance and associated disorders, regulation of acid-base balance and associated disorders

C4.4 Explain biochemistry of the endocrine system and biochemical aspects of diagnosis and treatment of endocrine disorders including conception, reproduction and contraception.

C4.5 Explain biochemical basis of hematopoietic disorders transfusion biology, hemostasis and thrombosis related laboratory tests, antiplatelet/anticoagulant/fibrinolytic therapy

C4.6 Explain the biochemistry of Atherosclerosis - pathogenesis, risk factors, prevention and treatment Cardiac failure, acute coronary syndrome, cardiac biomarkers

C4.7 Suggest, evaluate, monitor disease states, interpret biochemical investigation in a given clinical situation and apply knowledge in clinical problems

C4.8 Suggest, evaluate and interpret regarding the analysis of biological fluids for its chemical constituents & correlating the same in health & disease

C4.9 Update about recent advances and trends in research in the field of clinical biochemistry and implement important advanced techniques.

The PEO, PO and the CO are mapped with each other. (Table 1)

TABLE1. MAPPING OF PEO, PO AND CO

	PEO 1		PEO2	PEO3			PEO4	PEO5
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
C1	Y	Y			Y	Y	Y	
C2	Y							Y
C3		Y	Y					Y
C4		Y	Y	Y		Y		

All courses run concurrently for 3 years with a summative assessment at the end of 3 years. The program is competency based and the competencies, sub-competencies and milestones are detailed. These are mapped to the Entrustable professional activities (EPA) identified as essential for a specialist. Formative assessment is carried out every three months using appropriate tools, for identifying eligibility for transfer of trust.

5. COMPETENCIES, SUB-COMPETENCIES AND MILESTONE:

At the end of the MD course in Biochemistry, the student should have acquired various competencies i.e. medical knowledge, patient care, interpersonal communication skill, system-based practice, practice-based learning and implementation and professionalism. Details of each with milestone as level is described below. (Table 2)

TABLE 2. DESCRIPTION OF COMPETENCIES, SUB-COMPETENCIES AND MILESTONE

5.1 COMPETENCIES

5.1.1. Medical Knowledge (MK): Demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care)

5.1.2. Patient Care (PC): Provide patient-centered care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health)

5.1.3. Interpersonal communication skill (ICS): Demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals

5.1.4. System based practice (SBP): Demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care

5.1.5. Practice Based Learning and Improvement (PBLI): Demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and lifelong learning

5.1.6. Professionalism (P): Demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles

5.1 Sub Competencies

MK 1: Knowledge and importance of biomolecules and cell biology in sustaining the life process, in health and disease				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Demonstrates knowledge and importance of biomolecules in sustaining the life process, able to describe and apply biochemical principles to explain the normal state, pertaining to Biomolecules and cell biology	Able to Describe importance of biomolecules in sustaining the life process, able to describe and apply biochemical principles to explain the abnormal disease conditions pertaining to Biomolecules and cell biology	Applies a broad base and in-depth knowledge in clinical and biomedical sciences relevant to a given clinical condition. Able to Apply knowledge of general concepts related to the human genome, human genes, and inheritance of DNA	Applies the knowledge of Biochemistry for interpreting the findings in correlation with clinical features. (knowledge)	Expands understanding and publishes results of molecular and metabolic basis of pathogenicity or treatment of a disease or metabolic pathway

MK 2: Knowledge and application of the concept of nutrition in health and disease, essential nutrients, and interlinks of nutrients with metabolism and functions of a living system.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Demonstrates basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Applies** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders	**Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM	**Applies advanced** knowledge of cellular, and molecular basis to common diagnoses **Selects and orders** confirmatory laboratory studies. **Demonstrates** knowledge of triage for individuals with abnormal tests and NBS results	**Able to Integrate advanced knowledge** of cellular, and molecular pathology to common and uncommon diagnoses Independently interprets and applies the information obtained from testing and also generates a differential diagnosis based on NBS results	**Recognized as an expert** so able to teach others the integration of cellular, and molecular pathology knowledge to disease **Participates** in state, regional, or national New Born Screening program/ development or evaluation projects and Contributes to generalizable medical knowledge and diagnosis

MK 4: Knowledge of research and biostatistics to evaluate and interpret identify molecular and metabolic disease states, develops polices, evidence-based practice guidelines for testing and participates in assay development. knowledge about recent advances and trends in research in the field of clinical biochemistry				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Acquire knowledge on the basics of research methodology and biostatistics	Able to write a research protocol with guidance	Carry out research work under guidance and draw inferences from the study. Critically appraise articles and provide feedback	Present the findings in scientific forums and defend the work	Able to carry out research independently and guide others (peers and students)

MK 5: Knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes in general, including hematology and microbiology.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Explains the need for knowledge of pathogenesis, diagnostic techniques, and	**Demonstrates the application** of basic textbook-level knowledge as it applies to	**Applies medical knowledge** to interpret and report routine investigations in hematology	**Independently applies** medical knowledge to interpret and report routine	**Participates** in interdepartmental presentations
prognostic factors in disease processes including hematology and microbiology	clinical problems in medical microbiology and hematology	and microbiology under supervision	investigations in hematology and microbiology with clinical correlation	

MK 6: Knowledge on medical educational technology, pedagogy, andragogy heutagogy				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**

Demonstrates background content knowledge in Biochemistry. Participates in active learning	**Understands and begins** to acquire the skills needed for effective teaching. **Able to teach** undergraduates with guidance	**Demonstrates the** knowledge of pedagogical principles and teaching-learning tools in micro teaching session. **Teaches** peers as needed	**Apply the content and pedagogical** knowledge while teaching students in practical classes and theory classes	**Create teaching**-learning lesson plans based on content and pedagogical knowledge. **Models teaching** across departments and at all levels, including for clinicians, patients, and families.

PC 1: Understands principles of analysis and methodology of biochemical analytes Able to perform, interpret, and report routine and less commonly used biochemical tests and corelate with laboratory data's.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Explain the indications for ordering specific tests and	**Describe the principles** of analysis and methodology	**Able to describe** the utility and methodology of	**Analyse** the most complex test platforms,	**Proficient in** Biochemical investigations during
interpretation of commonly used biochemical tests.	of biochemical analytes **Able** to perform, interpret, and report less commonly used biochemical tests. **Able to analyse** with the test characteristics for less commonly used tests, and understands how these affect the establishment of a definitive diagnosis	currently outsourced biochemical tests and assists with strengths and limitations of all test **Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able to significantly** narrow a differential diagnosis using laboratory and clinical findings	methodology, and test indications. **Effectively** teaches the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts with** other health care teams to discuss test results and make recommendations	emergency situations such as pandemics.

PC 2: Able to suggest an evidence-based diagnosis based on laboratory and clinical findings, interaction with other health care teams to discuss test results and make recommendations, Able to infer the role of the consultant in Biochemistry.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Able to infer the role of the consultant in Biochemistry. **Observes and assists** in the consultation **Able to use** the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information	**Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance	**Effectively communicates** consultative recommendations and action plans and maintains a portfolio, independently **prepares** full and complete consultative reports	**Independently performs consultation** during regular working hours and while on call and **effectively teaches** consultation skills	**Proficient in** Biochemical consultations, including those involving complex clinical scenarios and patient evaluation

PC 3: Provide health care services in diagnostics for screening, diagnosing and monitoring health problems with commitment to patients by applying best practices and adhering to high ethical standards				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**

Able to suggest disease-specific tests for diagnosis, screening and monitoring health problems.	**Along with level one able to provide Dietary and supportive, management, offers and provides** disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provides referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations	**Able to assimilate information regarding** complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests	**Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing	**Interacts** with other health care teams to discuss test results and make recommendations

PC 4: Analyses results of IQC and proficiency tests, identifies problems, and suggests corrective action and preventive action so as to release reliable reports.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Becomes familiar with the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive	**Prepares a** differential diagnosis for abnormal test results or finding. **Identifies** the strengths and limitations	**Justifies** for additional testing. **Identifies** the strengths and limitations of all tests used in biochemistry	**Able to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Analysis** results of proficiency tests, identifies problems, and suggests corrective action **Demonstrates**

values (PPV and NPV)] for tests commonly used in Biochemistry, and **appreciates** how these affect the establishment of a definitive diagnosis	of tests commonly used.	including those sent to a reference laboratory		expertise at the level expected of a clinical biochemist

ICS 1: Appropriate use of language and nonverbal behavior to demonstrate respect and establish rapport. Identifies common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Uses language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system	**Demonstrates** usage of active listening and clear language	**Establishes rapport in challenging patient** encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision	**Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Mentors others in situational awareness** and critical self-reflection to consistently develop positive therapeutic relationships

ICS 2: Communicate effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable.				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Recognises the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Conforms**	**Communicates/Provides** timely and effective communication with health care providers, families, and patients (as applicable) with guidance **Produces** a	**Uses active listening** to adapt communication style to fit needs. **Independently communicates** with healthcare team.	**Effectively communicates** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news)	**Serves as a role model** for effective and professional communication to student's health care providers, families, and patients (as applicable)

to the fact that the written report is a form of communication that must be clear and understandable. **Effectively** utilizes the electronic medical record	written report information effectively	**Produces** a clear and understandable written report effectively.	**Independently and consistently produces** a clear and understandable written report. Coordinates recommendations from different members of the team to optimize patient care.	

ICS 3: Executes appropriate personnel management and conflict resolution				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Explains the importance of conflict and complaint resolution	**Observes** how conflict and complaints are resolved	**Independently manages** conflicts and complaints	**Anticipates, mitigates,** and manages potential conflicts and complaints	**Models flexible communication** strategies that value input from all health care team members, resolving conflict when needed.

SBP 1: Leads a quality improvement project to improve quality of care or access to resources (e.g., case presentation, consultation, test selection guidance) in health care team				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Recognises the importance of the role a clinical biochemist in the health care team Acquire knowledge on the teaching learning methods and modalities of assessment	**Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify the pros** and cons of various teaching-learning sessions	**Takes part in the role** of a biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Incorporates** multiple TL methods during seminars, journal club and UG teaching	Independently **participates as a part** of a health care team. **Evaluate the teaching** learning sessions and assessment critically for improvement	**Effectively plays** a lead role in the health care team **Works with peers** to create teaching-learning lesson plans keeping in mind the system errors, and assessment strategies **Coaches junior** postgraduates on following systems-based practice

SBP 2: Actively participates in, or performs, inspections of laboratory so as to establish total quality management				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Able to associate that laboratories are regulated by professional bodies. **Demonstrates** compliance with national regulations for patient privacy and confidentiality	**Explains the** basics of quality assurance according to (NABL, NABH and ISO 15189) guidelines	**Reviews IQC** and proficiency testing results. **Able to implement** corrective and preventive action based on IQC and proficiency testing results	**Participates** as a team member in mock or actual inspection of a laboratory, or equivalent	**Actively participates in, or performs,** inspections of a laboratory at an outside facility **Able to lead** an inspection of a laboratory

SBP 3: Lab Management: Resource Utilization (personnel and finance) Perform administrative role, practice management responsibilities for resource utilisation (Personnel and finance)				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Aware of the role of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) **Recognizes** how health care systems influence individual practice and patient care Sensitive to cost-effective care	**Well informed** about the personnel and lines of reporting in the laboratory **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system	**Describes** the process of personnel management and employment laws **Advocates for** laboratory services to enhance cost-effective care **Implements** state, national, and professional organizations' standards, or elements of checklists in the laboratory	**Participates** in employee interviews / **performance evaluation** (real or simulated experiences) **participates** in budgeting of a lab. **Manages** the variation in access to laboratory services.	**Manages** personnel effectively and able to develop a budget. **Leads** a quality improvement project to improve quality of care or access to resources

PBLI 1: Demonstrates Evidence-based Utilization by self-directed learning				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Demonstrates how to access and select applicable evidence **Aware of** the need for patient privacy, autonomy, and consent as applied to clinical research. **Demonstrates** the importance of evidence-based utilization of laboratory tests and results	**Identifies and applies** the best available evidence to guide diagnostic workup of simple cases **Develops** knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care	**Identifies and applies** the best available evidence to guide diagnostic work-up of complex cases **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, with assistance including laboratory tests and results	**Critically appraises** and applies evidence to guide care, even in the face of conflicting data **Proactively and consistently applies** knowledge of the basic principles of research such as informed consent and research protocols to clinical practice. Independently **performs a critical review** of the literature addressing evidence-based utilization of laboratory tests and results, and designs utilization guidelines	**Teaches others to critically appraise** and apply evidence for complex cases; and/or participates in the development of guidelines **Suggest improvements** to research regulations and/or substantially contributes to the primary literature through basic, translational, or clinical research. **Implements institutional utilization** guidelines for laboratory tests and results

PBLI 2: Demonstrates Reflective Practice and Commitment to Personal Growth				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Acknowledges gaps in knowledge and expertise in his own knowledge of biochemistry. **Accepts responsibility** for personal and professional development by establishing goals	**Incorporates feedback** for improving his knowledge and skills in the gap. **Demonstrates openness** to receiving performance data and feedback in order to inform goals	**Develops a learning plan** based on the knowledge and expertise gap and the obtained feedback. **Seeks performance** data and feedback with humility	**Implements the learning plan** to bridge the gap. **Actively and consistently** seeks performance data and feedback with humility **Critically evaluates** the effectiveness of behavioral	**Applies the principles of self-directed** learning in identifying and correcting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility

Identifies the gap(s) between expectations and actual performance **Actively seeks** opportunities to improve	**Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Designs and implements** a learning plan, with assistance	**Institutes behavioral** change(s) to narrow the gap(s) between expectations and actual performance **Independently creates and implements** a learning plan	changes in narrowing the gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary	**Teaches others** reflective practice **Facilitates the design and implementing** learning plans for others

P 1: Demonstrates Reflective Practice and Commitment to Personal Growth				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes when and how** to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses	**Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; takes responsibility for own professionalism lapses	**Recognizes the need and uses appropriate** resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations	**Independently resolves** and manages complex ethical situations **Recognizes situations** that may trigger professionalism lapses and intervenes to prevent lapses in self and others	**Identifies and seeks to** address system-level factors that induce or exacerbate ethical problems or impede their resolution **Coaches** others when their behavior fails to meet professional expectation

P 2: Accountability and Responsiveness to the Needs of Patients, Society, and the Profession				
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 5**
Responds promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession Acts with honesty and truthfulness	**Takes appropriate ownership and performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** the signs and symptoms of fatigue, stress, and substance abuse	**Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Recognizes** signs and symptoms of fatigue, stress, and substance abuse	**Anticipates and intervenes in situations that may impact others' ability to complete tasks and responsibilities in a timely manner** Coaches others to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects	**Takes ownership of system outcomes Designs new strategies to ensure that the needs of patients, teams, and systems are met Participates** in institutional or community peer counselling related to professionalism

6. SYLLABUS

6.1 Course 1: Biomolecules, Cell Biology, Biochemical Techniques, Biostatistics and Research Methodology, Basics of Medical Education in Teaching and Assessment of Biochemistry

1. Biomolecules:

- Properties of water
- Concept of an acid, a base, pH, pK, buffer and buffering capacity
- Classification, structure and functions of amino acids and peptides
- Structural organization of proteins and relationship with their functions
- primary, secondary, tertiary and quarternary structure of proteins
- protein folding and denaturation
- Structure-function relationship of proteins
    - Structure and functions of hemoglobin and myoglobi
    - Structure and function of collagen
    - Structure and function of immunoglobulins
- Classification, functions, properties and reactions of carbohydrates
- Classification, properties and importance of lipids
    - Fatty acids - nomenclature, classification, properties, reactions
    - Mono, di- and triacylglycerols
    - Trans fats
    - Cholesterol - structure, properties and functions
    - Phospholipids - definition, types, properties, s and importance
    - Glycolipids - definition, types, functions, examples.
    - Lipoproteins - definition, structure, types, functions, role of apoproteins, importance in health and disease.
    - Biological membranes - structure, function, properties and importance. Micelles and liposomes
- Nucleotides and nucleic acids
    - purine and pyrimidine bases in DNA and RNA
    - nucleosides and nucleotides
    - physiologically important nucleotides
    - synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents (anti-cancer drugs, anti-viral drugs)
    - Watson and Crick model of DNA structure
    - Structure and functions of different types of RNA.

2. Cell biology

- Structure of the cell and different subcellular organelles
- Structure and functions of cell membrane, solute transport across biological membranes

- Intracellular traffic and sorting of proteins
- Intracellular signalling pathways, membrane receptors and second messengers
- Extracellular matrix: composition, importance and biomedical importance, cellular adhesion molecules and intercellular communication
- Cytoskeleton, muscle contraction and cell motility
- Cell cycle, mitosis, meiosis and mechanisms of cell death
- Red and white blood cell

3. Analytical techniques in biochemistry

- Spectrophotometry (UV and visible spectrophotometry),
- Atomic absorption spectrophotometry
- Flame photometry
- Fluorometry
- Turbidimetry and nephelometry
- Gravimetry
- Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes)
- Chemiluminescence
- Water testing
- Electrophoresis (principle, types, applications; isoelectric focusing capillary electrophoresis; 2-D electrophoresis)
- Chromatography (principle, types [including high performance liquid chromatography and gas chromatography])
- Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, microarrays and DNA chip technology, cloning techniques, genomics, proteomics and metabolomics

  Nanotechnology and microfabrication

  Techniques to study in vivo metabolism - NMR, SPECT, PET scans, etc

  Radioisotope-based techniques and its applications

4. Biostatistics and research methodology

- Basic concepts of biostatistics as applied to health science
- Statistical tests: t-test, analysis of variance, chi-square test, non-parametric tests, correlation and regression
- Statistical methods of validation of diagnostic tests
- Basics of epidemiological study designs and sampling methodologies
- Meta-analysis and systematic reviews
- Bioethics
- To list the ethical guidelines for laboratory medicine given by various national and international councils

5. Basics of medical education in teaching and assessment of biochemistry

- Principles of adult learning, taxonomy of learning, educational objectives Principles of assessment

and question paper setting, methods of assessing knowledge, appropriate use of media, microteaching, small group teaching.

6.2 Course 2: Enzymes, Bioenergetics, Biological Oxidation, Intermediary Metabolism and Regulation, Inborn Errors of Metabolism and Nutrition

1. Enzymes:

- Properties, classification, mechanism of faction, coenzymes and cofactors, kinetics of enzyme activity, regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs.

2. Biological oxidation

- Basic concepts of thermodynamics and its laws, as applied to living systems,
- Exergonic and endergonic reactions and coupled reactions, redox potential
  - High energy compounds
- Classification and role of oxidoreductases
- Cytochromes; cytochrome P450 system

3. Respiratory chain and oxidative phosphorylation

- Components, complexes and functioning of the respiratory chain
- Process of oxidative phosphorylation
- Mechanisms of ATP synthesis and regulation
- Mitochondrial transport systems and shuttles
- Inhibitors, uncouplers and ionophores
- OXPHOS diseases

4. Overview of metabolism and intermediary metabolism

- Metabolism of carbohydrates
  - Digestion and absorption
  - Glycolysis and TCA cycle, including regulation
  - Glycogen metabolism and its regulation
  - Cori cycle, gluconeogenesis and control of blood glucose
  - Metabolism of fructose and galactose
  - Pentose phosphate and uronic acid pathways and their significance
  - Polyol pathway
  - Regulation of blood glucose levels
  - Diabetes mellitus (including gestational diabetes mellitus) – classification, pathogenesis, metabolic abnormalities, diagnostic criteria, principles of treatment, pathogenesis of complications, laboratory tests
  - Metabolism of ethanol
- Metabolism of lipids
  - Digestion and absorption, including role of bile salts

- Biosynthesis and oxidation of fatty acids
- Ketone bodies – formation, utilisation and regulation
- Metabolism of unsaturated fatty acids and eicosanoids
- Metabolism of triacylglycerol; storage and mobilisation of fats
- Metabolism of cholesterol
- Metabolism of lipoproteins
- Metabolism in adipose tissue
- Role of liver in lipid metabolism
- Role of lipids in atherogenesis
- Metabolism of phospholipids and associated disorders

- Metabolism of amino acids and proteins
  - Digestion and absorption
  - Pathways of amino acid degradation - transamination, oxidative deamination
  - Transport and metabolism of ammonia
- Metabolism of individual amino acids.
  - Plasma proteins
- Metabolism of nucleotides
  - De novo synthesis of purine nucleotides
  - Salvage pathway for purines
  - Degradation of purines
  - De novo synthesis of pyrimidine nucleotides
  - Degradation of pyrimidine
  - Synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents
- Metabolism of haem
  - Biosynthesis of heme and associated disorders
  - Degradation of heme and associated disorders
- Metabolism in individual tissues and in the fed and fasting states Liver, adipose tissue, brain, RBCs

5. Nutrition

- Principal food components
- General nutritional requirements
- Energy requirements
- Biological value of proteins
- Thermogenic effect of food
- Balanced diet, diet formulations in health and disease, mixed diet
- Nutritional supplements
- Food toxins and additives
- Parenteral nutrition

- Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders
- National Nutrition Programme.
- Vitamins
  - Classification, biochemical role, sources, RDA and deficiency state of each vitamin (including diagnostic tests for deficiency and treatment)
- Minerals
  - Classification, biochemical role, sources, requirement and deficiency state of each mineral (including diagnostic tests for deficiency and treatment)
- Metabolism of xenobiotics
- Free radicals and anti-oxidant defence systems in the body and associations with disease processes

6.3 Course 3: Molecular Biology, Molecular and Genetic Aspects of Cancer, Immunology and Effects of Environmental Pollutants on the Body

1. Molecular Biology

- Structure and organization of chromosomes and chromatin re-modelling
- DNA replication
  - DNA replication in prokaryotes and eukaryotes (including important differences between the two):
  - Roles of DNA polymerase, helicase, primase, topoisomerase and DNA ligase
  - Replication fork
  - Okazaki fragments and its importance in replication.
  - Overview of role of major DNA repair mechanisms – mismatch repair, base excision repair, nucleotide excision repair and double strand break repair.
  - Diseases associated with abnormalities of DNA repair systems
  - DNA recombination
- Transcription
  - Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
  - Process of transcription in prokaryotes and eukaryotes – initiation, elongation and termination (including important differences).
  - Post-transcriptional processing – capping, tailing and splicing.
- Genetic code and mutations
- Characteristics of the genetic code
  - Molecular basis of degeneracy of the genetic code (Wobble hypothesis)
  - Mutagens- examples of physical, chemical and biological mutagens.
  - Types of mutations – point mutations and chromosomal mutations
  - Relationship of mutations with specific diseases
- Translation
  - Basic structure of prokaryotic and eukaryotic ribosomes.
  - Structure of tRNA (diagram of clover leaf model of tRNA structure) and its function in protein

synthesis.

- Function of aminoacyl tRNA synthase.
- Process of protein synthesis (translation) – initiation, elongation and termination (including important differences between prokaryotic and eukaryotic translation).
- Inhibition of prokaryotic translation by antibiotics.
- Post-translational modifications

- Regulation of gene expression in prokaryotes and eukaryotes
  - The operon concept in prokaryotes
  - Role of general and gene specific transcription factors
  - Small interference RNA (siRNA) and micro RNA (miRNA).
  - Other modes of regulation of gene expression: alternative splicing, alternative promoter usage, DNA methylation, Histone acetylation / deacetylation, RNA editing, alterations of RNA stability
- Recombinant DNA technology and its applications in modern medicine
  - Concepts of recombinant DNA, genetic engineering, biotechnology and cloning.
  - Restriction endonucleases.
  - Vectors for cloning – plasmids and phages.
  - Genomic and cDNA libraries.
  - Applications of recombinant DNA technology in medicine. \
  - Gene therapy
- Diagnosis of genetic diseases and genetic counseling
  - DNA fingerprinting
  - DNA sequencing
  - Microarrays
  - Fluorescent in situ hybridization (FISH)
  - DNA vaccines
  - Transgenic animals
  - Application of molecular techniques in forensic investigation and medicolegal cases
- Overview of Human Genome Project
- Basics of bioinformatics
- Principles of human genetics
  - Alleles, genotypes and phenotypes
  - Patterns of inheritance: monogenic and polygenic inheritance
  - Population genetics
  - Genetic factors in causation of diseases
  - Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders
  - Screening for genetic diseases and prenatal testing

- Ethical and legal issues related to medical genetics

- Stem cells in clinical medicine
  - Basic concepts regarding stem cells
  - Types of stem cells: embryonic and induced pleuripotent stem cells (IPSC)
  - Potential applications in the clinical medicine
  - Ethical and legal issues related to use of stem cells in medicine

2. Cancer

- Carcinogens: physical, chemical and biological
- Clonal origin of cancers
- Genetic basis of carcinogenesis
- Role of oncogenes and tumour suppressor genes
- Familial cancer syndromes
- Cancer stem cells
- Epigenetic regulation in cancer
- Gene expression profiling in cancer
- Cancer cell biology: cell cycle abnormalities, telomerase activity, proliferative capacity and decreased apoptosis
- Metastasis
- Tumor markers
- Biochemical basis of cancer chemotherapy and drug resistance
- New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.

3. Immunology

- Innate and acquired immunity
- Humoral and cell-mediated immunity
- Cells and organs of the immune system - T and B cells, macrophages, dendritic cells, NK cells, granulocytes
- Antigens, epitopes and haptens
- Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching
- Antigen-antibody interaction - immunochemical techniques
- Major histocompatibility complex, antigen processing and presentation,
- T cell and B cell receptor, toll like receptors
- T cell maturation/activation/differentiation
- B cell generation/activation/differentiation
- Cytokines
- Complement system, cell
- Immune response to infections
- Hypersensitivity reactions

- Vaccines
- Immuno-deficiency syndromes
- Autoimmunity
- Transplantation immunology
- Cancer and immune system,
- Immunodiagnostics
- Immunotherapy

4. Environmental pollution

6.4 Course 4: Clinical biochemistry and Molecular diagnostics related to different body systems/organs, endocrinology, and Recent advances in biochemistry

1. Basic principles and practice of clinical biochemistry

- Units of measure, reagents, clinical laboratory supplies, basic separation techniques,
- laboratory calculations, specimen collection and processing, safety in the laboratory, clinical utility of laboratory tests (including sensitivity, specificity, ROC curves, etc), analysis in the laboratory, selection and evaluation of methods (including statistical techniques), evidence based laboratory medicine, establishment and use of reference values, pre-analytical variables and biological variations, quality management, c1inical laboratory informatics.
- Analytical techniques and instrumentation

  Principles of basic techniques used in a clinical biochemistry laboratory (spectrophotometry, electrochemistry, electrophoresis, osmometry, chromatography, mass spectrometry, immunochemical techniques, molecular techniques, automation, point of care testing,

2. Clinical correlates and analytical procedures

- Amino acids, peptides and proteins; non-protein nitrogenous compounds
- enzymes
- carbohydrates
- lipids, lipoproteins and apolipoproteins and other cardiovascular risk factors
- electrolytes
- blood gases and pH
- hormones and associated disorders
- catecholamines and serotonin
- vitamins; trace and toxic elements
- Hemoglobin, and bilirubin , porphyrins and associated disorders
- bone and mineral metabolism
- tumour markers
- Assessment of organ functions (hypothalamus and pituitary, adrenal glands, gonads, thyroid, parathyroid, liver, kidney, heart, stomach, pancreas, intestine, etc) and associated disorders
- pregnancy and maternal and fetal health
- reproduction related disorders – infertility

- newborn screening
- inborn errors of metabolism
- hemostasis
- therapeutic drug monitoring
- clinical toxicology
- molecular diagnostics
- body fluid analyses

3. Regulation of fluid and electrolyte balance and associated disorders

4. Regulation of acid-base balance and associated disorders

5. Biochemistry of the endocrine system

- Classification and general mechanism of action of hormones
- Biosynthesis, secretion, regulation, transport and mode of action of hypothalamic peptides, adenohypophyseal and neurohypophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parahormones.
- Biochemistry of conception, reproduction and contraception
- Endocrine interrelationship and their involvement in metabolic regulation
- Neuro-modulators and their mechanism of action and physiological significance
- Biochemical aspects of diagnosis and treatment of endocrinal disorders: Hematopoietic disorders

6. Iron deficiency and other hypoproliferative anaemias - iron metabolism, laboratory tests of iron status, iron therapy

- Anaemia of chronic disease, anaemia of renal disease
- Hemoglobinopathies - sickle cell anaemia, methaemoglobinemias, thalassemia syndromes, Megaloblastic anaemia
- RBC membrane and metabolism
- Hemolytic anaemia - inherited defects in RBC membrane and enzymes (G6PD deficiency), immunologic causes of hemolysis
- ABO blood group system - biochemical basis, transfusion biology.
- Plasma cell disorders - multiple myeloma.
- Hemostasis and thrombosis
  - Biochemical mechanisms, related laboratory tests, antiplatelet/anticoagulant/fibrinolytic therapy
- Cardiovascular system
  - Atherosclerosis - pathogenesis, risk factors, prevention and treatment Cardiac failure, acute coronary syndrome, cardiac biomarkers
- Respiratory system
  - Gaseous exchange in lungs - physiological features and disturbances, arterial blood gases
  - Pathogenesis of cystic emphysema, alpha-1 anti-trypsin deficiency
- Kidney
  - Kidney function tests; pathophysiology, biochemistry, laboratory findings and manage-

ment in acute kidney injury and chronic kidney disease; estimation of GFR; glomerular diseases - pathogenesis and mechanisms of glomerular injury, nephrotic syndrome, diabetic nephropathy; tubular disorders - renal tubular acidosis, proteinuria, nephrolithiasis, kidney transplant; biochemical aspects of renal stones.

- Gastrointestinal system
  - Gastric physiology
  - Pathophysiology of peptic ulcer disease, including role of H. pylori; gastric function tests; Zollinger-Ellison syndrome
  - Digestion and absorption of nutrients; evaluation of malabsorption (steatorrhea, lactose intolerance)
  - Celiac disease
  - Inflammatory bowel disease
  - Protein losing enteropathy
  - Regulatory peptides in the gut
  - Neuroendocrine tumours
- Liver
  - Liver function tests
  - Hyperbilirubinemias
  - Viral hepatitis
  - Serologic/virologic markers
  - Alcoholic liver disease, fatty liver, chronic liver disease, cirrhosis and its complications
  - Pathogenesis of ascites
  - Hepatic encephalopathy
  - Metabolic diseases affecting liver
  - Reye's syndrome
  - Diseases of gall bladder/bile ducts - pathogenesis of gallstones
  - Pancreas - acute and chronic pancreatitis, cystic fibrosis, pancreatic function tests.
- Bone and mineral metabolism
  - Bone structure and metabolism; metabolism of calcium, phosphate and magnesium; regulation and abnormalities of bone metabolism; vitamin D;
- parathyroid hormone; calcitonin;
  - parathyroid hormone-related (PTHrP); osteoporosis – pathophysiology; markers of bone turnover
- Nervous system
  - Neurotransmitters and their receptors
  - Ion channels and channelopathies
  - Neurotrophic factors
  - Protein aggregation and neurodegeneration
  - Alzheimer’s disease, Parkinson's disease, Huntington’s disease, multiple sclerosis
  - Prions and prion diseases

- Guillain-Barre syndrome – immunopathogenesis
- Myasthenia gravis – pathophysiology
- Hereditary myopathies - Duchenne muscular dystrophy
- Inherited disorders of muscle energy metabolism
- Mitochondrial myopathies
- Pathophysiology of psychiatric disorders such as anxiety, depression and schizophrenia

PRACTICALS

Part – I : General Biochemistry Practicals

1. Reactions of carbohydrates, lipids, proteins and amino acids
2. Reactions of haemoglobin and its derivatives – detection by spectroscope
3. Analysis of normal Urine
4. Analysis of abnormal Urine
5. Separation of sugars and amino acids by chromatography (paper/TLC)
6. Separation of proteins in serum / plasma by electrophoresis (paper / agarose)
7. Preparation of buffers and determination of pH using pH meter.
8. Assay of antioxidant capacity and lipid peroxidation
9. Isolation and estimation of DNA
10. Blotting techniques
11. Gene amplification techniques and identification of SNPs
12. Ion exchange chromatography
13. Estimation of ethyl alcohol in blood and urine
14. Estimation of vitamin A, E & C
15. Planning and organization of biochemical experiments in the laboratory
16. Method validation.
17. Basic Trouble shooting of an auto analyser.
18. To do Precision and accuracy checks.
19. Basic criteria for selecting instruments.
20. Basic maintenance of Electrolytes, Hormone and ABG analyser.
21. To prepare a workflow chart for clinical biochemistry lab.
22. To interpret internal and external quality control charts.
23. To prepare and discuss Monthly Lab audit report.
24. Interpretation of basic biochemistry reports.
25. Interpretation of ABG reports

Part – II: Clinical Biochemistry Practicals

1. Estimation of glucose in blood

2. Glucose tolerance test
3. Estimation of glycosylated hemoglobin
4. Estimation of lipid profile

    a. Cholesterol b. Triacylglycerol (Triglycerides)

    c. LDL, d. VLDL, e. HDL

    5. Estimation of Renal profile

    a. Urea b. Creatinine c. Uric acid d. Ammonia

5. Estimation of protein, albumin and A/G ratio in serum
6. Separation of proteins by polyacrylamide gel electrophoresis (PAGE)
7. Separation of lipoproteins by electrophoresis
8. Separation of normal and abnormal hemoglobins by electrophoresis
9. Separation of Isoenzymes of LDH and CPK by PAGE
10. Immunoelectrophorosis
11. Estimation of calcium and phosphorus in blood
12. Estimation of Bilirubin (Total, Direct and indirect Bilirubin) in serum or plasma
13. Estimation of electrolytes (Sodium, potassium and chloride) in blood and urine using ion selective electrodes / flame photometer.
14. Estimation of blood gases (ABG): pO2, pCO2, pH, etc
15. Estimation of trace elements in blood

    a. Iron b. Iron binding capacity c. Copper d. Ceruloplasmin

    e. Magnesium f. Lithium

16. Estimation of hormones by non-isotopic assays (ELISA / Chemiluminescence)

    a. T3, T4, TSH b. Insulin c. LH & FSH d.Steroid hormones

17. Analysis of bio fluids and interpretation of reports

    a. CSF b. Ascitic acid c. Plural fluid d. Peritoneal fluid

18. Estimation of Lp (a)
19. Estimation of troponin, myoglobin, microalbumin
20. Analysis of renal and biliary calculi
21. Coagulation profile
22. Estimation of urine proteins
23. Detection of Bence –Jones proteins in urine
24. Estimation of 17 keto steroids, VMA, 5HIAA in urine
25. Interpretation of laboratory data on biochemical parameters and correlation with clinical profile related to the liver function, renal function, gastric function and thyroid function.
26. Method validation
27. Preparation and interpretation of quality charts and application of six sigma for clinical chemistry laboratory

28. Trouble shooting of instruments

29. Conducting internal audits, writing SOPs and quality manual for NABL accreditation

7. TEACHING AND LEARNING METHODS

Teaching methodology Active and interactive learning should be the mainstay of the program. The following methods are to be used to facilitate learning by and training of MD students.

1. Interactive lectures, tutorials, problem-based learning, case discussions, seminars, guest lectures, E-learning

The above teaching learning methods should be employed for the post graduate students to acquire updated knowledge on various aspects of basic and clinical biochemistry, immunology and molecular biology, and their application in modern medicine and also to learn to communicate effectively.

2. Journal club

Journal club sessions should be used by post graduate students to learn to search medical literature, to learn how scientific data is to be disseminated, to develop skills in presentation of research papers, to critically analyse and evaluate data, to become familiar with research methodologies, to keep oneself updated on new developments/emerging trends in biochemistry and to learn to communicate effectively

3. Practical exercises

These exercises should be used by post graduate students to equip themselves with knowledge and hand-on skills in various techniques used for laboratory bench-work in biochemistry and molecular biology and in a diagnostic laboratory, and to learn to analyze and interpret data obtained.

4. Thesis

Under the supervision of a Professor or Associate Professor in the Department of Biochemistry, each PG student is expected to generate a hypothesis/research question and design a research protocol to test/answer it. The protocol should have clearly defined objectives and a work plan. The post graduate student will carry out the experimental research work proposed, analyze data, interpret results and write a thesis/dissertation based on the work done and results obtained.

5. Presentation of work done on thesis to peers

A post graduate student of a postgraduate degree course in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

6. Teaching of undergraduates

Postgraduate students in Biochemistry shall be required to participate in teaching and training programmes of undergraduate students. They should learn how to organize, conduct and co-ordinate UG laboratory teaching in practical classes, to participate in clinical case-based teaching sessions and small group discussions (as part of a team that includes faculty members and senior residents of the department), to develop skills of self-directed learning, effective communication and leadership. They should learn how to work as part of a team and to facilitate learning by students.

7. Horizontal and vertical integration of teaching of Biochemistry with other preclinical, para-clinical and clinical departments

The post graduate students should take part in integrated teaching of undergraduates by participation in joint teaching sessions and seminars with different departments, participation in clinical rounds for discussing cases of interest and by small group discussions of case-based problems.

8. **Training in the basics of medical education and technology**

The post graduate students may be provided with training in the basics of medical education and technology through workshops at the departmental and/or institutional level.

9. **Development of communication skills**

The post graduate students should develop effective communication skills by making presentations at seminars and journal club sessions and by teaching undergraduates.

10. **Training in clinical Biochemistry:**

The post graduate students should receive hands-on training in a diagnostic laboratory in Biochemistry; such training should be extensive and rigorous enough for each post graduate student to acquire adequate skills and expertise to manage and supervise such a laboratory. The post graduate students should be posted in all sections of the laboratory in the institution, starting from sample collection and processing. They should become proficient in working with the autoanalysers in the laboratory, in quality control methods, setting up of a clinical biochemistry laboratory, specialized assays and statistical analysis of data. It would also be desirable for them to acquire experience in running a 24-hours diagnostic laboratory; towards this end, it would help if they are posted in the laboratory out of regular hours as well.

11. **Rotation in clinical departments**

It would be desirable for the post graduate students to be posted in clinical departments after their training period in the diagnostic laboratory, for up to 3 months of the course. Suggested departments and durations of postings are as follows: General medicine (1 month which includes endocrinology and intensive care units), Hematology (1 month), Routine Microbiology (1 month), Paediatrics (10 days). These postings will help post graduate students get a better perspective on diagnostic tests in clinical practice and will enable them to contribute more effectively to patient care.

12. **Log Book:**

All post graduate students should maintain a log book that documents all the work that they have done during their years of training. This log book should be checked and assessed periodically by the faculty members involved in the training programme.

13. **Department should encourage e-learning activities.**

During the training programme, patient safety is of paramount importance, therefore skills are to be learnt initially on the models, later to be performed under supervision followed by performing

8. ASSESSMENT

8.1 Formative Assessment

Formative assessment is continual and assess medical knowledge, patient care, procedural & academic skills, interpersonal communication skills, system-based practice, self-directed learning and professionalism of the activities mentioned every 3/6 monthly. EPAs are listed as bellow (Table 3) with description of each EPA (Table 4). Progress of the students is recorded after discussion with the student in Entrustable Professional Activity (EPA) assessment form Annexure-1. These EPAs are also mapped with PO and CO. (Table 5)

TABLE 3: LIST OF ENTRUSTABLE PROFESSIONAL ACTIVITY

EPA No.	GENERAL
1	Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis
2	Recommending and interpreting common screening and diagnostic tests and data
3	Giving the necessary instructions to the patients related to biochemical investigations
4	Obtain informed consent for investigations and for academic research
5	Collaborate as a member of an interprofessional team
6	Form clinical questions and retrieve evidence to advance patient care
	CLINICAL BIOCHEMISTRY
7	Evaluate and report clinical laboratory testing including critical values and special investigations
8	Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues
9	Provide biochemistry support for interdisciplinary presentations/clinicopathological meet
10	Provide patient care consultations
11	Optimize test utilization
12	Improve quality and patient safety
13	Evaluate and choose a new test/assay or instrument
14	Perform a laboratory audit
	RESEARCH METHODOLOGY
15	Should be able to write a scientific protocol for clinical research
16	Reporting and communication of scientific research
	TEACHING
17	Select and demonstrate competency in a range of teaching methods

18	Select a learning outcome and design and develop an appropriate assessment method
19	Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it

Description of Entrustable Professional Activity with Relevant Domains of Competence, Domain Critical Behavior

TABLE 4. EPAS, Competency Levels And Entrustability

EPA 1: Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to perform complete history taking and physical examination in an organized manner without supervision and with respect for the patient. The history and physical examination should be tailored to the clinical situation and specific patient encounter. This data gathering and patient interaction activity serves as the basis for clinical work and as the building block for patient evaluation.
2. Most relevant domains of competence:	**MK, PC, ICS, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK1.4,MK 2.4** **PC1.4,PC2.3** **ICS1.4** **P1.3**
4. Methods of assessment	1. Periodic written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 1.4	**Lacks adequate** knowledge and importance of biomolecules in sustaining the life process, unable to describe and apply biochemical principles to explain the normal state, pertaining to Biomolecules and cell biology **Unable to** Describe importance of biomolecules in sustaining the life process, **not able** to describe and apply biochemical principles to explain the abnormal disease conditions pertaining to Biomolecules and cell biology Unable to Apply a broad base and in depth knowledge in clinical and biomedical sciences relevant to a given clinical condition.	**Demonstrates** knowledge and importance of biomolecules in sustaining the life process, able to describe and apply biochemical principles to explain the normal state, pertaining to Biomolecules and cell biology **Able to** Describe importance of biomolecules in sustaining the life process, able to describe and apply biochemical principles to explain the abnormal disease conditions pertaining to Biomolecules and cell biology **Applies** a broad base and in-depth knowledge in clinical and biomedical sciences relevant to a given clinical condition.
	Not able to Apply knowledge of general concepts related to the human genome, human genes, and inheritance of DNA and to interpret laboratory data the in correlation with clinical features	**Able to Apply** knowledge of general concepts related to the human genome, human genes, and inheritance of DNA **Applies** the knowledge of Biochemistry for interpreting the findings in correlation with clinical features.

MK 2.4	**Unable** Demonstrate basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Inability to Apply** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies, carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders Applies cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM **Lacks** advanced knowledge of cellular, and molecular basis to common diagnoses **Unable** to Select and orders confirmatory laboratory studies. **Lacks adequate knowledge** of triage for individuals with abnormal tests and NBS results and doesn't interpret and generate a differential diagnosis based on newborn screening results	**Demonstrates** basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Applies** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies, carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders -urea cycle disorders **Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM **Applies** advanced knowledge of cellular, and molecular basis to common diagnoses **Selects and orders** confirmatory laboratory studies. **Demonstrates** knowledge of triage for individuals with abnormal tests and NBS results **able to Independently interpret** and applies the information obtained from testing and also generates a differential diagnosis based on NBS results

PC 1.4	**Not able to explain** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Unable to describe** principles of analysis and methodology of biochemical analytes **Not** Able to perform, interpret, and report less commonly used biochemical tests. **Unable to analyse** test characteristics for less commonly used tests, and how these affect the establishment of a definitive diagnosis **Not able to describe** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Lacks to observe and fails** to assist with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings	**Explain** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Describe** principles of analysis and methodology of biochemical analytes **Able to** perform, interpret, and report less commonly used biochemical tests. **Able to analyse** test characteristics for less commonly used tests, and how these affect the establishment of a definitive diagnosis **Able to describe** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Observes** and **assists** with interaction with other health care teams to discuss test results and make recommendations **Able to** significantly narrow a differential diagnosis using laboratory and clinical findings **Effectively** teaches the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts with** other health care teams to discuss test results and make recommendations

PC 2.3	**Unable to** infer the role of the consultant in Biochemistry. **Fails to** observe and assist in the consultation **Not Able** to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Unable to perform** clinically useful consultation in a timely manner. **Unable to prepare** full and complete consultative reports with even faculty member guidance **Not able to** Effectively communicates consultative recommendations and action plans and maintain a portfolio,	**Able to** infer the role of the consultant in Biochemistry. **Observes and assists** in the consultation **Able to use** the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance **Effectively communicates** consultative recommendations and action plans and maintains a portfolio, **independently prepares** full and complete consultative reports
ICS 1.4	**Does not use** language and nonverbal behavior to demonstrate respect and establish rapport. **Unable to Identify** common barriers to effective communication (e.g., language, disability) **and not able to** accurately communicate own role within the health-care system **Unable to** Demonstrates usage of active listening and clear language **Fails to** Establish rapport in challenging patient encounters, as appropriate. **Not able to** Communicates to the patients the preparatory requirements for the test while overcoming the barriers to communication even under supervision	**Uses** language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

P1.3	**Unable to** Demonstrate knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to** Analyze straight forward situations using ethical principles **Unable to** demonstrate insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 2: Recommending and interpreting common screening and diagnostic tests and data	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to integrate patient data to formulate an assessment, develop a list of potential diagnoses that can be prioritized and lead to selection of a working diagnosis based on the lab data
2. Most relevant domains of competence:	**MK, PC, ICS, PBLI, P**
3. Competencies within each domain critical to entrustment decisions:	**MK2.4** **PC 3.4** **ICS 1.4** **PBLI 1.4** **P1.3**

4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 2	**Unable** Demonstrate basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Inability to Apply** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies , carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders **Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM	**Demonstrates** basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Applies** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies , carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders **Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM
	Lacks advanced knowledge of cellular, and molecular basis to common diagnoses **Unable** to Select and orders confirmatory laboratory studies. **Lacks adequate knowledge** of triage for individuals with abnormal tests and NBS results	**Applies** advanced knowledge of cellular, and molecular basis to common diagnoses **Selects and orders** confirmatory laboratory studies. **Demonstrates** knowledge of triage for individuals with abnormal tests and NBS results **able to Independently interpret** and applies the information obtained from testing and also generates a differential diagnosis based on NBS results

PC 3	**Fails to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Unable to provide** Dietary and supportive, management, disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provide referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations **Not aware of** more complex test platforms, methodology, and test indications. **Not able to** recognise the utility and methodology of currently outsourced chemistry tests	**Able to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Able to provide** dietary and supportive, management, **offers and provides** disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provides referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations. **Able to assimilate information** regarding more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing
ICS 1	**Does not use** language and nonverbal behavior to demonstrate respect and establish rapport. **Unable to Identify** common barriers to effective communication (e.g., language, disability) **and not able to** accurately communicate own role within the healthcare system **Unable to** Demonstrates usage of active listening and clear language **Fails to** Establish rapport in challenging patient encounters, as appropriate.	**Uses** language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate.
	Not able to Communicates to the patients the preparatory requirements for the test while overcoming the barriers to communication even under supervision	**Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

PBLI 1	**Unable to** Demonstrates how to access and select applicable evidence **Not Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Unable to recognise** the importance of evidence-based utilization of laboratory tests and results **Inability to** Identify and apply the best available evidence to guide diagnostic workup of simple cases **Lacks to** Develop knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care Identifies and applies the best available evidence to guide diagnostic work-up of complex cases **Not able to** Apply knowledge of the basic principles of research such as informed consent and research protocols to clinical practice, with assistance including laboratory tests and results.	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Able to recognise** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple cases **Develops** knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care. **Identifies and applies** the best available evidence to guide diagnostic work-up of complex cases **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, with assistance including laboratory tests and results. **Able to Critically appraise** and apply evidence to guide care, even in the face of conflicting data addressing evidence-based utilization of laboratory tests and results, and designs utilization guidelines
P1	**Unable to** Demonstrate knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources

	resources **Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to Analyze** straight forward situations using ethical principles **Unable** to demonstrate insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 3: Giving the necessary instructions to the patients, related to biochemical investigations	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to define the clinical question posed by the consultation request. Evaluate patient clinical history, signs and symptoms, ancillary findings, and laboratory tests pertinent to the consult request and provide necessary instructions required for the biochemical evaluation.
2. Most relevant domains of competence:	**MK, PC, ICS, PBLI, P**
3. Competencies within each domain critical to entrustment decisions:	**MK1.4, MK2.4** **PC2.4, PC 3.4** **ICS 1.4** **PBLI 1.4** **P1.3**

4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 1	**Lacks adequate** knowledge and importance of biomolecules in sustaining the life process, **unable to** describe and apply biochemical principles to explain the normal state, pertaining to Biomolecules and cell biology **Unable to** Describe importance of biomolecules in sustaining the life process, **not able to** describe and apply biochemical principles to explain the abnormal disease conditions pertaining to Biomolecules and cell biology **Unable to** Apply a broad base and in depth knowledge in clinical and biomedical sciences relevant to a given clinical condition. **Not able to** Apply knowledge of general concepts related to the human genome, human genes, and inheritance of DNA	**Demonstrates** knowledge and importance of biomolecules in sustaining the life process, **able to** describe and apply biochemical principles to explain the normal state, pertaining to Biomolecules and cell biology **Able to** Describe importance of biomolecules in sustaining the life process, **able to** describe and apply biochemical principles to explain the abnormal disease conditions pertaining to Biomolecules and cell biology **Applies** a broad base and in-depth knowledge in clinical and biomedical sciences relevant to a given clinical condition. **Able to** Apply knowledge of general concepts related to the human genome, human genes, and inheritance of DNA **Applies** the knowledge of Biochemistry for **interpreting** the findings in correlation with clinical features.

MK 2	**Unable** Demonstrate basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Inability to Apply** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies , carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders **Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM	**Demonstrates** basic medical knowledge of cellular, and molecular systems and its interrelation to nutrition in health and disease **Applies** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups -amino-acidopathies , carbohydrate metabolism -fatty acid oxidation disorders -lysosomal storage diseases -mitochondrial disorders -organic acidurias -urea cycle disorders **Applies** cellular, and molecular knowledge to identify pathologic processes, selects and recommends diagnostic studies including IBEM **Applies** advanced knowledge of cellular, and molecular basis to common diagnoses
	Lacks advanced knowledge of cellular, and molecular basis to common diagnoses Unable to Select and orders confirmatory laboratory studies. **Lacks adequate knowledge** of triage for individuals with abnormal tests and NBS results	**Selects and orders** confirmatory laboratory studies. Demonstrates knowledge of triage for individuals with abnormal tests and NBS results **able to Independently interpret and applies** the information obtained from testing and also generates a differential diagnosis based on NBS results

PC 2	**Unable to** infer the role of the consultant in Biochemistry. **Fails to** observe and assist in the consultation **Not Able** to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Unable to perform** clinically useful consultation in a timely manner. **Unable to prepare** full and complete consultative reports with even faculty member guidance **Not able to** Effectively communicates consultative recommendations and action plans and maintain a portfolio,	**Able to** infer the role of the consultant in Biochemistry. **Observes and assists** in the consultation **Able to use** the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance **Effectively communicates** consultative recommendations and action plans and maintains a portfolio, **independently prepares** full and complete consultative reports
PC 3	**Fails to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Unable to provide** Dietary and supportive, management, disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provide referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations **Not aware of** more complex test platforms, methodology, and test indications. **Not able to** recognise the utility and methodology of currently outsourced chemistry tests	**Able to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Able to provide** dietary and supportive, management, **offers and provides** disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provides referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations. **Able to assimilate information** regarding more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests **independently prepares full** and complete consultative reports

ICS 1	**Does not use** language and nonverbal behavior to demonstrate respect and establish rapport. **Unable to Identify** common barriers to effective communication (e.g., language, disability) and not able to accurately communi cate own role within the healthcare system **Unable to** Demonstrates usage of active listening and clear language **Fails to** Establish rapport in challenging patient encounters, as appropriate. **Not able to** Communicates to the patients the preparatory requirements for the test while overcoming the barriers to communication even under supervision	**Uses** language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict
P1	**Unable to** Demonstrate knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to** Analyze straight forward situations using ethical principles **Unable to** demonstrate insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 4: Obtain informed consent for investigations and for academic research	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to obtain informed consent for investigations that have been ordered or for research purposes and also that which depends on the socioeconomic status of the patients.
2. Most relevant domains of competence:	**PC, ICS, P**
3. Competencies within each domain critical to entrustment decisions:	**PC 2.3** **ICS 1.4** **P1.3**
4. Methods of assessment	1. Workplace assessment by Faculty 2. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
PC 2	**Unable to** infer the role of the consultant in Biochemistry. **Fails to** observe and assist in the consultation **Not Able** to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Unable to perform** clinically useful consultation in a timely manner. **Unable to prepare** full and complete consultative reports with even faculty member guidance **Not able** to Effectively communicates consultative recommendations and action plans and maintain a portfolio,	**Able to** infer the role of the consultant in Biochemistry. **Observes and assists** in the consultation **Able to use** the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance **Effectively communicates** consultative recommendations and action plans and maintains a portfolio, **independently prepares** full and complete consultative reports

ICS 1	**Does not use** language and nonverbal behavior to demonstrate respect and establish rapport. **Unable to Identify** common barriers to effective communication (e.g., language, disability) **and not able to** accurately communicate own role within the healthcare system	**Uses** language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language
	Unable to Demonstrates usage of active listening and clear language **Fails to** Establish rapport in challenging patient encounters, as appropriate. **Not able to** Communicates to the patients the preparatory requirements for the test while overcoming the barriers to communication even under supervision	**Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict
P1	**Unable to** Demonstrate knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to** Analyze straight forward situations using ethical principles **Unable to** demonstrate insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 5: Collaborate as a member of an interprofessional team	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Effective teamwork is necessary to achieve the Institute of Medicine competencies for care that is safe, timely, effective, efficient, and equitable. Introduction to the roles, responsibilities, and contributions of individual team members early in professional development is critical to fully embrace the value that teamwork adds to patient care outcomes.
2. Most relevant domains of competence:	**MK, PC, ICS, SBP, P .**
3. Competencies within each domain critical to entrustment decisions:	**MK 5.5** **PC 2.3** **ICS 2.3** **SBP1.4** **P 2.4**
4. Methods of assessment	1. Workplace assessment by Faculty 2. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 5	**Fails to demonstrate and lacks understanding of the need for** knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes in general, including hematology and microbiology. **Fails to demonstrate** the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Fails to apply medical knowledge** to interpret and report routine investigations in hematology and microbiology with clinical correlation **Fails to participate** in interdepartmental presentations	**Demonstrates and understands the need for** knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes in general, including hematology and microbiology. **Demonstrates** the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Applies medical knowledge** to interpret and report routine investigations in hematology and microbiology with clinical correlation **Participates** in interdepartmental presentations

PC 2	**Fails to demonstrate** the ability to suggest an evidence-based diagnosis based on laboratory and clinical findings, interaction with other health care teams to discuss test results and make recommendations **Lacks understanding** of the role of the consultant in Biochemistry. **Fails to observe** and assist in the consultation. **Fails to demonstrate** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Fails to perform** clinically useful consultation in a timely manner. **Fails to prepare** full and complete consultative	**Demonstrates** the ability to suggest an evidence-based diagnosis based on laboratory and clinical findings, interaction with other health care teams to discuss test results and make recommendations **Understands** the role of the consultant in Biochemistry. **Observes and assists** in the consultation. **Demonstrates** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Performs** clinically useful consultation in a timely manner. Prepares full and complete consultative reports during regular working hours and while on call and effectively teaches consultation skills.
	reports during regular working hours and while on call and effectively teaches consultation skills. **Fails to** effectively **communicate** consultative recommendations and action plans and maintains a portfolio. **Fails to demonstrate** proficiency in Biochemical consultations, including those involving complex clinical scenarios and patient evaluation	Effectively **communicates** consultative recommendations and action plans and maintains a portfolio. **Demonstrates** proficiency in Biochemical consultations, including those involving complex clinical scenarios and patient evaluation

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. Fails to communicate with guidance, fails to provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently. **Fails to effectively communicate** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news) **Fails to coordinate** recommendations from different members of the team to optimize patient care. **Does not serve** as a role model for effective and professional communication to student's health care providers, families, and patients (as applicable)	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. **Effectively utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently. Effectively **communicates** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news) **Coordinates** recommendations from different members of the team to optimize patient care. **Serves** as a role model for effective and professional communication to student's health care providers, families, and patients (as applicable)

SBP 1	**Fails to demonstrate** the ability to lead a quality improvement project to improve quality of care or access to resources (e.g., case presentation, consultation, test selection guidance) in health care team. **Lacks** knowledge on the teaching learning methods and modalities of assessment **Fails to observe** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars, journal club and UG teaching **Fails to participate** as a part of a healthcare team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement **Fails to demonstrate** the ability to work with peers to create teaching-learning lesson plans keeping in mind the system errors, and assessment strategies **Lacks the ability to coach** junior postgraduates on following systems based practice	**Demonstrates** the ability to lead a quality improvement project to improve quality of care or access to resources (e.g., case presentation, consultation, test selection guidance) in the health care team. **Acquire** knowledge on the teaching learning methods and modalities of assessment **Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars, journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement **Demonstrates** the ability to work with peers to create teaching-learning lesson plans keeping in mind the system errors, and assessment strategies Coaches junior postgraduates on following systems-based practice

P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the pro fession **Fails to act** with honesty and truthfulness **Does not take** appropriate ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and **responsive** to requests for assistance; **completes** administrative duties (e.g., medical records, reports) on time and without reminders

	Lacks to be consistently punctual for clinical assignments and **lacks to be responsive** to requests for assistance; **c Fails to complete** administrative duties (e.g., medical records, reports) on time and without reminders **Fails to understand** and **recognize** the signs and symptoms of fatigue, stress, and substance abuse **Fails to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects **Does not take** ownership of system outcomes **Fails to design** new strategies to ensure that the needs of patients, teams, and systems are met **Fails to participate** in institutional or community peer counselling related to professionalism	**Understands and Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; **offers** assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects **Takes** ownership of system outcomes **Designs** new strategies to ensure that the needs of patients, teams, and systems are met **Participates** in institutional or community peer counselling related to professionalism

EPA 6: Form clinical questions and retrieve evidence to advance patient care	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to identify key clinical questions in caring for patients, identify information resources, and retrieve information and evidence that will be used to address those questions. Residents should have basic skill in critiquing the quality of the evidence and assessing applicability to their patients and the clinical context. Underlying the skill set of practicing evidence-based medicine is the foundational knowledge an individual has and the self-awareness to identify gaps and fill them.

2. Most relevant domains of competence:	**PC, PBLI, ICS, P**
3. Competencies within each domain critical to entrustment decisions:	**PC1.4** **PBLI1.4** **ICS2.3** **P2.4**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
PC 1	**Lacks understanding** of the principles of analysis and methodology of biochemical analytes **Unable** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Lacks understanding** of the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Does not familiarize** with the test characteristics for less commonly used tests, and understands how these affect the establishment of a definitive diagnosis **Lacks understanding** of the utility and methodology of currently outsourced biochemical tests and **fails to assist** with strengths and limitations of all test **Fails to observe and assist** with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings **Fails to understand** the most complex test platforms, methodology, and test indications. **Does not effectively teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Unable to interact** with other health care teams to discuss test results and make recommendations	**Understands** principles of analysis and methodology of biochemical analytes **Able** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Understands** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Familiarizes** with the test characteristics for less commonly used tests, and understands how these affect the establishment of a definitive diagnosis **Understands** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able** to significantly narrow a differential diagnosis using laboratory and clinical findings **Understands** the most complex test platforms, methodology, and test indications. **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts** with other health care teams to discuss test results and make recommendations.

PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence-based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Fails to critically appraise and apply** evidence to guide care, even in the face of conflicting data **Fails to independently performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines **Does not teach** others to critically appraise and apply evidence for complex cases; and/or **fails to participate** in the development of guidelines **Fails to suggest** improvements to research regulations and / or **does not contribute** to the primary literature through basic, translational, or clinical research.	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines **Teaches** others to critically appraise and apply evidence for complex cases; and/ or **participates** in the development of guidelines **Suggest** improvements to research regulations and/or substantially **contributes** to the primary literature through basic, translational, or clinical research. **Implements** institutional utilization guidelines for laboratory tests and results

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable).	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable).
	Lacks understanding that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently. **Fails to effectively communicate** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news) **Fails to coordinate** recommendations from different members of the team to optimize patient care.	**Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently. Effectively **communicates** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news) **Coordinates** recommendations from different members of the team to optimize patient care.

P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the profession. **Fails to act** with honesty and truthfulness Does not take appropriate ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail **Lacks to be consistently punctual** for clinical assignments and **lacks to be responsive** to requests for assistance; **c Fails to complete** administrative duties (e.g., medical re cords, reports) on time and without reminders **Fails to understand and recognize** the signs and symptoms of fatigue, stress, and substance abuse	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands and Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and
	Fails to recognize situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects	describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 7 : Evaluate and report clinical laboratory testing of critical values and special investigations	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to perform an accurate complete or focused evaluation and reporting of the clinical laboratory test in a prioritized, organized manner without supervision. The report should clinically correlate with the patient details. Identification of critical values must be made promptly without delay and communicated to the treating clinician in an organised manner and documented. This interpretation and reporting of a laboratory test serves as the basis for clinical work and as the building block for patient evaluation and management.
2. Most relevant domains of competence:	**MK, PC** **ICS** **SBP** **PBLI** **P**
3. Competencies within each domain critical to entrustment decisions:	**MK1.4,MK2.4** **PC1.4,PC3.4** **ICS2.4** **SBP2.3** **PBLI1.4** **P1.3**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 1	**Fails to demonstrate knowledge** of the importance of biomolecules in sustaining the life process, **fails to describe and apply** biochemical principles to explain the normal state and abnormal disease conditions, pertaining to Biomolecules and cell biology **Fails to apply** a broad based and in-depth knowledge in clinical and biomedical sciences relevant to a given clinical condition **Unable** to apply knowledge of general concepts related to the human genome, human genes and inheritance of DNA. **Fails to apply the knowledge** of Biochemistry for interpreting the findings in correlation with clinical features (knowledge)	**Demonstrates knowledge** of the importance of biomolecules in sustaining the life process, **describe and apply** biochemical principles to explain the normal state and abnormal disease conditions, pertaining to Biomolecules and cell biology **Applies** a broad based and in-depth knowledge in clinical and biomedical sciences relevant to a given clinical condition **Able** to apply knowledge of general concepts related to the human genome, human genes and inheritance of DNA. **Applies the knowledge** of Biochemistry for interpreting the findings in correlation with clinical features (knowledge)
MK 2	**Fails to demonstrate** basic medical knowledge of cellular, and molecular systems and its inter-relation to nutrition in health and disease **Fails to apply** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups (amino-acidopathies , disorders of carbohydrate metabolism, fatty acid oxidation disorders, lysosomal storage diseases, mitochondrial disorders, organic acidurias, urea cycle disorders) **Fails to apply** cellular, and molecular knowledge to identify pathologic processes, **unable to select and recommend** diagnostic studies for disease states including IBEM **Fails to apply** advanced knowledge of cellular, and molecular basis to common diagnoses **Unable to select and order** confirmatory laboratory studies. **Fails to demonstrate** knowledge of triage for individuals with abnormal tests and NBS results	**Demonstrates** basic medical knowledge of cellular, and molecular systems and its inter-relation to nutrition in health and disease **Applies** knowledge of molecular and metabolic pathogenesis of disease to diagnosis and treatment recognizes signs and symptoms of inborn errors of metabolism, including these disease groups (amino-acidopathies , disorders of carbohydrate metabolism, fatty acid oxidation disorders, lysosomal storage diseases, mitochondrial disorders, organic acidurias, urea cycle disorders) **Applies** cellular, and molecular knowledge to identify pathologic processes, **selects and recommends** diagnostic studies for disease states including IBEM **Applies** advanced knowledge of cellular, and molecular basis to common diagnoses **Selects and orders** confirmatory laboratory studies. **Demonstrates** knowledge of triage for individuals with abnormal tests and NBS results

	Fails to integrate advanced knowledge of cellular, and molecular pathology to common and uncommon diagnoses **Unable to interpret and apply** the information obtained from testing and **fails to generate** a differential diagnosis based on NBS results	**Integrates** advanced knowledge of cellular, and molecular pathology to common and uncommon diagnoses **Able to Independently interpret and apply** the information obtained from testing and also **generates** a differential diagnosis based on NBS results
PC1	**Lacks understanding** of the principles of analysis and methodology of biochemical analytes **Unable** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Lacks understanding** of the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Does not familiarize** with the test characteristics for less commonly used tests , and understands how these affect the establishment of a definitive diagnosis **Unable to describe** the utility and methodology of currently outsourced biochemical tests and **fails to assist** with strengths and limitations of all test **Fails to observe and assist** with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings **Fails to analyse** the most complex test platforms, methodology, and test indications. **Does not effectively teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Fails to interact** with other health care teams to discuss test results and make recommendations	**Understands** principles of analysis and methodology of biochemical analytes **Able** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Understands** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Familiarizes** with the test characteristics for less commonly used tests , and understands how these affect the establishment of a definitive diagnosis **Able to describe** the utility and methodology of currently outsourced biochemical tests and **assists** with strengths and limitations of all test **Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able** to significantly narrow a differential diagnosis using laboratory and clinical findings **Able to analyse** the most complex test platforms, methodology, and test indications. **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts** with other health care teams to discuss test results and make recommendations

PC 3	**Unable to** suggest disease specific tests for diagnosis, screening and monitoring health problems **Unable to** offer dietary and supportive management, offers and provides disease modifying therapy (eg: solid organ transplant, enzyme replacement therapy, cell based therapy) **fails to screen and provide** referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluation **Unable to** assimilate information on more complex test platforms, methodology, and test indications. **Fails to compute** the utility and methodology of currently outsourced chemistry tests	**Able to** suggest disease specific tests for diagnosis, screening and monitoring health problems **Able to** offer dietary and supportive management, offers and provides disease modifying therapy (eg: solid organ transplant, enzyme replacement therapy, cell based therapy) **screens and provides** referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluation **Able to** assimilate information on more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests **Independently prepares** full and complete consultative reports
ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **Fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) Does not use active listening to adapt communication style to fit needs. Fails to produce a clear and understandable written report effectively and consistently.	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates and provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently. Effectively **communicates** complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news)

	Fails to effectively communicate complex, difficult, or challenging information (e.g., errors, complications, adverse events, and bad news) **Unable to independently and compassionately** deliver medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Coordinates** recommendations from different members of the team to optimize patient care. **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict
SBP2	**Fails to actively participate** in, or performs, inspections of laboratory so as to establish total quality management **Lacks understanding** that laboratories are regulated by professional bodies. **Fails to demonstrate** compliance with national regulations for patient privacy and confidentiality **Lacks understanding of** the basics of quality assurance according to (NABL,NABH and ISO 15189) guidelines **Fails to review** IQC and proficiency testing results. **Unable to** implement corrective and preventive action based on IQC and proficiency testing results	**Actively participates** in, or performs, inspections of laboratory so as to establish total quality management **Understands** that laboratories are regulated by professional bodies. **Demonstrates** compliance with national regulations for patient privacy and confidentiality **Understands** the basics of quality assurance according to (NABL,NABH and ISO 15189) guidelines **Reviews** IQC and proficiency testing results. **Able to** implement corrective and preventive action based on IQC and proficiency testing results **Participates** as a team member in mock or actual inspection of a laboratory, or equivalent
PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence based **utilization of laboratory** tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care

	Fails to apply knowledge of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results Fails to critically appraise and apply evidence to guide care, even in the face of conflicting data Fails to independently performs a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and fails to design utilization guidelines	**Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines
P1	**Fails to demonstrate** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Does not describe** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **Unable to identify and describe** potential triggers for professionalism lapses **Fails to analyze** straight forward situations using ethical principles **Fails to demonstrate** insight into professional behavior in routine situations; **Does not take responsibility** for own professionalism lapses	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **identifies and describes** potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; **takes responsibility** for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations

EPA 8 : Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident should have knowledge of the various preanalytical, analytical and post analytical factors that could interfere with the analysis of a biochemical investigation and its interpretation. The resident should also have knowledge about the technical know-how for detecting them and appropriately communicating to the concerned clinician about the measures required to be taken to prevent such factors and thus promote safe, optimum and reliable patient care services.

2. Most relevant domains of competence:	**MK** **PC** **ICS** **SBP** **PBLI** **P**
3. Competencies within each domain critical to entrustment decisions:	**MK3.4** **PC1.4, PC4.4** **ICS1.4** **SBP1.4** **PBLI1.4** **P1.3**
4. Methods of assessment	4. Written exam and practicals (Every 6 months)Workplace assessment by Faculty 5. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 3	**Fails to describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Lacks understanding of** the technology and utilization of diagnostic testing **Fails to describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication techniques to study in vivo metabolism - NMR, SPECT, PET	**Describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Understands** the technology and utilization of diagnostic testing **Describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication techniques to study in vivo metabolism - NMR, SPECT, PET
	scans, radioisotope-based techniques and its applications **Does not identify** troubleshoot and **fails to resolve** equipment related issues. **Not able to identify** best methods for diagnosis and subsequent laboratory monitoring	scans, radioisotope-based techniques and its applications **Identifies** troubleshoot and **resolves** equipment related issues. **Able to identify** best methods for diagnosis and subsequent laboratory monitoring

PC 1	**Lacks understanding** of the principles of analysis and methodology of biochemical analytes **Unable** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **unable to explain** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Does not familiarize** with the test characteristics for less commonly used tests , and understands how these affect the establishment of a definitive diagnosis **Lacks understanding** of the utility and methodology of currently outsourced biochemical tests and **fails to assist** with strengths and limitations of all test **Fails to observe and assist** with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings **Fails to understand** the most complex test platforms, methodology, and test indications.. **Fails to interact** with other health care teams to discuss test results and make recommendations	**Explain the indications** for ordering specific tests and interpretation of commonly used biochemical tests. **Describe** the principles of analysis and methodology of biochemical analytes **Able to perform, interpret, and report** less commonly used biochemical tests. **Able to analyse with the test characteristics** for less commonly used tests, and delineates how these affect the establishment of a definitive diagnosis **Able to describe** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Explains** the utility and methodology of currently outsourced biochemical tests and **assists** with strengths and limitations of all test **Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able** to significantly narrow a differential diagnosis using laboratory and clinical findings Able to analyse the most complex test platforms, methodology, and test indications. **Effectively** teaches the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts** with other health care teams to discuss test results and make recommendations

PC 4	**Fails to describe** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **lacks understanding of** how these affect the establishment of a definitive diagnosis **Fails to prepare** a differential diagnosis for abnormal test results or finding. **Lacks understanding of** justifications for additional testing. **Fails to understand** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory	**Describes** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **understands** how these affect the establishment of a definitive diagnosis **Prepares** a differential diagnosis for abnormal test results or finding. **Understands** justifications for additional testing. **Understands** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory
ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate. **Unable to communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision
SBP 1	**Fails to demonstrate** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Lacks** knowledge on the teaching learning methods and modalities of assessment **Fails to observe** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions	**Demonstrates** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Acquire** knowledge on the teaching learning methods and modalities of assessment **Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions

	Fails to incorporate multiple TL methods during seminars , journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement **Fails to demonstrate** the ability to work with peers to create teaching-learning lesson plans keeping in mind the system errors, and assessment strategies **Lacks the ability to coach** junior postgraduates on following systems based practice	**Incorporates** multiple TL methods during seminars , journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement **Demonstrates** the ability to work with peers to create teaching-learning lesson plans keeping in mind the system errors, and assessment strategies **Coaches** junior postgraduates on following systems based practice
PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Fails to critically appraise and apply** evidence to guide care, even in the face of conflicting data. **Fails to independently performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines **Does not teach** others to critically appraise and apply evidence for complex cases; and/or **fails to participate** in the	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data. Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines **Teaches** others to critically appraise and apply evidence for complex cases; and/or **participates** in the development of guidelines Suggest improvements to research regulations and/or substantially

	development of guidelines **Fails to suggest** improvements to research regulations and/or **does not contribute** to the primary literature through basic, translational, or clinical research. **Fails to implement** institutional utilization guidelines for laboratory tests and results	**contributes** to the primary literature through basic, translational, or clinical research. **Implements** institutional utilization guidelines for laboratory tests and results
P1	**Fails to demonstrate** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Does not describe** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **Unable to identify and describe** potential triggers for professionalism lapses Fails to analyze straight forward situations using ethical principles **Fails to demonstrate** insight into professional behavior in routine situations; **Does not take responsibility** for own professionalism lapses **Fails to recognize** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to demonstrate** professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **identifies and describes** potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; **takes responsibility** for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 9 : Provide biochemistry support for interdisciplinary conferences	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to correlate biochemical aspects with other basic sciences and clinical sciences and should be able to provide in-depth biochemistry support to interdisciplinary conferences, clinicopathological meetings including active participation and guidance regarding biochemical aspects.
2. Most relevant domains of competence:	**PC, ICS, SBP** **PBLI** **P**

3. Competencies within each domain critical to entrustment decisions:	**PC 3.4** **ICS 1.4** **SBP 3.3** **PBLI 1.4** **P 2.4**
4. Methods of assessment	1. Workplace assessment by Faculty 2. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
PC 3	**Unable to** suggest disease specific tests for diagnosis, screening and monitoring health problems **Unable to** offer dietary and supportive management, offers and provides disease modifying therapy (eg: solid organ transplant, enzyme replacement therapy, cell based therapy) **fails to screen and provide** referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluation **Unable to** assimilate information on more complex test platforms, methodology, and test indications. **Fails to compute** the utility and methodology of currently outsourced chemistry tests	**Able to** suggest disease specific tests for diagnosis, screening and monitoring health problems **Able to** offer dietary and supportive management, offers and provides disease modifying therapy (eg: solid organ transplant, enzyme replacement therapy, cell based therapy) **screens and provides** referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluation **Able to** assimilate information on more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests. **independently** prepares full and complete consultative reports

ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate.	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language Establishes rapport in challenging patient encounters, as appropriate.
	Unable to communicate to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **unable to independently, sensitively, and compassionately deliver** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately** delivers medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

SBP 3	**Unaware** of the role of a biochemist in managing personnel **Unable to interpret** an organizational chart **Fails to recognize** different budget types (i.e., capital vs. operating budget) **Fails to recognize** how health care systems influence individual practice and patient care **Insensitive** to cost-effective care **Lacks knowledge of** the personnel and lines of reporting in the laboratory **Fails to describe** the elements of a budget. **Unable to function** effectively within different systems of the health care system **Fails to describe** the process of personnel management and employment laws **Unable to advocate** for laboratory services to enhance cost-effective care **Fails to implement** state, national,and professional organizations' standards, or elements of checklists in the laboratory	**Aware** of the role of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) **Recognizes** how health care systems influence individual practice and patient care Sensitive to cost-effective care **Knows** the personnel and lines of reporting in the laboratory **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates** for laboratory services to enhance cost-effective care **Implements** state, national,and professional organizations' standards, or elements of checklists in the laboratory
PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence-based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics,

	Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Fails to critically** appraise and apply evidence to guide care, even in the face of conflicting data. **Fails to independently performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines **Does not teach** others to critically appraise and apply evidence for complex cases; and/or fails to participate in the development of guidelines **Fails to suggest** improvements to research regulations and/or **does not contribute** to the primary literature through basic, translational, or clinical research. **Fails to implement** institutional utilization guidelines for laboratory tests and results	Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data. Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines **Teaches** others to critically appraise and apply evidence for complex cases; and/or **participates** in the development of guidelines **Suggest** improvements to research regulations and/or substantially **contributes** to the primary literature through basic, translational, or clinical research. **Implements** institutional utilization guidelines for laboratory tests and results

P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the profession **Fails to act** with honesty and truthfulness **Does not take appropriate** ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail Lacks to be consistently punctual for clinical assignments and lacks to be responsive to requests for assistance; c Fails to complete administrative duties (e.g., medical records, reports) on time and without reminders	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and **responsive** to requests for assistance; **completes** administrative duties (e.g., medical records, reports) on time and without reminders
	Fails to understand and recognize the signs and symptoms of fatigue, stress, and substance abuse **Fails to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Understands** and **Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; **offers** assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 6: Form clinical questions and retrieve evidence to advance patient care	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Residents should be able to describe various disease states, the biochemical alterations that can be expected in such situations. This is required to correlate the biochemical reports of patients and provide appropriate guidance in its interpretation and suggest further evidence-based Investigations that may be needed for the management of the patient in a timely manner.
2. Most relevant domains of competence:	**PC, ICS, SBP** **PBLI** **P**
3. Competencies within each domain critical to entrustment decisions:	**PC 2.3** **ICS 1.4** **ICS 2.3** **SBP 1.4** **PBLI 1.4** **P 1.3** **P 2.4**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
PC 2	**Unable to infer** the role of the consultant in Biochemistry. **Fails to observe and assist** in the consultation. **Fails to demonstrate** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Fails to perform** clinically useful consultation in a timely manner. **Fails to prepare** full and complete consultative reports. **Fails to** effectively **communicate** consultative recommendations and action plans and maintains a portfolio.	**Able to infer** the role of the consultant in Biochemistry. **Observes and assists** in the consultation. **Demonstrates** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports. Effectively **communicates** consultative recommendations and action plans and maintains a portfolio.

ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate. **Unable to communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Fails to independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict
ICS 2	**Fails to recognize** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record.	**Recognizes** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record.
	Fails to communicate with guidance, **Fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently.	**Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently.

SBP 1	**Lacks** knowledge on the teaching learning methods and modalities of assessment **Fails to recognize the importance and does not observe** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars, journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement	**Acquire** knowledge on the teaching learning methods and modalities of assessment **Recognizes the importance and observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars, journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement
PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence-based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results

	practice, including laboratory tests and results **Fails to critically appraise and apply** evidence to guide care, even in the face of conflicting data. **Fails to** independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines	**Critically appraises and applies** evidence to guide care, even in the face of conflicting data. Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines
P 1	**Fails to demonstrate** knowledge of the ethical principles underlying informed consent, surrogate decision making, advancedirectives, confidentiality, error disclosure, stewardship of limited resources **Does not describe** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **Unable to identify and describe** potential triggers for professionalism lapses **Fails to analyze** straight forward situations using ethical principles **Fails to demonstrate** insight into professional behavior in routine situations; **Does not take responsibility** for own professionalism lapses **Fails to recognize** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to demonstrate** professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **identifies and describes** potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; **takes responsibility** for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations
P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the profession **Fails to act** with honesty and truthfulness	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **per**

	Does not take appropriate ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail **Lacks to be consistently punctual** for clinical assignments and **lacks to be responsive** to requests for assistance; **c Fails to complete** administrative duties (e.g., medical records, reports) on time and without remind ers **Fails to understand and recognize** the signs and symptoms of fatigue, stress, and substance abuse **Fails to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**forms** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and **responsive** to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** and **Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; **offers** assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 11: Optimize test utilization	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Resident should be able to compute the availability of resources, know the indications of the routine and special tests performed, so as to be able to identify unnecessary tests ordered and guide clinicians on the appropriate requisitions for laboratory testing
2. Most relevant domains of competence:	**MK** **PC** **ICS** **SBP, PBLI, P**

3. Competencies within each domain critical to entrustment decisions:	**MK 3.4** **PC 1.4** **ICS 2.3** **SBP 3.3** **PBLI 2.5** **P 1.3**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 3	**Fails to describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Lacks understanding of** the technology and utilization of diagnostic testing **Fails to describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Does not identify** trouble shoot and **fails to resolve** equipment related issues. **Unable to identify** best methods for diagnosis and subsequent laboratory monitoring	**Describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Understands** the technology and utilization of diagnostic testing **Describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Identifies** trouble shoot and **resolves** equipment related issues. **Identifies** best methods for diagnosis and subsequent laboratory monitoring

PC 1	**Lacks understanding** of the principles of analysis and methodology of biochemical analytes **Unable** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Lacks understanding** of the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Does not familiarize** with the test characteristics for less commonly used tests , and understands how these affect the establishment of a definitive diagnosis **Lacks understanding** of the utility and methodology of currently outsourced biochemical tests and **fails to assist** with strengths and limitations of all test	**Understands** principles of analysis and methodology of biochemical analytes **Able** to perform, interpret, and report routine and less commonly used biochemical tests and correlate with laboratory datas. **Understands** the indications for ordering specific tests and interpretation of commonly used biochemical tests. **Familiarizes** with the test characteristics for less commonly used tests , and understands how these affect the establishment of a definitive diagnosis **Understands** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test
	Fails to observe and assist with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings **Fails to understand** the most complex test platforms, methodology, and test indications. **Does not effectively teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Fails to interact** with other health care teams to discuss test results and make recommendations	**Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able** to significantly narrow a differential diagnosis using laboratory and clinical findings **Understands** the most complex test platforms, methodology, and test indications. **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts** with other health care teams to discuss test results and make recommendations

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **Fails to provide** timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently.	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently.
SBP 3	**Unaware** of the role of a biochemist in managing personnel **Unable to interpret** an organizational chart **Fails to recognize** different budget types (i.e., capital vs. operating budget)	**Aware** of the role of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) Recognizes how health care systems influence

	Fails to recognize how health care systems influence individual practice and patient care **Insensitive** to cost-effective care **Lacks knowledge of** the personnel and lines of reporting in the laboratory **Fails to describe** the elements of a budget. **Unable to function** effectively within different systems of the health care system **Fails to describe** the process of personnel management and employment laws **Unable to advocate** for laboratory services to enhance cost-effective care **Fails to implement** state, national,and professional organizations' standards, or elements of checklists in the laboratory	individual practice and patient care **Sensitive** to cost-effective care **Knows** the personnel and lines of reporting in the laboratory **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates** for laboratory services to enhance cost-effective care **Implements** state, national,and professional organizations' standards, or elements of checklists in the laboratory
PBLI 2	**Fails to identify** gaps in knowledge and expertise in his own knowledge of biochemistry. **Does not accept** responsibility for personal and professional development by establishing goals **Fails to identify** the gap(s) between expectations and actual performance **Does not seek** opportunities to improve **Fails to incorporate** feedback for improving his knowledge and skills in the gap . **Does not demonstrate** openness to receiving performance data and feedback in order to inform goals **Fails to analyze and reflect** on the factors which contribute to gap(s) between expectations and actual performance **Unable to design and implement** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. Does not seek performance data and feedback with humility Fails to institute behavioral change(s) to narrow the gap(s) between expectations and actual performance	**Identifies** gaps in knowledge and expertise in his own knowledge of biochemistry. **Accepts** responsibility for personal and professional development by establishing goals **Identifies** the gap(s) between expectations and actual performance Actively **seeks** opportunities to improve **Incorporates** feedback for improving his knowledge and skills in the gap . **Demonstrates** openness to receiving performance data and feedback in order to inform goals **Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Designs and implements** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Seeks** performance data and feedback with humility **Institutes** behavioral change(s) to narrow the gap(s) between expectations and actual performance **Critically evaluates** the effectiveness of behavioral changes in narrowing the

		gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary **Applies the principles of self-directed** learning in identifying and correcting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility **Teaches others** reflective practice **Facilitates the design and implementing** learning plans for others
P 1	**Fails to demonstrate** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Does not describe** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **Unable to identify and describe** potential triggers for professionalism lapses **Fails to analyze** straight forward situations using ethical principles **Fails to demonstrate** insight into professional behavior in routine situations; **Does not take responsibility** for own professionalism lapses **Fails to recognize** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to demonstrate** professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **identifies and describes** potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; **takes responsibility** for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 12: Improve quality and patient safety in laboratory	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident must be able to contribute to a culture that promotes patient safety, analyze patient safety incidents to enhance systems of care. Contribute to quality management in laboratory, the formulation and execution of a quality plan of action, and the assessment of that plan.

2. Most relevant domains of competence:	**MK, PC, ICS, SBP, PBLI, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK3.4, MK 5.5** **PC2.3, PC3.4, PC4.4,** **ICS2.3** **SBP 2.3, SBP3.3** **PBLI 1.4** **P2.4**
4. Methods of assessment	1. Periodic written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK3	**Not able** describe the working principle, instrumentation and uses of routine analytical techniques in a clinical biochemistry laboratory. **Unable to explain** the technology and utilization of diagnostic testing **Unable** to describe the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Not able to** Identify trouble shoot and resolve equipment related issues. **Inability to Identify** best methods for diagnosis and subsequent laboratory monitoring	**Describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Able to explain** the technology and utilization of diagnostic testing **Describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Identifies** trouble shoot and resolves equipment related issues. **Identifies** best methods for diagnosis and subsequent laboratory monitoring

MK5	**Unable to illustrate** the need for knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes including hematology and microbiology **Lacks ability to** Demonstrates the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Lack of medical knowledge** to interpret and report routine investigations in hematology and microbiology with	**Able to illustrate** the need for knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes including hematology and microbiology **Demonstrates** the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Applies** medical knowledge to interpret and report routine investigations in hematology and microbiology with
	clinical correla tion, under supervision and independently **Does not participate** in interdepartmental presentations	clinical correlation, under supervision and independently **Participates** in interdepartmental presentations
PC2	**Unable to** infer the role of the consultant in Biochemistry. **Fails to** observe and assist in the consultation **Not Able** to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Unable to perform** clinically useful consultation in a timely manner. **Unable to prepare** full and complete consultative reports with even faculty member guidance **Not able to** Effectively communicates consultative recommendations and action plans and maintain a portfolio	**Able to** infer the role of the consultant in Biochemistry. **Observes and assists** in the consultation **Able to use** the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance **Effectively communicates** consultative recommendations and action plans and maintains a portfolio, **independently prepares** full and complete consultative reports

PC 3	**Fails to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Unable to provide** Dietary and supportive, management, disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provide referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations **Not aware of** more complex test platforms, methodology, and test indications. **Not able to** recognise the utility and methodology of currently outsourced chemistry tests **Unable to teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing	**Able to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Able to provide** dietary and supportive, management, **offers and provides** disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provides referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations. **Able to assimilate information** regarding more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing
PC4	**Unable to familiar with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **does not explain how** these affect the establishment of a definitive diagnosis **Unable to prepare a differential** diagnosis for abnormal test results or finding. **Unable to justify** additional testing. **Fails to identify** the strengths and limitations of all tests used in biochemistry in cluding those sent to a reference laboratory **Unable to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Becomes familiar with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **explains how** these affect the establishment of a definitive diagnosis **Prepares a differential** diagnosis for abnormal test results or finding. **Justifies for** additional testing. **Identifies** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Able to suggest** an evidence-based solution to outliers in IQC based on laboratory data

ICS2	**Does not recognise** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Unable to conform** to the fact that the written report is a form of communication that must be clear and understandable. **Unable to** Effectively utilizes the electronic medical record **Not able to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Lacks ability** to produce a clear and understandable written report information effectively **Does not Use** active listening to adapt communication style to fit needs. **Unable to** Independently communicates with healthcare team.	**Recognises** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Conforms to the fact** that written report is a form of communication that must be clear and understandable. **Effectively** utilizes the electronic medical record **Communicates/Provides** timely and effective communication with health care providers, families, and patients (as applicable) with guidance, **Produces** a clear and understandable written report information effectively **Uses active listening** to adapt communication style to fit needs. Independently communicates with healthcare team.
SBP2	**Unable to associate** that laboratories are regulated by professional bodies. **Fails to Demonstrates compliance** with national regulations for patient privacy and confidentiality **Unable to Describe** the basics of quality assurance according to (NABL, NABH and ISO 15189) guidelines	**Able to associate** that laboratories are regulated by professional bodies. **Demonstrates** compliance with national regulations for patient privacy and confidentiality **Explains** the basics of quality assurance according to (NABL, NABH and ISO 15189) guidelines
	Fails to Review IQC and proficiency testing results. **Unable to implement** corrective and preventive action based on IQC and proficiency testing results.	**Reviews IQC** and proficiency testing results. **Able to implement** corrective and preventive action based on IQC and proficiency testing results.

SBP 3	**Unaware of the role** of a biochemist in managing personnel **Not able to interpret** an organizational chart and recognize different budget types (i.e., capital vs. operating budget) **Unable to recognize** how health care systems influence individual practice and patient care Sensitive to cost-effective care **Not able to describe** the elements of a budget and **function** effectively within different systems of the health care system **Unable to Describe** the process of personnel management and employment laws. **Not able to Advocate** for laboratory services to enhance cost-effective care **Does not implement** state, national, and professional organizations' standards, or elements of checklists in the laboratory	**Aware of the role** of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) Recognizes how health care systems influence individual practice and patient care Sensitive to cost-effective care **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates for** laboratory services to enhance cost-effective care **Implements** state, national, and professional organizations' standards, or elements of checklists in the laboratory
PBLI 1	**Unable to Demonstrate** how to access and select applicable evidence **Not Aware of** the need for patient privacy, autonomy, and consent as applied to clinical research. **Not able to Demonstrate** the importance of evidence-based utilization of laboratory tests and results **Does not Identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lack of interest to develop** knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Unable to Apply knowledge** of the basic principles of research such as informed consent and	**Demonstrates** how to access and select applicable evidence **Aware of** the need for patient privacy, autonomy, and consent as applied to clinical research. **Demonstrates** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple cases **Develops** knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Identifies and applies** the best available evidence to guide diagnostic work-up of complex cases **Applies knowledge** of the basic principles of research such as in
	research protocols to clinical practice, with assistance including laboratory tests and results	formed consent and research protocols to clinical practice, with assistance including laboratory tests and results

P2	**Does not take appropriate ownership and perform** tasks and responsibilities in a timely manner with attention to detail **Lack of punctuality** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Unable to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describe the impact on team **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Unable to Anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Unable to** offer assistance to ensure patient care duties are completed in a timely fashion **lacks to Demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Takes appropriate ownership and performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Anticipates and intervenes in** situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** other to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 13: Evaluate and choose a new test/assay or instrument	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident must be able to analyse the need of the community, hospital or population and appropriately choose a test/assay and the type of instrument needed for the laboratory to provide health care services.
2. Most relevant domains of competence:	**MK, PC, ICS, SBP, PBLI, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK3, MK 5** **PC1, PC3, PC4,** **ICS1, ICS2** **SBP 1, SBP3** **PBLI 1** **P2**

4. Methods of assessment	1. Periodic written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK3	**Not able** describe the working principle, instrumentation and uses of routine analytical techniques in a clinical biochemistry laboratory. **Unable to explain** the technology and utilization of diagnostic testing **Unable** to describe the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Not able to** Identify trouble shoot and resolve equipment related issues. **Inability to Identify** best methods for diagnosis and subsequent laboratory monitoring	**Describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Able to explain** the technology and utilization of diagnostic testing **Describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Identifies** trouble shoot and resolves equipment related issues. **Identifies** best methods for diagnosis and subsequent laboratory monitoring
MK5	**Unable to illustrate** the need for knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes including hematology and microbiology **Lacks ability to** Demonstrates the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Lack of medical knowledge** to interpret and report routine investigations in hematology and microbiology with clinical correlation, under supervision and independently **Does not participate** in interdepartmental presentations	**Able to illustrate** the need for knowledge of pathogenesis, diagnostic techniques, and prognostic factors in disease processes including hematology and microbiology **Demonstrates** the application of basic textbook-level knowledge as it applies to clinical problems in medical microbiology and hematology **Applies** medical knowledge to interpret and report routine investigations in hematology and microbiology with clinical correlation, under supervision and independently **Participates** in interdepartmental presentations

PC1	**Not able to explain** the indications for ordering specific tests and interpretation of commonly used biochemical tests.	**Explain** the indications for ordering specific tests and interpretation of commonly used biochemical tests.
	Unable to describe principles of analysis and methodology of biochemical analytes **Not** Able to perform, interpret, and report less commonly used biochemical tests. **Unable to analyse** test characteristics for less commonly used tests, and how these affect the establishment of a definitive diagnosis **Not able to describe** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Lacks to observe** and **fails to** assist with interaction with other health care teams to discuss test results and make recommendations **Unable** to significantly narrow a differential diagnosis using laboratory and clinical findings **Fails to analyse** the most complex test platforms, methodology, and test indications. **Unable to effectively teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Fails to interact** with other health care teams to discuss test results and make recommendations	**Describe** principles of analysis and methodology of biochemical analytes **Able to** perform, interpret, and report less commonly used biochemical tests. **Able to analyse** test characteristics for less commonly used tests, and how these affect the establishment of a definitive diagnosis **Able to describe** the utility and methodology of currently outsourced biochemical tests and assists with strengths and limitations of all test **Observes and assists** with interaction with other health care teams to discuss test results and make recommendations **Able to** significantly narrow a differential diagnosis using laboratory and clinical findings **Analyse** the most complex test platforms, methodology, and test indications. **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing. **Interacts** with other health care teams to discuss test results and make recommendations

PC 3	**Fails to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Unable to provide** Dietary and supportive, management, disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provide referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations **Not aware of** more complex test platforms, methodology, and test indications. **Not able to** recognise the utility and methodology of currently outsourced chemistry tests **Does not effectively teach** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing	**Able to suggest disease-specific** tests for diagnosis, screening and monitoring health problems. **Able to provide** dietary and supportive, management, **offers and provides** disease modifying therapy (e.g., solid organ transplant, enzyme replacement therapy, cell-based therapy), screens and provides referral for neurodevelopmental disorders, orders disease-specific monitoring and referrals for further evaluations. **Able to assimilate information** regarding more complex test platforms, methodology, and test indications. **Computes** the utility and methodology of currently outsourced chemistry tests **Effectively teaches** the salient features of chemistry testing, including the utility, and the strengths and limitations of the various methods of testing
PC4	**Unable to familiarize with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **does not explain how** these affect the establishment of a definitive diagnosis **Fails to prepare a differential** diagnosis for abnormal test results or finding. **Unable to justify** for additional testing. **Fails to identify** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Unable to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Becomes familiar with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **explains how** these affect the establishment of a definitive diagnosis **Prepares a differential** diagnosis for abnormal test results or finding. **Justifies for** additional testing. **Identifies** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Able to suggest** an evidence-based solution to outliers in IQC based on laboratory data

ICS1	**Not able to use language and nonverbal behavior to demonstrate** respect and establish rapport. **Unable to** Identify common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Does not demonstrate** usage of active listening and clear language **Unable to Establish rapport in challenging patient** encounters, as appropriate. **Not able to Communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Unable to independently, sensitively, and compassionately deliver** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Uses language and nonverbal behavior to demonstrate** respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes rapport in challenging patient** encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict
ICS2	**Does not recognise** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Unable to conform** to the fact that the written report is a form of communication that must be clear and understandable. **Unable to** Effectively utilizes the electronic medical record **Not able to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Lacks ability** to produce a clear and understandable written report information effectively **Does not Use** active listening to adapt communication style to fit needs. **Unable to** Independently communicate with healthcare team.	**Recognises** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Conforms to the fact** that written report is a form of communication that must be clear and understandable. **Effectively** utilizes the electronic medical record **Communicates/Provides** timely and effective communication with health care providers, families, and patients (as applicable) with guidance, **Produces** a clear and understandable written report information effectively **Uses active listening** to adapt communication style to fit needs. Independently communicates with healthcare team.

SBP1	**Lacks** knowledge on the teaching learning methods and modalities of assessment **Fails to recognize the importance and does not observe** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars, journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement	**Acquire** knowledge on the teaching learning methods and modalities of assessment **Recognizes the importance and observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars, journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement
SBP 3	**Unaware of the role** of a biochemist in managing personnel **Not able to interpret** an organizational chart and **recognize** different budget types (i.e., capital vs. operating budget) **Unable to recognize** how health care systems influence individual practice and patient care Insensitive to cost-effective care	**Aware of the role** of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) **Recognizes** how health care systems influence individual practice and patient care Sensitive to cost-effective care
	Not able to describe the elements of a budget and **function** effectively within different systems of the health care system **Unable to Describe** the process of personnel management and employment laws. **Not able to Advocate for** laboratory services to enhance cost-effective care **Does not implement** state, national, and professional organizations' standards, or elements of checklists in the laboratory	**Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates for** laboratory services to enhance cost-effective care **Implements** state, national, and professional organizations' standards, or elements of checklists in the laboratory

	Unable to Demonstrate how to access and select applicable evidence	**Demonstrates** how to access and select applicable evidence
	Not Aware of the need for patient privacy, autonomy, and consent as applied to clinical research.	**Aware of** the need for patient privacy, autonomy, and consent as applied to clinical research.
	Not able to Demonstrate the importance of evidence-based utilization of laboratory tests and results	**Demonstrates** the importance of evidence-based utilization of laboratory tests and results
	Does not Identify and apply the best available evidence to guide diagnostic workup of simple and complex cases	**Identifies and applies** the best available evidence to guide diagnostic workup of simple cases
	Lack of interest to develop knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care	**Develops** knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care
PBLI 1	**Unable to Apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, with assistance including laboratory tests and results	**Identifies and applies** the best available evidence to guide diagnostic work-up of complex cases
	Fails to critically appraise and apply evidence to guide care, even in the face of conflicting data.	**Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, with assistance including laboratory tests and results
	Fails to independently performs a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines	**Critically appraises** and applies evidence to guide care, even in the face of conflicting data Proactively and consistently applies knowledge of the basic principles of research such as informed consent and research protocols to clinical practice. Independently
		performs a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and designs utilization guidelines

P2	**Does not take appropriate ownership and perform** tasks and responsibilities in a timely manner with attention to detail **Lack of punctuality** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Unable to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describe the impact on team **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Unable to Anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Unable to** offer assistance to ensure patient care duties are completed in a timely fashion **lacks to Demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Takes appropriate ownership and performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** other to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 14: Perform a laboratory Audit	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident must be able to make statement of facts and observations made after an investigation or inspection of a laboratory, clinic, or facility where research is carried out. A laboratory audit program is critical to ensuring the institution meets applicable requirements
2. Most relevant domains of competence:	**MK, PC, ICS, SBP, PBLI, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK3.4** **PC4.4,** **ICS2.3** **SBP2.3,** **SBP3.3** **PBLI 1.4** **P1.3** **P2.4**

4. Methods of assessment	1. Periodic written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Patient b. Lab professionals c. Health care workers d. Peers

Competency	Pre-Entrustable	Entrustable
MK3	**Not able** describe the working principle, instrumentation and uses of routine analytical techniques in a clinical biochemistry laboratory. **Unable to explain** the technology and utilization of diagnostic testing **Unable** to describe the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Not able to Identify** trouble shoot and resolve equipment related issues. **Inability to Identify** best methods for diagnosis and subsequent laboratory monitoring	**Describe** the working principle, instrumentation and uses of routine Analytical techniques in a clinical biochemistry laboratory **Able to explain** the technology and utilization of diagnostic testing **Describe** the working principle, instrumentation and uses of Analytical techniques such as Nanotechnology and microfabrication Techniques to study in vivo metabolism - NMR, SPECT, PET scans, radioisotope-based techniques and its applications **Identifies** trouble shoot and resolves equipment related issues. **Identifies** best methods for diagnosis and subsequent laboratory monitoring
PC4	**Unable to familiarize with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **does not explain how** these affect the establishment of a definitive diagnosis **Fails to prepare a differential** diagnosis for abnormal test results or finding. **Unable to justify** additional testing. **Does not identify** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Unable to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Becomes familiar with the test characteristics** [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **explains how** these affect the establishment of a definitive diagnosis **Prepares a differential** diagnosis for abnormal test results or finding. **Justifies for** additional testing. **Identifies** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Able to suggest** an evidence-based solution to outliers in IQC based on laboratory data

ICS2	**Does not recognise** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Unable to conform** to the fact that the written report is a form of communication that must be clear and understandable. **Unable to** Effectively utilizes the electronic medical record **Not able to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Lacks ability** to produce a clear and understandable written report information effectively **Does not Use** active listening to adapt communication style to fit needs. **Unable to** Independently communicates with healthcare team.	**Recognises** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Conforms to the fact** that written report is a form of communication that must be clear and understandable. **Effectively** utilizes the electronic medical record **Communicates/Provides** timely and effective communication with health care providers, families, and patients (as applicable) with guidance, **Produces** a clear and understandable written report information effectively **Uses active listening** to adapt communication style to fit needs. Independently communicates with healthcare team.
SBP2	**Unable to associate** that laboratories are regulated by professional bodies. **Demonstrates compliance** with national regulations for patient privacy and confidentiality **Describes** the basics of quality assurance according to (NABL, NABH and ISO 15189) guidelines **Reviews** IQC and proficiency testing results. **Able to implement** corrective and preventive action based on IQC and proficiency testing results	**Able to associate** that laboratories are regulated by professional bodies. **Demonstrates** compliance with national regulations for patient privacy and confidentiality **Explains** the basics of quality assurance according to (NABL, NABH and ISO 15189) guidelines **Reviews IQC** and proficiency testing results. **Able to implement** corrective and preventive action based on IQC and proficiency testing results

SBP 3	**Unaware of the role** of a biochemist in managing personnel **Not able to interpret** an organizational chart and **recognize** different budget types (i.e., capital vs. operating budget) **Unable to recognize** how health care systems influence individual practice and patient care Insensitive to cost-effective care **Not able to describe** the elements of a budget and **function** effectively within	**Aware of the role** of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) **Recognizes** how health care systems influence individual practice and patient care Sensitive to cost-effective care **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system
	different systems of the health care system **Unable to Describe** the process of personnel management and employment laws. **Not able to Advocate for** laboratory services to enhance cost-effective care **Does not implement** state, national, and professional organizations' standards, or elements of checklists in the laboratory	**Describes** the process of personnel management and employment laws **Advocates for** laboratory services to enhance cost-effective care **Implements** state, national, and professional organizations' standards, or elements of checklists in the laboratory

PBLI 1	Fails to demonstrate how to access and select applicable evidence Unaware of the need for patient privacy, autonomy, and consent as applied to clinical research. Fails to understand the importance of evidence based utilization of laboratory tests and results Fails to identify and apply the best available evidence to guide diagnostic workup of simple and complex cases Lacks knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care Fails to apply knowledge of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results Fails to critically appraise and apply evidence to guide care, even in the face of conflicting data. Fails to independently performs a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and fails to design utilization guidelines	Demonstrates how to access and select applicable evidence Aware of the need for patient privacy, autonomy, and consent as applied to clinical research. Understands the importance of evidence based utilization of laboratory tests and results Identifies and applies the best available evidence to guide diagnostic workup of simple and complex cases Develops knowledge of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care Applies knowledge of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results Critically appraises and applies evidence to guide care, even in the face of conflicting data. Independently performs a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and designs utilization guidelines
P1	Fails to demonstrate knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources	Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources

	Does not describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; Unable to identify and describe potential triggers for professionalism lapses Fails to analyze straight forward situations using ethical principles Fails to demonstrate insight into professional behavior in routine situations; Does not take responsibility for own professionalism lapses Fails to recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations Unable to demonstrate professional behavior in complex or stressful situations	Describes when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses Analyzes straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses Recognizes the need and uses appropriate resources to seek help in managing and resolving complex ethical situations Demonstrates professional behavior in complex or stressful situations
P2	Does not take appropriate ownership and perform tasks and responsibilities in a timely manner with attention to detail Lack of punctuality for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders Unable to recognize situations that may impact own ability to complete tasks and responsibilities in a timely manner and describe the impact on team Recognizes signs and symptoms of fatigue, stress, and substance abuse Unable to Anticipate and intervene in situations that may impact others' ability to complete tasks and responsibilities in a timely manner Unable to offer assistance to ensure patient care duties are completed in a timely fashion lacks to Demonstrate self-awareness of fatigue and stress, and mitigates the effects	Takes appropriate ownership and performs tasks and responsibilities in a timely manner with attention to detail Consistently punctual for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders Understands the signs and symptoms of fatigue, stress, and substance abuse Recognizes situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team Serves as an example for others in punctuality, responsiveness, and timely completion of duties Recognizes signs and symptoms of fatigue, stress, and substance abuse Anticipates and intervenes in situations that may impact others' ability to complete tasks and responsibilities in a timely manner Coaches other to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion Demonstrates self-awareness of fatigue and stress, and mitigates the effects

EPA 15: Should be able to write a scientific protocol for clinical research	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Resident should be able to formulate a research question, derive objectives, design methodology and write up a comprehensive, clear and complete scientific protocol for clinical research for betterment of patient care services. This would entail improvement of scientific writing and communication skills besides identifying a solution to a research question for patient care
2. Most relevant domains of competence:	**MK** **PC** **ICS** **SBP** **PBLI** **P**
3. Competencies within each domain critical to entrustment decisions:	**MK 4.4** **PC 4.4** **ICS 1.4** **ICS 2.3** **SBP 3.3** **PBLI 1.4** **PBLI 2.5** **P 2.4**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 4	**Does not acquire** knowledge on the basics of research methodology and biostatistics **Unable** to write a research protocol with guidance **Fails to carry out** research work adequately under guidance and **cannot** draw inferences from the study.	**Acquire** knowledge on the basics of research methodology and biostatistics **Able** to write a research protocol with guidance **Carry out** research work under guidance and draw inferences from the study. **Critically appraise** articles and provide feedback

	Unable to critically appraise articles and provide feedback **Unable to present** the findings in scientific forums and **defend** the work	**Present** the findings in scientific forums and **defend** the work
PC 4	**Fails to describe** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **lacks understanding of** how these affect the establishment of a definitive diagnosis **Fails to prepare** a differential diagnosis for abnormal test results or finding. **Lacks understanding of** justifications for additional testing. Fails to understand the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Unable to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Describes** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **understands** how these affect the establishment of a definitive diagnosis **Prepares** a differential diagnosis for abnormal test results or finding. **Understands** justifications for additional testing. **Understands** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Able to suggest** an evidence-based solution to outliers in IQC based on laboratory data
ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate. **Unable to communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Fails to independently, sensitively, and compassionately deliver** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **Fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently.	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently.

SBP 3	**Unaware** of the role of a biochemist in managing personnel **Unable to interpret** an organizational chart Fails to recognize different budget types (i.e., capital vs. operating budget) **Fails to recognize** how health care systems influence individual practice and patient care **Insensitive** to cost-effective care **Lacks knowledge of** the personnel and lines of reporting in the laboratory **Fails to describe** the elements of a budget. **Unable to function** effectively within different systems of the health care system **Fails to describe** the process of personnel management and employment laws **Unable to advocate** for laboratory services to enhance cost-effective care	**Aware** of the role of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) Recognizes how health care systems influence individual practice and patient care **Sensitive** to cost-effective care **Knows** the personnel and lines of reporting in the laboratory **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates** for laboratory services to enhance cost-effective care **Implements** state, national, and professional organizations' standards, or elements of checklists in the laboratory
	Fails to implement state, national, and professional organizations' standards, or elements of checklists in the laboratory	

PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence-based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Fails to critically appraise and apply** evidence to guide care, even in the face of conflicting data. **Fails to** independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence-based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data. Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines
PBLI 2	**Fails to identify** gaps in knowledge and expertise in his own knowledge of biochemistry. **Does not accept** responsibility for personal and professional development by establishing goals **Fails to identify** the gap(s) between expectations and actual performance **Does not seek** opportunities to improve **Fails to incorporate** feedback for improving his knowledge and skills in the gap. **Does not demonstrate** openness to receiving performance data and feedback in order to inform goals	**Identifies** gaps in knowledge and expertise in his own knowledge of biochemistry. **Accepts** responsibility for personal and professional development by establishing goals **Identifies** the gap(s) between expectations and actual performance Actively **seeks** opportunities to improve **Incorporates** feedback for improving his knowledge and skills in the gap.

	Fails to analyse and reflect on the factors which contribute to gap(s) between expectations and actual performance **Unable to design and implement** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Does not seek** performance data and feedback with humility **Fails to institute** behavioral change(s) to narrow the gap(s) between expectations and actual performance	**Demonstrates** openness to receiving performance data and feedback in order to inform goals **Analysis and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Designs and implements** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Seeks** performance data and feedback with humility **Institutes** behavioral change(s) to narrow the gap(s) between expectations and actual performance **Critically evaluates** the effectiveness of behavioral changes in narrowing the gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary **Applies the principles of self-directed** learning in identifying and correcting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility **Teaches others** reflective practice **Facilitates the design and implementing** learning plans for others
P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the profession **Fails to act** with honesty and truthfulness **Does not take** appropriate ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail **Lacks to be consistently punctual** for clinical assignments and **lacks to be responsive**	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities Understands that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and **responsive** to requests for assistance; **completes** administrative duties (e.g., medical records,

	to requests for assistance; c **Fails to complete** administrative duties (e.g., medical records, reports) on time and without reminders **Fails to understand** and recognize the signs and symptoms of fatigue, stress, and substance abuse **Fails to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects	reports) on time and without reminders **Understands** and **Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team Serves as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; **offers** assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 16: Reporting and communication of scientific research	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Resident should be able to systematically collect, organise, analyse the data to derive meaningful conclusions and suggest translational value of the research work. The resident should further be able to communicate the findings in a clear, comprehensive and scientific way along with evidences supporting or refuting the research work.
2. Most relevant domains of competence:	**MK, PC, ICS, SBP, PBLI, P**

3. Competencies within each domain critical to entrustment decisions:	**MK 4.4** **PC 4.4** **ICS 1.4** **ICS 2.3** **SBP 3.3** **PBLI 1.4** **PBLI 2.5** **P 2.4**
4. Methods of assessment	1. Written exam (Every 6 months) 2. Workplace assessment by Faculty 3. Multisource feedback a. Lab professionals b. Health care workers c. Peers

Competency	Pre-Entrustable	Entrustable
MK 4	**Does not acquire** knowledge on the basics of research methodology and biostatistics **Unable** to write a research protocol with guidance **Fails to carry out** research work adequately under guidance and **cannot** draw inferences from the study. **Unable to critically appraise** articles and provide feedback **Unable to present** the findings in scientific forums and **defend** the work	**Acquire** knowledge on the basics of research methodology and biostatistics **Able** to write a research protocol with guidance **Carry out** research work under guidance and draw inferences from the study. **Critically appraise** articles and provide feedback **Present** the findings in scientific forums and **defend** the work

PC 4	**Fails to describe** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **lacks understanding of** how these affect the establishment of a definitive diagnosis **Fails to prepare** a differential diagnosis for abnormal test results or finding. **Lacks understanding of** justifications for additional testing. **Fails to understand** the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Unable to suggest** an evidence-based solution to outliers in IQC based on laboratory data	**Describes** the test characteristics [e.g., sensitivity, specificity, and positive and negative predictive values (PPV and NPV)] for tests commonly used in Biochemistry, and **understands** how these affect the establishment of a definitive diagnosis **Prepares** a differential diagnosis for abnormal test results or finding. **Understands** justifications for additional testing. Understands the strengths and limitations of all tests used in biochemistry including those sent to a reference laboratory **Able** to suggest an evidence-based solution to outliers in IQC based on laboratory data
ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating
	communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate. **Unable to communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Fails to independently, sensitively, and compassionately deliver** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **Fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently.	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently.
SBP 3	**Unaware** of the role of a biochemist in managing personnel **Unable to interpret** an organizational chart **Fails to recognize** different budget types (i.e., capital vs. operating budget) Fails to **recognize** how health care systems influence individual practice and patient care	**Aware** of the role of a biochemist in managing personnel **Interprets** an organizational chart **Recognizes** different budget types (i.e., capital vs. operating budget) Recognizes how health care systems influence individual practice and patient care **Sensitive** to cost-effective care

	Insensitive to cost-effective care **Lacks knowledge of** the personnel and lines of reporting in the laboratory **Fails to describe** the elements of a budget. **Unable to function** effectively within different systems of the health care system **Fails to describe** the process of personnel management and employment laws **Unable to advocate** for laboratory services to enhance cost-effective care **Fails to implement** state, national,and professional organizations' standards, or elements of checklists in the laboratory	**Knows** the personnel and lines of reporting in the laboratory **Describes** the elements of a budget. **Functions** effectively within different systems of the health care system **Describes** the process of personnel management and employment laws **Advocates** for laboratory services to enhance cost-effective care **Implements** state, national,and professional organizations' standards, or elements of checklists in the laboratory

PBLI 1	**Fails to demonstrate** how to access and select applicable evidence **Unaware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Fails to understand** the importance of evidence based utilization of laboratory tests and results **Fails to identify and apply** the best available evidence to guide diagnostic workup of simple and complex cases **Lacks knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Fails to apply knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Fails to critically appraise and apply** evidence to guide care, even in the face of conflicting data. **Fails to** independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **fails to design** utilization guidelines	**Demonstrates** how to access and select applicable evidence **Aware** of the need for patient privacy, autonomy, and consent as applied to clinical research. **Understands** the importance of evidence based utilization of laboratory tests and results **Identifies and applies** the best available evidence to guide diagnostic workup of simple and complex cases **Develops knowledge** of the basic principles of research (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care **Applies knowledge** of the basic principles of research such as informed consent and research protocols to clinical practice, including laboratory tests and results **Critically appraises and applies** evidence to guide care, even in the face of conflicting data. Independently **performs** a critical review of the literature addressing evidence-based utilization of laboratory tests and results, and **designs** utilization guidelines

PBLI 2	**Fails to identify** gaps in knowledge and expertise in his own knowledge of biochemistry. **Does not accept** responsibility for personal and professional development by establishing goals **Fails to identify** the gap(s) between expectations and actual performance **Does not seek** opportunities to improve Fails to incorporate feedback for improving his knowledge and skills in the gap . Does not demonstrate openness to receiving performance data and feedback in order to inform goals **Fails to analyze and reflect** on the factors which contribute to gap(s) between expectations and actual performance **Unable to design and implement** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Does not seek** performance data and feedback with humility **Fails to institute** behavioral change(s) to narrow the gap(s) between expectations and actual performance	**Identifies** gaps in knowledge and expertise in his own knowledge of biochemistry. **Accepts** responsibility for personal and professional development by establishing goals **Identifies** the gap(s) between expectations and actual performance Actively **seeks** opportunities to improve **Incorporates** feedback for improving his knowledge and skills in the gap . **Demonstrates** openness to receiving performance data and feedback in order to inform goals **Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Designs and implements** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Seeks** performance data and feedback with humility **Institutes** behavioral change(s) to narrow the gap(s) between expectations and actual performance
P 2	**Fails to demonstrate** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Fails to respond** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Lacks understanding** that physicians are accountable to patients, society, and the profession **Fails to act** with honesty and truthfulness **Does not take** appropriate ownership and **Fails to perform** tasks and responsibilities in a timely manner with attention to detail **Lacks to be consistently punctual** for clinical assignments and **lacks to be responsive** to requests for assistance; c **Fails to complete** administrative duties (e.g., medical records, reports) on time and without reminders	**Demonstrates** accountability and Responsiveness to the Needs of Patients, Society, and the Profession **Responds** promptly to instructions, requests, or reminders to complete tasks and responsibilities **Understands** that physicians are accountable to patients, society, and the profession **Acts** with honesty and truthfulness **Takes** appropriate ownership and **performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for clinical assignments and **responsive** to requests for assistance; **completes** administrative duties (e.g., medical records, reports) on time and without reminders

	Fails to understand and recognize the signs and symptoms of fatigue, stress, and substance abuse **Fails to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Does not serve** as an example for others in punctuality, responsiveness, and timely completion of duties **Fails to anticipate and intervene** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Does not coach** others to improve punctuality and responsiveness; **Fails to** offer assistance to ensure patient care duties are completed in a timely fashion **Fails to demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Understands and Recognizes** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Anticipates and intervenes** in situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** others to improve punctuality and responsiveness; **offers** assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 16: Reporting and communication of scientific research	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	Resident should be able to identify the type of teaching method most appropriate to the learning objective and be able to adapt the teaching method in such a way to bring out clear presentation of concepts in a systematic and appropriate manner so as to generate interest and understanding in the students.
2. Most relevant domains of competence:	**MK, PC, ICS, SBP, PBLI, P**
3. Competencies within each domain critical to entrustment decisions:	**MK 6.5** **PC 2.3** **ICS 1.4** **ICS 2.3** **ICS 3.3** **SBP 1.4** **PBLI 2.5** **P 1.3**

4. Methods of assessment	1. Regular theory and practical classes 2. Feedback from faculty, peers and students

Competency	Pre-Entrustable	Entrustable
MK 6	**Fails to demonstrate** background content knowledge in Biochemistry. **Does not participate** in active learning **Fails to understand and does not acquire** the skills needed for effective teaching. **Unable** to teach undergraduates with guidance **Fails to demonstrate** the knowledge of pedagogical principles and teaching-learning tools in micro teaching session. **Unable to teach** peers as neeeded **Fails to apply the content and pedagogical knowledge** while teaching students in practical classes and theory classes **Unable to create teaching**-learning lesson plans based on content and pedagogical knowledge. **Does not model teaching** across departments and at all levels, including for clinicians, patients, and families.	**Demonstrates** background content knowledge in Biochemistry. **Participates** in active learning **Understands** and begins to **acquire** the skills needed for effective teaching. **Able** to teach undergraduates with guidance **Demonstrates** the knowledge of pedagogical principles and teaching-learning tools in micro teaching session. **Teaches** peers as needed **Apply the content and pedagogical knowledge** while teaching students in practical classes and theory classes **Create teaching**-learning lesson plans based on content and pedagogical knowledge. **Models teaching** across departments and at all levels, including for clinicians, patients, and families.

PC 2	**Fails to demonstrate** the ability to suggest an evidence based diagnosis based on laboratory and clinical findings, interaction with other health care teams to discuss test results and make recommendations **Lacks understanding** of the role of the consultant in Biochemistry. **Fails to observe and assist** in the consultation. **Fails to demonstrate** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Fails to perform** clinically useful consultation in a timely manner. **Unable to prepare** full and complete consultative reports with even faculty member guidance **Not able to** Effectively communicates consultative recommendations and action plans and maintain a portfolio	**Demonstrates** the ability to suggest an evidence based diagnosis based on laboratory and clinical findings, interaction with other health care teams to discuss test results and make recommendations **Understands** the role of the consultant in Biochemistry. **Observes and assists** in the consultation. **Demonstrates** the ability to use the electronic medical record (EMR) and other electronic resources to obtain clinical and disease information. **Performs** clinically useful consultation in a timely manner. **Prepares** full and complete consultative reports with faculty member guidance **Effectively communicates** consultative recommendations and action plans and maintains a portfolio, **independently prepares** full and complete consultative reports
ICS 1	**Fails to demonstrate** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Does not identify** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Fails to demonstrate** usage of active listening and clear language **Fails to establish** rapport in challenging patient encounters, as appropriate. **Unable to communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Unable to independently, sensitively, and compassionately deliver** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Demonstrates** use of appropriate language and nonverbal behavior to demonstrate respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes** rapport in challenging patient encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

ICS 2	**Fails to communicate** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Lacks understanding** of the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Lacks understanding** that the written report is a form of communication that must be clear and understandable. **Does not effectively utilize** the electronic medical record. **Fails to communicate** with guidance, **Fails to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Does not use** active listening to adapt communication style to fit needs. **Fails to produce** a clear and understandable written report effectively and consistently. **Unable to** Independently communicate with healthcare team.	**Communicates** effectively with students, colleagues within specialty, other health professionals, and health-related agencies (Vendors and management) as applicable. **Understands** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Understands** that the written report is a form of communication that must be clear and understandable. Effectively **utilizes** the electronic medical record. **Communicates** with guidance, **provides** timely and effective communication with health care providers, families, and patients (as applicable) **Uses** active listening to adapt communication style to fit needs. **Produces** a clear and understandable written report effectively and consistently. Independently communicates with healthcare team.
ICS 3	**Fails to understand** the importance of conflict and complaint resolution **Does not observe** how conflict and complaints are resolved **Fails to independently manage** conflicts and complaints	**Understands** the importance of conflict and complaint resolution **Observes** how conflict and complaints are resolved Independently **manages** conflicts and complaints

SBP 1	**Fails to demonstrate** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Lacks** knowledge on the teaching learning methods and modalities of assessment **Fails to observe** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars , journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement	**Demonstrates** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Acquire** knowledge on the teaching learning methods and modalities of assessment **Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars , journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement
PBLI 2	**Fails to identify** gaps in knowledge and expertise in his own knowledge of biochemistry. **Does not accept** responsibility for personal and professional development by establishing goals **Fails to identify** the gap(s) between expectations and actual performance **Does not seek** opportunities to improve **Fails to incorporate** feedback for improving his knowledge and skills in the gap . **Does not demonstrate** openness to receiving performance data and feedback in order to inform goals **Fails to analyze and reflect** on the factors which contribute to gap(s) between expectations and actual performance	**Identifies** gaps in knowledge and expertise in his own knowledge of biochemistry. **Accepts** responsibility for personal and professional development by establishing goals **Identifies** the gap(s) between expectations and actual performance Actively **seeks** opportunities to improve **Incorporates** feedback for improving his knowledge and skills in the gap. **Demonstrates** openness to receiving performance data and feedback in order to inform goals **Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance

	Unable to design and implement a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. **Does not seek** performance data and feedback with humility **Fails to institute** behavioral change(s) to narrow the gap(s) between expectations and actual performance	**Designs and implements** a learning plan, with assistance and independently, based on the knowledge and expertise gap and the obtained feedback. Seeks performance data and feedback with humility **Institutes** behavioral change(s) to narrow the gap(s) between expectations and actual performance **Critically evaluates** the effectiveness of behavioral changes in narrowing the gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary **Applies** the principles of self-directed learning in identifying and correcting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility **Teaches** others reflective practice **Facilitates** the design and implementing learning plans for others
P 1	**Fails to demonstrate** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Does not describe** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; **Unable to identify and describe** potential triggers for professionalism lapses **Fails to analyze** straight forward situations using ethical principles **Fails to demonstrate** insight into professional behavior in routine situations; **Does not take responsibility** for own professionalism lapses **Fails to recognize** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to demonstrate** professional behavior in complex or stressful situations	**Demonstrates** knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources **Describes** when and how to appropriately report professionalism lapses, including

		strategies for addressing common barriers; **identifies and describes** potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; **takes responsibility** for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

EPA 18: Select a learning outcome, design and develop an appropriate assessment method	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident must be able to compose measurable learning objectives for individual classes design a lesson plan and develop an appropriate method for assessment pertaining to the objective both for theory and practical
2. Most relevant domains of competence:	**MK, ICS, SBP, PBLI, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK 6.5** **ICS 1.4** **ICS 2.3** **ICS 3.3** **SBP 1.4** **PBLI 2.5** **P1.3** **P2.4**
4. Methods of assessment	Regular theory and practical classes Feedback from faculty, peers and students

Competency	**Pre-Entrustable**	**Entrustable**

MK6	**Lacks adequate background** content knowledge in Biochemistry. **Unable to pursue** active learning and acquire the skills needed for effective teaching.	**Demonstrates background** content knowledge in Biochemistry. **Participates** in active learning **Understands and begins** to acquire the skills needed for effective teaching.
	Able to teach undergraduates with guidance **Not able to demonstrate the knowledge of** pedagogical principles and teaching-learning tools in micro teaching session and peer teaching **Unable to apply the content** and pedagogical knowledge while teaching students in practical classes and theory classes **Unable to create teaching**-learning les son plans based on content and pedagogical knowledge. **Does not model teaching** across departments and at all levels, including for clinicians, patients, and families.	**Able to teach** undergraduates with guidance **Demonstrates the knowledge of** pedagogical principles and teaching-learning tools in micro teaching session. **Teaches** peers as needed **Apply the content** and pedagogical knowledge while teaching students in practical classes and theory classes **Create teaching**-learning lesson plans based on content and pedagogical knowledge. **Models teaching** across departments and at all levels, including for clinicians, patients, and families.
ICS1	**Not able to use language and nonverbal behavior to demonstrate** respect and establish rapport. **Unable to** Identify common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Does not demonstrate** usage of active listening and clear language **Unable to Establish rapport in challenging patient** encounters, as appropriate. **Not able to Communicate** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Unable to independently, sensitively, and compassionately** deliver medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict	**Uses language and nonverbal behavior to demonstrate** respect and establish rapport. **Identifies** common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system **Demonstrates** usage of active listening and clear language **Establishes rapport in challenging patient** encounters, as appropriate. **Communicates** to the patients the preparatory requirements for the test while overcoming the barriers to communication under supervision **Independently, sensitively, and compassionately delivers** medical information, elicits patient/family values, goals and preferences, and acknowledges uncertainty and conflict

ICS2	**Does not recognise** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Unable to conform** to the fact that the written report is a form of communication that must be clear and understandable.	**Recognises** the importance of timely and effective communication with students, health care providers, families, and patients (as applicable). **Conforms to the fact** that written report is a form of communication that must be clear and understandable.
	Unable to Effectively utilizes the electronic medical record **Not able to** provide timely and effective communication with health care providers, families, and patients (as applicable) **Lacks ability** to produce a clear and understandable written report information effectively **Does not Use** active listening to adapt communication style to fit needs. **Unable to** Independently communicates with healthcare team.	**Effectively** utilizes the electronic medical record **Communicates/Provides** timely and effective communication with health care providers, families, and patients (as applicable) with guidance, **Produces** a clear and understandable written report information effectively **Uses active listening** to adapt communication style to fit needs. Independently communicates with healthcare team.
ICS3	**Not able to explain** the importance of conflict and complaint resolution **Lack of observation on** how conflict and complaints are resolved **Unable to** Independently manage conflicts and complaints	**Explains** the importance of conflict and complaint resolution **Observes** how conflict and complaints are resolved **Independently manages** conflicts and complaints

SBP1	**Fails to demonstrate the ability to lead** a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Lacks knowledge** on the teaching learning methods and modalities of assessment **Fails to observe the role of** clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars , journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement	**Demonstrates** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Acquire** knowledge on the teaching learning methods and modalities of assessment **Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars , journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement

PBLI 2	**Denies gaps** in knowledge and expertise in his own knowledge of biochemistry. **Not responsible** for personal and professional development by establishing goals **Unable to Identify the gap**(s) between expectations and actual performance **Not open** to receiving and incorporate performance data and feedback in order to inform goals **Does not analyze and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Unable to design and implement** a learning plan, with assistance and independently, **based** on the knowledge and expertise gap and the obtained feedback. **Not able to institute behavioral** change(s) to narrow the gap(s) between expectations and actual performance	**Acknowledges gaps** in knowledge and expertise in his own knowledge of biochemistry. **Accepts responsibility** for personal and professional development by establishing goals **Identifies the gap**(s) between expectations and actual performance **Incorporates feedback** for improving his knowledge and skills in the gap. **Demonstrates openness** to receiving performance data and feedback in order to inform goals **Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Designs and implements a learning plan, with assistance and independently, based** on the knowledge and expertise gap and the obtained feedback. **Seeks performance** data and feedback with **humility Institutes behavioral change**(s) to narrow the gap(s) between expectations and actual performance **Critically evaluates** the effectiveness of behavioral changes in narrowing the gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary **Applies** the principles of self-directed learning in identifying and cor recting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility **Teaches** others reflective practice **Facilitates** the design and implementing learning plans for others
P1	**Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to** Analyze straight forward situations using ethical principles **Unable to** demonstrate insight into professional behavior in routine situations;	**Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses

	takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations
P2	**Does not take appropriate ownership and perform** tasks and responsibilities in a timely manner with attention to detail **Lack of punctuality** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Unable to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describe the impact on team **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Unable to Anticipate and intervene in** situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Unable to** offer assistance to ensure patient care duties are completed in a timely fashion **lacks to Demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Takes appropriate ownership and performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team Serves as an example for others in punctuality, responsiveness, and timely completion of duties **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Anticipates and intervenes in** situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** other to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

EPA 19: Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it	
1. Description of the activity: This included a brief rationale and a list of the functions required for the EPA.	The resident must be able to compose measurable learning objectives for individual classes design a lesson plan and develop an appropriate method for assessment both theory and practical, seek feedback from senior professionals, peers and students, work on the negative comments to improve on one's own skills.
2. Most relevant domains of competence:	**MK, ICS, SBP, PBLI, P1**
3. Competencies within each domain critical to entrustment decisions:	**MK6.5** **ICS 3.3** **SBP 1.4** **PBLI 2.5** **P 1.3** **P 2.4**
4. Methods of assessment	Regular theory and practical classes Feedback from faculty, peers and students

Competency	Pre-Entrustable	Entrustable
MK6	**Lacks adequate background** content knowledge in Biochemistry. **Unable to pursue** active learning **and** acquire the skills needed for effective teaching. **Able to teach** undergraduates with guidance **Not able to demonstrate the knowledge of** pedagogical principles and teaching-learning tools in micro teaching session and peer teaching **Unable to apply the content** and pedagogical knowledge while teaching students in practical classes and theory classes **Unable to create teaching**-learning lesson plans based on content and pedagogical knowledge. Does not model teaching across departments and at all levels, including for clinicians, patients, and families.	**Demonstrates background** content knowledge in Biochemistry. **Participates** in active learning **Understands and begins** to acquire the skills needed for effective teaching. **Able to teach** undergraduates with guidance **Demonstrates the knowledge of** pedagogical principles and teaching-learning tools in micro teaching session. **Teaches** peers as needed **Apply the content** and pedagogical knowledge while teaching students in practical classes and theory classes **Create teaching**-learning lesson plans based on content and pedagogical knowledge. **Models teaching** across departments and at all levels, including for clinicians, patients, and families.

ICS3	**Not able to explain** the importance of conflict and complaint resolution **Lack of observation on** how conflict and complaints are resolved **Unable to Independently manage** conflicts and complaints	**Explains** the importance of conflict and complaint resolution **Observes** how conflict and complaints are resolved **Independently manages** conflicts and complaints
SBP1	**Fails to demonstrate** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Lacks knowledge** on the teaching learning methods and modalities of assessment **Fails to observe the role** of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Fails to identify** the pros and cons of various teaching-learning sessions **Fails to incorporate** multiple TL methods during seminars , journal club and UG teaching **Fails to participate** as a part of a health care team. **Fails to evaluate** the teaching learning sessions and assessment critically for improvement	**Demonstrates** the ability to lead a quality improvement project to improve quality of care or access to resources(e.g., case presentation, consultation, test selection guidance) in health care team. **Acquire** knowledge on the teaching learning methods and modalities of assessment **Observes** the role of clinical biochemist in the health care team (e.g., case presentation, consultation, test selection guidance) **Identify** the pros and cons of various teaching-learning sessions **Incorporates** multiple TL methods during seminars , journal club and UG teaching **Participates** as a part of a health care team. **Evaluates** the teaching learning sessions and assessment critically for improvement
PBLI 2	**Denies gaps** in knowledge and expertise in his own knowledge of biochemistry. **Not responsible** for personal and professional development by establishing goals **Unable to Identify the gap**(s) between expectations and actual performance **Not open** to receiving and incorporate performance data and feedback in order to inform goals **Does not analyze and reflects** on the factors which contribute to gap(s) between expectations and actual performance **Unable to design and implement** a learning plan, with assistance and independently,	**Acknowledges gaps** in knowledge and expertise in his own knowledge of biochemistry. **Accepts responsibility** for personal and professional development by establishing goals **Identifies the gap**(s) between expectations and actual performance **Incorporates feedback** for improving his knowledge and skills in the gap. **Demonstrates openness** to receiving performance data and feedback in order to inform goals **Analyzes and reflects** on the factors which contribute to gap(s) between expectations and actual performance

	based on the knowledge and expertise gap and the obtained feedback. **Not able to institute behavioral change**(s) to narrow the gap(s) between expectations and actual performance	**Designs and implements a learning plan, with assistance and independently, based** on the knowledge and expertise gap and the obtained feedback. **Seeks performance** data and feedback with humility **Institutes behavioral change**(s) to narrow the gap(s) between expectations and actual performance **Critically evaluates** the effectiveness of behavioral changes in narrowing the gap(s) between expectations and actual performance **Uses performance data to measure** the effectiveness of the learning plan and improves it when necessary **Applies** the principles of self-directed learning in identifying and correcting the knowledge and expertise, gaps in knowledge in general Models seeking performance data with humility **Teaches** others reflective practice **Facilitates** the design and implementing learning plans for others
P1	**Not able to** Describe when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Inability to** Analyze straight forward situations using ethical principles **Unable to** demonstrate insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Not able to** Recognize the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Unable to** Demonstrates professional behavior in complex or stressful situations	**Describes** when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses **Analyzes** straight forward situations using ethical principles **Demonstrates** insight into professional behavior in routine situations; takes responsibility for own professionalism lapses **Recognizes** the need and uses appropriate resources to seek help in managing and resolving complex ethical situations **Demonstrates** professional behavior in complex or stressful situations

P2	**Does not take appropriate ownership and perform** tasks and responsibilities in a timely manner with attention to detail **Lack of punctuality** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Unable to recognize** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describe the impact on team **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Unable to Anticipate and intervene in** situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Unable** to offer assistance to ensure patient care duties are completed in a timely fashion **lacks to Demonstrate** self-awareness of fatigue and stress, and mitigates the effects	**Takes appropriate ownership and performs** tasks and responsibilities in a timely manner with attention to detail **Consistently punctual** for laboratory assignments and responsive to requests for assistance; completes administrative duties (e.g., medical records, reports) on time and without reminders **Understands** the signs and symptoms of fatigue, stress, and substance abuse **Recognizes** situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team **Serves** as an example for others in punctuality, responsiveness, and timely completion of duties **Recognizes** signs and symptoms of fatigue, stress, and substance abuse **Anticipates and intervenes in** situations that may impact others' ability to complete tasks and responsibilities in a timely manner **Coaches** other to improve punctuality and responsiveness; offers assistance to ensure patient care duties are completed in a timely fashion **Demonstrates** self-awareness of fatigue and stress, and mitigates the effects

TABLE 5. MAPPING OF PO,CO, EPA, COMPETENCY AND SUB-COMPETENCY WITH LEVEL

General										
EPA		**Program outcomes**								Domains and levels of competency
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1	Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis	✓	✓		✓		✓			MK – 1.4,2.4 / PC -1.4,2.3 / ICS – 1.4 /P – 1.3
2	Recommending and interpreting common screening and diagnostic tests and data	✓	✓	✓	✓		✓			MK2.4/PC3.4/ICS1.4/ PBLI1.4/P1.3
3	Giving the necessary instructions to the patients related to biochemical investigations	✓	✓	✓	✓					MK1.4,2.4/PC2.3,3.4/ ICS1.4/ PBLI1.4/P1.3

4	Obtain informed consent for investigations and for academic research	✓	✓	✓			✓			PC2.3/ICS1.4/P1.3
5	Collaborate as a member of an interprofessional team	✓	✓		✓	✓	✓			MK5.5/PC2.3/ICS2.3/ SBP1.4/P2.4
6	Form clinical questions and retrieve evidence to advance patient care	✓	✓	✓	✓		✓	✓	✓	PC1.4/ICS2.3/ PBLI1.4/ P2.4
Clinical Biochemistry										
7	Evaluate and report clinical laboratory testing including critical values	✓	✓	✓	✓					MK1.4,2.4/PC1.4,3.4/ ICS2.3/SBP2.3/PBLI1.4/ P1.3
8	Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues	✓	✓	✓	✓		✓		✓	MK3.4/PC1.4,4.4/ICS1.4/ SBP1.4/PBLI1.4/P.31
9	Provide biochemistry support for interdisciplinary presentations/ clinicopathological meet						✓			PC3.4/ICS1.4/SBP3.3/ PBLI1.4/P2.4
10	Provide patient care consultations	✓	✓	✓	✓		✓		✓	PC2.3/ICS1.4,2.3/SBP1.4/ PBLI1.4/P.31,2.4
11	Optimize test utilization			✓	✓		✓			MK3.4/PC1.4/ICS2.3/ SBP3.3/ PBLI2.5/P1.3
12	Improve quality and patient safety		✓	✓			✓		✓	MK3.4,5.5/PC2.3,3.4,4.4/ ICS2.3/SBP2.3,3.3/ PBLI1.4,P2.4
13	Evaluate and choose a new test/ assay or instrument		✓	✓			✓		✓	MK3.4,5.5/PC1.4,3.4,4.4/ ICS1.4,2.3/SBP1.4.3,3/ PBLI1.4/P2.4
14	Perform a laboratory Audit		✓	✓			✓		✓	MK3.4/PC4.4/ICS2.3/ SBP2.3,3.3/PBLI1.4/ P1.3,2.4
Research methodology										
15	Should be able to write a scientific protocol for clinical research							✓		MK4.4/PC4.4/ICS1.4,2.3/ SBP3.3/PBLI1.4,2.5/P2.4
16	Reporting and communication of scientific research							✓		Mk4.4/PC4.4/ICS1.4,2.3/ SBP3.3/PBLI1.4,2.5/P2.4
Teaching										
17	Select and demonstrate competency in a range of teaching methods					✓	✓			MK6.5/PC2.3/ ICS1.4,2.3,3.3/SBP1.4/ PBLI2.5/P1.3

18	Select a learning outcome and design, select and develop an appropriate assessment method					✓	✓			MK6.5/ICS1.4,2.3,3.3/ SBP1.4/PBLI2.5/P.1.3,2.4
19	Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it					✓	✓			MK6.5/ICS3.3/SBP1.4/ PBLI2.5/P1.3,2.4

- The Internal Assessment should be conducted in theory and clinical examination every 6 months
- Quarterly assessment during the MS training should be based on following educational activities:

1. Journal based / recent advances learning 2. Patient based /Laboratory or Skill based learning 3. Self-directed learning and teaching 4. Departmental and interdepartmental learning activity
2. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form **(Annexure-2).**

8.2 Summative Assessment

At the end of training,

The summative examination will be carried out as per the Rules given in

POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

Eligibility for appearing in the final university exam

- **Attendance: 75 % in each year**
- **One poster presentation in International/National/ State level conference.**
- **One oral presentation International/National/ State level conference.**
- **Submission of one scientific paper for publication to an indexed journal The postgraduate examination shall be in three parts.**

1. Thesis

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized post-graduate teacher. The results of the work done shall be written up and submitted in the form of a thesis. The aim of doing a thesis is to contribute to development of a spirit of enquiry, to familiarize the post graduate students with research methodology, literature searches, laboratory techniques, analysis of data, interpretation of results and skills in scientific writing. The thesis shall be submitted at least six months before the theory and clinical / practical examination.

The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for theory and clinical examinations. A post graduate student shall be allowed to appear for the theory and practical/clinical examination only after the acceptance of the thesis by the examiners.

2. Theory examination

The examinations shall be organized on the basis of a 'Grading'or 'Marking' system to evaluate and certify a post graduate student's level of knowledge, skills and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' and 'Practical' examinations separately shall be mandatory for passing the examination as a whole. The examination for MD/MS shall be held at the end of the 3rd

academic year. There shall be 4 theory papers each of three hours duration:

PATTERN OF EXAMINATION			
Theory	**Title**	**Duration**	**Marks**
Paper-I	Biomolecules, cell biology, biochemical techniques, biostatistics, bioethics and research methodology, basics of medical education in teaching and assessment of biochemistry	**3 hrs**	**100**
Paper-II	Enzymes, bioenergetics, biological oxidation, metabolism of biomolecules, intermediary metabolism and regulation, inborn errors of metabolism and nutrition	**3 hrs**	**100**
Paper-III	Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body	**3 hrs**	**100**
Paper-IV	Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry	**3 hrs**	**100**

3. Practical and oral/viva voce examination: This should be held over two days.

i. Practical examination

The practical examinations will be held over 2 days; one day will be mainly for the practical exercises and the second day for the oral/ viva voce. The practical examinations will have the following components: -

A. A clinical case for which an actual patient or a paper-based case may be used, as per the facilities available in each institution running the course. The clinical features of the patient and relevant laboratory investigation of biochemical abnormalities present will be discussed

B. Quantitative assays for the given parameters one in autoanalyzer and one by standardisation graph and calculation

C. Performance of an electrophoresis for serum proteins and discussion of electrophoretic pattern. Quality Control, its interpretation and Method validation, Calculation of TAE,CV,bias, sigma metrics and selecting the appropriate QC rules and Interpretation of results of PCR

D. Identification the carbohydrate/amino acid provided and confirm of its identity by paper chromatography, Urine analysis.

Viva-voce Examination
E. Thesis presentation (of about 15 mins duration)
F. Pedagogy (20 mins duration plus 10 mins for questions)

Viva voce shall comprise Theoretical and Practical knowledge of the candidate related to Biochemistry wherein in-depth knowledge can be assessed. This includes the discussion on case presentation as well as the Dissertation work carried out by the candidate.

Pedagogy (seminar)

The candidate will be given a choice of at least two topics in biochemistry on 1st day of the examination of which one topic will have to be presented by the candidate to the examiner in the form of class room teaching for a period of 10-15 minutes in the 2nd day

9. BLUE PRINT

10.1 Paper 1 : Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry

Sl.N0	Discipline	Topics	Weight-age	Marks Allotted	No. of Question
1	**Biomolecules**	Water, Buffer system, Basic chemistry, Structure function relationships of biomolecules (Carbohydrates, amino acids, proteins, hemoglobin, enzymes, immunoglobulins, collagen, lipids, nucleotides & nucleic acids), Biological membranes	30	30	3
2	**Cell biology**	Structure of cell, sub-cellular organelles including cell membrane, Transport mechanisms across cell, intracelular traffic and sorting of proteins, extracellular matrix, cellular adhesion molecules, Cell cycle, cell division, cell death, cytoskeleton, muscle contraction, cell motility, red and white blood cell	10	10	1
3	**Biochemical techniques**	Photometry (colorimetry, spectrophotometry, Reflectance, flame photometry, absorption spectroscopy and fluorimetery, mass spectrometry, fluorescence and Chemiluminescence, spectroscopy), Ion selective electrodes, Centrifugation, Electrophoresis (including isoelectric focusing, isotachophoresis, immunoelectrophoresis), Radioactivity, Chromatography (paper, column, affinity, ion exchange, adsorption and partition, GLC, TLC, HPLC, Gel filtration), Turbidimetry and nephelometry, Gravimetry, Water testing, Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, microarrays and DNA chip technology, cloning techniques, genomics, proteomics and metabolomics, Nanotechnology and microfabrication, Techniques to study in vivo metabolism - NMR, SPECT, PET scans, etc, Radioisotope-based techniques and its applications	40	40	4
4	**Biostatistics and research methodology**	concepts of biostatistics as applied to health science, Statistical tests, Statistical methods of validation of diagnostic tests, Basics of epidemiological study designs and sampling methodologies, Meta-analysis and systematic reviews	10	10	1

5	**Basics of medical education in teaching and assessment of biochemistry**	Principles of adult learning, taxonomy of learning, educational objectives, principles of assessment and question paper setting, methods of assessing knowledge, appropriate use of media, microteaching, small group teaching.	10	10	1

10.2 Paper 2: Enzymes, bioenergetics, biological oxidation, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

Sl.No	Discipline	Topics	Weight-age	Marks Allotted	No. of Question
1	**Enzymes**	ties, classification, mechanism of action, coenzymes and cofactors, kinetics of enzyme activity, regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs.	20	20	2
2	**Bioenergetics Basi**	concepts of thermodynamics and its laws, as applied to living systems, Exergonic and endergonic reactions and coupled reactions, redox potential, High energy com	10	10	1
		pounds, Classification and role of oxidoreductases, Cytochromes			
3	**Biological oxidation**	Components, complexes and functioning of the respiratory chain, Process of oxidative phosphorylation, Mechanisms of ATP synthesis and regulation, Mitochondrial transport systems and shuttles, Inhibitors, uncouplers and ionophores, OXPHOS diseases	10	10	1
4	**Intermediary metabolism and regulation**	Metabolism of carbohydrates, lipids, amino acids and proteins, nucleic acids, heme and in specialised tissues, starvation and fed state. Inborn errors of metabolism.	30	30	3
5	**Nutrition**	Principal food components, General nutritional requirements, Energy requirements, Biological value of proteins, Thermogenic effect of food, Balanced diet, diet formulations in health and disease, mixed diet, Nutritional supplements, Food toxins and additives, Parenteral nutrition, Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders, National Nutrition Programme, Vitamins, Minerals, Metabolism of xenobiotics, Free radicals and antioxidant defence systems in the body and associations with disease processes	30	30	3

10.3 Paper 3: Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body

Sl.No	Discipline	Topics	Weight-age	Marks Allotted	No. of Question
1	**Molecular biology**	Structure and organization of chromosomes and chromatin re-modelling, DNA replication, Transcription, Genetic code and mutations, Translation, Regulation of gene expression in prokaryotes and eukaryotes, Recombinant DNA technology and its applications in modern medicine, Diagnosis of genetic diseases and genetic counseling, Overview of Human Genome Project, Basics of bioinformatics, Principles of human genetics, Stem cells in clinical medicine	40	40	4
2	**Molecular and genetic aspects of cancer**	Carcinogens, Clonal origin of cancers, Genetic basis of carcinogenesis, Role of oncogenes and tumour suppressor genes, Familial cancer syndromes, Cancer stem cells, Epigenetic regulation in cancer, Gene expression profiling in cancer, Cancer cell biology, Metastasis, Tumor markers, Biochemical basis of cancer chemotherapy and drug resistance, New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.	10	10	1
3	**Immunology**	Innate Innate and acquired immunity, Humoral and cell-mediated immunity, Cells and organs of the immune system, Antigens, epitopes and haptens, Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching, Antigen-antibody interaction - immunochemical techniques, Major histocompatibility complex, antigen processing and presentation, T cell and B cell receptor, toll like receptors, B and T cell generation/ activation/ differentiation, Cytokines, Complement system, cell, Immune response to infections, Hypersensitivity reactions, Vaccines, Immuno-deficiency syndromes, Autoimmunity, Transplantation immunology, Cancer and immune system, Immunodiagnostics, Immunotherapy	40	40	4

4	**Environmental pollutants**	Environmental pollutants and their effects on the body	10	10	1

10.4 Paper 4: Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry

Sl.N0	Discipline	Topics	Weightage	Marks Allotted	No. of Question
1	**Clinical biochemistry and molecular diagnostics related to different body systems/ organs**	Principles and practice of clinical biochemistry, Analytical techniques and instrumentation, Clinical correlates and analytical procedures, Regulation of fluid and electrolyte balance and associated disorders, Regulation of acid-base balance and associated disorders, Hematopoietic disorders, Hemostasis and thrombosis Cardiovascular system, Respiratory system, Kidney, Gastrointestinal system, Liver Gall bladder/bile ducts,Pancreas, Bone and mineral metabolism, Nervous system	60	60	6
2	**Endocrinology**	Classification and general mechanism of action of hormones. Biogenesis, secretion, regulation, transport, mode of action and disorders of hormones (hypothalamic peptides, adenohypophyseal and neurohy pophyseal hormones, thyroid hormones, parathyroid hormones, calcitonin, pancreatic hormones, adenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, Endorphins and encephalins), Conception, reproduction and contraception.	30	30	3
3	**Recent advances in biochemistry**	Recent biochemical concepts in health and disease, Newer analytical methods	10	10	1

Practical's

		Marks Allocation
I	**a. Clinical examination of a patient making of a provisional diagnosis and giving differential diagnosis with relevant investigations and interpretation with case discussion**	**30**
	b. Quantitative assays for the given parameters one in autoanalyzer and one by standardisation graph and calculation	**30 And 40**

II	c.Two Clinical Biochemistry experiments i. Method validation ii. Reference interval calculation iii. Interpretation of westgard rule iv. Calculation of TAE,CV,bias, sigma metrics and selecting the appropriate QC rules v. Interpretation of results of PCR) including separation of proteins by electrophoresis.	60
	d. One qualitative identification of a carbohydrate or an amino acid and confirmation by Chromatography	40
Total (I + II)		200
III	a) General Viva-Voce	80
	b) Pedagogy	20
Total (a+b)		100
GRAND TOTAL		300

10. MODEL QUESTION PAPER

Subject- Biochemistry

Paper I :Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry

3 Hours (10 x 10 = 100 marks)

ANSWER ALL QUESTIONS

(Draw labelled diagram wherever required)

1. Describe the structure, composition, synthesis, functions and significance of Phospholipids.
2. Describe the types, principle and clinical applications of PCR.
3. Describe Bloom's taxonomy of learning domains.
4. Explain the structure function relationship of hemoglobin molecule.
5. Describe the basic instrumentation of mass spectrometry. Add a note on its applications
6. Explain the fluid mosaic model of membrane.
7. Describe the principle, instrumentation and clinical applications of capillary electrophoresis.
8. Describe the evaluation of a new diagnostic test.
9. Describe the levels of organisation of protein structure.
10. Describe the principle, instrumentation and clinical applications of HPLC.

Paper II: Enzymes, bioenergetics, biological oxidation, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

3 Hours (10X10=100 marks)

(Draw labelled diagram wherever required)

ANSWER ALL QUESTIONS

1. Describe the sources, RDA, metabolism, functions and deficiency of Vitamin B12.
2. Discuss the mechanisms of enzyme action with suitable examples.
3. Describe the characteristics of Cytochrome P450.
4. Discuss the metabolism in fasting and fed state.
5. Discuss the causes, clinical features and laboratory diagnosis of Iron deficiency.
6. Explain therapeutic enzymes with suitable examples.
7. Explain the chemiosmotic theory.
8. Explain the regulation of calcium and phosphate in the body.
9. Explain how phenylalanine is both ketogenic and glucogenic. Add a note on phenylketonuria
10. Discuss the reverse cholesterol transport.

Paper III: Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body

3 Hours (10 x 10 = 100 marks)

ANSWER ALL QUESTIONS

1. a. Discuss the various DNA binding motifs seen in protein DNA interactions.
   b. What is the role of cyclins and cyclin dependent kinases in the cell cycle?
2. a. What is post translational modification of proteins? Explain with the help of an example. b. Mention the role of vitamins in their modification.
3. Types of stem cells and their therapeutic potential
4. a.RT-PCR
   b.Antisense therapy
5. Tumor markers their role in diagnosis, prognosis and therapy of cancers.
6. Monoclonal antibody, their uses and related clinical aspects. 6+4
7. Immunological tests for thyroid functions
8. Describe the structure of an immunoglobulin. List the different types of immunoglobulin along with their functions
9. Transplant immunology
10. Pollution and cancer

Paper IV: Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry

3 Hours (10 x 10 = 100 marks)

ANSWER ALL QUESTIONS

1. Total quality management

2. How is the reference range of a laboratory parameter established?

3. What is anion gap? What is its clinical significance?

4. What type of lipid profile is seen in diabetes mellitus (D.M.) patients? What is the biochemical basis for it?

5. Biochemical basis and clinical features of Gout. Add a note on investigations and different treatment modalities

6. POCT

7. Peptide hormones regulating food intake

8. How can primary, secondary and tertiary thyroid dysfunctions be differentiated by using laboratory tests?

9. Classify hormones on the basis of their mechanism of action. Write about the hormones that are transported by plasma proteins

10. Diagnostic utility of saliva

11. RECOMMENDED READING

Books (Latest Editions Recommended)

1. Devlin's Textbook of Biochemistry with clinical correlations - Paslow G.P and Wood E.J.
2. Lehninger's Principles of Biochemistry - David L. Nelson and Michael M. Cox
3. Harper's Illustrated Biochemistry – Robert K. Murray etal.
4. Biochemistry – Donald Voet and Judith Voet
5. Lippincott's illustrated reviews of Biochemistry - Parnela C. Champe etal
6. Biochemistry – Zubay
7. Biochemistry – Lubert Stryer and Jeremy M. Berg
8. Textbook of Biochemistry – West and Todd
9. Medical Biochemistry - Baynes
10. Marks Essentials of Medical Biochemistry – A clinical approach – Liebermann etal
11. Will's Biochemical basis of Medicine - Gillham
12. Tietz Text book of Clinical Chemistry and Molecular Diagnostics – Burtis etal.
13. Clinical chemistry - Bishop
14. Clinical chemistry - Kaplan
15. Clinical Biochemistry - Marshall
16. Lecture notes in Clinical Biochemistry – Beckett etal
17. Zilva's Clinical chemistry in diagnosis and Treatment – Mayne
18. Biochemistry – A case oriental approach – Montgomery

19. Gaw's Clinical Biochemistry – A Pictorial manual
20. Metabolic and Molecular basis of diseases – Scriver etal.
21. Molecular cell biology – Lodsh H and Baltimore
22. Genes – VIII – Levin
23. Molecular Biology of the cell – Alberts.B etal
24. William's Textbook of Endocrinology – Reed Larsen etal
25. Modern nutrition in health and disease – Maurina E. Shilb and Mosby
26. Human nutrition and dietetics – Garrow
27. Duncan's Diseases of Metabolism – Bondy etal
28. Text book of Biochemistry – Chatterjee and Shinde
29. Text book of Biochemistry – A clinically oriented approach – Dinesh Puri
30. Principles and techniques of Biochemistry and Molecular biology – Keith Wilson and John Walkar
31. Varley's Practical Biochemistry - Allen Gowenlock
32. Clinical diagnosis and management by laboratory methods – Todd etal
33. Immunogy – Roitt
34. Harrison's principles of internal Medicine – Dennis L. Hasper etal.
35. Methods in Biostatistics - Mahajan

List of Journals

1. Clinical chemistry
2. Clinical Biochemistry
3. Clinical Chemical Acta
4. Biochemical Journal
5. Journal of Endocrinology
6. European Journal of Molecular Biology
7. American Journal of Clinical Nutrition
8. Food and Nutrition
9. Clinical chemistry reviews
10. Journal of Laboratory investigation
11. Trends in Biochemical sciences
12. Annual Review of Biochemistry
13. Indian Journal of biochemistry and Biophysics
14. Indian Journal of Clinical Biochemistry
15. Indian Journal of Medical Research
16. Recent advances in Endocrinology and metabolism
17. Recent advances in clinical chemistry
18. Nature
19. Science
20. British Medical Journal

12. ANNEXURES

Annexure-1: Entrustable Professional Activities Assessment

Department Of Biochemistry

Entrustable Professional Activities Assessment Form MD Biochemistry

Name of the Resident: UIN No:

Levels of competence:

- Level I: Knowledge only; can observe
- Level II(A): Can assist
- Level II(B): Can do under strict supervision
- Level III: Can do under loose supervision (Entrustability decision to be made based on milestones)
- Level IV: Can do independently
- Level V: Has expertise to teach others

EPA		On the joining day	End of first month	1st quarter		2nd quarter	
		Resident	Faculty	Resident	Faculty	Resident	Faculty
General							
1.	Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis						
2.	Recommending and interpreting common screening and diagnostic tests and data						
3.	Giving the necessary instructions to the patients related to biochemical investigations						
4.	Obtain informed consent for investigations and for academic research						
5.	Collaborate as a member of an interprofessional team						
6.	Form clinical questions and retrieve evidence to advance patient care						
Clinical Biochemistry							
7.	Evaluate and report clinical laboratory testing including critical values						

8.	Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues						
9.	Provide biochemistry support for interdisciplinary presentations/ clinicopathological meet						
10.	Provide patient care consultations						
11.	Optimize test utilization						
12.	Improve quality and patient safety						
13.	Evaluate and choose a new test/assay or instrument						
14.	Perform a laboratory Audit						
Research							
15.	Should be able to write a scientific protocol for clinical research						
16.	Reporting and communication of scientific research						
Teaching							
17.	Select and demonstrate competency in a range of teaching methods						
18.	Select a learning outcome and design and develop an appropriate assessment method						
19.	Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it						

Second year of the residency

EPA		5th (half yearly)		6th (half yearly)	
		Resident	**Faculty**	**Resident**	**Faculty**
General					
1.	Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis				
2.	Recommending and interpreting common screening and diagnostic tests and data				

3.	Giving the necessary instructions to the patients related to biochemical investigations				
4.	Obtain informed consent for investigations and for academic research				
5.	Collaborate as a member of an interprofessional team				
6.	Form clinical questions and retrieve evidence to advance patient care				
Clinical Biochemistry					
7.	Evaluate and report clinical laboratory testing including critical values				
8.	Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues				
9.	Provide biochemistry support for interdisciplinary presentations/clinicopathological meet				
10.	Provide patient care consultations				
11.	Optimize test utilization				
12.	Improve quality and patient safety				
13.	Evaluate and choose a new test/assay or instrument				
14.	Perform a laboratory Audit				
Research					
15.	Should be able to write a scientific protocol for clinical research				
16.	Reporting and communication of scientific research				
Teaching					
17.	Select and demonstrate competency in a range of teaching methods				
18.	Select a learning outcome and design, and develop an appropriate assessment method				
19.	Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it				

Third year of the residency

EPA		7th (half yearly)		8th (half yearly)	
		Resident	**Faculty**	**Resident**	**Faculty**
General					
1.	Prioritizing a differential diagnosis based on history, physical examination and biochemical analysis				

2.	Recommending and interpreting common screening and diagnostic tests and data				
3.	Giving the necessary instructions to the patients related to biochemical investigations				
4.	Obtain informed consent for investigations and for academic research				
5.	Collaborate as a member of an interprofessional team				
6.	Form clinical questions and retrieve evidence to advance patient care				
Clinical Biochemistry					
7.	Evaluate and report clinical laboratory testing including critical values				
8.	Provide guidance for the resolution of preanalytical, analytical and post analytical testing issues				
9.	Provide biochemistry support for interdisciplinary presentations/clinicopathological meet				
10.	Provide patient care consultations				
11.	Optimize test utilization				
12.	Improve quality and patient safety				
13.	Evaluate and choose a new test/assay or instrument				
14.	Perform a laboratory Audit				
Research					
15.	Should be able to write a scientific protocol for clinical research				
16.	Reporting and communication of scientific research				
Teaching					
17.	Select and demonstrate competency in a range of teaching methods				
18.	Select a learning outcome and design, and develop an appropriate assessment method				
19.	Solicit feedback on one's leadership and teaching from multiple observers & critically reflect on it				

Annexure 2: Postgraduate Students Appraisal Form

Sri Balaji Vidyapeeth

Department of Biochemistry

Name of the PG Student: UNI No:

Period of Training FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1.	Journal based / recent advances learning				
2.	Patient based /Laboratory or Skill based learning				
3.	Self-directed learning and teaching				
4.	Departmental and interdepartmental learning activity				
5.	External and Outreach Activities / CMEs				
6.	Thesis / Research work				
7.	E-portfolio Maintenance				

Publications

Yes/ No

Remarks*.....
.....

***REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.**

SIGNATURE OF ASSESSEE **SIGNATURE OF CONSULTANT**

SIGNATURE OF HOD

Annexure 3: Multi Source Feedback Form

Sri Balaji Vidyapeeth

Department of Biochemistry

EVALUATION SHEET FOR POSTGRADUATE CLINICAL LABORATORY WORK

(To be completed by / Technician / Other Health Professionals)

Name of the Resident: ..... UIN No.: .....

Name of the Respondent: ..... Date: .....

Sl. No.	Criteria to be assessed	Score		
		Below par (1)	At par (2)	Above par (3)
1.	Shows a compassionate attitude to patients			
2.	Is respectful towards patients			
3.	Communicates effectively with patients			
4.	Empathetic counselling of patient's relatives			
5.	Communicates effectively with colleagues			
6.	Communicates effectively with other health professionals			
7.	Allows them to express their doubts or concern regarding laboratory reporting			
8.	Proper and complete documentation			
9.	Works constructively in the health care system			
		Total score:		
	General Comments:			
	Highlights in performance (strengths)			
	Possible suggested areas for improvement (weakness)			
			Signature:	

Annexure 4: Work Place Based Assessment (WPBA)

Sri Balaji Vidyapeeth

Department of Biochemistry

EVALUATION SHEET FOR POSTGRADUATE (WPBA)

Direct observation of practical skills (DOPS)

Name of the Resident: ..... UIN No.: .....

Name of the Respondent: ..... Date: .....

Designation:

Brief outline of procedure, indicating focus for assessment

Automated instrumentation/ Clinical competencies /Enzymology/electrophoresis Manual technique/ QC/QA POCT solid/dry phase chemistry /Spectrometric methods/others

Complexity of procedure: Low Average High

		Below expectation	Borderline	Meet expectation	Above expectation	Able to perform unobserved
1	**Explains the indications for and scientific principles of procedure**					
2	**Consideration of health and safety requirements (e.g. risk assessment)**					
3	**Proficient with SOP**					
4	**Interpretation of QC/QA**					
5	**Technical ability and correct use of equipment**					
6	**Post-procedural documentation**					
7	**Communication skills (written and/or verbal)**					
8	**Professionalism (e.g. patient confidentiality, respect)**					
9	**Ability to seek help where appropriate**					
10	**Overall ability to perform procedure**					

Scoring and comments:	Suggestions for improvement:
Agreed upon action:	
Signature of the resident	**Signature of the Accessor**

Annexure 5: Evaluation Sheet for Postgraduate Journal Club

(To be marked individually by each faculty)

Name of the Resident: ..... UIN No.: .....

Name of the Respondent: ..... Date: .....

Sl. No.	Criteria to be assessed	Score		
		Below par (1)	At par (2)	Above par (3)
1.	Relevance of article chosen			
2.	Identifies the problem addressed in the paper			
3.	Completeness of presentation			
4.	Analyses and gives comments on methodology and statistics			
5.	Brief summary of results			
6.	Comparison of work with other published work			
7.	Merits and demerits of the paper			
8.	Summary and take-home message			
9.	Time management			
10.	Overall performance – relevant answers to questions, attitude during presentation and confidence			
		Total score:		
	General Comments:			
	Highlights in performance (strengths)			
	Possible suggested areas for improvement (weakness)			
			Signature:	

Annexure 6: Evaluation Sheet for Postgraduate Seminar

(To be marked individually by each faculty)

Name of the Resident: ..... UIN No.: .....

Name of the Respondent: ..... Date: .....

Sl. No.	Criteria to be assessed	Score		
		Below par (1)	At par (2)	Above par (3)
1.	Introduction of subject and its importance / Objectives			
2.	Completeness of presentation			
3.	Cogency of presentation			
4.	Consulted all relevant literature			
5.	Use of audio-visual aids			
6.	Understanding of subject			
7.	Summary and take-home message			
8.	Cites appropriate references / suggests further reading			
9.	Time management			
10.	Overall performance – relevant answers to questions, attitude during presentation and confidence			
		Total score:		
	General Comments:			
	Highlights in performance (strengths)			
	Possible suggested areas for improvement (weakness)			
			Signature:	

Annexure 7: Evaluation Sheet for Postgraduate Case Presentation

(To be marked individually by each faculty)

Name of the Resident: ..... UIN No.: .....

Name of the Respondent: ..... Date: .....

Sl. No.	Criteria to be assessed	Score		
		Below par (1)	At par (2)	Above par (3)
1.	Clarity and logical order in presentation with completeness in History taking, general and systemic examination			
2.	Summarizes the case and analyses the appropriate differential diagnoses giving logical reasons for the diagnosis			
3.	Investigations required: Completeness of list, relevant order, interpretation of investigations			
4.	Time management			
5.	Overall performance – relevant answers to questions, attitude during presentation and confidence			
		Total score:		
	General Comments:			
	Highlights in performance (strengths)			
	Possible suggested areas for improvement (weakness)			
			Signature:	