Department of Biochemsitry, UCS, Osmania Univeristy

Approved MSc. CBCS Syllabus

(Effective for 2016 admitted batch)

SEMESTER I					
PAPERS	TITLE (WITH CODE)	Teaching hrs/week	Credits	Internal marks	Final exam marks
1	BI101T:ChemistryandMetabolismofProteinsandLipidsandPorphyrins (core)	4	4	20	80
2	BI102T:ChemistryandMetabolismofCarbohydrates,VitaminsandNucleicAcids (core)	4	4	20	80
3	BI 103T: Bio-AnalyticalTechniques (core)	4	4	20	80
4	BI104T:BioenergeticsAndCellBiology (core)	4	4	20	80
5	BI105P:Biomolecules	8	4	--	100
6	BI106P:BioanalyticalTechniques	8	4	--	100
Total		32	24	80	520
SEMESTER II					
PAPERS	TITLE	Teaching hrs/week	Credits	Internal marks	Final exam marks
1	BI201T:Enzymology (core)	4	4	20	80
2	BI202T:MolecularBiology (core)	4	4	20	80
3	BI203T:BiochemicalGeneticsAndModelOrganisms (core)	4	4	20	80
4	BI 204T: EndocrinologyandMetabolicDisorders	4	4	20	80
5	BI205P:Enzymology and Molecular biology	8	4	--	100
6	BI206P:MolecularBiology and bioinformatics	8	4	--	100
Total		32	24	80	520
SEMESTER III					
PAPERS	TITLE	Teaching hrs/week	Credits	Internal marks	Final exam marks
1	BI301T:GeneRegulationandGeneticEngineering (core)	4	4	20	80
2	BI302T:ImmunologyandImmunotechnology (core)	4	4	20	80
3	BI303T:ClinicalBiochemistry (Elective)	4	4	20	80
4	BI304T:Chemistry of biomolecules and Methods of Study (Interdisciplinary Elective)	4	4	20	80
5	BI305P:RecombinantDNAandImmunotechnology	8	4	--	100
6	BI306P:Nutrition, ClinicalBiochemistryandVirology	8	4	--	100
Total		32	24	80	520
SEMESTER IV					
PAPERS	TITLE	Teaching hrs/week	Credits	Internal marks	Final exam marks
1	BI401T: Bioinformatics (core)	4	4	20	80
2	BI402T: Cell-CellCommunicationandSignalTransduction (core)	4	4	20	80
3	BI403T: Microbiology (Elective)	4	4	20	80
4	BI404T: Biotechnology (Elective)	4	4	20	80
5	BI405P:Endocrinology and Biotechnology	8	4	--	100
6	BI 406 P: Project	8	4	--	100
Total		32	24	80	520

Note: no change in examination paper format

Detailed syllabus for Semester I

Paper-I: BI 101T: Chemistry and Metabolism of Proteins and Lipids &Porphyrins (4Credits; 100 Marks)

Unit–I:ChemistryofAminoAcids,&Proteins

1. Classificationandstructureof20aa,essential,non–essential,unusualandnon-protein2. Generalpropertiesofaa,acid–basetitrations,pKa
3. Peptidebond–stabilityandformation,Primarystructure,GNRamachandranplots4. Secondarystructureandmotifs,αhelix,βsheet,3-10helix
5. Leucinezipper,Zincfinger,Trans-membraneregions,βLHL6. Tertiary&Quaternarystructure(myoglobin,hemoglobin)
7. Protein-proteininteractions(actin,tubulin)
8. Smallpeptides(glutathione,peptidehormones),Cyclicpeptides(Gramicidin)
9. Classificationofproteins-globular,fibrous,membrane,metallo-proteins,SCOP,CATH
10. Denaturation(pH,temperature,chaotropicagents),refolding,Roleofchaperonesinfolding

Unit–II:MetabolismofAminoacids,&Proteins

1. Metabolicfateofdietaryproteinsandaminoacids2. Degradationstoglucoseandketonebodies
3. AminoacidsdegradedtoPyruvate,Oxaloacetate
4. AminoacidsdegradedtoAcetyl-CoA,Succinyl-CoA5. Metabolismofbranchedchainaminoacids
6. Roleofglutamatecycleinformation&circulationofammonia7. Glucosealaninecycle,ureacycle
8. Linkingofcitricacidandureacycles,regulationofureacycle
9. Geneticdefectsinmetabolismofaminoacids(albinism,Phenylketonuria,maplesyrupurinedisease,homocystinuriaalkaptonuria,methylmalonicAcidemia)
10. Geneticdefectsinmetabolismofurea(Argininemia,ArignosuccinicAcidemia,CarbamoylPhosphateSynthetase-Ideficiency)

Unit–III:ChemistryofLipids&Porphyrins

1. Classification&biologicalsignificanceoflipids&fattyacids2. Steroids,Sterols,relationtovitaminDandsteroidhormones3. Bileacidsandsalts,Phospholipids
4. Oils,waxes,isopreneunits5. Lipoproteins
6. Glycolipids,Sphingolipids
7. Structure&functionofporphyrins(e.g.Heme,Chlorophyll)8. Cerebrosides,Gangliosides

9.Prostaglandins,Prostacyclins10.Thromboxanes,Leukotrienes

Unit–IV:MetabolismofLipids&Porphyrins

1. FateofdietarylipidsandApo-lipoproteins
2. Fattyacidbiosynthesis,Desaturationoffattyacids
3. Betaoxidation,breakdownofoddchainfattyacids,energyyields4. Regulationofβ–oxidation,ώ–oxidation&α–oxidation
5. Metabolismofphospholipids&Sphingolipids
6. RegulationandBiosynthesisofcholesterolandothersteroids7. FateofacetylCoA,formationofketonebodiesandketosis
8. Biosynthesisofprostaglandins,Prostacyclins,Thromboxanes,Leukotrienes
9. RoleofHDL,LDL,andVery-low-densitylipoprotein(VLDL)!and!cholesterol!levels!in!body10. CatabolismofPorphyrins,Geneticdefectsinlipidandnucleotidemetabolism, MediumchainacylcoenzymeAdehydrogenasedeficiencyMCAD,Long-chain3-hydroxyacyl-CoAdehydrogenase(LCHAD)deficiency,Familialhypercholesterolemia,Gout

References:

1.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman.2.Biochemistry-JeremyMBerg,JohnLTymoczko,andLubertStryer.:WHFreeman
3.Biochemistry,4thEdition-DonaldVoet,JudithG.Voet.–PublisherJohnWiley&Sons.

PaperIIBI102T:ChemistryMetabolismofCarbohydrates,NucleicAcidsandVitamins.(4Credits;100Marks)

Unit–I:ChemistryofCarbohydrates

1Classification,monosaccharides(aldoses&ketoses)
2Configurationandconformationofmonosaccharides(pyranose&furanose,chair&boat)3Reducin gandopticalpropertiesofsugars
4Stabilityofglycosidicbonddisaccharides,oligosaccharides
5Structuralpolysaccharides-
cellulose,hemicellulose,pectin,lignin,chitin,chitosan6Storagepolysaccharides;starch,gly cogen,inulin
7Stericfactorsinpolysaccharidesfolding,sugarcodeandlectin8Glycos aminoglycans,mucopolysaccharides,hyaluronicacid
9Chondriotinsulfate,keratansulfate,dermatansulfate10Bacte rialcellwall–proteoglycansandpeptidoglycans

Unit–II:MetabolismofCarbohydrates

1 ReactionsandenergybalanceinGlycolysis
2 ReactionsandenergybalanceinGluconeogenesis3 ReactionsandenergybalanceinTCAcycle
4 Pentosephosphate,PasteurandCrabtreeeffect5 Anapleuroticreactions
6 Glyoxylatecycle
7Glucuronicacidcycle8Gly cogenmetabolism
9 Photosynthesisreactionsforbiosynthesisofglucose10C 3andC4cycleinplants

Unit–III:ChemistryandMetabolismofNucleicAcids

1 Purines,pyrimidines,nucleosides,nucleotides,unusualbases2 StructureofDNA–WatsonCrickModel,A-andZ-forms
3 SupercoilingofDNA–negativeandpositive,linkingnumber4 StructureofRNA,tRNA,rRNA,siRNA/miRNA
5 PropertiesofNA–denaturationandrenaturation6 Tm(factorsaffectingT_m)andC_ot curves
7 Heteroduplexmapping–DloopsandRloops8 Biosynthesisofpurinesandpyrimidines
9 Degradationofpurinesandpyrimidines
10Regulation:*denovo*,salvation,nucleotideanalogs**Unit–IV:ChemistryandMetabolismofVitamins**

1Discoveryofvitamins,classification,RDA
2VitaminA–source,biologicalrole,deficiency
3VitaminB1–Thiamine–
source,biologicalrole,deficiency4VitaminB2–Riboflavin–
source,biologicalrole,deficiency
5VitaminB3–Niacin–andB5–Pantothenicacid–
sources,biologicalrole,deficiency6VitaminB6–Pyridoxamine–andB7–Biotin–
source,biologicalrole,deficiency
7VitaminB9–Folicacid–andB12–Cobalamine–source,biologicalrole,deficiency8VitaminC–
Ascorbicacid–source.Biologicalrole,deficiency
9VitaminD–Calciferol–
source,biologicalrole,biologicalrole,deficiency10VitaminE,VitaminK–
source,biologicalrole,deficiency

References:

1.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman.2.Biochemistry-
JeremyMBerg,JohnLTymoczko,andLubertStryer.:WHFreeman
3.Biochemistry,4thEdition-DonaldVoet,JudithG.Voet–PublisherJohnWiley&Sons
4.PrinciplesofBiochemistry:MammalianBiochemistry:SmithEL,HillRL,…WhiteA,McGrawHill

PaperIIIBI103T:BioanalyticalTechniques.(4Credits;100!Marks)

Unit–I:Spectroscopy

1 BeerLambert'sLaw,Molarextinctioncoefficient,Absorptionmaximum
2 UV-Vis:Spectroscopy,Colorimetry–principle,instrumentation,application3 FluorescenceSpectroscopy–principle,instrumentation,application
4 AtomicAbsorptionSpectrometry–principle,instrumentation,application5 NMR–principle,instrumentationapplication
6 ESR–principle,instrumentationapplication7 CD–principle,instrumentation,application8 ORD–principle,instrumentation,application
9 Massspectroscopy–principle,instrumentation,application10X-raycrystallography

Unit–II:Chromatography

1Partitioningandcountercurrentdistribution2PC–principle,instrumentation,application3TLC–principle,instrumentation,application4GC–principle,instrumentation,application
5Ion–exchange–principle,instrumentation,application
6Gelfiltration(Gelexclusionchromatography)–principle,application
7Affinitychromatography–principleinstrumentation,application;immunoprecipitation8HPLCandRP-HPLC–principle,instrumentation,application
9FPLC,LC–principle,instrumentation,application
10PeptidemappingandN-terminalsequencingofproteins

Unit–III:CentrifugationandElectrophoresis

1 Centrifugation,RCFandtypesofrotors
2 Ultracentrifugation–principle,instrumentation,application
3 CsCldensitygradientandsucrosegradientcentrifugation–principle,application4 Electrophoresis–movingboundaryandzonalelectrophoresis
5 NativeandSDSPAGE,IEFand2DPAGE6 AgaroseGels,PFGE
7 Zymography,PAGEforDNAsequencing8 DNase-Ihypersensitivitymapping
9 DNA-Foot-printingandChromatinIPmethods
10DenaturinggelsforRNA,SouthernandNorthernBlots

Unit–IV:TracerTechniques

1 Stableandradioactiveisotopes,Radioactivitytheory,halflifeandemissionspectraofhalflifeofbiologicallyusefulisotopes-^{2}H, ^{3}H, ^{14}C, ^{18}O, ^{32}P, ^{35}S, ^{125}I
2 Isotopesusedforlabelingproteins(^{3}H ^{14}C, ^{35}S, ^{125}I)andnucleicacids(^{3}H, ^{32}P)
3Detectionofradioactivitybyscintillationcounting
4Autoradiography,Fluorography,Phosphor-imaging,applications5GMcounter,gammacounter
6Radiationhazardsandsafedisposalofradioactivitywaste;luxometryand chemiluminescenceasalternativetoradioactivity
7Isotopedilutionmethod–pulsechase
8Historicexamples-$^{14}C$and^{18}Otostudyphotosynthesis
9Historicexamples-$^{32}P$and^{35}Stostudyviralreplication(Hershey-Chaseexperiment)10Historicexamples-$^{14}N$and ^{15}NinDNAreplication(MeselsonandStahlexperiment)

References:

1.PrinciplesandTechniquesofPracticalBiochemistry-Wilson.K.AndWalker.J.Pub:CambridgePress2.PhysicalBiochemistry-Friefelder,PublisherD.W.H.FreemanPress
3.BiophysicalChemistry:PrinciplesandTechniques,2ndeditionbyA.Upadhyay,K.UpadhyayandN.Nath.Himalaya PublishingHouse,Delhi.
4.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman5.TheToolsofBiochemistry,Cooper TG,JohnWileyandSons

!PaperIVBI104T:BioenergeticsandCellBiology.(4Credits;100!Marks)

Unit–I:Bioenergetics

1 Elementsofimportanceinbiochemistry(H,C,N,O,P,S),typesandenergyofbondsandinteractions(ionic,covalent,coordinate,H-bonds,vanderWaals,hydrophobicinteractions)

2 Lawsofthermodynamics,Gibbsfreeenergy,relevanceofentropyandenthalpyinbiologicalsystemsandreactions;firstandsecond-orderreactions

3 **Log**and**ln**scalesinbiologicalprocesses(exponentialgrowthcurves,radioactivedecay)4 Biologicaloxidation,highenergycompounds

5 Highenergybonds,redoxandphosphatepotential

6 Structureofmembrane,forcesstabilizingmembranes

7 Formationofiongradientsacrossamembrane(protongradientsinorganelles),roleoftransportersandchannels

8 ETCinmitochondriaandchloroplasts,un-couplersandinhibitorsofenergytransfer9 Polarizationofcell,restingpotential,actionpotential,propagationofimpulse

10Biologicalfluorescence(GFPandderivatives),Bioluminescence**Unit –II:StructureofProkaryoticcells**

1 Classificationofprokaryotes(systemsofclassification)

2 Ultra-structureofeubacteria,cyanobacteria,mycoplasma

3 Motilityofbacteria,bacterialfilms,isolationofbacteriafromnaturalsources

4 Sterilizationofmaterials(autoclaving,dryheat,filtration,chemicaldisinfection,irradiation)andcommonly-usedmedia(minimal,enriched,selective)forbacterialgrowth

5 Stainingmethodsforbacteria;maintenance,andpreservationofbacterialcultures

6 Growthcurve,Doublingtime,Factorseffectinggrowth–pH,temperature,oxygen,agitation7 Batchandcontinuousgrowthofbacteria,chemostat,synchronizedcultures

8 Industrial(large-scale)growthofbacteria,fermenterdesign

9 Bacteriaofindustrialimportance,developmentofcommerciallyvaluablestrains

10Discoveryofantibiotics,modeofactionofvariousclassesofantibiotics,antibioticresistance**Unit-III:StructureofEukaryoticcells**

1 Ultra-structureofanimalcells2 Ultra-structureofplantcells

3 Compositionofcytoskeleton-microfilaments,microtubules,intermediatefilaments4 Nuclearskeleton-lamina,scaffold

5 Vesicletrafficking(endocytosis,exocytosis),roleofRabsandRabGTPases

6 Structureofchromatinandchromosomes(centromere,telomere,kinetochore)

7 Mitosis,meiosis,andinteractionofchromatinwithcytoskeleton(attachmentofspindlefibers).8 Formationandstructureofspecialchromosomes(polytene,lampbrush)

9Cellcycle10A poptosis

Unit–IV:MethodsofCellStudy

1 Simpleandcompoundmicroscope.

2 Phasecontrast,darkfieldandpolarizationmicroscopy.3 Electronmicroscopy,SEM,TEM;freezefracture.

4 FluorescenceandConfocalmicroscopy;imaginglivecells.5 FRETandFRAP.

6 Atomicforcemicroscopy.

7 Flow-Cytometryandcellsorting(FACS).8 Planttissueculture.

9 Animalandinsecttissueculture.

10Methodsofcelldisruptionandfractionation,isolationoforganelles.

References:

1.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman2.MolecularBiologyoftheCell,3rdedition.BruceAlberts,DennisBray,JulianLewis, MartinRaff,KeithRoberts,andJamesDWatson.PublisherNewYork:GarlandScience;3.TheCell:AMolecularApproach,FifthEdition,byGeoffreyM.Cooperand RobertE.Hausman,publishedbyASMPress!

!**SemesterI:Practical's**

(Note:Eachtopiccorrespondsonepracticalsession)

PaperV:BI105P:Biomolecules(3 credits; Max Marks 75)	**PaperVI:BI106P:BioanalyticalTechniques** (4 Credits; Max Marks 100)
1Lab safety, GLP, calculations and preparation of standard solutions 2Preparation of buffers, use of balance and pH meter 3Qualitative analysis of amino acids 4Determine **pKa** and **pI** of acidic, basic, and neutral amino acids 5Estimate amino acids by Ninhydrin methods 6Quantify glycine by formal titration 7Estimate tryptophan by Spies and Chambers method 8Qualitative analysis of carbohydrates 9Estimate total sugars by phenol sulfuric acid method 10Estimate reducing sugars by DNS 11Estimate fructose by Roe's method 12Qualitative analysis of lipids 13Saponification value of fats 14Iodine number of oil 15Peroxide value of fats 16Acid value of fats 17Estimate DNA by DPA 18Estimate RNA by Orcinol- Method 19SDS PAGE for proteins 20Agarose gel for DNA	1Absorption spectrum of tyrosine, determination of molar extinction coefficient, calculations based on Beer Lambert's Law 2Estimate inorganic phosphate by Fiske-Subbarow method 3Estimate protein by Biuret method 4Estimate protein by Lowry method 5Titrate calcium in milk 6Titrate vitamin C 7Photometric analysis of iron 8AAS analysis of metals 9Anion-exchange capacity of resin 10Cation-exchange capacity of resin 11Separate amino acids by ion-exchange chromatography 12Separate purines and pyrimidines by paper chromatography 131-D PC of amino acids 142-D PC of amino acids 15PC of plant pigments 16TLC of plant pigments 17TLC of lipids 18Desalting proteins by dialysis 19Gel filtration (size exclusion) 20Cell fractionation (centrifuge)

Project ideas:

1Compare pigments in different plant parts, different flowers, plants and algae
2Compare unsaturation of various oils and fats
3Determine sugar /vitamin C content in various fruits and soft drinks, calcium content in various milk brands

References:

1.An introduction to practical biochemistry. By: David T Plummer. Publisher Tata McGraw- Hill
2.BiochemicalCalculations–Segel,I.H.JohnWiley&sons
3.Experimental Biochemistry: A Student companion- SashidharRao, B and Deshpande, V. IK International (P) Ltd
4.Experiments And Techniques In Biochemistry: by Sheel Sharma, Galgotia publications.

Semester II

Paper-I: BI 201T:Enzymology. (4 Credits; 100 Marks)

Unit–I:Enzymes,Coenzymes,andcatalysis

1 Thermodynamicsofcatalysis,Energyofactivation,RelationofΔGandK$_{eq}$2 Coupledreactions(endergonicandexergonic)inbiochemicalpathways
3 Methodstoisolateandpurifyenzymes,Assays,ActivityUnits,Specificactivity4 Nomenclatureandclassificationofenzymes:EC,SCOP,CATH
5 Metal,co-factor,andco-enzymerequirements
6Vitamincofactors:TPP,FMN/FAD,NAD/NADP,Pantothenicacid7Vitam incofactors:PLP,Biotin,Folate,Cobalamine,Phylloquinone
8 Factorsaffectingcatalysis(pH,temperature,pressure,enzymeandsubstrateconcentration)9 Chemicalstoidentifyactivesiteresidues:Arg,Cys,Lys,His
10Site-directedmutagenesistoidentifyactivesiteresidues:TriosePhosphateIsomerase**Unit–II:EnzymeKinetics**
1Singlesubstrateassumptions,Briggs-Haldaneequation.
2Steadystate,Michaelis-Mentonkinetics(deriveequationandtransformations)3TransformationofMichaelis-Mentonequation.
4Bisubstratereactions:ordered,random,sequential,Ping-Pong
5Distinctionbetweenorderedandrandomadditionofsubstratesandproductsrelease.
6Inhibitors(competitive,uncompetitive,noncompetitive,suicide),effectonkineticconstants7Enzym einhibitorsasdrugs:RTandProteaseinhibitorsasanti-HIVdrugs
8Cooperativityinbinding(oxygenbindingtohemoglobin)9Multi plesites;Cooperativity:MWCmodel,KNFmodel10Slow transition and Hysteretic behavior in enzymes

Unit–III:CatalyticMechanisms

1Typesofcatalysis:acid-base,transitionstate,covalentintermediates
2Reversibleandirreversibleactivationofenzymes(pro-enzymes,phosphorylation)
3Enzymesactivationbyligandbindinganddimerization(proteintyrosinekinasereceptors)4Catalyti cmechanismofRNase
5CatalyticmechanismofChymotrypsin,Trypsin6Cata lyticmechanismofLysozyme
7CatalyticmechanismofCarboxypeptidase,Subtilisin8Allo stericregulationofAspartateTranscarbamylase9Regulation ofGlutamineSynthetase
10Multi-enzyme Complex: fatty acid synthase

Unit–IV:EnzymesinPhysiologyandBiotechnology

1Regulatory enzymes in carbohydrate metabolism (glycolysis, TCA cycle)
2Regulatory enzymes in nucleotide metabolism
3Enzymecascades(bloodclotting,complementactivation)4Enzy mecascades(celldivisionandapoptosis)
5Convergent and divergent evolution of enzymes
6Reporterenzymesforgeneexpression(β-gal,β-glucuronidases,CAT);Restrictionenzymesandligasesinrecombinant DNA technology
7Enzymesindairy(Rennin,lipases,lactases),brewing(amylases,proteases,glucanases),Foodproc essingtechnology(invertase,pectinases,papain)
8Enzymesindetergent(lipases,cellulases,proteases),paper(cellulases),andtanning9Enzyme sinbioremediation,biofuelindustry(cellulases)
10Enzymeengineering:CatalyticRNAandantibodies;DesigningHigh-Throughputenzymeassays

References:

1.FundamentalsofEnzymology,Price.NC.AndStevens.L.,OxfordUniversityPress
2.Enzymes-Biochemistry,Biotechnology,Clinicalchemistry-Palmer,T.,AffiliatedEast-Westpress3.FundamentalsofEnzymeKinetics,SegelIH;WileyInterscience,
4.Biochemicalcalculations,2ndEditionByIrwinH.Segel.JohnWiley&Sons,
5.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman!

PaperII:BI202T:MolecularBiology.(4Credits;100Marks)

Unit–I:DNAReplication

1Modelsofreplication–random,conservative,semiconservative
2ProkaryoticandeukaryoticDNApolymerases,helicases,ligases,topoisomerases3Initiation–primosome,ori-sequences,accessoryproteins
4Elongation–replisome,leadingandlaggingstrands,Okazakifragments5Termination,Inhibitorsofreplication
6Replicationofcircularchromosomesbythetamodel-φX174,E.coli
7Replicationofcircularchromosomesbyrollingcircle(lambdaphage)andStranddisplacementmodels(mt-DNA)
8Replicationoflinearchromosomes,telomeres,telomerase9Amplification–Polyteneanddoubleminutechromosomes10*Invitro*replication-PCR

Unit–II:DNARepair

1Typesofdamage–oxidation,deamination,alkylation,adducts,breaks2Directrepair–MGMT,photo-reactivation,AlkB
3BaseExcisionRepair(ShortandLongPatch)4NucleotideExcisionRepair
5MismatchRepair
6RepairofDSBsbyNHEJandHomologousrecombination7Hollidayjunctionsandrepairofcollapsedforks
8SOSandbypassrepair
9DiseasesduetodefectsinDNArepair10RolesofATM,BRCAinDNArepair

Unit–III:TranscriptionandTranslation

1ProkaryoticandeukaryoticRNApolymerases
2Initiation–prokaryoticandeukaryoticpromotersequences3Elongation,Termination–rhodependentandindependent
4Post-transcriptionalmodifications-capping,PolyAaddition5Splicing,RNAediting;Inhibitorsoftranscription
6Structureofribosome,natureofgeneticcode7Initiationoftranslation(roleofcap,IRESIFs)8Elongationoftranslation(roleofEFs)
9Terminationoftranslation(roleofRFs)10Inhibitorsofproteinsynthesis

Unit–IV:ProteinSorting,Targetinganddegradation

1Posttranslationalmodificationsofproteins,roleintargeting(isoprenylation)2Signalpeptide(ERLS),roleofSRPintranslationofsecretedproteins
3NLS,Mitochondrial&chloroplastLS4Chaperones,HSPsinproteinfolding
5Lysosomalpathways(endocytosis,crinophagy,macroautophagy,microautophagy,directtranslocationfromcytosol)
6Lysosomalstoragediseases
7Ubiquitin-proteasomepathway,N-endrule
8Immuno-proteasomes,Misfoldedproteinsinneurodegenerativediseases,9PESTsequencesandproteolysis
10Actionofcytotoxic,hemotoxic,myotoxic&hemorrhagicvenoms

References:
1.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman.2.MolecularBiologyoftheCell,3rdedition.BruceAlberts,DennisBray,JulianLewis,MartinRaff,KeithRoberts,andJamesDWatson.PublisherNewYork:GarlandScience;
3.Biochemistry,4thEdition-DonaldVoet,JudithG.Voet–PublisherJohnWiley&Sons
4.TheCell:AMolecularApproach,byGeoffreyM.CooperandRobertE.Hausman,pub.ASMPress

!Paper-III: BI 203T: Biochemical Genetics and Model Organisms. (4 Credits; 100Marks)

Unit–I:MendelianGenetics

1Mendel'sLaws,Importanceofmeiosisinheredity
2Non-MendelianInheritance–
Maternaleffect,Maternalinfluence,Cytoplasmicinheritance3Geneinteractions-
Epistasis,Expressivity,Penetrance
4Sexlinked,sexlimited,andsexinfluencedgenes;Polygenicinheritanceandpolyploidy
5Mutations(spontaneous/induced,somatic/germinal,forward/reverse,transition/transversions)6Mutations
(Silent,missense,nonsense,andframeshiftmutations,conditional,leaky)
7Detection,selection&isolationofmicrobialmutants,Estimationofmutationrates8Reversio
nandsuppressionofmutations
9Mutagens–physical,chemical
10Transposonmutagenesis,site-
directedmutagenesis**Unit–II:LinkageandMapping**
1Discoveryoflinkage,Morgan'sexperiments2Cyto
logicalproofofcrossingover
32-and3-pointcrosses
4Recombination,Interference5Te
tradanalysis
6Mappinghumangenesbypedigreeanalysis;Fundamentalsofpopulationgenetics(HWLaw)7Pedigrees
ofAR,AD,XR,andXDinheritedtraits
8Mobilegeneticelements–
ZeaAc,DsandSpmelements9*Drosophilacopia*,YeastTyelement
s
10Usingrecombinationtomakeknockoutcells/organisms**Unit–
III:BacterialGenetics**
1Discoveryofconjugation
2Mappingbacterialgenesbyconjugation3Disc
overyoftransformation
4Mappingbacterialgenesbytransformation5Disc
overyoftransduction
6Mappingbacterialgenesbytransduction7Disc
overyoftransposition
8Structureoftransposons,replicativeandconservativetransposition,useasmutagens9Mappin
gphagegenes–FinestructureofrIIlocus:Complementationanalysis
10FinestructureofrIIlocus:Deletionmapping**Unit
–IV:ModelOrganisms**
1*Dictyostelium*tostudycell–cellcommunicationanddifferentiation.
2*Saccharomyces*tostudyhomologousrecombinationinmatingtypeswitch;siteofformationofbuds3*Neurospor
a*tostudyonegene–oneenzymehypothesis
4*Drosophila*tostudyembryonicdevelopment(homeoticmutations)5*C.ele
gans*tostudydevelopmentandnervoussystem
6*Danio*tostudyvertebratedevelopment,GLOfish7*Xeno
pus*tostudyembryogenesis
8*Mus*inbredandknockoutstrains,NODandnudemice9*Zea*tod
emonstratecytologicalproofofcrossingover10*Arabidopsis*to
studyflowerdevelopment

References:

1. Microbiology–PrescottLM,HarleyJP.&KleinDA,McGraw-Hill
2. PrinciplesofGeneticsbyEldonJohnGardner,MichaelJ.Simmons,D.PeterSnustad;JohnWiley3.
ModernGeneticAnalysisAnthonyJFGriffiths,WilliamMGilbert,JeffreyHMiller,andRichardC
Lewontin.Pub.W.H.Freeman;

!

Paper-IV: BI 204T: Endocrinology and Metabolic Disorders.(4 Credits; 100 Marks)

Unit–I:HormonesandEndocrineglands1 Historyofendocrinology
2 Organizationandclassificationofhormonesandendocrinesystems3 Basicmechanismofactionofpeptidehormonesandreceptors
4 Basicmechanismofactionofsteroidhormonesandreceptors
5 Chemistry,physiology,anddisordersrelatedtoHypothalamus-Pituitaryaxis
6 Chemistry,physiology,anddisordersrelatedtothyroidandparathyroidglands7 Glycoproteinhormones(LSH,FSH,TH,hCG,POMC)
8 Growthhormonefamily(GH,hCS,Prolactin)9 Adrenalhormones
10Gonadalhormones

Unit–II:Endocrineregulation

1Regulatorypathways(positive,negative,feedbackloops),Regulationofbiosynthesisofsteroidhormonesbypeptide hormones(LH,FSH,ACTH)
2Endocrineregulationofgrowth3En docrineregulationofstress
4EndocrinologyofCahomeostasis
5Endocrinologyofbloodsugar,hunger,digestion,andobesity6Endoc rineregulationofrenalfunction
7Endocrineregulationofcardiovascularsystem(angiotensin,BNP,ET1)
8Endocrinologyoffertility(changesinmenstruation,pregnancy,andmenopause)
9Medicalusesofsteroidhormones(contraception,HRT,hydrocortisone,anabolicsteroids)10Erythr opoietin,Adipo-cytokines,Orexins

Unit–III:DisordersofAminoAcidandCarbohydrateMetabolism1Hyperp henylalaninemia
2Disordersofprolineandhydroxyprolinemetabolism3Alca ptonuria
4Disordersoflysinemetabolism
5Disordersoftyrosinemetabolism6Hem oglobinopathies;Thalassemia7Disorder sofglycogenstorage
8Disordersoffructosemetabolism9Disor dersofGalactosemetabolism10Pentosuri a,Diabetes

Unit–IV:DisordersofLipidsandNucleicAcidsMetabolism

1DisordersofacidLipasedeficiency
2Farber'sdisease
3Neeman-Picksdisease4Goucher'sdi sease
5Krabbedisease
6Sulphatide-lipdosisdisease7Fabrydisease
8DownsandTurner'ssyndrome9Hy peruricemiaandGout
10HeriditaryXanthineUreaandLesch-Nyhansyndrome

References:

1.WilliamsTextbookofEndocrinology– Larsen,R.P.Korenberg,H.N.Melmed,S.andPolensky,K.S.Saunders.
2.HumanPhysiology–Chatterjee.C.C,MedicalAlliedAgency
3.PrinciplesofBiochemistry:MammalianBiochemistry:SmithEL,HillRL,…WhiteA,McGrawHill4.Themetab olicbasisofInheriteddiseases(VolI&II)ScriverCR..ValleD,PubMcGrawHill

SemesterII:Practical's
(Note:EachtopiccorrespondsonepracticalSession)

Paper-V:BI205P:Enzymology,MolecularBiolo	**Paper-VI:BI206P:Molecular biology and bioinformatics**(4 credits; Max marks 100)
1N-terminal residue of proteins 2Purify casein from milk, calculate yield at each step 3Purify albumin from egg, calculate yield at each step 4Fractionate BSA by salt precipitation 5Assay urease (horse gram / any source) 6Assay catalase (liver / any source) 7Assay α amylase (saliva) 8Assay β amylase (sweet potato) 9Purify theenzyme; calculate yield, total activity and specific activity at each stage 10Time course and enzyme concentration (salivary amylase) 11Effect of pH on enzyme activity 12Effect of temperature on enzyme activity 13Effect of [S], determine $K_m$and V_{max}14Competitive inhibition 15Saturation of Glutamine Synthetase or ATCase (cooperative enzyme) 16Absorption spectrum, molar extinction coefficient of purine/pyrimidine 17Isolate DNA (onion/thymus/other source), absorption spectrum to assess purity (A260/A280 ratio)	1. OMIMdatabaseandhumangeneticdisorders 2. RetrieveDNAsequencefromdatabase(NCBI) 3. Retrieveproteinsequencefromdatabase(NCBI) 4. Retrieveproteinstructurefromdatabase(PDB) 5. KEGGdatabaseforpathways 6. LocalalignmentofDNA,protein 7. GlobalalignmentofDNA,protein 8. Multiplesequencealignments 9. PrimerdesignforPCR, 10. *insilico*PCR 11. *Insilico*restrictionmapping 12. *Insilico*translation 13. HapMapanddiseaseassociation 14. Preparation of competent E.colicells 15. Bacterial transformation and calculating transformation efficiency. 16. Cloning desired gene into plasmid (Plasmid isolation restriction digestion and ligation) 17. Screening for positive clones by SDS-PAGE 18. Screening for positive clones by colony PCR 19. Over expression and desired gene by IPTG, Purification of expressed protein by Affinity chromatography. 20. Purity analysis of expressed protein by SDS-PAGE and Western blotting.

Project ideas:

1Compare abundance of an enzyme in various sources
2Compare sensitivity and/or specificity of different assays for the same enzyme
3Find the effect of some treatment (drug) on your model organism
4Screen natural sources for biodiversity (bacteria, phage, algae, antibiotic-resistant bacteria)
5Use MS Excel or other software (R, SPSS) to analyze publicly available dataset, or do a population survey to generate your own dataset and analyze for correlation (age and BP, Physical exercise and weight, BP and blood glucose)

References:

1.Enzymeassays-APracticalApproach,Eisenthal,RandDawson,MJ,IRLpress2.PracticalBiochemistry-Rameshwar.A,KalyaniPublisher
3.PrinciplesofGeneticsbyEldonJohnGardner,MichaelJ.Simmons,D.PeterSnustad;JohnWiley4.ModernGeneticAnalysisAnthonyJFGriffiths,WilliamMGelbart,JeffreyHMiller,andRichardC Lewontin.Pub.W.H.Freeman;
5.Statistics,BasicConceptsandMethodologyfortheHealthSciencesDanielWW,PubWileyIndia
6.LehningerPrinciplesofBiochemistry,DavidL.Nelson,MichaelM.CoxPublisher:W.H.Freeman.