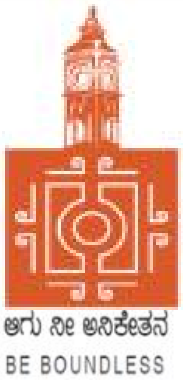

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course- as per NEP 2020)

Syllabus for B.Sc. Biotechnology
III & IV Semester

2022-23 onwards

Assessment:

Weightageforassessments(inpercentage)

TypeofCourse	FormativeAssessment/ IA	SummativeAssessment
Theory	40	60
Practical	25	25
Projects	-	-
ExperientialLearning(Internshipsetc.)	-	-

Contents of Courses for B.Sc. Biotechnology as MajorModelIIA

Semester	Course code	Course Category	Theory /Practical	Credits	PaperTitle	Marks	
						SA	FA
3.	**BTC:103**	DSC-7	Theory	3	Biomolecules	60	40
	BTC:103		Practical	2	Biomolecules	25	25
	BTC:303	OE- 3	Theory	3	NutritionandHealth	60	40
4.	**BTC:104**	DSC-8	Theory	3	MolecularBiology	25	25
	BTC:104		Practical	2	MolecularBiology	60	40
	BTC: 304	OE- 4	Theory	3	IntellectualPropertyRights	25	25
	ExitOptionwithDiplomainBiotechnology(100 Credits)						

ProgramName	**BScBiotechnology**		Semester	**III Sem**
CourseTitle	**Biomolecules**			
CourseNo.	**BTC:301**	**DCS -3T**	No. ofTheoryCredits	**4**
Contacthours	**56hrs**		DurationofESA/Exam	**2.30Hours**
FormativeAssessmentMarks	**40**		SummativeAssessmentMarks	**60**

CoursePre-requisite(s):	
CourseOutcomes(COs):At theend ofthecoursethe studentshould beable to: 1. Acquireknowledgeabouttypesofbiomolecules,structure,andtheirfunctions 2. Willbeabletodemonstratetheskillstoperformbioanalyticaltechniques 3. Applycomprehensive innovations and skillsofbiomolecules to biotechnologyfield	
Content	**Hrs**
Unit–I	**14 Hrs**
a. Carbohydrates: Introduction,sources,classificationofcarbohydrates.Structure,properties andfunction ofcarbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives Oligosaccharides–SucroseandFructose Polysaccharides – Classification as homo and heteropolysaccharides, Homopolysaccharides - storagepolysaccharides(starchandglycogen-structure,reaction,properties),structuralpolysaccharides(celluloseandchitin-structure,properties),Heteropolysaccharides-glycoproteins and proteoglycans. **b. AminoAcids,PeptidesandProteins** Introduction, classification and structure of amino acids. Concept of – Zwitterion, isoelectricpoint,pKvalues.Essentialandnonessentialaminoacids.Peptideandpeptide bond,classificationofproteinsbasedonstructureandfunction,Structuralorganizationofproteins[primary,secondary, tertiary andquaternary].Fibrousandglobularproteins,Denaturationand renaturationofproteinssecondary (α, β) and tertiary structures.	
Unit–II	**14 Hrs**
a. Lipids Classification and function of lipids, properties (saponification value, acid value, iodine number,rancidity),Hydrogenationoffatsandoils,saturatedandunsaturatedfattyacids.Generalstructureandbiologicalfunctionsofphospholipids,sphingolipids,glycolipids,lipoproteins,prostaglandins and cholesterol.	

b. Enzymes Introduction,nomenclatureandclassification,enzymekinetics,factorsinfluencingenzymeactivity,metalloenzymes,activationenergyandtransitionstate,enzymeactivity,specificactivity.Coenzymes and their functions (one reaction involving FMN, FAD, NAD). Enzyme inhibition-Irreversible and reversible (competitive, non-competitive and uncompetitive inhibition with an example each). Zymogens (trypsinogen, chymotrypsinogen and pepsinogen), Isozymes (LDH).	
Unit-III	**14 Hrs**
a. Vitamins Waterandfatsolublevitamins,dietary sourceandbiologicalroleofvitamins. Deficiencymanifestationof vitamin A, B, C, D, EandK **b. Nucleicacids** Structures of purines and pyrimidines, nucleosides, nucleotides in DNA **c. Hormones** Classificationofhormonesbasedonchemicalnatureandmechanismofaction.Chemicalstructureandfunctionsofthefollowinghormones:Glucagon,Cortisone,Epinephrine,Testosteroneand Estradiol.	
Unit-IV	**14 Hrs**
Bioanalyticaltools: **a. Electrophoresis:** Principle, procedure and applications of electrophoresis (Gelelectrophoresis -PAGE, SDS-PAGE& agarosegel electrophoresis). **b. Spectroscopy:** UV-Visspectrophotometry;massandatomicabsorptionspectroscopy.	

CourseArticulationMatrix:Mappingof CourseOutcomes(COs)withProgramOutcomes(POs1-12)

CourseOutcomes(COs)/ProgramOutcomes(POs)	**ProgramOutcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Acquire knowledge about types of biomolecules,structure,and their functions	✓				✓							✓
Willbeabletodemonstratetheskillstoperformbioanalytical techniques			✓								✓	✓
Apply comprehensive innovations and skills ofbiomoleculesto biotechnologyfield	✓				✓							✓

Pedagogy: Lectures,Seminars, IndustryVisits,Debates,QuizandAssignments

SummativeAssessment=60Marks	
FormativeAssessmentOccasion/type	**WeightageinMarks**
Attendance	10
Seminar and Assignment	10
Debatesand Quiz	10
Test	10
Total	**60marks + 40marks= 100 marks**

CourseTitle	**Biomolecules(Practical)**		PracticalCredits	**2**
CourseNo.	**BTC:301**	**DSC-3P**	Contacthours	

Content

1. Calculations of Molarity, Molality, Normality, percent by mass % (w/w), Percent byvolume(%v/v),partspermillion(ppm),partsperbillion(ppb)
2. Preparation of standardsolutions.
3. Preparation of buffers – Acetate, phosphate, Tris
4. Estimationof reducing sugarbyDNS method
5. Determination ofα-amylase activitybyDNSmethod
6. Estimationof proteinsby Lowry's/Biuret/Bradford'smethod
7. Estimationofamino acidbyNinhydrinmethod
8. Extractionofprotein fromsoaked/sproutedgreengram bysaltingoutmethod
9. Separationofplant pigmentsbypaper chromatography
10. Separationofamino acids bythin layerchromatography
11. Demonstration of active protein by NativePAGE
12. Determinationof Saponification and iodine numberoflipids

Practicalassessment

Assessment			
Formativeassessment		**SummativeAssessment**	**TotalMarks**
AssessmentOccasion /type	**Weightagein Marks**	**PracticalExam**	
Record	5	**25**	**50**
Test	10		
Attendance	5		
Performance	5		
Total	**25**	**25**	

References

1 DavidPlummer; 2001. 3rdEdition. AnIntroductiontoPracticalBiochemistry,TataMcGrawHillEdu.Pvt.Ltd. NewDelhi,India

2 Sadashivam,S.Manickam, A.1995.BiochemicalMethods,1stEdition,NewAgeInternationalPublishers, India

3 Sawhney, S.K.&RandhirSingh. IntroductoryPracticalbiochemistry,(ed)NarosaPublishing.House,NewDelhi,ISBN 81-7319-302-9

4 BeeduSasidharRao&VijayDespande. ExperimentalBiochemistry:AStudentCompanion,(ed) I.K.InternationalPvt.LTD,NewDelhi.ISBN 81-88237-41-8

5 Thimmaiah, S.K.(ed),KalyaniPublishers,StandardMethodsofBiochemicalAnalysis,LudhianaISBN81-7663-067

Date: SubjectCommitteeChairperson

ProgramName	**BScBiotechnology**		Semester	**III Sem**
CourseTitle	**NutritionandHealth**			
CourseCode	**BTC:303**	**OE-3**	No. ofTheoryCredits	**3**
Contacthours	**Lecture**		DurationofESA/Exam	**Hours**
	Practical			
FormativeAssessmentMarks			SummativeAssessmentMarks	

CoursePre-requisite(s):	
CourseOutcomes(COs):At theend ofthecoursethe studentshould beable to: 1. Studytheconcepts of food, nutrition, diet and health 2. Toapplythe best practices offood intakeand dietaryrequirements 3. Acquireknowledgeon varioussourcesofnutrientsand good cookingpractices	
Content	**45 Hrs**
Unit–I	**14 Hrs**
Introduction Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Foodpyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods,Probiotics, Prebiotics,and antioxidants.	
Unit-II	**14 Hrs**
Nutrients Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats – Sourcesand calories. Minerals–Calcium,Iron,Iodine. Vitamins – Fat soluble vitamins –A, D, E& K. Water soluble vitamins – Vitamin C, Thiamine,Riboflavin,Niacin.Water–Functionsandwaterbalance.Fibre– Functionsandsources.RecommendedDietaryAllowance,BodyMassIndexand Basal Metabolic Rate.	
Unit-III -	**14 Hrs**
NutritionandHealth Methodsofcookingaffectingnutritionalvalue.Advantagesanddisadvantages.Boiling,steaming, pressure cooking. Oil/Fat – Shallow frying, deep frying. Baking. Nutrition andlifestyle.Nutritionalrequirement,dietaryguidelines:Adulthood,Pregnancy,Lactation,Infancy-Complementaryfeeding,Pre-school,Adolescence,geriatric.Nutritionrelatedmetabolicdisorders-diabetes and cardiovascular disease.	

Pedagogy: Lectures,Seminars, IndustryVisits,Debates,QuizandAssignments

SummativeAssessment=60Marks	
FormativeAssessmentOccasion/type	**WeightageinMarks**
Attendance	10
Seminar and Assignment	10
Debatesand Quiz	10
Test	10
Total	**60marks + 40marks= 100 marks**

References

1 SriLakshmiB, (2007),Dietetics.NewAgeInternationalpublishers.NewDelhi

2 SriLakshmiB, (2002),NutritionScience.NewAgeInternationalpublishers.NewDelhi

3 SwaminathanM.(2002),AdvancedtextbookonfoodandNutrition.VolumeI.Bappco

4 Gopalan.C.,RamaSastryB.V.,andS.C.Balasubramanian(2009),NutritivevalueofIndianFoods.NIN.ICMR.Hyderabad.

5 MudambiSRandRajagopalMV,(2008),FundamentalsofFoods,Nutrition&diettherapybyNewAgeInternational Publishers, NewDelhi

Date: SubjectCommitteeChairperson

ProgramName	**BScBiotechnology**		Semester	**IVSem**
CourseTitle	**MolecularBiology**			
CourseNo.	**BTC:104**	**DCS -4T**	No. ofTheoryCredits	**4**
Contacthours	**56hrs**		DurationofESA/Exam	**2Hours**
FormativeAssessmentMarks	40		SummativeAssessmentMarks	60

CoursePre-requisite(s):

CourseOutcomes(COs):At theend ofthecoursethe studentshould beable to:

1. Studytheadvancements in molecularbiologywith latest trends.
2. Willacquirethe knowledgeof structure,functional relationshipof proteinsand nucleicacids.
3. Awareaboutthebasic cellularprocessessuchastranscription,translation,DNAreplicationandrepairmechanisms.

Content	Hrs
Unit–I **Molecularbasisoflife -NucleicAcids** An introduction to DNA and RNA, experimental proof of DNA as genetic material,Structure and functions of DNA and RNA, Watson and Crick model of DNA and forms ofDNA(AandZ).Ribozymes.	**14 Hrs**
Unit-II **DNAReplicationandRepair** ReplicationofDNAinprokaryotesandeukaryote.Enzymesandproteinsinvolvedinreplication,Thetamodel,linearandrollingcirclemodel. DNA Polymerases. **Replication complex:** Pre-priming proteins, primosome, replisome, unique aspects ofeukaryoticchromosomereplication,fidelityofreplication,DNAdamageandrepairmechanism**:**photoreactivation, excision repair, mismatchrepair and SOS repair.	**14 Hrs**
Unit-III **TranscriptionandRNAprocessing**	**14 Hrs**
Centraldogma,typesofRNA,Transcriptioninprokaryotes,RNApolymerase,roleof sigmafactor, promoter, Initiation, elongationand terminationofRNAchains. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters,enhancers,mechanismoftranscriptioninitiation,promoterclearanceandelongationRNAsplicing and processing: processing of pre-mRNA: 5’ cap formation, polyadenylation, splicing,rRNAand tRNAsplicing.	
Unit-IV	**14 Hrs**

Regulationof geneexpression andtranslation Geneticcodeanditscharacteristics,Wobblehypothesis.Translation inprokaryotesandeukaryotes, ribosome, enzymes and factors involved in translation. Mechanism of translation-activation of amino acid, aminoacyl tRNA synthesis, Mechanism- initiation, elongation andterminationofpolypeptidechain.Fidelityoftranslation, Inhibitorsoftranslation.Proteinfoldingandmodifications, Post translational modifications of proteins. Operon concept Lac and Trp.	

CourseArticulationMatrix:Mappingof CourseOutcomes(COs)withProgramOutcomes(POs1-12)

CourseOutcomes(COs)/ProgramOutcomes(POs)	**ProgramOutcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Studytheadvancementsinmolecularbiologywithlatesttrends	✓				✓							✓
Willacquiretheknowledgeofstructure,functionalrelationshipof proteins and nucleicacids					✓	✓						✓
Awarenessonthebasiccellularprocessessuchastranscription,translation,DNAreplicationandrepairmechanisms	✓				✓				✓			✓

Pedagogy: Lectures,Seminars, IndustryVisits,Debates,QuizandAssignments

SummativeAssessment=60Marks	
FormativeAssessmentOccasion/type	**WeightageinMarks**
Attendance	10
Seminar and Assignment	10
Debatesand Quiz	10
Test	10
Total	**60marks + 40marks= 100 marks**

CourseTitle	**MolecularBiology(Practical)**		PracticalCredits	**2**
CourseNo.	**BTC:104**	**DSC-4P**	Contacthours	

Content

1. Isolation of DNA from yeast/plant/animal sources
2. Estimationof DNAbyDPA method
3. Analysis of DNA by Agarose gel electrophoresis
4. Estimationof RNA byOrcinol method
5. Extractionand partialpurification ofprotein fromanimal sourcebyorganicsolvents.
6. ProteinseparationbySDS-PolyacrylamideGelElectrophoresis(PAGE)
7. Study of Conjugation, TransformationandTransduction,
8. DNAreplication model
9. TypesofRNA (Model)
10. Preparationof forms of DNA model
11. Demonstration of Replica plating technique

Practicalassessment

Assessment			
Formativeassessment		**SummativeAssessment**	**TotalMarks**
AssessmentOccasion /type	**Weightagein Marks**	**PracticalExam**	
Record	5	25	**50**
Test	10		
Attendance	5		
Performance	5		
Total	**25**	**25**	

References

1 Glick,B.RandPasternak,J.J1998.Molecularbiotechnology,PrinciplesandapplicationofrecombinantDNA, Washington D.C. ASM press

2 Howe.C.1995.Genecloningandmanipulation,CambridgeUniversityPress,USA

3 Lewin,B. GeneVINewYork, OxfordUniversityPress

4 Rigby,P.W.J.1987 GeneticEngineeringAcademicPress Inc.Florida,USA

5 Sambrooketal2000.MolecularcloningVolumesI,II&III,ColdspringHarborLaboratoryPressNewYork,USA

6 Walker,J.M.andGingold,E.B.1983.MolecularBiology&Biotechnology(IndianEdition)RoyalSocietyofChemistryU.K

7 Karp.G2002. Cell &MolecularBiology, 3rd Edition, JohnWiley&Sons; I

Date: SubjectCommitteeChairperson

ProgramName	**BScBiotechnology**		Semester	**IVSem**
CourseTitle	**IntellectualPropertyRights**			
CourseCode	**BTC:304**	**OE-4**	No. ofTheoryCredits	**3**
Contacthours	**Lecture**		DurationofESA/Exam	**2 Hours**
	Practical			
FormativeAssessmentMarks	40		SummativeAssessmentMarks	60

CoursePre-requisite(s):SemesterIandIIofcompositeHomeScience.	
CourseOutcomes(COs):At theend ofthecoursethe studentshould beable to: 1. Knowledgeabout needandscopeof Intellectualpropertyrights 2. Acquireknowledgeaboutfilingpatents,process, andinfringement 3. Knowledgeabouttrademarks,industrialdesigns,andcopyright	
Content	**45 Hrs**
Unit–I	**14 Hrs**
IntroductiontoIntellectualpropertyrights(IPR): Genesisandscope.TypesofIntellectualpropertyrights-Patent,Trademarks,Copyright,Design,Tradesecret,Geographicalindicators,Plantvarietyprotection .NationalandInternationalagencies – WIPO, World Trade Organization (WTO), Trade-Related Aspects of IntellectualPropertyRights (TRIPS),GeneralAgreement onTariffsand Trade(GATT).	
Unit-II	**14 Hrs**
Patenting,process,andinfringement Basics of patents - Types of patents; Patentable and Non-Patentable inventions, Process andProduct patent. Indian Patent Act 1970; Recent amendments; Patent Cooperation Treaty (PCT)and implications. Process of patenting. Types of patent applications: Provisional and completespecifications;Conceptof"priorart",patentdatabases(USPTO,EPO,India).Financialassistance, schemes, and grants for patenting. Patent infringement- Case studies on patents(Basmatirice, Turmeric,Neem)	
Unit-III -	**14 Hrs**
Trademarks,Copyright,industrialDesigns	
Trademarks- types, Purpose and function of trademarks, trademark registration, Protection oftrademark.Copyright-Fundamentalsofcopyrightlaw,Originalityofmaterial,rightsofreproduction,industrialDesigns: Protection,Kind ofprotection provided byindustrial design.	

Pedagogy

Summativeassessment=40markstheorypaper,EndsemesterExamdurationofexam2hours	
FormativeAssessmentOccasion/type	**WeightageinMarks**
Assignment	10
Seminar	10
Casestudies	10
Test	10
Total	**40marks**

References

1 ManishArora.2007.Universal'sGuidetoPatentsLaw(English)4th Edition)-Publisher:UniversalLawPublishingHouse

2 KalyanC.Kankanala.2012.FundamentalsofIntellectualProperty.AsiaLawHouse

3 Ganguli,P.2001.IntellectualPropertyRights:Unleashingtheknowledgeeconomy.NewDelhi:TataMcGraw-HillPub

4 Worldtradeorganization -http://www.wto.org

5 WorldIntellectualPropertyorganization–www.wipo.int
OfficeofthecontrollergeneralofPatents,Design&Trademarks -www.ipindia.nic.in

Date: SubjectCommitteeChairperson