Shiromani Gurdwara Parbandhak Committee's
Guru Nanak Khalsa College of
Arts, Science and Commerce
(Autonomous)
Matunga, Mumbai – 400 019, Maharashtra

Syllabus for MSc Biotechnology Semester I and II

Program: Masters of Science

Course: Biotechnology

(As per NEP 2020 Choice Based Semester and Grading System with effect from Academic year 2023-2024)

SEMESTER-I

Course Code	CourseType	Course Title	Credits	Lectures/Week
GNKPSBT1501	Mandatory Paper-I (MP I)	**BiochemistryandImmunology-I**	4	4
GNKPSBT2501	Mandatory Paper-II (MP II)	**BiophysicsandMolecularBiology**	4	4
GNKPSBT3501	Elective Subject-T (ES)	**AdvancedBiotechnology-I**	3	3
GNKPSBT4501	Research Methodology-Department	**ResearchMethodology-I**	2	2
GNKPSBT4501	Research Methodology-Common	**ResearchMethodology-II**	2	2
GNKPSBT1P501	PracticalofMP- I	**Practical of GNKPSBT1501**	2	8
GNKPSBT2P501	PracticalofMP- II	**Practicalof GNKPSBT2501**	2	8
GNKPSBT3P501	PracticalofES(P)	**Practical of GNKPSBT3501**	1	4

SEMESTER-II

Course Code	CourseType	Course Title	Credits	Lectures/Week
GNKPSBT1502	Mandatory Paper -I (MP I)	**BiochemistryandImmunology-II**	4	4
GNKPSBT2502	Mandatory Paper - II (MP II)	**BioprocessTechnologyand Biosafety**	4	4
GNKPSBT3502	Elective Subject-T (ES)	**AdvancedBiotechnology-II**	3	3
GNKPSBT4502	OJT	**On-job training**	4	4
GNKPSBT1P502	PracticalofMPI	**PracticalofGNKPSBT1502**	2	8
GNKPSBT2P502	PracticalofMPII	**Practical of GNKPSBT2502**	2	8
GNKPSBT3P502	PracticalofES(P)	**Practical of GNKPSBT3502**	1	4

SEMESTER - I

BIOCHEMISTRYANDIMMUNOLOGY-I

Unit 4		MolecularImmunology	15
	4.1	OrganizationandExpressionofImmunoglobulingene:Multigene organization and Variable region gene rearrangement	
	4.2	GenerationofAntibodyDiversity	
	4.3	Classswitching(Immunoglobulinand TCR)	

References:

1. Guyton,TextbookofMedicalPhysiology,SaundersPublishers,12thedition,2010.
2. TextbookofBiochemistrywithClinicalCorrelations,7thEdition,ThomasM.Devlin,January2010.
3. Proteins:biotechnologyandbiochemistry,1st edition(2001),GaryWalsch,Wiley,USA.
4. BiochemicalCalculations,2ndEd.,(1997)SegelIrvinH.,Publisher:JohnWileyandSons,New York.
5. OutlinesofBiochemistry:5th Edition,EriceConn&PaulStumpf;JohnWileyandSons, USA.
6. FundamentalsofBiochemistry.3rdEdition(2008),DonaldVoet&JudithVoet,JohnWileyandSons,Inc.USA
7. Lehninger,PrinciplesofBiochemistry.5thEdition(2008),DavidNelson&MichaelCox,W.H.Freemanand company, NY.
8. Biochemistry:7thEdition,(2012),JeremyBerg,LubertStryer,W.H.Freemanandcompany,NY.
9. ImmunologybyKuby,5thEdition.

Biochemistry&Immunology-I(GNKPSBT1P501) (Practical-2credits)(75Marks)

1. Paper-basedsensorsforclinicalbiochemistryassaysfromserum/urine.
2. Native-PAGEandCBBstainingofproteincomplexes.
3. DiscontinuousSDS-PAGEwithSilverStainingofproteincomplexes.
4. Antigenantibodyreactions:oneofeachtype:Precipitation -VDRL(setupintubeorgels)andWIDAL (Qualitative and Quantitative).
5. DOTELISA/BLOT
6. Tostudytheprocessofphagocytosisusingbacterial/yeastcells.
7. Hypersensitivitytest(Type1)-Kitbased.
8. ProteinestimationusingBradfordassay.

References:

1. BiochemicalMethodsforAgriculturalSciences-SadasivamandManikam.WileyEasternLimited,1992.
2. PracticalClinicalBiochemistryHaroldVarley,CBS;6edition(1December2006)
3. AnIntroductiontoPracticalBiochemistry(3rdEdition)–DavidTPlummer.TataMcGraw-HillPublishing Company Limited, 1992.
4. Practicalimmunology,FrankHay,4thEdition,Blackwell Science
5. MedicalMicrobiology,Ananthanarayana
6. IntroductiontoPracticalBiochemistry,D.T.Plummer,TataMcGrawHill

MOLECULARBIOLOGYANDBIOPHYSICALTECHNIQUES

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT2501	04	60	100 Marks

LearningObjective:Anintroductiontogeneregulationandadvancedbiophysicaltechniques instrumentation used in biology

LearningOutcome: ConversantwithlatesttechniquesinMolecularBiologyandwithbiophysical methods used for biological research.

Unit		Title	No. of Lectures
Unit 1		**RNAprocessingandProtein folding**	**15**
	1.1	**RNA processing in eukaryotes:** Origin of Introns, Chemistry of RNASplicing,Spliceosomemachinery,Splicingpathways,GroupI and II introns, Alternative splicing, Exon shuffling, mRNA transport.	
	1.2	**Protein folding and processing:** Chaperons and protein folding (HSP70andHSP90),Enzymesinproteinfolding,Protein cleavage, Glycosylation,Attachmentoflipids,Regulationofproteinfunction and small molecules, Protein phosphorylation.	
Unit 2		**ProteinSortingandmobileDNAelements**	**15**
	2.1	Proteinsortingandtransport	
	2.2	DNArearrangements(VDJ,Yeastmating types,*Trypansomacruzi*)	
	2.3	MobileDNAelements,Transposableelementsinbacteria,Controlling elements in Tn A and Tn10 transposition	
	2.4	SINESandLINES,retro-transposons.	
Unit 3		**X-raydiffraction techniques**	**15**
	3.1	Crystalphysicsandmethodsforgrowing/evaluatingcrystals	
	3.2	X-raydiffractometer:Instrumentationandworking,x-ray sources	
	3.3	MolecularstructuredeterminationusingX-raydiffraction	
Unit 4		**Spectroscopy**	**15**
	4.1	Circulardichroism,ORD,Surfaceplasmonresonance methods	
	4.2	NMR and ESR spectroscopy	
	4.3	Molecularanalysisusinglightscattering,massspectrometryand LC-MS.	

References:

1. GenesXI,11thedition(2012),BenjaminLewin,Publisher,JonesandBartlettInc.USA.
2. Molecular Biology of the Gene, 6thEdition(2008),JamesDWatson,PearsonEducation,Inc.andDorling Kindersley Publishing, Inc. USA.
3. MolecularBiology,5thEdition(2011),WeaverR.,McGrawHillScience.USA.
4. FundamentalsofMolecularBiology,(2009),PalJ.K.andSarojGhaskadbi,OxfordUniversityPress, India.
5. PrinciplesandTechniquesofBiochemistryandMolecularBiology,7theditionWilsonK.M.,WalkerJ.M., Cambridge University Press, UK (2010).
6. Biochemicalspectroscopy.Volume46ofMethodsinEnzymology.(1995)KennethSauer.AcademicPress,USA.7. Modern experimental biochemistry, 3rd Edition, USA Edition (2000) Rodney Boyer, Prentice Hall.
8. BiophysicsVasanthaPattabhiN.Gautham2002NarosaPublishingHouse.
9. Physicalbiochemistry:applicationtobiochemistryandMolecularbiologyDavidFreifelder2nd edition, 1982.

MolecularBiologyandBiophysicaltechniques(GNKPSBT2P501)(Practical -2credits)(75 Marks)

1. Expressionofrecombinant protein.
2. Ligationreaction.
3. IsolationoftotalRNAfromplants/animaltissue/bacteria.
4. Extractionofpigmentsfrombiologicalsources–plantsand/ormicroorganismsandstudyoftheirabsorption spectrum in visible light.
5. UseofUV spectrophotometrytodeterminetheconcentrationand qualityof protein/NA.
6. Interactionstudiesofprotein-drugorprotein-ligandusingUV-spectroscopytechniqueunderdifferent conditions (pH, concentration, temperature).
7. Studyof NMR and ESR Spectra.
8. VisittotheResearchLaboratoryforstudyingvariousinstrumentation techniques.

References:

1. Molecularcloningalaboratory manual,Sambrook and Russell
2. AnIntroductiontoPracticalBiochemistry(3rdEdition)–DavidTPlummer.TataMcGraw-HillPublishing Company Limited, 1992.
3. Principlesandtechniquesinbiochemistry,WilsonandWalker

MAJOR PAPER III - ADVANCED GENOMICS AND PROTEOMICS IN HEALTH

PaperCode	Credits	No. of Lectures	Marks
GNKPSBTMJ3501			50

Learning Objective: Advanced Genomics and Proteomics in Health.
Learning Outcome:

Unit		Title	No. of Lectures
Unit 1		**Genomics**	**-**
	1.1	Assembly of contiguous DNA: Shotgun approach Clone Conti Approach, Whole Genome Shotgun Sequencing.	
	1.2	Next generation sequencing: Pyro sequencing, Sequencing by Ligation.	
	1.3	Human Genome Project and its application in health and diseases.	
	1.4	Genome Editing: CRISPR and TALENs	
Unit 2		**Proteomics**	**-**
	2.1	Drug and vaccine discovery.	
	2.2	Personalized medicine.	
	2.3	Research and diagnosis of diseases.	

ELECTIVE PAPER -
ADVANCEDBIOTECHNOLOGY-I

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT3501	03	45	100 Marks

LearningObjective: Introductiontoadvanced Immuno-analyticaltechniqueswithclinicalcorrelation.
LearningOutcome: Conversantwith Immunologicaltechniquesanditsclinical significance.

Unit		Title	No. of Lectures
Unit 1		**Antibodymodificationand applications**	**15**
	1.1	ProductionofAntibodies:Polyclonal,Monoclonaland Hybridoma	
	1.2	Labelingofantibodies: Directandindirectimmunochemical procedures, Radiolabeling, labeling with fluorochromes/enzymesandbiotinylation	
	1.3	Immuno-precipitation:OuchterlonyandMancinimethod, Co-precipitation	
	1.4	Immunoblotting:Competitivebindingassays,immunometric assay, solid-phase immunobinding assay, enhanced immunoassay	
Unit 2		**Immunohistochemistry**	**15**
	2.1	Detection of Antigens in cells and tissues: Immunoenzyme microscopy, Peroxidase-anti-peroxidase technique, Immunofluorescencetechnique,Capping,Flowcytometry, Immuno-electronmicroscopy	
	2.2	AffinityandAvidity:Measurementofaffinityand avidity	
	2.3	Immunochemicaluseof surfaceplasmonresonance	
Unit3		**AdvancedImmuno-techniques**	**15**
	3.1	ChromatinImmuno-precipitation	
	3.2	ChIP-on-chiptechnology,ProteinandAntibodymicroarrays	
	3.3	Immune Functional Assays (IFA) - Basic introduction and applicationslikeInterferon-GammaReleaseAssays(IGRAs) for MTB detection, Lymphocyte Transformation Test (LTT) for assessing lymphocyte function and ImmuKnow™ assay for organ transplant outcome.	

References:

1. KubyImmunology,JudyOwen,JenniPunt,SharonStranford.,7thedition(2012),FreemanandCo.,NY

2. Textbookofbasicandclinicalimmunology,1stedition(2013),SudhaGangalandShubhangiSontakke, University Press, India 8.

3. Immunology,7thedition(2006),DavidMale,JonathanBrostoff,DavidRoth,IvanRoitt,Mosby,USA9.
4. IntroductiontoImmunology-CVRao-NarosaPublishingHouse
5. Albert-VegaChloé,TawfikDinaM.,Trouillet-AssantSophie,VachotLaurence,MalletFrançois,TextorisJulien "Immune Functional Assays, From Custom to Standardized Tests for Precision Medicine", FrontiersinImmunology,9,2018.
6. AurimasVinckeviciusandDebabrataChakravarti,"Chromatinimmunoprecipitation:advancinganalysisof nuclear hormone signaling",Journal of Molecular Endocrinology (2012) 49, R113–R123.
7. PrinciplesandtechniquesofbiochemistryandmolecularbiologybyKeithWilsonandJohnWalker,6thEdition.

AdvancedBiotechnology-1(GNKPSBT3P501)(Practical-1credit)(50Marks)

1. Ouchterlony-double-diffusion(Teachingkit).
2. Serumelectrophoresis.
3. Counter-current-immuno-electrophoresis(Teachingkit).
4. Immunoglobulin-G-isolationusingchromatography.
5. RadialImmunodiffusion.

References:

1. AnIntroductiontoPracticalBiochemistry.3rdEdition,(2001),DavidPlummer,TataMcGrawHill Edu.Pvt.Ltd. New Delhi, India.
2. Textbookofbasicandclinicalimmunology,1stedition(2013),SudhaGangalandShubhangiSontakke, University Press, India

ResearchMethodology -I(Common)

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT4501	02	30	50 Marks

LearningObjective: IntroductiontoResearchMethodologyanditstechniques.
LearningOutcome: Guidelinesforconductingresearch workand relatedpublications.

Unit		Title	No. of Lectures
Unit 1		**ResearchFundamentalsand Terminology**	15
	1.1	Meaning and Objective of research, features of a good research study, types of Research (qualitative and quantitative research)	
	1.2	Study designs and variations: basic, applied, historical, exploratory,experimental,ex-post-facto,casestudy,diagnostic research, crossover design, case control design, cohort study design,multifactorial design	
Unit 2		**LiteratureSurvey Methods**	15

	2.1	Journal and abbreviation, current titles and review, monographs, textbooks, introduction to abstract, Beilstein, subject and author index	
	2.2	Digital:Websources,E-journals,Journalaccess,TOCalerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines,Sciurus,GoogleScholar,Wiki-databases,Science Direct,SciFinder,Scopus.	

ResearchMethodology -II(Department)

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT4501	**02**	**30**	**50 Marks**

LearningObjective: Tounderstanddifferentstatisticaltestswithexamplesandproblems.
LearningOutcome: Applicationofthetestsinbiologicalstudiestodeterminethesignificanceofthe results obtained by conducting a study.

Unit		Title	No. of Lectures
Unit 1		**TestofSignificance**	**15**
	1.1	Steps in Hypothesis testing. Theoryoferrors-TypeIandTypeII errors, Null hypothesis	
	1.2	t-test,z-test,Pvalues-onev/stwotailPvalues,Confidence intervals	
Unit 2		**Non-parametric test**	**15**
	2.1	Non-parametric tests: Introduction, Types, Advantages, Disadvantages and uses.	
	2.2	Signtest(Onesampleandmatchedpairs),Wilcoxon test, Mann-Whitneytest,KrushkalWallistest,Kolmogorov-Smirnov Test.	

References:

1. BiostatisticsbyAroraandMalhan-2nd Edition
2. Biostatistics:AfoundationforanalysisinHealthSciences(1999)WayneW.Daniel(9th Edition) John Wiley and Sons Inc.

SEMESTER-II

BIOCHEMISTRYANDIMMUNOLOGY-II

Paper Code	Credits	No. of Lectures	Marks
GNKPSBT1502	04	60	100 Marks

Learning Objective: Introduction to membrane biochemistry and trafficking, Autoimmunity and transplantation, and Cancer immunology and vaccines.

Learning Outcome: Conversant with basic concepts of membrane biochemistry and trafficking, Autoimmunity and transplantation, and Cancer immunology and vaccines.

Unit		Title	No. of Lectures
Unit 1		**Membrane Biochemistry and Trafficking**	**15**
	1.1	Membrane Proteins; Membrane Structure and Assembly, Lipoprotein and receptor mediated endocytosis, Transport across membrane	
	1.2	Translocation of Secretory Proteins across the ER Membrane, Insertion, Protein Modifications and Folding, Control in the ER, Protein sorting and export from Golgi Apparatus. Sorting of Proteins to Mitochondria and Chloroplasts.	
	1.3	Molecular Mechanisms of Vesicular Traffic, early and later Stages of the Secretory Pathway, Receptor-Mediated Endocytosis	
	1.4	Protein degradation: Ubiquitin-proteasome pathway and Lysosomal proteolysis	
Unit 2		**Autoimmunity and transplantation**	**15**
	2.1	Autoimmune mechanism, altered antigens, Systemic Lupus Erythematosus, Rheumatoid arthritis, Myasthenia Gravis, Multiple sclerosis, GvH, Animal models of autoimmunity, Immunologic basis of graft rejection, clinical manifestation of graft rejection, clinical transplantation.	

	2.2	Cell Cytotoxicity, mixed lymphocyte reaction, Apoptosis, Cytokine expression; Cell cloning, Reporter Assays, In-situ gene expression techniques.	
Unit 3		**Cancer immunology and vaccines**	**15**
	3.1	Origin, malignant transformation of cells, oncogenes and cancer induction, tumors of the immune system.	
	3.2	Tumor antigens, tumor evasion of the immune system, cancer immunology.	
	3.3	Subunit vaccines, attenuated vaccines, vector vaccines.	
Unit 4		**AIDS and other immunodeficiency**	**15**

	4.1	Primary immunodeficiency –lymphoid and myeloid immunodeficiency,experimental models	
	4.2	AIDSandotheracquiredimmunodeficiency	

References:

1. Biochemistry,LStryer,FreemanandCo,NY
2. Biochemistry,Zubay,AddisonWesleyandCo.
3. Textbook ofPhysiology, Guyton
4. Physiology,BerneandLevy
5. Harper'sBiochemistry-27thEdition
6. TextbookofHumanBiochemistry6Ed.G.P.Talwar
7. Lodish,H.F.(2016).MolecularCellBiology(8thEd.).NewYork:W.H.Freeman.
8. Cooper,G.M.,&Hausman,R.E.(2013).TheCell:AMolecularApproach(6thEd.).Washington:ASM;Sunderland
9. Immunology5thEditionJanisKuby.
10. Molecularbiotechnology3rdeditionbyBernardGlickandJackPasternak
11. FundamentalImmunology5thEdition(August2003):byWilliamE.,Md.Paul(Editor)ByLippincottWilliams&Wilkins Publishers.
12. EssentialImmunology,IvanM.Roit(1994)BlackwellScientificPub,Oxford.
13. CellularandMolecularImmunology,3rdedition,Abbas.
14. Friedman,ThomasW.Klein,AndreaL.Friedman,CRCPress,1996.
15. MolecularBiotechnology-PrinciplesandApplicationsofRecombinantDNAbyGlick-3rdEdition

BiochemistryandImmunology-II(GNKPSBT1P502)(Practical–2credits)(75Marks)

1. ToprepareAcetateandphosphatebuffersusingtheHenderson-Hasselbalchequation.
2. Isolationofcholesterolandlecithinfromeggyolks.
3. Preparationofliposomes(Demo).
4. Latexbeadagglutination/precipitationtestfordetectionofrheumatoidfactor(RF).
5. PreparationofTABvaccinesandsterilitytesting.
6. Videodemonstrationorfieldvisit:a.Raisingantibodiesinlaboratoryanimalsb.Vaccineproduction(Subunit,Attenuated and Vector).
7. StudyofAIDS,anytwoautoimmunediseases,andCancer.
8. CytotoxicityusingMTTAssay.

References:

1. AnIntroductiontoPracticalBiochemistry(3rdEdition) -DavidPlummer.TataMcGraw-HillPublishingCompany Limited, 1992.

BIOPROCESSTECHNOLOGYAND BIOSAFETY

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT2502	04	60	100 Marks

LearningObjective:IntroductiontoIndustrialBiotechnologyandBiosafety.
LearningOutcome: Studentswillbeacquaintedwithcomplicatedbioprocesstechnologyandapplied microbiology processes and the importance of Biosafety.

Unit		Title	No. of Lectures
Unit 1		**Basicconceptsoffermentation**	**15**
	1.1	Mediaformulationandoptimizationmethods	
	1.2	Sterilizationoffermenterandfeeds, aerationandagitationin bioreactors,KLavalue(factorsaffectingandmethodsof determination), heat transfer in bioprocess	
	1.3	Measurementandcontrolofbioprocessparametersand instruments used	
Unit 2		**Biotransformation**	**15**
	2.1	Mechanism of enzyme function and reactions in process techniques: Enzymic bioconversions e.g. starch and sugar conversion processes; High-Fructose Corn Syrup; lipase and Interesterified fat; proteases and Hydrolysed protein etc. and theirdownstreamprocessing;bakingbyamylases,enzymesin beermashingandchillproofing;enzymesincheese	
	2.2	Otherenzymecatalyticactionsinfoodprocessing-deoxygenation and desugaring by glucose oxidase	
Unit 3		**Productionanddownstreamprocessingofproteins from Recombinantmicro-organism**	**15**
	3.1	Principles of Microbial Growth: Batch Fermentation, Fed-Batch Fermentation,ContinuousFermentationMaximizingtheEfficiency oftheFermentationProcessHigh-DensityCellCultures,Increasing Plasmid Stability, Quiescent E. coli Cells, Protein Secretion and Reducing Acetate	
	3.2	Bioreactors:TypicalLarge-ScaleFermentationSystems:Two-Stage Fermentation in Tandem Airlift Reactors, Two-Stage Fermentation in a Single Stirred-Tank Reactor, Batch versus Fed-Batch Fermentation	
	3.3	DownstreamProcessing:HarvestingMicrobialCells,Disrupting MicrobialCells,Proteinsolubilization,Purificationtechniques, drying, crystallization and packaging	
Unit 4		**Biosafety**	**15**

	4.1	HistoricalBackground; IntroductiontoBiologicalSafetyCabinets; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines Government of India; Definition of GMOs & LMOs; Roles of Institutional BiosafetyCommittee,RCGM,GEACetc.forGMOapplicationsin foodandagriculture;EnvironmentalreleaseofGMOs	

References:

1. Stanbury,P.F.,&Whitaker,A.(2010).PrinciplesofFermentationTechnology.Oxford:PergamonPress.
2. El-Mansi,Bryle,DemainandAllman.FermentationMicrobiologyandBiotechnology3rdedition2012,CRCpress
3. Lee,Y.K.(2013).MicrobialBiotechnology:PrinciplesandApplications. Hackensack, NJ:WorldScientific.
4. AlexanderN.GlazerandHiroshiNikaido-MicrobialBiotechnology:FundamentalsofAppliedMicrobiology,2ndEdition 2007, Cambridge university press
5. MichaelWaitesandMorgan,RockneyandHighton-Industrialmicrobiology:AnIntroduction2001BlackwellScience
6. RobertWhitehurstandMaartenVanOort-Enzymesinfoodtechnology2ndEdition2010Blackwellpublishinglimited
7. Molecularbiotechnology:principlesandapplicationsofrecombinantDNAby BernardGlick,JackPasternakandCheryl Patten 4th edition 2010 ASM press 8. Gaikar and Mahajani (ICT Publication)

Bioprocesstechnology andBiosafety(GNKPSBT2P502)(Practical–2credits)(75Marks)

1. DemonstrationofPlackett-Burmandesignforformulationoffermentationmedia.
2. Useofmicroorganismstoproduceaproduct.Detectsutilizationofsubstrateandformationofproductattimeintervals. Attempt purification of product e.g. enzyme.
3. Immobilizeanorganism/enzymeanddetecttheconversionofsubstratetoproduct.
4. Microbialpigment:a)Production:factorsaffecting-pH,temp,nutrients,static/shakerconditions,submerged/surface.b) Extraction: soluble and insoluble pigments- organic solvent extraction and purification.
5. Methodsformeasurementofcellmass:a)Direct physicalmeasurementofdryweight,wetweight,orvolumeofcells aftercentrifugation.b). Directchemicalmeasurementof some chemicalcomponent ofthecells suchastotalprotein/ total DNAcontent. c) Indirect measurement of chemical activity such as nutrient utilization and product synthesized.
6. WritingofSOPfor3-4laboratoryequipment's/instruments

References:1.http://www.ableweb.org/volumes/vol-6/10-miller.pdf

2. AnIntroductiontoPracticalBiochemistry(3rdEdition)-DavidPlummer.TataMcGraw-HillPublishing Company Limited, 1992.

MAJOR PAPER III-
ANIMAL AND PLANT CELL TISSUE CULTURE

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT...			

Learning Objective:
Learning Outcome:

Unit		Title	No. of Lectures
Unit 1		**Animal Cell Culture**	**15**
	1.1	**Cell Culture Media and Supplements** • Types of Culture Media: Natural and Synthetic • Serum and Serum-Free Media • Role of Growth Factors and Supplements • Preparation, Filtration, and Storage of Media	
	1.2	**Cell Growth and Maintenance** • Cell Adhesion, Proliferation, and Differentiation • Subculturing (Passaging) of Cells • Cryopreservation and Revival of Cells • Cell Counting and Viability Assays	
	1.3	**Cell-Based Assays and Applications** • Cytotoxicity and Viability Assays (MTT, Trypan Blue, etc.) • Cell Proliferation and Apoptosis Assays	
Unit 2		**Plant Cell Culture**	**15**
	2.1	**Culture Media and Growth Regulators** • Composition of Culture Media: MS, B5, and Other Media • Role of Macronutrients, Micronutrients, and Vitamins • Plant Growth Regulators: Auxins, Cytokinins, Gibberellins • Preparation, Sterilization, and Storage of Media	
	2.2	**Micropropagation and Clonal Propagation** • Stages of Micropropagation • Explant Selection and Surface Sterilization • Somatic Embryogenesis and Organogenesis • Hardening and Acclimatization of Plantlets	
Unit 3		**Secondary Metabolite Production**	**15**
	3.1	• Role of plant cell culture in Secondary Metabolite Production.	

ELECTIVEPAPER-ADVANCEDBIOTECHNOLOGY-II

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT3502	03	45	100 Marks

LearningObjective: IntroductiontoIPissues/rights,priorartand IPfilingprocess.
LearningOutcome: ConversantinIPissuesandcapableoffilingforIP.

Unit		Title	No. of Lectures
Unit 1		**IntellectualPropertyRightandPatenting-Basics**	**15**
	1.1	ConceptofIPR-UnderstandingthemeaningofIPRandits significance in knowledge based economy	
	1.2	TypesofIPR:Patents,TrademarksandServicemarks,Design registration,TradeSecrets,GeographicalIndications,Protectionof new plant varieties, Copyright	
	1.3	GlobalHarmonization:ImpactofIPRonglobaltradeandneed for harmonization, WTO and its role in global harmonization, TRIPS and Introduction to articles in TRIPS documents.	
	1.4	Internationalagreementsrelatedto IPRandpatents:Paris Convention,PCT,Budapesttreaty,UPOV	
Unit 2		**IntellectualProperty Right and Patenting -Advanced**	**15**
	2.1	Criteria to be fulfilled for patentability: new/novel, non-obvious/inventivestep,useful/capableofindustrialapplications. Non-patentable subject matter: what is not patentable	
	2.2	ConceptofmailboxandEMRandhowithashelpedIndiainits transition to full TRIPS compliance	
	2.3	HowIndiahasleveragedtheflexibilitiesprovidedbyTRIPSto safeguard the industry and prevent ever-greening of patents Provisional Patents, Divisional patents and patents of addition	
Unit3		**IPRasStrategic tool**	**15**
	3.1	RoleofPatenteeandpatentofficesinpatentmanagementincluding lab documentation, Confidentiality agreements, pre and post grant opposition, servicing of patents, Concept of piracy, reverse engineeringandknowledgeworker	

	3.2	BenefitsofcreatingandorowingpatentsandotherIPR	

		IPClearance:Precautionbeforelaunchingofproductanywherein the world Basic of Patent searching, Introduction to patent databases, Concepts of freedom to operate (FTO) search and analysis for patents, Exclusivity and SPC status check	
	3.3	OtherIPRcheckslikeTrademarks,Copyrights(forprinteddataon leaflets,packagesetc.)PuttingIPRrelatedDisclaimerswhile advertising products list or selling products.	

References:

1. IntellectualPropertyrights–UnleashingtheKnowledgeEconomy:Ganguli,TataMcGraw Publishing Company (2001)
2. Patentlaw:P.Narayanan.EasternLawHouse
3. ThePatentAct,1970 and thePatentRules, 2003:ProfessionalBook Publishers
4. AgreementonTrade-relatedAspectsofIntellectualPropertyrights(TRIPS Documents)
5. LawrelatingtoDrugsandCosmetics-VijayMalik21stEdition,EasternBookCompany, Chapter on Pharmaceuticals and Patents by Dr. Elizabeth Verkey
6. www.uspto.gov
7. http://worldwide.espacenet.com
8. ipindia.nic.in

AdvancedBiotechnology -II(GNKPSBT3P502)(Practical –1credit)(50Marks)

1. Studyofapatentand/ordevelopingahypotheticalpatentapplicationforahypothetical product / process. (To be submitted for an exam).
2. UseofMicrosoftPowerPoint/CorelDrawtoprepareaposter(ideallyonatopictobe pursued for Semester IV project, otherwise to prepare a poster on a paper from peer-reviewed journal no more than 5 years old – to be brought for practical exam).
3. Priorartsearchreportonanytwohypotheticalbiotechnology-relatedinnovationsusingIPOandinternational FTO databases.
4. Casestudies(IPRcases)

On-JobTraining (OJT)

PaperCode	Credits	No.ofLectures	Marks
GNKPSBT4502	04	60	100 Marks

EVALUATIONPATTERNSem-I

Subject	Credits	InternalEvaluation	SemesterEnd Examination	Total
MP-I	04	25	75	100
MP-II	04	25	75	100
PracticalofMP-I	02	-	75	75
PracticalofMP- II	02	-	75	75
ElectiveSubject-T	03	25	75	100
ElectiveSubject-P	01	-	50	50
ResearchMethodology (RM)	02+02	50	50	100

GrandTotal=600

EVALUATIONPATTERNSem-II

Subject	Credits	InternalEvaluation	SemesterEnd Examination	Total
MP-I	04	25	75	100
MP-II	04	25	75	100
PracticalofMP-I	02	-	75	75
PracticalofMP- II	02	-	75	75
ElectiveSubject-T	03	25	75	100
ElectiveSubject-P	01	-	50	50
OJT	04	50	50	100

GrandTotal=600