NATIONAL MEDICAL COMMISSION
Postgraduate Medical Education Board

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GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME FOR MD IN BIOCHEMISTRY

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Implementation of Revised Competency Based Post Graduate Training Programme for MD in biochemistry as per the guidelines prepared by the National Medical Commission through Subject Expert Groups{ Date of Bos 21.07.2022 Ref :SBKSMIRC/Dean/Outward No.1301/2021-22, Date of Academic council :29.07.2022 Ref :SVDU/NOTFN/O370/2021-22 dated 30.07.2022}

Preamble

Acompetencyisthecapabilitytoapplyoruseasetofrelatedknowledge,skills,andabilitiesrequired tosuccessfullyperform"criticalworkfunctions"ortasksinadefinedworksetting.Competency-based training is a learning model in which the required level of knowledgeand skill (competency) on a task must be demonstrated. The purpose of the competency-based postgraduate education in Biochemistry is to create specialists, with the requiredknowledge, skills, and attitude, who would provide high-quality healthcare complying withthe principles of personal integrity and professional ethics and would advance the cause ofscience through teaching,research & training along with constant updating of his/herknowledgeand skills as alifelongself-directed learner.

The student, after undergoing training in MD Biochemistry, should be able to demonstratehis/her knowledge of the basic concepts and recent advances in the subject, and a definedsetofskillsincludingexpertiseinvariouslaboratorytechniquesapplicabletometabolican dmolecular aspects of medicine, planning and executing research projects, writing researchpapers/articlesdemonstratingtheacquiredtraininginresearchmethodology.Thepostgr aduate training course should equip the student with skills to become a competentteacher who is also able to demonstrate his/her competence in planning teaching programsand apply those to facilitate the learning of the students in medical and allied health sciencecourses in compliance with the curriculum while advancing the same with needful andfeasibleinnovations.He/sheshoulddemonstratecompetenceinintegratingteaching-

learning of Biochemistry with other relevant subjects/disciplines to facilitate the holisticapplicationofthesubjectofBiochemistryinpatientcare.He/sheshouldbeabletodemonstratehis/hertrainingingoodlaboratorypracticeswiththeabilitytoset up/manageaquality-controlled and quality-assured diagnostic laboratory, generate, evaluate, interpretandreportthediagnosticlaboratorydata,withagoodunderstandingofthesourcesoferrors,

correctiveandpreventiveactions,hospitalandlaboratoryinformationsystemnetwork,andinteractwith clinicians asmaybeneeded for effectivepatientcare.

Thisdocumentaimstoprovideteachersandlearnerswithcomprehensiveguidelinestoachieve a defined set of outcomes through learning and assessment and apply those ina given setup. This document has been framed by the Expert Group of the NationalMedical Commission with an aim to render a uniform PG medical curriculum to beimplemented by all the medical colleges in the country. The curriculum so designedhasbeennamedthecompetency-basedPGmedicaleducationcurriculuminconformitywiththepurposeand content ofPGmedicaleducation.

SUBJECT-SPECIFICLEARNINGOBJECTIVES

Goal:

The goal of the training program in MD Biochemistry is to enable a student to become acompetent teacher/facilitator of teaching-learning processes, researcher, problem solver, andhealthcare provider. He/ she should be able to acquire a defined set of cognition and skills asdetailedbelow and demonstrate his abilityto applythesameinagiven healthcaresetup.

a. AcquisitionofKnowledge

The student should be able to explain the molecular, physical, and physiological logic of theprocesses involved in the maintenance of normal health and their deviation in a disease state.He/should be able to integrate his/her acquired knowledge in principles and concepts ofclassical biochemistry, biophysics, and molecular biology, comprehend and apply his/hercognitionand skillsin aprofessional patient caresetup.

b. Acquisitionof Skills

The student should be able to facilitate the UG and PG learning of biochemical concepts andprinciples and should be able to render hands-on training in the Biochemical laboratoryinvestigations and experimentations relevant to the strengthening of biochemical concepts,scientificandclinicalproblem-solving,andbiomedicalresearch.He/sheshouldbeableto analyze,interpretandevaluatethedata,andrationalizetheirapplicationinclinicalmanagementande xperimental research.

c. Teachingandtraining

As a competent healthcare personnel, the student should develop his/her learning skills byapplying the fundamental principles of medical education, through teaching and assessing theundergraduate students in medicine and allied health science courses and, by contributing tothetrainingof postgraduate students.

d. Diagnosticlaboratoryskills

The student should be competent in setting up/supervising/managing a diagnostic laboratoryin Biochemistry in a hospital or in any other setup (diagnostic units in remote places orindependent of a hospital setting) ensuring quality control along with quality assurance andprovidingreliablehealthcaresupportservices.Thestudentshouldbeabletoprovideconsultation

tocliniciansandalsocontributetocommunityhealthcarebyconductingscreeningtests.

e. Professionalism,Ethics,Communicationskills

The student should be able to develop and sustain work ethics and empathetic behavior withstudentsandcolleagues.He/sheshouldbeabletodemonstrateprofessional integrity,honesty,and higher ethical standards and be able to display appropriate attitude and communicationskillstointeractwithcolleagues,teachers,students,laboratorypersonnel,andother healthcareprofessionals.Whiledealingwiththepatientsandtheirrelatives,he/sheshouldexhibitcompassion,care, and concern.

f. Research

The student should be able to demonstrate his/her competence in carrying out research workandrelatedactivitiesfromtheplanningphasetowriting(dissertation/thesis,researchreport/researchpaper)byapplyingtheprinciples of research methodology.

LEARNINGOBJECTIVES

At the end of three years of training in the MD Biochemistry course, a postgraduate studentshould beable to:

- Demonstrate his/her knowledge of Biochemistry, Cell Biology, Molecular Biology,Molecular diagnostics, Biophysics, and applied aspects of all the mentioned branchestocontributeto theteaching-learningprocessesand healthcaremanagement.
- Identifylearningneedsandsetthelearningobjectivesforhis/herself-directedlearningand acquire and apply the needful learning in subjects like Genetics, Nutrition &Dietetics, Immunochemistry, andLaboratoryMedicineina relevantcontext.
- ApplytheMedicalEducationprinciplestoeffectivelycontributetoTeaching-Learningprocesses,Assessment &Integratedlearning.
- Demonstrate his/her knowledge about various aspects of the Competency-based UGmedicaleducation implemented w.e.f academicyear 2019-20.
- Explain, comprehend and analyze the basics of Cellular and Molecular Biochemistry,functional mechanisms of the biomolecules and their logistics in the human body innormal health and their deviations in the disease conditions. He/she should be able

tointegratehis/hercognitionandskillstofacilitatemedicaleducationforundergraduate,post graduate,andalliedhealthsciences studentsand forpatientmanagement.

- Demonstrateadministrative,decision-making,groupactivity,teamwork,andleadership skills in (a) setting up a department in the medical institution and (b)diagnosticservicesinthehospitaland managingthemas apartofthehealthcareteam.
- Analyze,interpretandevaluatelaboratorydataandprovideconsultancytotheclinicianfor judicious use of lab tests, with appropriate interpretation whenever needed, tofacilitatethediagnosis,treatment,follow-up,andoverallmanagementofpatients.
- ConductresearchandrelatedactivitiesinthefieldofBiochemistry,ClinicalBiochemistry,M oleculardiagnostics,and MedicalEducation.
- Analyze,interpret,evaluate,appraiseandpresentresearch-relateddataandpublications to identify the best clinical evidence for research and demonstrate his/hercompetencein scientific /clinicalwork presentation.
- Describe the principles of evidence-based medicine, evidence-based practice, goodlaboratorypractice,andgood clinical practice.
- Communicate effectively to fellow colleagues, teachers, patients & their relatives andotherhealthcaremembers forprovidingservices to thecommunity.
- Activelyparticipateinalltheteaching-learning-relatedactivitieslikeCMEs/workshops/conferences/hands-on-training/Interdepartmentalmeets/clinicalmeetingsandacquireinterpersonal skills.

SUBJECT/DOMAIN-SPECIFICCOMPETENCIES

At the end of three years training course, the postgraduate student should be able todemonstrate thecompetencies underthe following threedomains:

A. Cognitivedomain(Knowledgedomain)

1. Describe the biochemical principles and mechanisms to define and explain a healthy,andadiseasedstate,andexecutetheapplicationofthebiochemicalmechanismsinth eperception,diagnosis, and treatment of adisease.
2. Describethebiomoleculesandtheirimportanceinsustaininglifeprocesses.
3. Explain the concept of intermediary metabolism, energy transactions, and metabolicandmolecularhomeostasisin thesustenanceof life.

4. Explainthecharacteristics,components,andfunctionalsignificanceofdifferentmetabolic pathways, their specific intermediates, their inter-conversions, pathway-specific, organ-specific, and interrelated regulation of metabolic pathways, and applythat in explaining the biochemical logic in the functioning of the body in health anddisease.
5. Describeandapplytheconceptofnutritioninhealthanddisease,andcriticallyevaluatethe role of essential micro- and macro-nutrients, and their interlinks with cellularmetabolism.
6. Apply the integrated knowledge and understanding of biochemical principles andmechanismsin clinicalproblem-solving.
7. Demonstrateknowledge ofgeneticengineeringinvariousfieldsofmedicine.
8. Applytheprinciplesofbiostatisticsinresearch,clinicallaboratorypractices,community-basedhealthdata collection,andepidemiologicalsurveys.
9. Demonstrateknowledgeoftheestablishmentofadiagnosticlaboratoryanditsaccreditation process.
10. Analyze,interpretandevaluatebiochemicallaboratoryfindingsinintegrationwiththerelevantclinical datatoevaluate,analyzeand monitoradiseasestate.
11. Apply the knowledge acquired in the basic principles of research methodology todeveloparesearch protocol.
12. Make use of the latest available statistical tools for analyzing the research data, andinterpretingand disseminatingthe results.
13. Demonstratefamiliaritywiththeadvancesinartificialintelligenceandcomputer-basedmodelingas andwhen required.
14. Describe and implement various components of the Competency-based UG MedicalEducation.
15. Applytheprinciplesofteaching-learningtechnologywhiletakinginteractiveclassroomlectures,preparemodulesforcase-basedlearning(CBL)andproblem-basedlearning (PBL), organize and conduct CBLs/PBLs, case discussions, small groupdiscussions,seminars, journal clubs,and researchpresentations.
16. Explain the principles of instrumentation and their automation in the Biochemistrylaboratoryand demonstrateknowledgeabout thelatest advances

intechnology.

17. Exhibit knowledge of professional ethics and integrity in his/her day-to-day conductandservices rendered.
18. Apply the updated knowledge to suggest and implement judicious use of clinicallaboratoryinvestigations.
19. Demonstrate knowledgeon the use oflaboratory gadgets and instruments takingnecessaryprecautions.
20. Demonstrate knowledge on the preparation of solutions and reagents with necessaryprecautions as may be required for the estimations in experimental and diagnosticlaboratories.
21. Displayknowledgeaboutrecentadvancesandtrendsinthecoresubjectarea,research,andlaboratorypracticealongwithpoint-of-caretesting(POCT)inthefieldofbiochemistry.

B. Affective domain (Attitudes including Communication andProfessionalism)

1. Communicateappropriatelywithpeers,teachers,healthcareprofessionals,andpatientscomingfromavarietyofbackgroundstoexplainthemolecularandmetabolicbasisofhealthand diseasein integrationwithlifestyle management.
2. Demonstrate care, concern, respect, empathy, and compassion while dealing withpatientsand theirrelatives at anypoint of interaction.
3. DemonstrateprogressiveimprovementinAETCOMinroutineendeavorsthroughself-assessment,feedbackfromthepeers,stakeholdersandadaptingtorelevantlearning.
4. Explain effectively to the patients/their relatives the precautions and preparationsneededforthem tocomplywith forspecificbiochemical analysis/laboratorytestsththattheywill besubjected to.
5. Ensurethattherelatedtechnicalstaffisapprisedoftheaboveandisdulytrainedwhiledealing with thepatients.
6. Applyethical principlesand displayproperetiquettein dealingwithpatients,relatives,and other health personnel.
7. Demonstrateappropriateattitudeandethicalbehaviorinexchangingfeedbackwithpeers,teachers, clinicians, patients, and their relatives.
8. Displayethicalbehavior,andpersonalandprofessionalintegrityinhis/herconductandservi

ces.

9. Demonstratetheabilitytomaintainconfidentialityindeclaringthelaboratoryresultstotheconcerned personnel whereverapplicable.
10. Displayawareness andrespect fortherights ofthepatients.
11. Demonstrate counseling skills, especially in the context of nutritional and geneticcounseling.
12. Demonstratecompetencyinjudiciousdecision-makingfreefrompersonalbeliefs/thoughts, pride, and prejudice and, that, no such limitations impact his/herprofessionalperformance.

C. Psychomotordomain

1. Demonstratetheprinciplesandfactsofcellularandmolecularbiochemistrybyperformingrelevantlaboratoryexercisesandanalyticaltestsonbodyfluids,andother biologically important substances, along with documentation of the test procedures,results,and interpretation offindings.
2. Develop a differential diagnosis, wherever applicable, based on the results obtainedafterperformingtherequisite tests.
3. Plan & conduct lectures, practical demonstrations, tutorial classes, and case-based orproblem-based small group discussions for undergraduate students of medical andallieddisciplines.
4. Identify, select and perform various biochemical tests in the clinical laboratory whichare useful in the diagnosis, treatment, follow-up, and overall management of diseasesandbeable to interpret theresults of such tests.
5. Performrelevantbiochemical,immunological,andmolecularbiology techniques,whereverapplicable.
6. Demonstrate compliance with the standard operating procedures of various methodsandtechniques used inaclinical biochemistrylaboratory.
7. Performenzymaticassaysandconductexperimentstostudyenzymekineticsaffirmingtheabilityto discuss, interpret and document the relateddata.
8. Performroutineinvestigationsinhematologyandmicrobiology,asandwhenrequired.

9. Demonstrate presentation skills at academic meetings and scientific paper writingskills.
10. Prepareresearchprotocols andconductrelevantexperimentalstudies.
11. Analyzeandsolveclinicalandexperimentalproblems.

By the end of the course, the postgraduate student should be able to demonstrate hiscompetencyinperformingthefollowingproceduresindependently:

- Demonstrate the use of all the routine glassware/equipment used in UG teaching-learning in Biochemistry (as per MSR) and advanced instruments used in theclinicallaboratoryattachedto therespectivehospital for patientcare.
- Preparation of buffers, normal laboratory solutions like molar/molal/normal andreagentswith validation.
- Performalltheundergraduatepracticals asperthenewcompetency-basedmedicaleducation prescribed byNMC.
- Performexperimentstostudyselectedreactionsofcarbohydrates,aminoacidsandproteins,and lipids.
- Performexperimentstodemonstrate constituentsofmilk.
- Performexperimentsto demonstratenormaland abnormalconstituentsofurine.
- PerformPaper chromatographyforseparationofaminoacids.
- Determination of enzyme activity and study of enzyme kinetics, using any twosuitableenzymes(e.g.,alkalinephosphatasefromanylivertissueoracidphosphatasefrom potatoes).
- Plotstandardcurvefordifferentestimations.
- Estimate(includingcalibration)andinterpret clinicalanalytes asdetailedbelow:
    - Bloodglucose,glycatedhemoglobin,theperformanceofglucosetolerancetestandglucosechallengetest,
    - Totalprotein,albumin,andA:Gratio,
    - Electrolytes,arterialbloodgas analysis,
    - Cholesterol,triglycerides,freefattyacids,low-densitylipoproteincholesterol(LDL-C),high-density lipoproteincholesterol(HDL-C),phospholipids,

Lp(a),andcalculatedparametersunderlipid profile,

- Amylase,lipase,
- Urea,creatinine,uricacid,urinarymicroalbumin,
- Parameters of liver function tests (bilirubin, hepato-biliary enzymessuchasAST,ALT,ALP,GGT,serumproteins/albuminandprothrombintime, CRP),
- Calcium, magnesium, phosphorus, copper (and ceruloplasmin), serumiron,TIBC, andferritin,
- Markersofmyocardialdamage(CK,CK-MB,troponins,LDH),
- VitaminD, B_{12},and folate,
- Point-of-caretesting(POCT).

- Electrophoresisofserumproteins**,**lipoproteins,
- Separationandmolecular weightdeterminationof proteinsbySDS-PAGE,
- Electrophoreticseparation of LDHisozymesoranyotherisoenzymes,
- Hbelectrophoresis,
- Renalclearancetests,
- CSFand otherbodyfluidanalysis,
- Stoneanalysis,
- Thyroidfunctiontests,Tumormarkers,andrelevanthormoneassaysbyELISA/RIA/Chemiluminescence.

ClinicalLaboratory

- Demonstrate familiarity with the essentials of a clinical laboratory setup, theworking of autoanalyzer, data transfer, statistical considerations, authorizing andreporting results in an advanced clinical laboratory with an ability to enlist thepossible sources of errors (pre-analytical, analytical and post-analytical), performrootcauseanalysis,andundertakecorrectiveactions,andpreventiveactions(CAPA).
- Performanddemonstrateactivitiesundertotalqualitymanagement(TQM)oftheLaboratory:
  a. Specimencollection,handling,processing,andstorageofthesample.
  b. Methodsofstandardization&calibration.
  c. Methods of qualitycontrol, qualityassurance,CAPA&assessment.

- DemonstrateabilitytoprepareandinterpretaLevy-Jenningschartandplotinter-assayand intra-assayvariation foranyanalyteestimated inthe laboratory.
- ImplementationandinterpretationofWestgardrulesfollowedbytheirCAPA,asrequired.
- Determinationofreferencevaluesforanyoneparameterfortheclinicallaboratory.
- Performinter-instrumentalcomparisonforatleast fourparameters.
- Performin-housecalibrationofpipettes,centrifuge,hot-airoven,thermometer,andthermo-hygrometer.
- Student should undergo internal auditor training as per ISO 15189:2012, NABL(optional).
- Able topreparea labquality manualandframe relevantStandard OperatingProcedure(SOP)andWorkDeskInstructions(WDI),foreveryprocedurefollowedina clinical lab.

Molecularlaboratorytechniques

Thestudentshould beable toperform the following:

- IsolationofgenomicDNAfromblood,
- Isolationof RNA, synthesisof cDNA byreversetranscription,
- PCRandReversetranscriptasePCR(bothconventionalandreal-time),
- Primerdesigning,
- Blottingtechniques,
- Basictechniquesandprinciplesofprotein/enzymepurificationanddeterminingho mogeneity.

By the end of the course, the postgraduate student should be able to perform undersupervisionor,demonstratefamiliaritywith,asthecasemaybe,thefollowingproceures(atleast any five):

1. Separationofperipheralbloodleukocytes usingrelevantisolation technique,
2. Subcellular fractionation/marker enzymes for organelles to demonstratefractionation and purityof thefraction,
3. Ultracentrifugation,
4. Isolationofplasmids,

5. Basictechniquesandessentialsincellcultureandestablishingdifferentcellculturefacilities,
6. High-performanceliquidchromatography(HPLC)/GC-MS/LC-MS,
7. Restrictionfragmentlengthpolymorphism(RFLP),
8. Fluorescentin-situhybridization(FISH),
9. DNAfingerprinting,
10. Immunodiffusiontechniques,
11. Immuno-electrophoresis,
12. Therapeuticdrugmonitoring,
13. Flowcytometry,
14. Nephelometry,
15. HLAtyping.

SYLLABUS

Thecoursecontentsare outlinedbelow:

A. CognitiveDomain

PaperI

Biomolecules, Principles of Biophysics and its biomedical importance, Cell biology,Fluid, electrolyte and acid-base balance, Analytical techniques and instrumentation,Biostatistics and research methodology, Basics of medical education in teaching andassessmentofBiochemistry.

BIOMOLECULES

Ionizationofwater,theconceptofacidandbase,weakacidsandbases,pH,pK,Henderson-Hasselbalch equation, bufferand bufferingcapacity.

Proteins:

- Classification,structure,propertiesandfunctionsofaminoacidsandpeptides,biologicallyimportant peptides,
- Classification,biological significanceandstructuralorganizationofproteins,
- Structure-functionrelationshipofproteins(haemoglobin,myoglobin,collagenandimmunoglobulins),
- Fractionation,purification,structuralanalysisand characterizationofproteins,
- Proteinfoldingand itsassociateddisorders,
- Proteindenaturation,

- Proteindegradation –lysosomalandproteosomal,
- Plasmaproteins.

Carbohydrates:

- Classification,biomedicalimportance,functions,propertiesandreactionsofcarbohydrates,
- Structuralaspectsofmonosaccharides,disaccharidesandpolysaccharides,
- Mucopolysaccharides/glycosaminoglycans,glycoproteinsandglycolipids,
- Glycation,glycosylationandroleofcarbohydratesinbloodgroupsubstances.

Lipids:

- Types,propertiesandbiomedicalimportanceoflipids,
- Fattyacids-nomenclature,classification,properties,reactionsincludingessentialfattyacids, polyunsaturatedfattyacids and trans fattyacids,
- Mono,di-andtriacylglycerols,
- Transfats,
- Cholesterol-structure,propertiesandbiomedicalimportance,
- Phospholipids–classification,properties,composition,andbiomedicalimportanceofvarious phospholipids,
- Glycolipids–classification,properties,composition,andbiomedicalimportance,
- Lipoproteins–classification,properties,composition,andfunctionsofvariouslipoproteinsincludingtheroleofapoproteins,theirimportanceinhealth anddisease,
- Roleoflipids inthestructureandfunction ofbiologicalmembranes,
- Structure,properties,andbiomedicalapplicationsofmicellesandliposomes.

Nucleotidesandnucleicacids:

- Purineand pyrimidinebases in DNAand RNA,
- Nucleosidesandnucleotides,
- Biologicallyimportantnucleotides(includingsyntheticanalogsofpurine/pyrimidinebases and nucleosides used as therapeuticagents),
- Structure,functions,properties,andtypesof DNA andRNA.

PRINCIPLESOFBIOPHYSICSANDITSBIOMEDICALIMPORTANCE

- Diffusion,osmosis,dialysis,surfacetension,viscosity,colloids,crystalloids,andsuspensoids.

CELLBIOLOGY

- Structuralorganizationandfunctionsofabiologicalcellanddifferentsubcellularorganelles

alongwith their markerenzymes,

- Molecularorganization,functions,andstructure-functionrelationshipofacellmembrane,
- Solutetransportacrossbiologicalmembraneswithrelateddisorders,
- Cellfractionationandseparationoforganelles,
- Disordersrelatedtocellmembraneandsubcellularorganelles,
- Intracellulartrafficand sortingof proteins,
- Intracellularsignalingpathways,membrane receptors andsecond messenger,
- Intercellularjunctions,cellularadhesionmolecules,intercellularsignalingandcommunication,
- Extracellularmatrix:composition,andbiomedicalimportance,
- Componentsofthecytoskeleton,andtheirroleinmusclecontractionandcellmotility,
- Cellcycle,itsregulation,andmechanismofcelldeath,
- Structureandfunctionsofspecializedcells.

FLUID,ELECTROLYTE,ANDACID-BASEBALANCE

- Fluid,electrolyte,andacid-basebalance,mechanismofregulationandassociateddisorders.

ANALYTICALTECHNIQUESANDINSTRUMENTATION

- Colorimetry,
- Spectrophotometry,
- Atomicabsorptionspectrophotometry,
- Flamephotometry,
- Fluorometry,
- Turbidimetryandnephelometry,
- Gravimetry,
- Electrochemistry(pHelectrodes,ion-selectiveelectrodes,gas-sensingelectrodes,enzymeelectrodes),
- Chemicalsensors(biosensors),
- Osmometry,
- Chemiluminescence,
- Waterqualitytesting(TDS, pH,fluoride) for autoanalyzer,
- Electrophoresis (principle, types, applications; isoelectric focusing, capillaryelectrophoresis;2-D electrophoresis),

- Chromatography[principle,types(includinghigh-performanceliquidchromatographyandgas chromatography)],
- Massspectrometry,
- Immunochemicaltechniques,
- Techniquesinmolecular biology,
- Nanotechnologyandmicrofabrication,
- Techniquestostudyinvivometabolism (NMR,SPECT,PET scan, etc.),
- Radioisotope-based-techniquesandtheirapplications(permissions,precautions,managementofradioactivewaste),
- Automation,
- Point-of-caretesting.

BIOSTATISTICSANDRESEARCHMETHODOLOGY

- Basicconceptsofbiostatisticsasappliedtohealthscience,
- Statisticaltests:t-test,analysisofvariance,chi-squaretest,non-parametrictests,correlationand regression,
- Statisticalmethodsofvalidation ofdiagnostictests,
- Types of studydesigns and samplingmethodologies,
- Meta-analysisandsystematicreviews,
- Planningandmanagementofresearch,
- Electronicsearchoftheliterature,
- Ethicalaspectsrelatedtoresearchandpublication,
- Briefintroductionofsoftware fordata analysis,
- Essentialsof intellectualpropertyrights,patents andcopyrights.

BASICS OF MEDICAL EDUCATION IN TEACHING-LEARNING ANDASSESSMENTOFBIOCHEMISTRY

- Groupdynamics,
- Principlesofadultlearning, thetaxonomyoflearning,
- Curriculumplanning,
- Educationalobjectives,

- Developingalesson plan (appropriatetotheobjectiveandteachinglearningmethod),
- Interactiveandinnovativeteachingmethods forlargeandsmallgroups,
- Useof appropriatemedia(for alearningsession),
- Principlesofself-directedlearningandgivingfeedback,
- Framingappropriateessayquestions,shortanswerquestionsandmultiple-choicequestions,
- Item analysisandpreparationofquestionbank,
- Principlesandtypesofassessment,
- Methodsofassessingcognitiveskills,psychomotorskills,communicationskills,andprofes sionalism(includingviva voiceand OSPE),
- Developingaplanfor internalassessment andformative assessment,
- Preparationofblueprint andsettingofquestionpaper,
- Microteaching,
- Reflectionwriting.

PaperII

Enzymes,Bioenergetics,Biologicaloxidation,Intermediarymetabolismandinbornerrors of metabolism, Nutrition, Vitamins and Minerals, Detoxification and metabolismof xenobiotics, Free radicals and anti-oxidantdefensesystems

ENZYMES

- Properties,classification,mechanismofaction,coenzymesandcofactors,proenzymes,ribo zymes,nanozymes,catalyticantibodies,
- Factors affectingtherate ofenzyme-catalyzed reaction,
- Kineticsofenzymeactivity,regulationof enzymeactivity,
- Isoenzymesandisoforms,roleinmetabolic regulation,
- Enzymeinhibition,
- Principlesofenzymeassays,
- Applicationsofenzymes:diagnostic,therapeutic andcommercialusesofenzymes,
- Enzymesas targetsfordrugdevelopment.

BIOENERGETICS

- Basicconceptsofthermodynamics anditslaws,as applicabletolivingsystems,
- Exergonicandendergonicreactionsandcoupledreactions,redoxpotential,

- High energycompounds,
- Enzymes ofbiological oxidation,
- Cytochromes.

BIOLOGICALOXIDATION

- Components, complexesandfunctioningof therespiratorychainincluding inhibitors,
- Processandregulationofoxidativephosphorylationincludinguncouplers,
- MechanismsofATPsynthesisandregulation,
- Mitochondrialtransportsystemsandshuttles,
- Mitochondrialdiseases.

INTERMEDIARYMETABOLISMANDINBORNERROROFMETABOLISM

Metabolismofcarbohydrates:

- Digestionandabsorptionincludingassociateddisorders,
- GlycolysisandTCA(Kreb'scycle),includingregulation,
- Glycogenmetabolismanditsregulation,
- Coricycle, gluconeogenesis,
- Metabolismoffructose andgalactoseandtheirclinicalsignificance,
- Pentosephosphate/HMPshuntpathwayanduronicacidpathwaysandtheirclinicalsignificance,
- Polyol/sorbitolpathway,
- Regulationofbloodglucose,hyperglycemia,hypoglycemiaandtheirclinicalsignificance,
- Glucosetolerancetest anditsinterpretation,
- Diabetesmellitus– classification,pathogenesis,metabolicderangementsandcomplications,diagnosticcriteriaandlaboratoryinvestigations,principlesoftreatment(includingdiet and lifestylemodification),
- Inbornerrors anddisorders ofcarbohydratemetabolism.

MetabolismofLipids:

- Digestionandabsorptionandassociateddisorders,
- Metabolismoffattyacids, regulationand related disorders,

- Metabolismofeicosanoidsandtheirclinicalsignificance,
- Metabolismoftriacylglycerol,storageandmobilizationoffats,
- Metabolismofadiposetissue anditsregulation,
- Metabolismofcholesterol includingitstransportand hypercholesterolemia,
- Metabolismof lipoproteins, atherosclerosis, fattyliverand lipid profile,
- Metabolismofmethanolandethanol,
- Role ofliver in lipid metabolism,
- Metabolismofphospholipids andassociated disorders,
- Metabolismof glycolipidsand associated disorders,
- Inbornerrorsoflipidmetabolism.

Metabolismof amino acidsand proteins:

- Digestion,absorptionand associateddisorders,
- Deamination,transamination,disposaloftheaminogroup,catabolismofthecarbonskeleton ofamino acids,
- Formationanddisposalofammonia(includingureacycle)andrelateddisorders,ammoniato xicity,
- Metabolismofindividual aminoacidsand associateddisorders,
- Onecarbonmetabolism,
- Biogenicamines,
- Inbornerrorsof aminoacid metabolism.

Metabolismofnucleotides:

- Metabolismofpurinesandpyrimidinesandtheir associateddisorders.

Metabolismofhaem:

- Metabolismofhaemandassociateddisorders.

Interorganandintraorganinterrelationshipsandintegrationofmetabolicpathways:

- Metabolicadaptationinstarvation, diabetesmellitus,obesity, andduringexercise.

NUTRITION

- Calorificvalue,BasalMetabolicRate(BMR), Specifiedynamicaction(SDA)offood.

- Nutritionalimportanceofproximateprinciples offoodincludingsources and RDA.
- Glycemicindex.
- Biologicalvalueofproteinsandnitrogen balance.
- Thermogeniceffectoffood.
- Generalnutritionalrequirements.
- Balanceddiet,diet formulationsin healthanddisease, mixeddiet.
- Calculationofenergyrequirementsand prescribingdiet.
- Nutritionalsupplementsandparenteralnutrition.
- Foodtoxins andadditives.
- Disordersofnutrition,obesity,proteinenergymalnutrition,under-nutritionandlaboratorydiagnosis of nutritional disorders.
- NationalNutritionProgramme.

VITAMINSANDMINERALS

- Structure,functions,sources,RDA,andmetabolismofvitaminsandmineralsandtheirassociateddisorders.

DETOXIFICATION AND METABOLISM OF

XENOBIOTICSFREERADICALSANDANTI-

OXIDANTDEFENSESYSTEMS

- Freeradicalsandanti-oxidantdefensesystemsinthebody.
- Associationsoffreeradicalswithdiseaseprocesses.
- Oxygentoxicity.
- Oxidativestressmarkers inblood,urine,andotherbiologicalfluids.

PaperIII:

Molecularbiology,Molecularandgeneticaspectsofcancer,Immunology,andEnvironmentalBiochemistry

MOLECULARBIOLOGY

Structure and organization of chromosomes and chromatin re-modelingDNAreplication:

- DNAreplicationinprokaryotesandeukaryotes(includingimportantdifferencesbetweenth e two).
- Endreplicationproblem:Telomere,telomerase andtheirroleinhealthanddisease.
- DNArepairmechanisms andtheirassociateddisorders.
- InhibitorsofDNAreplicationandtheirclinicalsignificance.
- DNArecombination.
- DNAproteininteraction.

Transcription:

- Structureofagene-exonsandintrons,promoter,enhancers/repressorsandresponse elements.
- Processoftranscriptioninprokaryotes andeukaryotes.
- Post-transcriptionalmodifications.
- Inhibitorsoftranscription.
- RNAeditingandstability.

Geneticcode,genepolymorphism,andmutation:

- Characteristicsofthe geneticcode.
- Molecularbasis of thedegeneracyof the geneticcode(Wobble hypothesis).
- Mutation and genepolymorphism.
- Mutagens-examplesofphysical, chemical, andbiologicalmutagens.
- Typesofmutations.
- Mutationinhealthanddisease.

Translation:

- Basicstructureofprokaryoticandeukaryoticribosomes.
- Processofproteinsynthesis(translation)inprokaryotesandeukaryotes.
- Post-translationalmodifications.
- Proteinsorting,proteintargeting,proteinfoldingandrelateddisorders.
- Inhibitorsoftranslationinprokaryotes andeukaryotes,andtheirclinicalsignificance.

Regulation of gene expression in prokaryotes and

eukaryotesRecombinantDNAtechnologyanditsapplicationsinmodernm

edicineOverview ofhuman genomeproject

Basicsofbioinformatics

Principlesofhumangenetics:

- Alleles,genotypesandphenotypes.
- Patternsofinheritance:monogenic andpolygenicinheritance.
- Populationgenetics.
- Geneticfactors incausationofdiseases.
- Typesofgeneticdiseases:Chromosomal,monogenicandpolygenicdisorders, mitochondrialdisorders, nucleotiderepeatexpansiondisorders,imprintingdisorders.
- Screeningforgeneticdiseases andprenataltesting.
- Ethicalandlegalissuesrelatedtomedical genetics.

Stemcellsandregenerativemedicine:

- Basicconceptsregardingstemcells
- Typesofstemcells:embryonic andinducedpluripotentstemcells(IPSC)
- Applicationinregenerativemedicineanddiseasetherapeutics
- Ethicalandlegal issuesrelated touseofstem cellsin medicine.

MOLECULARANDGENETICASPECTSOFCANCER

- Biochemicalcharacteristicsofacancercell
- Biochemistryof carcinogenesis
- Carcinogens
- Roleofoncogenes andtumorsuppressorgenes
- Geneticalterationsandadaptationsincancer
- Tumormarkers,cancer riskassessment, and communityscreening
- Biochemicalbasisof cancerchemotherapyand drugresistance
- Anti-cancertherapy.

IMMUNOLOGY

- Organizationandcomponentsof theimmunesystem
- Innateandadaptiveimmunity-componentsandfunctions
- Antigens,immunogens,epitopesandhaptens, carriers,adjuvants

- Immunoglobulin:structure,types,and functions
- Mechanism of antibody diversity: organization and expression of immunoglobulingenes,immunoglobulin generearrangement,classswitching
- Humoralandcell-mediatedimmunity,regulationofimmuneresponses,immuneresponseto infections
- Majorhistocompatibilitycomplex,antigenprocessing,andpresentation
- Antigen-antibodyinteraction,immuneeffectormechanisms
- Complementsystem
- Hypersensitivityreactions
- Tolerance,autoimmunity
- Immunodeficiency,immuneunresponsiveness,andtheirclinicalimplications
- Vaccines
- Immunologyofchronicdiseases
- Transplantationimmunology
- Immunodiagnosticsandimmunotherapy.

ENVIRONMENTALBIOCHEMISTRY

Healthandpollution

Effectsofenvironmentalpollutantson thebody

PaperIV

Basicprinciplesand practiceofclinical biochemistry,Biochemicalanalytes,Assessmentof organ systemfunctions, and Recent advances inbiochemistry

BASICPRINCIPLESANDPRACTICEOFCLINICALBIOCHEMISTRY

- Units of measurement, reagents, clinical laboratory supplies, basic separation techniques,laboratorycalculations,specimencollection,transportandprocessing,safetyinthe laboratory,
- Essentialsofclinicalinvestigationsin Biochemistry,theclinicalutilityoflaboratorytests(including accuracy, precision, sensitivity, specificity, ROC curves, etc), analysis in thelaboratory,andselectionandevaluationof methods(includingstatistical techniques),
- Evidence-based laboratory medicine, establishment and use of reference values, pre-

analytical, analytical, and post-analytical variables and biological variations, total qualitymanagement (TQM), clinical laboratory and hospital informatics, concepts and reportingofcritical values.

BIOCHEMICALANALYTES

Biochemicalanalysesandtheirclinicalsignificance:

- Aminoacids,peptidesandproteins;non-proteinnitrogenous compounds
- Enzymes
- Carbohydrates
- Lipids,lipoproteinsandapolipoproteinsandothercardiovascularriskmarkers
- Electrolytes
- BloodgasesandpH
- Hormones
- Catecholamines,serotonin,andotherneurotransmitters
- Vitamins,minerals,trace andtoxicelements
- Hemoglobin,andbilirubin
- Porphyrins
- Bonemarkers
- Tumourmarkers.

Body fluid

analysisStoneanaly

sis

Therapeuticdrugmonitoring

Clinical

toxicologyPharmacogenomic

s

Pediatricandgeriatricbiochemicalinvestigations

- Biochemistryofaging

ASSESSMENTOFORGANSYSTEMFUNCTIONS

Hematopoieticdisorders:

- Hemostasis and thrombosis-biochemical mechanism, related laboratorytests,antiplatelettherapyanticoagulant therapy,and fibrinolytictherapy
- Anemia-classification,etiology,laboratoryinvestigations,andmanagement
- Hemoglobinopathies-sicklecellanemia,methemoglobinemia,thalassemiasyndromes
- RBCmembrane,metabolism,inheriteddefectsinRBCmembrane, andenzymes
- ABObloodgroupsystem–thebiochemicalbasisofincompatibilityandtransfusion biology
- Plasmacelldisorders
- Otherdisordersofhematopoieticcellsandtheirprogenitors.

Endocrinesystem:

- Classificationandgeneralmechanismofactionofhormones
- Biosynthesis, secretion, regulation, transport, and mode of action of hypothalamicpeptides,adenohypophysealandneurohypophysealhormones,thyroidandparathyroidhormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones,gonadalhormones,gastrointestinal hormones,opioidpeptides, parahormones
- Neuro-modulatorsandtheirmechanismofaction andphysiologicalsignificance
- Biochemicalaspectsofdiagnosisandtreatmentofendocrinaldisorders
- Endocrinologyofconception, reproduction,andcontraception
- Antenataltesting,newbornscreening,andinbornerrorsofmetabolism.

Cardiovascularsystem:

- Atherosclerosis-pathogenesis,riskfactors,preventionandtreatment
- Biochemistryofcardiacfailure,acutecoronarysyndrome,cardiomyopathies,andcardiacarrhythmias
- Cardiacbiomarkers.

Respiratorysystem:

- Pulmonarygaseousexchangesinhealthanddisease
- Biochemistryofrespiratorydisorders.

Renalsystem:

- Biochemistryofkidneyfunctions
- Pathophysiology,biochemistry,laboratory findingsandmanagementinacuteandchronickidneydiseases
- Nephrolithiasis,biochemicalaspectsof renalstones
- Biochemistryof renaltransplant.

Gastrointestinalsystem:

- Biochemistryofgastricfunctions
- Regulatorypeptidesinthegut
- Digestionandabsorptionofnutrients,evaluationofmalabsorption
- Biochemical aspects of- Peptic ulcer diseases, Zollinger-Ellison syndrome, Celiacdisease, Inflammatory bowel disease, Protein losing enteropathy and Neuroendocrinetumors.

Hepato-biliaryandpancreaticsystem:

- Biochemistryof hepato-biliaryand pancreaticfunctions
- Formation,compositionandfunctionsofbile
- Pathophysiology,biochemistry,laboratory findingsandmanagementinacuteandchronichepato-biliaryand pancreaticdisorders.

Skeletalsystem:

- Bonestructure**,**metabolism,associateddisorders andmarkers
- Bonemineral homeostasis.

Nervoussystem:

- Neurotransmittersandtheirreceptors
- Ionchannels andchannelopathies
- Neurotrophicfactors

- Infective andinflammatorydiseasesofnervoussystem(meningitis,encephalitisetc.)
- Proteinaggregation,neurodegenerationandrelateddisorders(Alzheimer’sdisease,Parkinson'sdisease, Huntington’s disease, and others)
- Prionsandpriondiseases
- Ischemicandhemorrhagicneurodisorders
- Neuro-immunedisorders(Guillain-Barresyndrome,Myastheniagravis,multiplesclerosisand others)
- Pathophysiologyand biochemistryof psychiatric disorders
- **RecentadvancesinBiochemistry.**

B. PsychomotorDomain

Thecoursecontentsare mentionedunderSubject/domain-specificcompetencies.

TEACHINGANDLEARNINGMETHODS

Generalprinciples

Acquisition of competencies being the keystone of doctoral medical education, such trainingshould be skill oriented. Learning in the program, essentially autonomous and self-directed,and emanating from academic and clinical work, shall also include assisted learning. Theformalsessions aremeant to supplement this coreeffort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residentsduring the period of training, attending not less than 80% of the training activity during thecalendaryear,andparticipatinginallassignmentsandfacetsoftheeducationalprocess.Theyshall maintain a logbook for recording the training they have undergone, and details of theproceduresdoneduringlaboratoryand clinical postings in real-time.

Teaching-Learningmethods

This should include a judicious mix of demonstrations, symposia, journal clubs,clinicalmeetings,seminars,smallgroupdiscussion,bed-sideteaching,case-basedlearning,simulation-basedteaching,self-

directedlearning,integratedlearning,interdepartmentalmeetings and any other collaborative activity with the allied departments. Methods withexposuretotheappliedaspectsofthesubjectrelevanttobasic/clinicalsciencesshouldalsobeused. **The suggested examples of teaching-learning methods are given below but are notlimited to these. The frequency of various below-mentioned teaching-learning methodscan vary based on the subject's requirements, competencies, workload, and overallworkingschedule in theconcerned subject.**

A. Lectures:Didacticlecturesshouldbeusedsparingly.Aminimumof10lecturesperyearinthecon cernedPGdepartmentissuggested.Topicstobeselectedaspersubjectrequirements.

All postgraduate trainees will be required to attend these lectures. Lectures can cover topicssuchas:

1. Subjectrelatedimportant topicsasperspecialtyrequirement
2. Recentadvances
3. Researchmethodologyand biostatistics
4. SalientfeaturesofUndergraduate/Postgraduatemedicalcurriculum
5. Teachingand assessmentmethodology.

Topic numbers 3,4,5 can be done during research methodology/biostatistics and medicaleducationworkshops in theinstitute.

B. Journalclub:Minimumofoncein1-2weeksissuggested.

Topics will include presentation and critical appraisal of original research papers published inpeer reviewed indexed journals. The presenter(s) shall be assessed by faculty and gradesrecordedin thelogbook.

C. StudentSeminar:Minimumofonceevery1-2weeksissuggested.

Importanttopicsshouldbeselectedaspersubjectrequirementsandallottedforin-depthstudybyapostgraduatestudent.Ateachershouldbeallocatedforeachseminarasfacultymoderatorto help the student prepare the topic well. It should aim at comprehensive evidence-basedreviewof thetopic. Thestudentshould begradedbythe facultyand peers.

D. StudentSymposium: Minimumofonceevery3months.

Abroadtopicofsignificanceshouldbeselected,andeachpartshallbedealtbyonepostgraduate student. A teacher moderator should be allocated for each symposium andmoderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by thefacultyand peers.

E. Laboratorywork/Bedsideclinics:Minimum-onceevery1-2weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty fromthedepartment.VariousmethodslikeDOAP(Demonstrate,Observe,Assist,Perform),

simulations in skill lab, and case-based discussions etc. are to be used. Faculty from thedepartment should participate in moderating the teaching-learning sessions during laboratorywork.

F. Interdepartmentalcolloquium

Faculty and students must attend monthly meetings between the main department and otherdepartment/son topics of current/common interest or clinicalcases.

G. a.Rotationalclinical/community /institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate traineesmay be posted in relevant departments/ units/ institutions. The aim would be to acquire morein-depth knowledge asapplicable to the concerned specialty. Postingswould be rotatedbetweenvariousunits/departmentsanddetailstobeincludedinthespecialty-basedGuidelines.

Suggesteddepartmentsanddurationofrotationalpostings:

- General Medicine - 1 month (includes Endocrinology, Pediatrics, and ICUposting)
  - ✓ Endocrinology [Focus: Clinical correlation and important investigationsrelated to diabetes mellitus and other diseases, dietary advice, point-of-caretesting]
  - ✓ ICU/ICCU[Focus:ABGanalysisandcorrelation,electrolyteimbalances, cardiac biomarkers and correlation, markers of septicemiaandits management, basics of ventilation]
  - ✓ Pediatrics[Focus:Inbornerrorsofmetabolismandothercommondiseases,nutritional disorders, and dietaryadvice]
- Hematology-15days
- Immunohematologyandbloodtransfusion(TransfusionMedicine)/Bloodbank-15 days
- Microbiology-15days
- MedicalEducationUnit(MEU)orDepartmentofMedicalEducation(DOME) -oneweek/shallattendaspecificworkshoporatrainingcourse[Focus:

Principlesofteaching-learning-assessmentandotherimportantaspectsofMedicalEducation].

G.b.Postingunder"DistrictResidency Programme"(DRP):

AllpostgraduatestudentspursuingMD/MSinbroadspecialtiesinallMedicalColleges/Institutions shall undergo a compulsory rotation of three months in the DistrictHospital/District Health System as a part of the course curriculum, as per the PostgraduateMedical Education (Amendment) Regulations (2020). Such rotation shall take place in the3rd or 4th or 5th semester of the Postgraduate program and the rotation shall be termed as"District Residency Programme" and the PG medical student undergoing training shall betermedas"District Resident".

Every posting should have its defined learning objectives. It is recommended that thedepartmentsdrawupobjectivesandguidelinesforeverypostingofferedinconjunctionwiththe collaborating department/s or unit/s. This will ensure that students acquire expectedcompetencies and are not considered as an additional helping hand for the department / unitin which they are posted.The PG student must be tagged along with those of other relevant departmentsforbedsidecasediscussion/basicscienceexercisesasneeded,undertheguidanceofan assigned faculty.

Opportunitiestopresentanddiscussinfectiousdiseasecasesthroughbedsidediscussionand ward/grandroundswithspecialists/cliniciansindifferenthospitalsettings must be scheduled to address antimicrobial resistance issues and strategies todeal with it.

To consider and approve the tmpte Students admitted in the 2021-22 batch as per the NMC notifications vide letter F.No. NMC23(1)(25)12021/PG/053909 dated 2211212022 and Clarification issued by NMC vide tetter F. N o. N M C/23 (1) (25) 12021 I Med. I 00 1 866 d ated 1 9 I Ot t 2023 Resolution ' with reference to the NMC notifications vide letter F.No. NMC-23(1)(25)t2o21tpcto53g0g dated 2211212022 and Clarification issued by NMC vide letter F.No.NMC/23(1)(25)t2021/Med./001g66 dated 1910112023. the District Residency Program (DRP) shall be implemented for the students admitted in 2021-22 batch onwards. The said notification and clarification from NMC were considered and passed unanimously.

The communication from National Medical Commission vide no. NMC-23 (1) (25) / 2021 / PG / 053909, dated 22.12.2022 regarding Implementation of District Residency Programme, and National Medical Commission vide no. NMC-23(1)(25)/2021/Med./001866, dated 19.01.2023 regarding Clarification on implementation of District Residency Programme, is adopted for execution.

(BOS-Ref :SBKSMIRC/Dean/Outward No.1158/2022-23, Date of Academic council : 11/02/2023)

(BOM-Ref. No.: SVDU/R/2431-A/2022-23, Date of Academic council : 29/05/2023)

- (Board of Studies letter no.:SBKS/DEAN/1576/2020,dated 0/10/2021 and Vide Notification of Board of Management Resolution : Ref no. SVDU/R/1271-1/2020-21, dated - 30th December 2020)

- To introduce Basic life support (BLS) and Advanced Cardiac Life Support (ACLS) trainingforalltheFirstyearPostgraduateResidentDoctorsfromacademicyear2017-18

- To introduce New chapter / topic 'Intellectual Property Rights (IPR) foralltheFirstyearPostgraduateResidentDoctorsfromacademicyear2020-2021 of duration of 4hrs (Board of Studies letter no.: SBKS/DEAN/742/2021,dated 05/06/2021 and Vide Notification of Board of Management Resolution Ref no.:SVDU/R/3051-1/2020-21, dated - 29" July 2021)

List of topics :

1. Introduction-ConceptofIntellectualProperty,Historicalviewof Intellectual Property system in India and International Scenario, Evolution of Intellectual Property Laws in India, Legal basis of Intellectual Property Protection, Need for Protecting Intellectual Property, Theories on concept of property - Major IP Laws in India.
2. Types of IPR: Patents, Copyright, Trademark Industrial Designs, TradeSecrets.
3. Patents: Concept of Patent, Criteria of Patentability, Inventions NOT patentable, Process of Obtaining a Patent, Duration of Patents, Rights of Patentee, Limitation of rights, Infringement andEnforcement.
4. Copyrights: Meaning of Copyright, Copyright Vs. Moral rights, Copyrighteligibility,TermofCopyright,RegistrationofCopyright, Infringement andRemedies
5. Trademark: Meaning of Trademark, Criteria for trademark, Procedure for Trademark Registration, Term of protection, Infringement andRemedies.
6. Industrial Designs: Meaning of Industrial Designs, Rights in Industrial Designs: Nature, Acquisition and duration ofrights.
7. Trade Secrets: Meaning of Trade Secrets, Need to protectTrade secrets, Criteria of Protection, Procedure for registration, Infringement.
8. Commercialization of IPR: Traditional IP and Evolving IP, Assignment, Licensing, Cross License, Patent Pool, Negotiations, Defensive Publications, TechnicalDisclosures, Patent Pooling, Patent Trolling, Brand Management, Brand and Pricing Strategies.

H. Teachingresearchskills

Writingathesisshouldbeusedforinculcatingresearchknowledgeandskills.Allpostgraduate students shall conduct a research project of sufficient depth to be presented tothe University

as a postgraduate thesis under the supervision of an eligible faculty memberof the department as a guide and one or more co-guides who may be from the same or otherdepartments.

In addition to the thesis project, every postgraduate trainee shall participate in at least oneadditional research project that may be started or already ongoing in the department. It ispreferable that this project will be in an area different from the thesis work. For instance, ifa clinical research project is taken up as thesis work, the additional project may deal withcommunity/field/laboratorywork.Diversityofknowledgeandskillscantherebybereinforce d.

I. Training in teaching skills

MEU/DOMEshouldtrainPGstudentsineducationmethodologiesandassessmenttechniques.
The PG students shall conduct UG classes in various courses and a faculty shallobserveand providefeedback on the teachingskills of thestudent.

J. Logbook

During the training period, the postgraduate student should maintain a logbook indicatingthe duration of the postings/work done in wards, OPDs, casualty, and other areas of
theposting.Thisshouldindicatetheproceduresassistedandperformedandtheteachingsessionsatt ended. The logbook entries must be done in real-time. The logbook is thus a record ofvariousactivitiesbythestudentlike(1)Overallparticipation&performance,(2)attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5)acquisitionofselectedcompetencies.

Thepurposeof thelogbook is to:

a) helpmaintainarecordoftheworkdoneduringtraining,
b) enablefaculty/consultantstohavedirectinformationabouttheworkdoneandinterve ne,if necessary,
c) providefeedbackandassesstheprogressoflearningwithexperience gainedperiodically.

Thelogbookshouldbeusedintheinternalassessmentofthestudent,andshouldbecheckedand assessed periodically by the faculty members imparting the training. The PG studentswill be required to produce a completed log book in original at the time of final practicalexamination.Itshouldbesignedbytheheadofthedepartment.Aproficiencycertificate

from the Head of Department regarding the clinical competence and skillful performance ofproceduresbythestudentwillbesubmittedbythePGstudentatthetimeoftheexamination.

The PG students shall be trained to reflect and record their reflections in the logbookparticularlyofthecriticalincidents.Componentsofgoodteachingpracticesmustbeassessedin all academic activity conducted by the PG student and atleast two sessions dedicated forassessmentofteachingskillsmustbeconductedeveryyearofthePGprogram.Theteachingfaculty are referred to the NMC (Erstwhile MCI) Logbook Guidelines uploaded on thewebsite.

K. Course in Research Methodology: All postgraduate students shall complete an onlinecourseinResearchMethodologywithinsixmonthsofthecommencementofthebatchand generatethe online certificate onsuccessful completion of thecourse.

Otheraspects

- Thepostgraduatetraineesmustparticipateintheteachingandtrainingprogramofundergraduatestudents and interns attendingthedepartment.
- Traineesshallattendaccreditedscientificmeetings(CME,symposia,andconferences)atleast once ayear.
- Departmentshallencouragee-learningactivities.
- ThepostgraduatetraineesshouldundergotraininginBasicCardiacLifeSupport(BCLS)andAdvanced CardiacLifeSupport (ACLS).
- Thepostgraduatetraineesmustundergotraininginformationtechnologyanduseofcomputers.

During the training program, patient safety is of paramount importance; therefore,relevantclinicalskillsaretobelearnedinitiallyonthemodels,andlatertobeperformedundersupervisionfollowedbyindependentperformance.Forthispurpose,theprovisionof skills laboratories inmedical collegesismandatory.

ASSESSMENT

Theassessmentforpostgraduatestudentin Biochemistrywill beof twotypes;Formativeand Summative

FORMATIVE ASSESSMENT

Formative assessment is the assessment conducted during the training with the primarypurposeofprovidingfeedbackforimprovinglearning.Itshouldbecontinualandshouldassess medical knowledge, patient care, procedural & academic skills, interpersonalskills, professionalism, self-directed learning, and ability to practice in the system. Theformative assessment will be used to determine the existing knowledge base and futureneeds,and identify priority areas.

GeneralPrinciples

The Internal Assessment will include both theory and practical examination. It should befrequent, cover all domains of learning, and should be used to provide feedback to improvelearning;it should alsocover professionalism andcommunication skills.

Formativeassessmentduring theMDtraining shouldbebased on:

- Casepresentation/caseworkup :onceaweek
    - The student will present a case from ward/lab along with investigationsdonein theclinical laboratory
- Laboratoryperformance :onceaweek
    - The student will analyze an unknown sample on an autoanalyzer, startingwithcalibration,qualitycontrolofthemachine,andthenloadingthesample. He/she will do the reporting and interpret the results and will beevaluatedthe next day.
    - He/shewillbeevaluatedseparatelyforpracticalslistedintheundergraduatesyllabus.
    - He/she will be evaluated at the end of each postgraduate practical sessionaslisted under thepsychomotor domain.
- Journalclub :onceaquarter

- The student will present and critically evaluate an original research article.The article should be preferably from outside his/her area of work so thathe/she can learn newer techniques. The focus should be on understandingthe research question and evaluating whether appropriate study design,methodology,andstatistical toolswereusedto findanswersto thesame.

- Seminar :onceafortnight
  - The student will present a topic from the syllabus and will try to researchand include recent advances on that topic. He/she will also present recentadvances (not included in thesyllabus) periodically.
- Micro-teaching :Onceaweek
  - The teaching skills of the student will be evaluated. Special topics can begiven, and the student will teach that topic to the evaluators or he/she maybeevaluated duringpre-practical briefingof undergraduatestudents.
- Interdepartmentalcaseor seminar : oncein 3 months
  - Thisshouldbeorganizedattheinstitutelevelandappropriateverticalandhorizontalintegration should be ensured.

Note: Thesesessions maybeorganizedandrecordedas aninstitutional activityforallpostgraduates.

- AETCOM :Onceineverysixmonths
  - ThepostgraduatestudentcanbeevaluatedduringtheAETCOMsessionsoftheundergraduates.
  - Case scenarios should be provided and the postgraduate will be asked todemonstratehowhe/shewill respond to thesituation.

- AttendanceatScientificmeetings,CMEprogrammes(atleast02eachduringthecourse)

Thestudentistobeassessedperiodicallyaspercategorieslistedintheappropriate(non-clinical/clinical)postgraduatestudent appraisalform(AnnexureI).

SUMMATIVE ASSESSMENT, ie., assessment at the end of training to evaluatewhetherthestudenthasacquiredsufficientknowledgeandskillstobeawardedMDdegree

Essentialpre-requisitesforappearingforexaminationinclude:

1. **Logbook**ofworkdoneduringthetrainingperiodincludingrotationalpostings,departmental presentations,andreportsoftheinternalassessmentconducteduringthetrainingperiod should besubmitted.

2. At least **two presentations** at national-level conferences. One research paper should beunder submission for publication/ accepted for publication/ published in an indexedjournal**. (It is suggested that the local or University Review committee assess theworksent forpublication).**

The summative examination would be carried out as per the rules given in the latestPOSTGRADUATEMEDICALEDUCATIONREGULATIONS.Thetheoryexaminationshall be held in advance before the clinical and practical examination so that the answerbooks can be assessed and evaluated before the commencement of the clinical/practicalandoral examination**.**

Thepostgraduateexamination shall bein threeparts**:**

1. **Thesis**

   ThesisshallbesubmittedatleastsixmonthsbeforetheTheoryandClinical/Practicalexamination. The thesis shall be examined by a minimum of three examiners; oneinternal and two external examiners, who shall not be the examiners for Theory andClinical examination. A post graduate student in broad specialty shall be allowed toappear for the Theory and Practical/Clinical examination only after the acceptance ofthe Thesis bytheexaminers**.**

2. **Theoryexamination**

   The examinations shall be organized on the basis of 'Grading' or 'Marking system' toevaluate and certify post-graduate student's level of knowledge, skill, and competenceattheendofthetraining,asgivenintheLatestPOSTGRADUATEMEDICAL

EDUCATION REGULATIONS. Obtaining a minimum of 50% marks in 'Theory' aswell as 'Practical' separately shall be mandatory for passing the examination as awhole.TheexaminationforM.D./M.Sshallbeheldattheendofthe3rd academicyear.

Thereshall befourtheorypapers (asper PG Regulations):

PaperI:
Biomolecules,PrinciplesofBiophysicsanditsbiomedicalimportance,Cellbiology,Fluid,electrolyte andacid-base balance,Analyticaltechniques,andinstrumentation,Biostatisticsandresearchmethodology,Basicsofmedicaleducationinteaching andassessment ofBiochemistry.

PaperII:
Enzymes,Bioenergetics,Biologicaloxidation,Intermediarymetabolismandinborn errors of metabolism, Nutrition, Vitamins and Minerals, Detoxificationandmetabolismof xenobiotics,Freeradicals,andanti-oxidantdefensesystems

PaperIII:
Molecular biology, Molecular and genetic aspects of cancer, Immunology, andEnvironmentalBiochemistry

PaperIV:
Basicprinciplesandpracticeofclinicalbiochemistry,Biochemicalanalytes,Assessmentoforgansystemfunctions,andRecentadvancesinbiochemistry

3. Practical/clinical and Oral/viva voce examinationPracticalexamination

The practical examination should be spread over **two** days and include various majorcomponents of the syllabus focusing mainly on the psychomotor domain. One dayshould be for conducting practical examination including table viva that will focus onthenuances of laboratorytechniques and qualityassurance.

Thepracticalexamination shouldinclude:

1. One Clinical / Paper case: An unknown sample will be analyzed by the student,andhe/shewillhavetopreparethereportalongwiththeinterpretationofthesame.Itshould include both serum and urine analysis.

2. Onepracticalexercise onanymolecularbiologytechnique.

3. Onepractical exercise onimmunologytechnique.
4. OSPE:Itshallbeconductedonvarioustopicswhichhavenotbeencoveredintheabove-mentionedpracticalandshouldinclude,ifpossible,evaluationofAETCOM(Attitude, Ethics, and Communication) skillsof thestudents.
5. Evaluationoflaboratorymanagementskills.

Oral/Vivavoceexamination on definedareas shouldbeconductedbyeachexaminerseparately.Theoralexaminationshallbecomprehensiveenoughtotestthepostgraduate student's overall knowledge of the subject focusing on the psychomotorandaffectivedomains.

The**Oral/Viva-voceexaminationshallbeconductedonthesecondday**andshouldinclude:

1. Thesispresentation
   Theabilityofthestudenttojustifythemethodology,andfindingswithinterpretation,should beevaluated.
2. Micro-teaching
   Theessentials ofclassroom teachingskillsshouldbeevaluated.
3. Grandvivavoce

RecommendedReading:

Books(latestedition)

1.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.Cox.WH Freeman &Co(Sd).
2. Biochemistry(Stryer),JeremyM. Berg,JohnL.Tymoczko,LubertStryer,W.H.Freeman.
3. Biochemistry(Voet&Voet),DonaldVoet,JudithG.Voet,JohnWiley&SonsInc.
4. TextbookofBiochemistrywithClinicalCorrelations,ThomasM.Devlin,JohnWiley& Sons.
5. KubyImmunology,JudyOwen,Jenni Punt, SharonStranford, W.H. Freeman.
6. Principles and Techniques of Biochemistry and Molecular Biology.Wilson/Walker;CambridgeUniversityPress

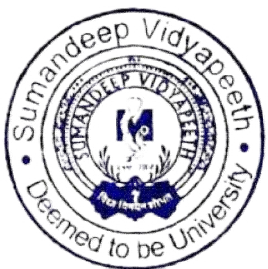
7. Clinical Chemistry: Principles, Techniques, and Correlations, Michael L Bishop,EdwardP Fody,LarryE Schoeff,LippincottWilliams and Wilkins.
8. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, Carl A. Burtis,EdwardR. Ashwood , Saunders.
9. HarpersIllustratedBiochemistry,VictorW.Rodwell,DavidBender,KathleenM.Botham,PeterJ. Kennelly,P.AnthonyWeil,McGraw-Hill Education/Medical.
10. Biochemistry(Lippincott'sIllustratedReviews),DeniseRFerrier,LippincottWilliams andWilkins.
11. Harrison's Principles of Internal Medicine, Dennis L. Kasper,Anthony S. Fauci,Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, Joseph Loscalzo, McGraw-HillEducation / Medical.
12. Davidson'sPrinciplesandPracticeofMedicine,Walker,ElsevierHealthSciences –UK.
13. ClinicalBiochemistry:MetabolicandClinicalAspects,WilliamJ.Marshall&MártaLapsley&AndrewDay&RuthAyling,Imprint-ChurchillLivingstone.
14. Biochemistry:ACase-orientedApproach,RexMontgomery,ThomasW.Conway,ArthurA. Spector,DavidChappell, Mosby.
15. InterpretationofDiagnostictests,JacquesWallach,LippincottWilliams&Wilkins.

Journals

03-05internationalJournalsand02national(allindexed)journals.

Annexure 1


National Medical Commission


Sumandeep Vidyapeeth
Deemed to be University

StudentappraisalformforMDin Biochemistry										
	Elements	**Less thanSatisfactory**			**Satisfactory**			**More thansatisfactory**			**Comments**
		1	2	3	4	5	6	7	8	9	
1	**Scholasticaptitude andlearning**										
1.1	Has knowledgeappropriate forleveloftraining										
1.2	Participationand contributionto learningactivity (e.g.,Journal Club, Seminars,CME etc)										
1.3	Conduct ofresearch andother scholarlyactivityassigned (e.g Posters,publications etc)										
1.4	Documentation ofacquisitionofcompetence(eg Logbook)										
1.5	Performancein workbasedassessments										
1.6	Self-directedLearning										
2	**Work relatedtotraining**										
2.1	Practical skillsthat areappropriate forthe levelof training										
2.2	Respect forprocesses andprocedures intheworkspace										

2.3	Ability to workwith othermembers ofthe team										
2.4	Participation and compliancewith the quality										

	improvement processatthe workenvironment										
2.5	Abilitytorecord and documentwork accurately andappropriate for leveloftraining										
3	**Professional attributes**										
3.1	Responsibility and accountability										
3.2	Contribution togrowth oflearningofthe team										
3.3	Conduct that isethicallyappropriateand respectfulatalltimes										
4	**Spacefor additionalcomments**										
5	**Disposition**										
	Has thisassessmentpatternbeen discussed withthetrainee?	Yes	No								
	Ifnotexplain.										
	Name andSignatureoftheassesse										
	Nameand Signatureofthassessor										
	Date										

SubjectExpertGroupmembersforpreparationofREVISEDGuidelinesfor competencybasedpostgraduatetrainingprogrammeforMDinBiochemistr y

1.	**Dr.NibrithiDas**, Professor (Retd), Dept. Biochemistry,AllIndiaInstituteofMedic alSciences,NewDelhi-110029	**Convener**
2.	**Dr.Tejas J.Shah** Professor and Head,DepartmentofBiochem istry, Smt.B.K.ShahMedicalInstitute&ResearchCentreSum andeepVidyapeethDeemedto beUniversity At.&Po.Piparia,Taluka:Waghodia,Va dodara-391760,Gujarat State.	**Co-convener**
3.	**Dr. Rajarshi Kar**ProfessorofBiochemi stryUCMS & GTB HospitalDelhi-110095	**Member**
4.	**Dr.VaishaliJain** Professor and Head, Department of Biochemistry,AtalBihariVajpayeeGovt.Medical Vidisha,MadhyaPradesh	**Member**
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Dr.RajarshiKar, Dr.KiranDahiya, Dr.VaishaliJain(Members,oftheexpertteam)

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12.11.2022

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