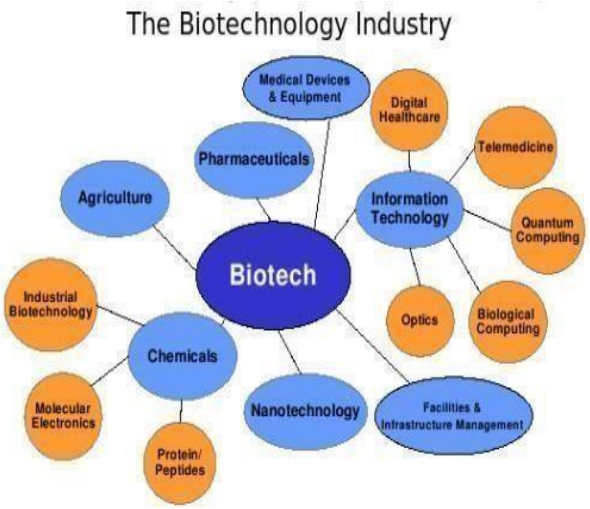
PERIYARUNIVERSITY

SALEM636 001

DegreeofBachelor of Science

OUTCOMEBASEDEDUCATION



Syllabusfor

B.Sc.BIOTECHNOLOGY

(SEMESTERPATTERN)

(For Candidates admitted in the Colleges affiliated to PeriyarUniversityfrom2021-2022 onwards)

OBEPATTERNREGULATIONS

(From2021–2022Onwards)

SchemeofExaminationandCourseStructure
(semesterwise)
PERIYAR UNIVERSITY,SALEM – 11BACHELOR OFSCIENCEBRANCH – BIOTECHNOLOGYOBEPATTERN REGULATIONS

(Therevisedsyllabusshallbeeffectivefromtheacademicyear2021-2022onwards)

1. Objectives

Biotechnology is the research-oriented science including a fusion of biology andtechnology. This study includes a large variety of subjects including Biochemistry,Genetics, Microbiology, Biochemistry , Immunology and Engineering. It is associatedwith other subjects such as Health and Medicine, Bio-statistics, Cell Biology, SeedTechnology, Plant Biotechnology etc. Biotechnology features the use of living cells andbacteria in the industrial process. Biotechnology can be applied in developing variousvaccines,medicinesanddiagnostics,improvingenergyproductionandconservationandincreasingproductivity.

Theobjectivesofthecourseare

- Toimpartheknowledgeaboutthetheoreticaldevelopmentof Biotechnology.
- ToelucidatetheuseofvariousBiologicalScienceconceptswhicharerequiredforthedevelopment of Biotechnology.
- Toemphasizethescopeofusingbiotechnologytoolsinvariousdisciplines.
- Toequipthestudentswitheffectiveapplicationsofvariousbiotechnologytoolsforsolvingmanyreallifeproblems.
- ToprovideaplatformforpursuinghigherstudiessuchasPost-graduateandDoctoratedegrees

LearningOutcomes

OnsuccessfulcompletionoftheB.Sc.Biotechnologyprogram,

- Thestudentsshouldbeabletodemonstrateproficiencyinbasicscienceandfundamentalbiotechnologicaltools
- Thegraduatescouldunderstandtheworkingprinciplesofadvancedbiologicalsciences

- Thegraduatesacquireemployabilityskillsinthefieldof Pharmaceutical,foodandagricultural industries
- Thegraduatesgetmotivatedtowardsdeeplearning,higherstudiesandresearchinlifesciences
- The graduates develop health and environment awareness towards social Responsibility.

PO No	PROGRAMMEOUTCOME	Knowledge Level
PO1	***Disciplinaryknowledge:*** Abilityto understand fundamentalconcepts of Biotechnology ;AbilitytoapplybasicprinciplesofchemistrytoBiologicalSystems andgenetics ;Ability to relate various interrelated Molecular biologyand Molecular genetics ; Ageneral awareness of current developments at the forefront in Biotechnology and Alliedsubjects;Abilitytocriticallyevaluateaproblemandresolvetochallengeblindlyaccepted concepts; Zeal and ability to work safely and effectively in a laboratory; Goodexperimental and quantitative skills encompassing preparation of laboratory reagents,conductingexperiments,satisfactoryanalysisofdataandinterpretationofresults;Awareness of resources, and their conservation; Ability to think laterally and in anintegrating manner and develop interdisciplinary approach; Overall knowledge of theavenues for research and higher academic achievements in the field of Biotechnology,nanotechnology, genecticenginerring,pharmaceutical biotechnology and bioinformaticssubjects.	K 3
PO2	***Communication Skills:*** Abilitytospeak and writeclearlyin English;Abilityto listerntoandfollow scientificview points and engage with them.	K 2
PO3	***Problemsolving:*** Abilityto closelyobservethe situation, andapplylateral thinkingandanalyticalskills.	K 4
PO4	***Analytical reasoning****:* Ability to evaluate the strengths and weaknesses in scholarlytexts spotting flaws in their arguments; Ability to use critics and theorists to create aframeworkandtosubstantiateone'sargumentinone'sreadingofscientifictexts.	K4
PO5	***Team work /Time Management****:* Ability to participate constructively in class roomdiscussions;Abilityto contributeto group work;Abilitytomeetadeadline.	K6
PO6	***Scientificreasoning:*** Abilitytoanalyse,interpretanddrawconclusionsfromquantitative/qualitative data; and critically evaluate ideas, evidence and experiencesfromanopen-mindedandreasonedperspective.Abilitytoformulatelogicalandconvincingarguments.	K4
PO7	***Self-directed learning:*** Ability to work independently in terms of organizing laboratory,and critically analyzing research literature; Ability to postulate hypothesis, questionsand searchforanswers.	K6
PO8	***Digital literacy:*** Ability to use digital sources, and apply various platforms to convey andexplainconcepts ofBiotechnology	K3

PO9	***Moral and ethical awareness/reasoning:*** Ability to interrogate one's own ethical valuesand to be aware of ethical and environmental issues; Ability to read values inherited insociety andcriticismvisa vis,the environment,religion andspiritualityasalsostructuresofpower	K3
PO10	***Leadership readiness:*** Ability to lead group discussions, to formulate questions relatedto scientific andsocialissues.	K6

K1–Remember;K2-Understand;K3-Apply;K4-Analyse;K5-Evaluate;K6-Create

OBE PATTERNREGULATIONS
(From 2021–2022Onwards)

PERIYARUNIVERSITY,SALEM–11.

DEFINITION

Programme:"Programme"meansacourseofstudyleadingtotheawardofadegreeinadiscipline.

Course:"Course"referstoasubjectofferedunderthedegreeprogrammespreadoverthecompleteProgrammeof studyasunder.

PartI :means"Tamil/otherlanguages"offeredundertheprogramme.

PartII :means"English"languageofferedundertheprogramme.

PartIII::means"Alliedsubjects"offeredasallied,whichisinterdisciplinaryinnaturebutrelatedto theprogramme.

PartIII: means"Electivesubjects"relatedtothecoresubjectsoftheprogrammeconcerned.

PARTIV

i) "Tamil"meansbasicorientationinTamillanguageforthosestudentswhohavenotstudiedTamilupto12standard.

ii) —AdvancedTamil‖means,thesubjectismeantforstudentswhohavestudiedTamillanguage upto12thstandard and chosen other languages in college but would like to advancetheirTamillanguageskills.

iii) "Non-Major Electives" means option is being given to students who do not comeunderthe abovetwocategories(i& ii).

iv) Skillbasedsubjectmeansthecoursesofferedundertheprogrammerelatedto Advanced Skill acquisition for industrial application for which a separate Diploma will beawardedalongwiththeDegree.

v) "FoundationCourse"meanscoursesofferedas

Value Education - Manavalakkalai yoga (1styear)

EnvironmentalStudies(1styear)

PartV

"ExtensionActivities"meansallthoseactivitieswhichformpartofNSS/NCC/Sports/YRCandothercoandextracurricular activities.

A detailed explanation of the above with relevant credits are given under "Scheme ofExaminationalongwithDistributionof Marks andCredits"

Duration: Means the stipulated years of study to complete a programme as prescribed by theUniversity time to time. Currently for the undergraduate programme the duration of study isTHREE years. These regulations apply to the regular course of study in approved institutions oftheUniversity.

Credits: Meanstheweightagegiventoeachcourseofstudy(subjects)attributedbytheexpertsof theBoardof Studiesconcerned.

Credit System: Means, the course of study under this pattern, where weightage of credits arespread over to different semesters during the period of study and the Cumulative Grade PointAverage will be awarded based on the credits earned by the students. The following are thetotalcreditpoints:

ForUndergraduateProgramme(Threeyears):140

4. AIMAND SCOPEOF THECOURSE:

- Thetopicsincludedindifferentunitsofdifferentpaperswouldenablethestudentstodevelop=technicalskills intechnologyandappliedbranches.

- Skill based subjects like Bioinstrumentation, Developmental Biology, Nanobiotechnology andBioinformaticsandProteomicsandGenomicshavebeenincludedinordertoprovideopportunitiesinemploymentandresearchinGovernmentand PrivateOrganizations.
- ThereisalsoscopeforselfemploymentforthestudentS.
- Practicals included in the syllabus will improve the skills of the students in Plant tissue culture,Animaltissueculture,Molecularbiology,Immunology,Geneticengineering,Bioprocesstechnology,EnzymologyandLaboratorytechniques.

i) EligibilityforAdmission

A candidate who has passed Higher Secondary Examination in any one of the biologicalsciences (Botany/Zoology, Biology).(Academic/Vocational stream-Agri, Home Science,Poultry) under higher secondary board of examination, Tamil Nadu or as per norms set bythe Government of Tamil Nadu or an examination accepted as equivalent thereto by theSyndicate.

ii) DurationoftheCourse

ThecourseforthedegreeofBachelorofScienceshallconsistofthreeacademicyearsdividedintosixsemesters.Eachsemester consistsof 90workingdays.

5. PASSINGMINIMUM

The candidate shall be declared to have passed the examination if the candidate secures notless than 30 marks out of 75 marks in the University Examination (UE) in each theory paperand10marks(outof25)inthe ContinuousInternalAssessment(CIA)ineachtheory paper.

For the Practical paper, a minimum of 24 marks (out of 60) in the University Examination (UE)and 16 marks (out of 40) in the Continuous Internal Assessment (CIA) is required to pass theexamination.

The CIA of each practical paper includes evaluation of record. However submission of recordfortheUniversityPracticalExaminationis mandatory.

Examinations	Maximum Marks			Passing Minimum		
	CIA	UE	Total	CIA	UE	Total
TheoryPaper	25	75	100	10	30	40
Practical Paper	40	60	100	16	24	40

6. CLASSIFICATIONOFSUCCESSFULCANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examinationshallbedeclaredtohavepassedtheexaminationinthe FirstClass.

AllothersuccessfulcandidatesshallbedeclaredtohavepassedintheSecondClass.Candidates who obtained 75% of the marks in the aggregate shall be deemed to have passedtheexaminationinFirstClasswithDistinctionprovidedtheypassalltheexaminationsprescribedfor thecourseatthefirstappearance.

Candidates who pass all the examinations prescribed for the course in the first instance andwithin a period of three academic years from the year of admission to the course only areeligiblefor UniversityRanking.

1. **PassingMinimum**is40%of the**ESE**andalso40% oftheminimumof thepaper/course.

2. **MinimumCredits tobe Earned:**

ForTHREEyearProgramme:Best140Credits

PartIandII: Languages
PartIII **:**Major,Elective,Allied
PartIV **:**SoftSkills
PartV **:**ExtensionActivities

6.**MarksandGrades:**

Thefollowingtablegivesthemarks,gradepoints,lettergradesandclassificationtoindicatetheperformanceof thecandidate.

Conversion of Marks to Grade Points and Letter Grade(Performancein aCourse/Paper)

RANGEOFMARKS	GRADEPOINTS	LETTER GRADE	DESCRIPTION
90–100	9.0-10.0	O	**Outstanding**
80–89	8.0- 8.9	D+	**Excellent**
75–79	7.5- 7.9	D	**Distinction**
70–74	7.0- 7.4	A+	**VeryGood**

60–69	6.0- 6.9	A	**Good**
50–59	5.0- 5.9	B	**Average**
40–49	4.0- 4.9	C	**Satisfactory**
00–39	0.0	U	**Re-appear**
ABSENT	0.0	AAA	**ABSENT**

CALCULATIONOFGPAANDCGPA

ForaSemester:

$$\text{GPA} = \frac{\text{Sum of the Multiplication of Grade Points by the Credits of the Courses}}{\text{Sum of the Credits of the Courses in a Semster}}$$

$$\text{Grade Point Average (GPA)} = \frac{\sum_i C_i G_i}{\sum_i C_i}$$

FortheentireProgramme:

$$\text{CGPA} = \frac{\text{Sum of the Multiplication of Grade Points by the Credits of the Entire Programme}}{\text{Sum of the Credits of the Courses of the Entire Programme}}$$

C_i=Creditsearnedforcourse**'i'**inanysemester**G_i**=GradePoint

obtainedforcourse **'i'**inanysemester.

nrefersto thesemesterinwhichsuchcourseswerecredited

CGPA	**GRADE**	**CLASSIFICATIONOFFINALRESULT**
9.5-10.0	O+	FirstClassWithExemplary*
9.0 and above but below9.5	O	
8.5 and above but below9.0	D++	FirstClassWithDistinction*
8.0 and above but below8.5	D+	
7.5 and above but below8.0	D	

7.0 and above but below7.5	A++	FirstClass
6.5 and above but below7.0	A+	
6.0 and above but below6.5	A	
5.5 and above but below6.0	B+	SecondClass
5.0 and above but below5.5	B	
4.5 and above but below5.0	C+	ThirdClass
4.0 and above but below4.5	C	
0.0 and above but below4.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed Semesterof theUGProgramme(Major,AlliedandElectiveCoursesAlone)areeligible

8.MAXIMUMDURATIONFORTHECOMPLETIONOFTHEUGPROGRAMME

The maximum duration for completion ofthe UGProgramme willnotexceed twelvesemesters.

9.COMMENCEMENTOFTHISREGULATION

The OBE regulations shall take effect from the academic year 2021 – 2022 (i.e.) for thestudents who are admitted in the first year of the course during the academic year 2021 – 2022and thereafter.

10.TRANSITARYPROVISION

CandidateswhowereadmittedtotheUGcourseofstudypriorto2021-2022willbepermitted to appear for the examination under those regulations for a period of three years(i.e.)up toand inclusiveoftheexaminationsofApril/May 2024.Thereaftertheywillbepermittedto appearfor theexaminationbasedonthe regulations theninforce.

QUESTIONPAPERPATTERNANDEVALUTIONFORALLCOURSES

11.1 DistributionofMarksforTheoryExaminations:

EXAMINATIONS	MARKS
CIA(ContinuousInternalAssessment)	25Marks
UE(UniversityExaminations)	75Marks
TOTAL	**100 Marks**

11.2 EvaluationofContinuousInternalAssessment(CIA):

S.NO	INTERNALASSESSMENT	DISTRIBUTIONOFMARKS
1	Test	15Marks
2	Assignments	5 Marks
3	Attendance	5 Marks
TOTAL		**25 Marks**

11.3.QuestionPaperPatternforCore/Allied/Elective/SBECPapers(Theory):

Time:Threehours **MaximumMarks: 75**

Part-A (15x1 =15)
Answer ALL questions(ThreeQuestionsfromEachUnit)

Part-B(2x5=10)
Answer any TWO questions(OneQuestionfromEachUnit)

Part-C(5x10=50)

***11.4*DistributionofMarksforCoreandAlliedIPractical:**

EXAMINATIONS	MARKS
CIA(ContinuousInternalAssessment)IncludingPracticalRecord	40Marks
UE(UniversityExaminations)	60Marks
TOTAL	**100 Marks**

11.5.EvaluationofContinuousInternalAssessment(CIA)forCoreandAlliedPractical:

S.NO	INTERNALASSESSMENT	DISTRIBUTIONOFMARKS
1	Record	25Marks
2	Test	10Marks
3	Attendance	5 Marks
TOTAL		**40 Marks**

		Value added courses/ Job orientedCertificate courses	Optional
		UGC-SWAYAMonline/MOOC's,NPTELcourses	Optional

Note:SubjectcodetobecrossverifiedespeciallyforalliedBiostatisticsandComputer Science Course

12.SCHEMEOFEXAMINATIONS

Theschemeofexaminationfordifferentsemestersshallbeasfollows:

Course structure under OBE (semester – wise details) B.Sc., Biotechnology (for thestudentsadmittedfromtheacademicyear 2021-2022onwards)

CoursestructureunderOBE(Semester-wiseDetails)

Biotechnology

(ForthestudentsadmittedfromtheAcademicyear2021-2022onwards)

PART	PAPER CODE	COURSE	TITLEOFTHEPAPER	HOURS	CREDIT	MARKS		TOTAL
						CIA	UE	
SEMESTER–I								
I	21UFTA01	Language I	Tamil–I	6	3	25	75	100
II	21UFEN01	Language II	English–I	6	3	25	75	100
IV	21UPEL01		ProfessionalEnglish I	6	4	25	75	100
III	21UBT01	CoreTheory – I	CellBiology	5	4	25	75	100
	21UBCA01	AlliedI:Theory- I	Biochemistry-I	5	3	25	75	100
	21UBCAP01	AlliedPractical– I	LabinBiochemistry-I*	3	-	-	-	-
	21UBTP01	CorePractical–I	Labin Cell biology	3	3	40	60	100
IV	21UVE01	Common	ValueEducation (Yoga)	2	2	10 0	75	100
NO.OFCOURESES– 7			**TOTAL**	**36**	**22**	**-**	**-**	**700**
***ExaminationattheEndofSecondSemester**								
SEMESTER –II								
I	21UFTA02	Language	Tamil–II	5	3	25	75	100
II	21UFEN02	Language	English–II	5	3	25	75	100
II	21UPEL02		ProfessionalEnglish II	4	4	25	75	100
	NMSDC	LanguageProficiency forEmployability	EffectiveEnglish	2	2	25	75	100
III	21UBT02	CoreTheory – II	Genetics	5	4	25	75	100
	21UBCA02	AlliedI:Theory- II	Biochemistry-II	5	3	25	75	100
	21UBTP02	CorePractical–II	LabinGenetics	3	3	40	60	100
	21UCAP01	Alliedpractical-I	LabinBiochemistry	3	3	40	60	100
IV	21UES01	Common	EnvironmentalStudies	2	2	25	75	100
IV	21UBTS01	SBEC –I	Bioinstrumentation	2	2	25	75	100
NO.OFCOURESES– 9			**TOTAL**	**36**	**29**	**-**	**-**	**1000**

SEMESTER –III								
I	21UFTA03	Language	Tamil– III	5	3	25	75	100
II	21UFEN03	Language	English– III	5	3	25	75	100
III	21UBT03	CoreTheory–III	GeneralMicrobiology	4	3	25	75	100
	21USTA05	AlliedII:Theory-III	Biostatistics	5	3	25	75	100
	21UBTP03	COREPRACTICAL –III	Labin Microbiology	3	3	25	75	100
		AlliedPractical	ComputerPractical*	3	-	-	-	-
IV	21UBTS02	SBEC- II	Developmental Biology	2	2	25	75	100
	NMEC–I			1	1	25	75	100
	NMSDC-Digital Skills for Employability – Microsoft Office Essentials			2	2	25	75	100
NO.OFCOURESES– 7			**TOTAL**	**30**	**20**	**-**	**-**	**700**
***ExaminationattheEndof FourthSemester**								
SEMESTER –IV								
I	21UFTA04	Language	Tamil– IV	5	3	25	75	100
II	21UFEN04	Language	English– IV	5	3	25	75	100
III	21UBT04	CoreTheory–IV	MolecularBiology	5	4	25	75	100
		Allied II:Theory –IV	E-CommerceTechniques (OR)Computer Applicationinoffice	4	4	25	75	100
	21UBTP04	CorePractical –IV	LabinMolecular Biology	3	3	40	60	100
		AlliedPracticalIV	HTML Programming(OR) Lab in OfficeAutomation	3	3	40	60	100
IV		NMSDC	Employability Skills - Microsoft	2	2	25	75	100
		NMEC–II		2	2	25	75	100
	InternshipProgramme	ClinicalLab,SericultureFarm, EffluentTreatmentPlant,SugarcaneIndustry,Fruit and Beverage Industries, Aavin Diary,Horticulture Research Station, Soil TestingOrganic Farming,Medical Coding, TNAU,VeterinaryUniversity,PlantTissueLab, Molecular Biology Lab, Medical LabTechnology,BioFertilizerUnit,MushroomProductionUnit.						
NO.OFCOURESES– 7			**TOTAL**	**30**	**24**	**-**	**-**	**800**

SEMESTER –V								
III	21UBT05	CoreTheory– V	PlantBiotechnology	5	4	25	75	100
	21UBT06	CoreTheory–VI	Immunology andImmunotechnology	5	4	25	75	100
	21UBT07	CoreTheory–VII	GeneticEngineering	6	4	25	75	100
		Elective–I		4	3	25	75	100
	21UBTP05	CorePractical–V	Lab in Plantbiotechnology	3	4	40	60	100
	21UBTP06	CorePractical–VI	Lab in GeneticEngineeringand Immunology	3	4	40	60	100
IV	21UBTS03	SBEC–III	Nano Biotechnology andBioinformatics	2	2	25	75	100
IV		**NMSDC**	**Advanced Technology for Employability in Life Science – Medical Coding**	**2**	**2**	**25**	**75**	**100**
NO.OFCOURESES– 7			**TOTAL**	**30**	**27**	**-**	**-**	**700**

SEMESTER– VI								
III	21UBT08	CoreTheory–VIII	AnimalBiotechnology	6	4	25	75	100
	21UBT09	CoreTheory–IX	FoodBiotechnology	6	4	25	75	100
	21UBT10	CoreTheoryX	Bioprocess andEnzymetechnol	5	4	25	75	100
		NMSDC	Bioinformatics forEmployability-Bioinformatics	2	2	25	75	100
	21UBTP07	CorePractical–VII	Lab in AnimalBiotechnology	4	4	40	60	100
	21UBTP08	CorePractical–VIII	LabinBioprocess Technology andenzymology	4	4	40	60	100
IV	21UBTS04	SBEC– IV	Pharmaceutical Biotechnology	2	2	25	75	100
V	21UEX01	Common	ExtensionActivities	-	1	-	-	-
NO.OFCOURESES– 8			**TOTAL**	**30**	**25**	**-**	**-**	**700**
TOTALNO. OFCOURESES–42			**GRANDTOTAL**	**180**	**147**	**-**	**-**	**4600**

UE – University ExaminationAssessment **CIA–Continuous Internal**

SBEC– SkillBasedElectiveCourseCourse **NMEC–Non-MajorElective**

SCHEME OF EXAMINATIONS FROM THE ACADEMIC YEAR 2021 - 2022CREDITDISTRIBUTIONASPERTHEUNIVERSITYNORM

SEMESTER	I	II	III	IV	V	VI	TOTALCREDITS
PART-I	3	3	3	3	-	-	12
PARI -II	3	3	3	3	-	-	12
ALLIED	4	4	4	4	-	-	16
ALLIEDPRACTICAL	-	3	-	3	-	-	6
CORETHEORY	4	4	4	4	12	12	40
COREPRACTICAL	3	3	3	3	8	8	28
ELECTIVE	-	-	-	-	4	4	8
SBEC	-	2	2	-	2	2	8
NMEC	-	-	2	2	-	-	4
EVS	-	2	-	-	-	-	2
VALUEEDUCATION	2	-	-	-	-	-	2
AD-ONCOURSE	-	-	-	-	-	-	-
EXTENSIONACTIVITY	-	-	-	-	-	1	1
PROFESSIONAL ENGLISHPHYSICALSCIENCE	4	4	-	-	-	-	8
CUMULATIVETOTALCREDIT	23	28	21	22	26	27	147

ELECTIVESUBJECTS

Sem	Part	SubjectCode	Subject
V	III	21UBTE01	MEDICALBIOTECHNOLOGY
		21UBTE02	ENTERPREUNERSHIPINBIOTECHNOLOGY

VI	III		MEDICALCODING

SKILL BASEDELECTIVECOURSESSUBJECTS

SEM	PART	SUBCODE	COURSE	Hrs.		CREDIT	MARKS		
				Lect.	LAB		CIA	EA	TOTAL
SEMESTER–IV									
IV	II		Bioinstrumentation	2	-	2	25	75	100
	III		Developmental Biology	2	-	2	25	75	100
	V		Nanobiotechnology and Bioinformatics	2	-	2	25	75	100
	VI		Pharmaceutical biotechnology	2	-	2	25	75	100
ALLIED PAPERS I YEAR									
III	I		Biochemistry I	6	-	4	25	75	100
	II		Biochemistry II	5	-	4	25	75	100
ALLIED PAPERS AND PRACTICAL									
IIII	III		Biostatistics	5	-	4	25	75	100
	IV	OPTION- I OPTION-II	THEORY -1 Computer application in office AND PRACTICAL --OFFICE AUTOMATION LAB OR THEORY -1 E-COMMERCE TECHNIQUES AND PRACTICAL -- HTML PROGRAMING LAB	6	-	4	25	75	100

NON MAJOR ELECTIVE COURSE SUBJECTS

Sem	Part	SubjectCode	Subject
III	PARTIV	21UBTN01	Conceptofbiotechnology

IV	PARTIV	21UBTN02	Biotechnologyforhumanwelfare

ALLIED:COMPUTER SCIENCE
OPTION–I THEORY:E-COMMERCE TECHNIQUES AND PRACTICAL: HTMLPROGRAMMING
OPTION–IITHEORY:COMPUTERAPPLICATIONINOFFICE ANDOFFICEAUTOMATIONLAB

Fromtheabovetwo OPTIONSstudentscan choose anyoneoption

FIRST SEMESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**I**
CORETHEORY	**I**
PAPERCODE	**21UBT01**
TITLEOFTHEPAPER	**CellBiology**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LearningObjectives

- Studentswillunderstandthestructuresandpurposesofbasiccomponentsofprokaryoticandeukaryoticcells,especially macromolecules,membranes,and organelles
- Studentswillunderstandhowthesecellularcomponentsareusedtogenerateandutilizeenergyincells
- StudentswillunderstandthecellularcomponentsunderlyingmitoticcelldivisionOnsuccessful completion of the subject the student should have understood theStructuralfeatures,Organelles andthecellular mechanisms

CourseOutccome

ONSUCCESSFULCOMPLETIONOFTHISCOURSE,STUDENTSSHOULDBEPROFICIENTTO

Course No	CourseOutcome Details	Knowledge level
CO1	Designthemodelof acell. Differentiatethestructureofprokaryoticandeukaryoticcell.	K2
CO2	ExplaintheorganizationofGenesandchromosomes,chromosomemorphologyandits aberrations	K2
CO3	Compareandcontrasttheeventsofcellcycleanditsregulation	K2
CO4	Explainthecommunicationsof cellswithothercellsandtotheenvironment	K3

CO5	To know the cell organelles and locate itspartsalongwithfunctions	K3

MAPINGWITHPROGRAMMEOUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S:STRONG M:MEDIUM L:LOWUNITI

Cellasabasicunit,Celltheory,CellsizeandShape,ProkaryoticandEukaryoticorganization,Structuralcomparisonof microbial ,plantandanimalcells.

UNITII

Cell wall and Membrane : Plasma membrane-Model of plasma membrane, fluidity ofmembranes,membraneproteinsandtheirfunctions;Transportacrossthemembrane-Selectivepermeabilityof membranes;Celladhesion;Celljunction.

UNITIII

Structure and functions of cell organelle;Mitochondria,chloroplast,Endoplasmicreticulam,GolgiComplex,Lysosomes,Ribosomes,Peroxisomes,Glyoxisomes,Vacuoles,centrioles,cytosols,Microtubulesand Microfilaments.

UNITIV

CellcycleandCellSignalling:Celldivision,Cellcycle,Mitosis,Meiosis,Cellsignaling,G-proteinreceptors,Cellmembranetraffic,Cellular senescenceandApoptosis.

UNITV

Specialisedcells,Motile cells(Amoeboid ,Ciliary,FlagellarMovements,Nerve cells and Nerveimpulse conduction,Muscle cells and Muscle contraction,Plant cells (Parenchyma cells,XylemandPhloemCells)

REFERENCEBOOKS:

1.**DeRobertis.,**CellBiology,BlazePublishersandDistributorsPvt.Ltd.,NewDelhi2.**GeraldKarp.**,Cellan

dMolecular BiologyConceptsandExperiments-4TH Edition

3.**Wilson&Marrison**.,Cytology,ReinformPublications.

4. **AjoyPaul.**,2011.TextBookofCellandMolecularBiology-BooksandAllied(P)Ltd,Kolkata,3rd Edition.

5.**AminulIslam** .,2011,Text Book of Cell Biology-Books and Allied(P)Ltd,Kolkata.1ST

Edition.6.**Sharp**.,FundamentalsofCytology-McGraw HillCompany.

7. **Pijushroy**.,2010,PlantAnatomy,NewCentralBookAgency,PutLit.,NewDelhi.

8. **P.S.Verma&V.K.Agarwal**.,(2016-Reprint)-Cell

Biology,Genetics,MolecularBiology,EvolutionandEcology,S.ChandPublishingCo

mpanyPvtLtd,NewDelhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]https://study.com/academy/lesson/symbiotic-relationships-mutualism-commensalism-amensalism.html

https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/energy-flow-primary-productivity

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**I**
COREPRACTICALI	**I**
PAPERCODE	**21UBTP01**
TITLEOFTHEPAPER	**LabInCellBiology**
HOURS/WEEK	**3**
NO.OFCREDITS	**3**

COURSEOUTCOME

Onsuccessfulcompletionofthiscourse,studentsshouldbeproficientto

Course No	CourseOutcome Details	Knowledge level
CO1	Tointroduceanfundamentalsofcellbiologyprinciplesandtechniques	K2
CO2	basictechniquesandtoteachstudentstheinstrumentmicrometry ,microscopes	K2
CO3	To give hands on cell biology experiments-cell counting and mounting plant andanimalcells	K2
CO4	Preparepermanentslides -musclecellsspermcellsandcardiacmuscle	K3
CO5	PrepareslideforMeiosisingrasshoppertestis/flowerbuds	K3

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

Sstrong ; M-medium; L-low

1. Microscopesanditsparts.
2. Micrometry-StageandOcularMicrometer.
3. CellCounting–Haemocytometer.
4. Mountingepitheliumandobservinglivinganimalandplantcellsusingvitalstaining.
5. MitosisinOnionroottipsquash.
6. Meiosisingrasshoppertestis/flowerbuds.
7. PreparationofPermanentSlides–Musclecells.
8. ObservationofPermanentSlides-Cardiacmuscle,Spermcell
9. Stainingofmacromolecules–CarbohydratesandLipids.
10. Microtomy(Demo).

WEBLINKS

https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology_Laboratory_Manual.pdf

https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Laboratory-Manual-17-18.pdf

SECOND SEMESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**II**
CORETheory	**II**
PAPERCODE	**21UBT02**
TITLEOFTHEPAPER	**Genetics**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

Themainobjectivesofthiscourseareto:

UnderstandonHistoricalintroductiontoGeneticsandgeneticmaterialsUnderstandingth
econceptandprinciplesofgeneticsexchangesand
Itsexpressioninhostandtoprovideanideaaboutgeneregulationsanditscontrol

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

CourseNo	CourseOutcomeDetails	Knowledge level
CO1	Obtainacquaintanceonhistoricaloverviewofmicrobialgeneticsandgeneticmaterials	K2
CO2	Comprehendtheconceptofreplicationofgeneticmaterials	K2
CO3	Understandaboutregulationofgeneexpressionandmutation	K2
CO4	GrasptheBasicofgeneticsandtheirrole	K3
CO5	Gainknowledgeonmutation	K3

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

History of Classical and Modern Genetics, Concept and organization of geneticmaterialinbacteria,PlantandAnimal,structure,types,formsandfunctionsofDNA and RNA. Genetic model organisms and significance (*E. Coli*, *Arabidopsisthaliana*, *Coenorhabditiselegans)*.

UNITII

Mendelianinheritance,Non-Mendelianinheritance,Linkage,Crossingover,Chromosomaltheoryofinheritance,SexlinkedandSexlimitedinheritance.Naturalgenetransfermethodsinbacteria.

UNITIII

Fine structure of genes, Genetic code, Structural andnumerical alterationsof chromosome deletion, Inversion, Duplication, Translocation. Mutations -(SpontaneousandInduced),mutagensBiochemicalbasisofmutation.

UNITIV

Ploidy–EuploidyandAneuploidy,InbornGeneticdisorders,Inheritedsinglegenedisorders.

UNITV

Cytogenetics,HumanKaryotyping,Bandingtechniques,HumanGeneticdiseases,Gene

theraphy,Pedigreeanalysis.

REFERENCEBOOKS

1. **Robertisetal.,1995**8thedition.cellandmolecularbiology-Waverlypublication.
2. **E.J.Gardener,M.J.Simmonsand D.P.Snustad**, Principles of genetics-John Wiley&sonspublications.
3. **Strickberger,M.W.,**1997.4th Edition.Genetics-Printicehall
4. **Alberts**.,2002.Molecularbiologyofthecell-Garlandpublications,4th edition.
5. **AjoyPaul**.,2011.TextBookofGenetics-BooksandAllied(P)Ltd,Kolkata,3rd Edition

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]https://www.khanacademy.org/science/biology/classical-genetics/chromosomal-basis-of-genetics/a/linkage-mapping

https://study.com/academy/lesson/genetic-structure-of-human-populations-definition-lesson- quiz.html

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**II**
SBEC–1	**I**
PAPERCODE	**21UBTS01**
TITLEOFTHEPAPER	**Bioinstrumentation**
HOURS/WEEK	**2**
NO.OFCREDITS	**2**

LEARNINGOBJECTIVES

Themainobjectivesofthiscourse:

- Thestudentshouldhaveunderstoodtheanalyticaltechniquesinthefield of Biotechnology
- Tomakethestudentstounderstandthebasicprinciplesof Bioanalyticalinstruments

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

CourseNo	CourseOutcomeDetails	Knowledgelevel

CO1	**Demonstratethebasicsofinstrumentationbyanalysis**	**K2**
CO2	**ExemplifythestructureofatomsandmoleculesbyusingtheprinciplesofSpectroscopy**	**K2**
CO3	**EvaluatebySeparatingandPurifyingthecomponents**	**K2**
CO4	**understandtheneedandapplicationsofimagingtechniques**	**K3**
CO5	**categorizetheworkingprincipleandapplicationsoffluorescenceandradiationbasedtechniques**	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNIT-I

Beer Lambert's law - Colorimeter and its applications.Spectrophotometer-Principle and itsapplications-TypesofSpectrophotometer-UV,visible,InfraredSpectrophotometer.

UNIT-II

Principle and working of pH meter. Electrophoresis - Principle and its applications - Types ofelectrophoresis-AgaroseGel,SDS-PAGEandisoelectricfocusing.

UNIT-III

Imagingtechniques-EEG,ECG,CTSCAN,MRISCAN,X-RAY,EMG,NMR,PET.

UNIT-IV

Centrifuge - Principle and its applications - Types of Centrifuge, Chromatograpy - Principle anditsapplications,Types-Paper,TLC,Column,AffinityandIon-exchange.

UNIT–V

Biosensors-Principleanditsapplications-Electrochemical,Thermometric,Potentiometric-Optical,Piezo-electricandAmperometricBiosensors.GMCounter,ScintillationCounter,Autoradiography,FlowCytometry.WorkingprincipleofAutoclave,IncubatorandHotairoven.

REFERENCES:

1. Chromatography:ConceptsandContrasts-1988.**JamesMiller**,JohnWileyandSons,Inc
2. **H.V.Volkones.**,GeneralBiophysics,VolI&II
3. **Upadhyay.**,BiophysicalChemistry-,HimalayaPublication,EditionIII
4. **S.Mahesh.,**2003BiophysicsNewAgeInternationalPrivateLtd.
5. **Ghatak,K.L.,**2003.TechniquesandMethodsInBiology.PHILearningPrivateLtd.NewDelhi
6. **Zubay.G.L,,**1993.Biochemistry,4thEdi.WmC.BrownPublishers.

RELATEDONLINECOURSE[MOOC,SWAYAM,NPTEL,Websitesetc.]

https://www.google.com/search?client=firefox-b-d&q=Spectroscopy

https://study.com/academy/lesson/medical-imaging-techniques-types-uses.html

https://www.erswhitebook.org/chapters/principles-of-respiratory-investigation/imaging-techniques

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**II**
COREPRACTICAL-II	**II**
PAPERCODE	**21UBTP02**
TITLEOFTHEPAPER	**LABINGENETICS**

HOURS/WEEK	**3**
NO.OFCREDITS	**3**

LEARNINGOBJECTIVES

The mainobjectivesofthiscourse areto:

- To teach students the concept of Mitosis and visualize the sex chromatin under themicroscope.
- Togivehandsonexperienceinquantificationofimportantbiologicalconstituentsofcell.

COURSE OUTCOMES On the successful completion of the course, student willbe able to

CourseNo	CourseOutcomeDetails	Knowledgelevel
CO1	**Successfullyquantifytheimportantbiologicalconstituentsofcell.**	**K2**
CO2	**Analyzethesexchromatinpresentindifferentcells**	**K2**
CO3	**.Examineandevaluatethestagesof Mitosis**	**K2**
CO4	**Couldabletoseparateandinterpretthemixtureofcomponents**	**K3**
CO5	**Prepareandexaminegeneticmodelorganism**	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S

CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

1. Mendel'slawofgenetics-MonoandDihybridcrosses(Demo).
2. RearingmorphologyofDrosophila(Mutanteyeidentification).
3. Observation of Genetic model organisms (*Arabidopsis thaliana* and *Coenorrabditiselegans*)-Permanentslides.
4. Isolationofspontaneousmutantcells.
5. Isolationof petitemutantyeastcell.
6. IdentificationofBarrbody(Buccalepitheliumsmear).
7. Preparation of polytene chromosomes (Chironomus larvae salivary gland)-squashpreparation.
8. Staining of DNA and RNA – Methyl green pyronin **WEB LINKS**

www.slideshare.net/TapeshwarYadav1/clinicalwww.niddk.nih.gov/research-funding/at-niddk/labs.

THIRDS EMESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**III**
CORETHEORY	**III**
PAPERCODE	**21UBTP02**
TITLEOFTHEPAPER	**GENERALMICROBIOLOGY**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

Themainobjectivesofthiscourseare:

1. ToappreciatetheeffortsoftheScientistsforthedevelopmentofMicrobiologyandMicroscopes.
2. Toequipthestudentswiththerealknowledgeofworkingwithdifferenttypesof Microbes.Tounderstandthe varietyofmicroorganisms andto analyzetheirtruepotential

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

CourseNo	Course OutcomeDetails	Knowledgelevel
CO1	Rememberandrecallthehistoricaleventswhichpavedthedevelopmentof differenttypesof microscopes.	K2
CO2	Understandanddifferentiatethedifferenttypesofmicrobes	K2
CO3	.Analyzethemediacompositionandgrowthedesiredmicrobe	K2
CO4	Applytheknowledgetoenumeratethemicroorganismsfromnaturalenvironment.	K3
CO5	Evaluatethesuccessofunderstandingtheviruses	K3

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

.

Definition and Scope of Microbiology.History and Recent Developments, Contribution ofLeeuwenhoek, Louis Pasteur, Robert Koch, ElieMetchinikoff, Edward Jenner and AlexanderFlemming.SpontaneousandBiogenesis of Microbiology.

UNITII

Microscopy-LightMicroscopy,Brightfield,Darkfield,Phasecontrast,DifferentialInterference contrast microscopy, Fluorescence and Electron microscopy. Stain and Stainingtechniques-Simple,Differential(GramandAcidfast)andSpecialStaining(Endospore ,Capsular).

UNITIII

Ultracellularstructureofprokaryoticcellstructureandfunctions,Bacterialcellwallanditscomposition, Flagella,Piliand Capsule.StructureandfunctionsofCyanobacteria.

UNITIV

Sterilization-Physical and Chemical methods, Culture media and its types, Microbial growth – Growth curve , Measurement and factors affecting growth, Pure culture techniques,Anaerobicculture,Preservationof Cultures.

UNITV

Antimicrobial Chemotherapy-Antibioticsand Types-Mode ofAction-Determining the level ofAntimicrobialactivity.Antimicrobial Agents.

REFERENCEBOOKS

1. **Dubey,RC and Maheswari DK(2005)**. A Test book of microbiology. Chand & CompanyLtd.,NewDehli

2. **SundaraRajanS(2003)**.CollageMicrobiology.Volume172.ReversedEdition,VaradhanaPublication,Bangalore.

3**PelczarTr.MJ,ChanECS&KreigNR(2006).**Microbiology.5th Edition,TataMcGraw-HillCompaniesLtd.

4.**PrescottLM,JPHarelyandDAKlien(2005**)Microbiology.6th InternationalEditionMcGrawHillCompaniesLtd.

RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]

https://www.microscopeworld.com/p-3658-types-of-microscopes.aspx

https://micro.magnet.fsu.edu/cells/bacteriacell.htmlhttps://www.biotopics.co.uk/microbes/tech1.html

https://courses.lumenlearning.com/microbiology/chapter/introduction-to-microbial-biochemistry/https://en.wikipedia.org/wiki/Pathogen

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**ForB.Sc.Bio-technologyandBio-Chemistry**
SEMESTER	**III**
ALLIEDTHEORYIII	**ALLIED-III**
PAPERCODE	**21USTA05**
TITLEOFTHEPAPER	**BIO–STATISTICS**
HOURS/WEEK	**5**
CREDIT	**4**

LearningObjectives:

- TointroducetheapplicationsofstatisticsinBio-Technology,Bio-ChemistryandMicrobiology.

CourseNo	Course OutcomeDetails	Knowledgelevel

CourseOutcomes:

CO1	**. Understandandapplythestatisticalmethodslikemeasuresoflocation,dispersionandtherelationship betweentwo variablesin bio-statistics**	**K2**
CO2	**Understandtestofsignificance**	**K2**
CO3	**Understandcorrelationandregression**	**K2**
CO4	**Understandmeasuresofcentraltendencylikemeanmedian-mode**	**K3**
CO5	**Understandlargeandsmallsamplesinlaboratorystudytoapplyitinreallifeproblems.**	**K3**

Thestudentswill beableto:

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

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UNIT–I CollectionandPresentationofStatisticalData

Biostatistics – Definition – Types of data – Primary and secondary data – Methods ofCollectionofdata–Sourcesofdatainlifescience–LimitationsandUsesofStatistics–ClassificationandTabulationofdata–DiagrammaticandGraphicalrepresentationofdata.

UNIT–II MeasuresofCentralTendency

Definitions – Mean – Median – Mode – Geometric mean – Harmonic mean – Characteristicsofagoodaverage –Meritsand demerits.

UNIT–III Measures ofDispersion

Range–Quartiledeviation–Meandeviationandtheirco-efficients–Standarddeviation–Co-efficientof variation–Meritsanddemerits.

UNIT–IVCorrelationand Regression

Definitions – Types and Methods of Correlation –Karl Pearson's coefficient of correlation – Spearman'sRankcorrelationcoefficient–Regression:Simpleregressionequations(twovariables)– SimpleProblems.

UNIT–V TestofSignificance

Samplingdistribution-Standarderror–TestofHypothesis:Simplehypothesis,Nullhypothesis and Alternative Hypothesis – Test of significance: Large sample tests based onMean, Differences of Means, Proportion and Difference of Proportions - Small sample testbasedonMean,DifferenceofMeans,Paired't'test -F-test -Chi-squaretest.

BooksforReference:

1. GuptaS.P.(2001),StatisticalMethods,SultanChand&Sons,NewDelhi.
2. PillaiR.S.N.AndBagavathi.V.(2005),Statistics,S.Chand&CompanyLtd.,NewDelhi.
3. P.S.S.SundarRao,J.Richard(2012).IntroductiontoBio-StatisticsandResearch methods,PrenticeHall ofIndiaPvtLtd,NewDelhi.
4. Gurumani.N(2005),AnintroductiontoBio-Statistics,2nd RevisedEdition,MJPPublishers.
5. Daniel.W.W,(1987),Bio-Statistics,JohnWileyandSons,NewYork.
6. BethDawson,RobertGTrapp(2004),BasicandClinicalBiostatistics,McGrawHill,NewDelhi.
7. ZarJ,BioStatisticalAnalysis,PrenticeHall,India.
8. BernardRosner,FundamentalsofBiostatistics,(8th edition),CengageLearning,USA.
9. Rossi R. J (2010), Applied Biostatistics for Health Science, John Wiley, New York.10.RaoC.R,AdvancedStatisticalMethodsinBiometricResearch,JohnWiley,NewYork.

Web links:

- https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/lec1.pdf
- https://www.tutorialspoint.com/statistics/

- http://www.stat.yale.edu/Courses/1997-98/101/sigtest.htm
- http://biostat.jhsph.edu/~jleek/teaching/2011/754/lecture1.pdf
- http://homepage.divms.uiowa.edu/~dzimmer/applied-multivariate/lecturenotesold.pdf

L (ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
E COURSE	**B.Sc.Biotechnology**
A SEMESTER	**III**
R SBEC–II	**II**
N PAPERCODE	**21UBTS02**
TITLEOF THEPAPER	**DEVELOPMENTALBIOLOGY**
G HOURS/WEEK	**2**
NO.OFCREDITS	**2**

OBJECTIVES:

Tounderstandsequentialchangesfromsinglecellorganizationtoorganleveloforganizationinthe developmentof multicellular organisms.

• Studentswillunderstandtheroleofdevelopmentalgeneticsindefiningbiologicalprocesses .

• Studentswillappreciatethatrecentadvancesinmolecularbiologyareduetoourever increasingdepthof understandingof basicbiologicalprocesses.

• Studentswillsolveavarietyofproblemsusingcreativethinkingskillsandanalyticalskillsinth elab

COURSEOUTCOME:

Oncompletionofthecourse,thestudentshouldbeableto:

CourseNo	CourseOutcomeDetails	Knowledge level

CO1	▪ **.explainthemolecularmechanismsthatunderlieanimalandplantdevelopment**	**K2**
CO2	▪ **explainunderlyingdevelopmentalbiologyprocessesofspermandegg.**	**K2**
CO3	▪ **reviewscientificliteratureinthesubjectdevelopmentalbiologycritically**	**K2**
CO4	▪ **planandcarryoutlaboratorysessionsaswellasinterpretresultstoexaminetheimportanceofspecificgenesindevelopmental biologyprocesses.**	**K3**
CO5	**understands the students about sequential changes from single cell** ▪ **organizationtoorganlevelinthedevelopment ofmulticellular organisms.**	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

SpermatogenesisandOogenesisinmammals,Menstrualcycle,Monitoringofestruscycle,Spermbanking.Hormonesinvolvedinreproduction

UNITII

Activationofspermandegg-interactionofspermandegg-Sequenceofeventsinspermentry-Eggsurfacechanges.Post-fertilizationchanges.Embryodevelopment.

UNITIII

Cell cleavage- pattern of cleavage- Chemical changes -Distribution ofcytoplasmic substances in the egg- Metamorphosis (Insects and amphibians)-Hormonecontrolofmetamorphosis.

UNITIV

DevelopmentofMicrosporangiumandMegasporangium,Pollination,Embryo-Embryosacdevelopmentanddoublefertilizationinplants,seedformationandgermination.Outlineof experimentalembryology.

UNITV

Organizationofshootandrootapicalmeristem,anddevelopment.

LeafdevelopmentandPhyllotaxy.

REFERENCES:

1. **Gilbert,Scott's.**10thedition(2014).Developmentalbiology .SinauerAssociation,Inc.,Publishers.
2. **Chattopadhyay.S**.2016.AnIntroductiontodevelopmentalBiology,Booksareallied(P)Ltd,Kolkata.FirstEdition.
3. **BruceMCarlson**,Patten'sFoundationofEmbryology,.TataMcGrawHillCo.
4. **Balinsky,B.I.,**1981.5th edition.AnIntroductiontoembryology,W.B.SaundersCo.,Philadephia.
5. **Verma,P.S.,Agarwal,V.K.,andTyagi.,**1995.Chordateembryology, S.Chand&Co.,NewDelhi.
6. **Berril,N.T.,Karp,G**.,1998.Development.TataMcGrawHillCo.,NewYork.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites

etc.]https://www.mooc-list.com/course/developmental-

biologysaylororg

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**III**
NMEC-1	**I**
PAPERCODE	**21UBTN01**
TITLEOFTHEPAPER	**CONCEPTOFBIOTECHNOLOGY**
HOURS/WEEK	**2**
NO.OFCREDITS	**2**

LEARNINGOUTCOMES

To provide students with an introduction to genetics, molecular biology, tools and applicationsofbiotechnology.

ToprovideastrongfoundationessentialforsubjectsinthelateryearsoftheBiotechnology.

COURSEOUTCOMES

Studentswhosuccessfullycompletethisunitwillbeableto:

Course No	CourseOutcomeDetails	Knowledgelevel

CO1	**Describethefundamentalbiochemicalprocessesofcellssuchasion/moleculeuptake,energytransfers,metabolismandtheimmune system**	**K2**
CO2	**Describethefundamentals ofcelldivisionand genetics,includingtheroleofDNAasgeneticmaterial**	**K2**
CO3	**Describethebasicprinciplesandtechniquesusedforthestudyandmanipulationof DNA**	**K2**
CO4	**Appreciatetheapplicationofbiotechnologyindiverseareassuchashealthandmedicine,agricultureand/ortheenvironment**	**K3**
CO5	▪ **understands the students about sequential changes from single cellorganizationtoorganlevelinthedevelopmentofmulticellularorganisms.**	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

ScopeofBiotechnology.HistoryofBiotechnology:ConventionalandModernBiotechnology–Biotechindustries.BiotechnologyTree.Strategiesofgenecloning.

UNITII

Toolsusedingenecloning–Restrictionendonucleases–Types–Features.Ligases–Linkers,adaptorsandhomopolymer tails.Modifyingenzymes.

UNITIII

Vectors–PropertiesofgoodVector.Constructedplasmids-pBR322.Cosmidvectors,Animalvectors-SV40. Plantvectors-Tiderivatives.

UNITIV

Introductionofgenes–Vectormode–transformationandtransfection.Vectorlessmode–Biolistics,Electroporation,Microinjection.

UNITV

Selectionofrecombinants.Markertechniques-

PCR,RFLP,RAPDandblottingtechniquesREFERENCES:

1. **PrinciplesofGeneManipulationOld&Primrose**,(1989),3rdedition
2. **Biotechnology**,Satyanarayana.U,(2008),BooksandAllied(p)Ltd
3. **BiotechnologyandGenomics**,GuptaP.K:(2004)Rastogipublication.
4. **GenecloningandDNAanalysis**Brown,T.A(1996),.Blackwellscience,OsneyMead,Oxford.
5. **AtextbookofBiotechnology**,Dubey,R.C.(2007),S.Chand&CompanyLtd.NewDelhi.
6. **Biotechnology**, Singh, B. D (2004). Kalyani Publishers, New DelhiNote: This paper is offered forothermajorstudents.

WEBLINKS

https://www.mooc-list.com/tags/biotechnology

https://onlinecourses.swayam2.ac.in/cec20_bt07/preview

(ForthecandidatesadmittedfromtheAcademicyear2021 –2022onw	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**III**
COREPRACTICAL-III	**III**
PAPERCODE	**21UBTP03**
TITLEOFTHEPAPER	**LABINMICROBIOLOGY**
HOURS/WEEK	**3**
NO.OFCREDITS	**3**

LEARNINGOBJECTIVES

The mainobjectivesofthiscourse areto:

To introduce an fundamentals of cell biology and microbiologytechniques

To teach students the basic techniques and instrument principlesinbiotechnology

Togivehandsonmicrobiologyandcellbiologyexperiments.

COURSEOUTCOMES

On the successful completion of the course, student will bea
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CourseNo t	CourseOutcomeDetails	Knowled
CO1 0 :	Beawareofthelaboratoryrulesandregulations	
CO2	Understandtheimportance,evolutionanddiversityofcellsandpreparationof Buffers	
CO3	Learnstovisualizethecellsbyemployingdifferenttypesofmicroscopes	
CO4	Bringinthe conceptsofmicrobialculturingtechniques	
CO5	Analysisofphenotypiccharacterizationofknownandunknownmicrobesa nd basicinstruments	

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

1. MediaPreparation(Solid&Liquid,SemiSolid)andSterilization.
2. Isolation&EnumerationofMicroorganismfromwaterandSoil.
3. TypesofculturemethodStreakplate,Pourplate,Stab&Slantpreparation .
4. MeasurementofGrowthrateofbacteria -Turbidometricmethod.
5. StainingTechniques– Gram'sstaining,SporeStaining,LactophenolCottonBlueStaining.
6. Hangingdroptechnique(MotilityTest).
7. Characterizationofmicroorganisms-IMVICtests.
8. Microscopicslidepreparation–Fungi&Bacteria.
9. AntibioticsensitivityTest-KirbyBauermethod

REFERENCEBOOKS

BensonHJ.Microbiologicalapplications:alaboratorymanualingeneralmicrobiology. WCB/McGraw-Hill;1998

CullimoreDR.Practicalmanualofgroundwatermicrobiology.CRCPress;2007Dec17

RelatedOnline Contents[MOOC,SWAYAM,NPTEL,Websitesetc.]

https://www.azolifesciences.com/article/What-is-a-pH-Meter-and-How-Does-it-Work.aspx

FOURTH SEMESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER	**IV**
CORETHEORY-IV	**IV**
PAPERCODE	**21UBT04**
TITLEOFTHEPAPER	**MOLECULARBIOLOGY**
HOURS/WEEK	**6**
NO.OFCREDITS	**4**

LEARNINGOUTCOME:

UponsuccessfulcompletionoftheMolecular&CellularBiologyundergraduatecurriculum,students will be ableto:

ofTranscriptionandprocessingoftranscripts,RNAediting.

1. **MolecularEventsofunderstandandappreciatethediversityoflifeasitevolvedovertimebyprocessesofmutation,selection andgeneticchange.**
2. **explain that the growth, development, and behavior of organisms are activated through theexpressionofgeneticinformation incontext.**
3. **Summarize that biological systems grow and change by processes based upon chemicaltransformationpathways andaregovernedbythe lawsofphysics.**
4. **executequantitativeanalysistointerpretbiologicaldata.**
5. **constructandutilizepredictivemodelstostudyanddescribecomplexbiologicalsystems.**
6. **applyconceptsfromothersciencesinordertointerpretbiologicalphenomena.**
7. **communicate biological concepts and understanding to members of a diverse scientificcommunityas well as to thegeneralpublic.**

COURSEOUTCOMES

Course No	CourseOutcome Details	Knowledgelevel
CO1	Learning structural levels of nucleic acids- DNA and RNA and genome organizationin prokaryotesandeukaryotes	K2
CO2	UnderstandingtheconceptofGeneandthegenearchitecture	K2
CO3	Learnstovisualizethecellsbyemployingdifferenttypesofmicroscopes	K2
CO4	`Overview of the central dogma of life and various molecular eventsLearningmolecularеventsintheDNAreplicationandroleofdifferentenzymes	K3
CO5	MolecularEventsTranslationleadingtoproteinsynthesisandPosttranslational modification.	K3

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

Centraldogma:DNAasageneticmaterial.Modernconceptofgeneorganization.DNAreplication in prokaryotes and Eukaryotes, Enzymes and proteins involved in replication. DNArepairmechanisms–LightandDark.

UNITII

Transcription & transcriptional control: (Prokaryotes and eukaryotes), Initiation, elongation,termination, promoter sequences, TATA box, Hogness box, CAAT box, Enhancers, upstreamactivatingsequences. Posttranscriptionalmodifications,splicing.

UNITIII

Translation: Prokaryotic and eukaryotic translation, Initiation, elongation and termination, Coandposttranslationalmodificationsofproteins.Importintonucleus,mitochondriaandchloroplast.Geneticcode:Codon,Anti-codon,

UNITIV

Control of gene expression at transcription and translation level: regulating the expression ofphages,viruses,prokaryoticandeukaryoticgenes,Regulationofgeneexpression-Operonconcepts(*lac*&*trp*).Recombination–HomologousandNon –homologousrecombination.

UNITV

Biology & Genetics of cancer: Genetic rearrangements in progenitor cells, oncogenes, tumorsuppressor genes (P53 and PRB genes), virus-induced cancer, metastasis, interaction of cancercellswithnormalcells. ProteinMicroarray.

REFERENCES:

1. **T.A.Brown.,**MolecularBiology,Labfax,BioscientificpublishersLtd,Oxford.
2. **J.D.Watson,N.H.Hopkins,J.W.Roberts,J.A.Steltz&A.N.Weiner**.MolecularBiologyofgene(4thedition) TheBenjamin/CummingspublicationsCInc.California.
3. PrinciplesofGeneManipulation**–**

   By**R.W.Old&S.B.Primrose,**Blackwellpublication**.WEBLINKS(MOOC,SWAYAM,NPTL)**https://www.mooc-list.com/tags/molecular-biology

https://onlinecourses.swayam2.ac.in/cec20_ma13/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERIV	**IV**

NMEC-2	**II**
PAPERCODE	**21UBTN02**

TITLEOFTHEPAPER	**BIOTECHNOLOGYFORHUMANWELFARE**
HOURS/WEEK	**2**
NO.OFCREDITS	**2**

LEARNINGOBJECTIVES

Thegoalofbiotechnologyistoproduce,drugs,vaccine,transgenicandplantsbyusinglivingorganismssuch asbacterialcells, yeast,mammaliancells, etc.,

Thecourseisdesignedtogiveanideaabouttheroleof biotechnologyinrelationtoHumanWelfarei.eSericulture.Aquaculture.Vermiculture,Mushroomtec hnology

Biofertilizers.Biopesticides.Biorepellants,Pestcontrolandmanagement.Biomass(SCP).Biopl astics.Bioweapons

COURSEOUTCOMES

Studentswhosuccessfullycompletethisunitwillbeableto

CourseNo	CourseOutcomeDetails	Knowledgelevel
CO1	Describethebasicprinciples andtechniquesusedforthe study andmanipulationofDNA	K2

CO2	Appreciatetheapplicationofbiotechnologyindiverseareassuchashealthandmedicine,agriculture and/ortheenvironment	K2
CO3	Conductand/orobserveavarietyoflaboratoryexerciseswheresomeoftheabovetheoretical knowledgeisappliedtopractical situations	K2
CO4	Demonstratetheabilitytoworksafelyandcommunicateeffectively	K3
CO5	**Demonstrateproductionofvaccine,antibiotics**	K3

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

Sericulture.Aquaculture.Vermiculture,Mushroomtechnology.

UNITII

Biofertilizers.Biopesticides.Biorepellants,Pestcontrolandmanagement.Biomass(SCP).Bioplastics.Bioweapons.

UNITIII

Biodyes,Biofuels,-Biodiesel&Biogas.Bioindicators.Biodegradation-RoleofGMO's.

UNITIV

Production of Penicillin, Recombinant Vaccines (HBV). Recombinant Insulin. Plantibodies.Vaccinesinanimalcells,Genetherapy.

UNITV

Transgenicanimalandtheirapplications– Mice,SheepandFish.Transgenicplantsandtheirapplications–BTCotton,Flavr–Slavr tomatoandGoldenrice.

REFERENCE

1. **AnimalBiotechnology**,M.M.Ranga,(2000),Agrobios(INDIA**),**
2. **IntroductiontoPlantBiotechnology**Chawla,(2003)(2nd edn)OxfordandIBHpublishers.
3. **Biotechnology,**Satyanarayana.U,(2008)Booksandallied(p)Ltd.
4. **IndustrialMicrobiology**–A.H.Patel,MacMillanPublishers,2005
5. **AtextbookofBiotechnology**,R.C.Dubey,(2001),Rajendra Printer**.**NewDelhi.
6. **EnvironmentalBiotechnology.**A.K.Chatterji.Thirdedition.PHILearningPvtLtd.NewDelhi.**Web link : (MOOC,SWAYAM,NPTEL)** https://www.mooc-list.com/tags/biotechnologyhttps://onlinecourses.swayam2.ac.in/cec20_bt07/previewhttps://onlinecourses.swayam2.ac.in/cec21_bt03/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERIV	**IV**
COREPRACTICAL–IV	**IV**
PAPERCODE	**21UBTP04**
TITLEOFTHEPAPER	**LABINMOLECULAR BIOLOGY**
HOURS/WEEK	**3**
NO.OFCREDITS	**3**

LEARNINGOBJECTIVES

Themainobjectives ofthiscourseareto:

ToteachthestudentsconceptofisolationofDNAfromlivingorganism

Togivehands onexperienceinisolationandseparationof Protein,RNAandDNA.

COURSEOUTCOMES

ATtheendofthiscoursethestudentsableto

CourseNo	CourseOutcome Details	Knowledg elevel
CO1	Toacquireknowledgeaboutbasicmolecularbiologytools	K3
CO2	Todeveloptheskillsinisolatingandidentifyingthechallengesinmolecularbiologyrelatedtools	K3
CO3	To develop the skill for implementingproject	K3
CO4	Acquiresskillsinseparationtechniques	K4
CO5	Understandthepracticalskillsinmolecularbiologytechniques	K4

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S

CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

1. IsolationofgenomicDNAfrombacteria.2.

Separationof DNA byAGE.

3. EstimationofDNA(DPAmethod).

4. Isolation and purification of protein (Dialysis) -

Demo5.Estimationof Protein(Lowry'smethod).

6. SeparationofproteinbySDSPAGE.
7. EstimationofRNA(Orcinolmethod).

8. Bacterialtransformation.

10. Isolationofantibioticresistantmutant

RELATEDWEB LINKS

https://www.researchgate.net/publication/320508474_Molecular_Biology_Laboratory_manual

http://www-personal.umd.umich.edu/~poelkers/OelkersMolbiolmanualUMD2016.pdf

https://vulms.vu.edu.pk/Courses/BIO203/Downloads/Manual_BIO203_Methods%20in%20Molecular%20Biology.pdf


FIFTHSE
MESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERV	**V**
CORETHEORY	**V**
PAPERCODE	**21UBT05**
TITLEOFTHEPAPER	**PLANTBIOTECHNOLOGY**
HOURS/WEEK	**6**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES:

- Tounderstandvarious*inVitro*culturetechniquesofPlants
- Tolearngenetransferringmechanisms inPlants
- Impartknowledgeonbasicsofplanttissueculture anditsrequirements
- Acquireknowledgeaboutthegenetransfertechniquesandapplications
- Understandthe geneticengineeringandgenemodificationinagriculture
- Gaininsightaboutvaluablesecondarymetabolites,itsproductionandpurification
- Highlighttheapplicationsofplantbiotechnologyinthemodernera

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledg elevel
CO1	Understandscientificandtechnicalskillsonplantsstudy	**K2**
CO2	Acquire knowledge on limitations and challenges in plant cell tissueculture.	**K2**
CO3	KnowtheapplicationsofPlantBiotechnology	**K2**
CO4	Learnthepreservativemethodsofcells	**K3**
CO5	Evaluateanddiscuss publicandethicalconcernsovertheuseofplantBiotechnology	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNIT-I **PLANTTISSIECULTURE:**

Tissues culture media - Composition and its preparation.Plant Tissue Culture applications - Micropropagation,Callusculture,somaticembryogenesis,suspensionculture,embryoculture, haploidculture,protoplastcultureandfusion,Somoclonalvariation,artificialseeds,hardening.

UNIT-II
Genetransfer:

Planttransformationtechnology-TiandRiplasmids,binary&co-integratedvectorsystems; viral vectors and their applications; 35S and other promoters; genetic markers-reporter genes-virulence genes- Cloning Strategies - Gene transfer methods in plants-DirectDNA transfermethods,Agrobacteriummediated nuclear transformation.

UNIT-III
PlantGeneticEngineering:

Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insectresistance, virus resistance, plants as bioreactors. Genetic modification in Agriculture -transgenicplants,geneticallymodifiedfoods,ecologicalimpactoftransgenicplants.

UNIT-IV
Secondarymetabolites:

Secondary metabolic pathways in plants. Industrial phytochemical products from plants - Alkaloids, Biodegradable Plastics, Therapeutic proteins, antibodies, plant vaccines, herbaldrugs,bioethanolandbiodiesel.

UNIT-V
Plantbiotechnologicalapplication:

Extraction & purification of phyto-chemicals.phytoremediation; Green house and greenhome technology. Molecular pharming; Applications for producing fine chemicals, drugs,and alternative fuels, herbicide and pest resistant plants, ethical issues relating to plantbreeding.

TEXTBOOKS:

1. Chawla,H.S.2013.IntroductiontoPlantBiotechnology.3rdedition.Oxford&IBHpublishingcompany.
2. Razdan,M.K.2002.IntroductiontoPlanttissueculture.2ndedition.Oxford&IBHpublishingcompany.

REFERENCEBOOKS:

1. Grierson,D.andCovey,S.V.1988.PlantMolecular Biology.2ndedition.BlackiePublishers.
2. Bhojwan, S. S. 1996. Plant tissue culture - Theory and Practice. 1st edition. ElsevierPublishers

WEB LINKS

https://onlinecourses.swayam2.ac.in/cec21_bt03/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERIV	**V**
CORETHEORYVI	**VI**
PAPERCODE	**21UBTP06**
TITLEOFTHEPAPER	**IMMUNOLOGYANDIMMUNOTECHNOLOGY**
HOURS/WEEK	**6**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

The mainobjectivesofthiscourse areto:

- Thiscoursepresentsthebasicdefensemechanismofanimals
- Tomakethestudenttounderstoodtheconceptimmunology
- On successful completion of the subject the student should have understood:Immunity,Antigen,Antibody,Cellsofimmunesystemandtheirfunctionandregulations

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledgelevel
CO1	DesignamodelofImmunoglobulin/Antibodies	**K2**
CO2	DescribewhichcellMtypesandorganspresentintheimmuneresponse	**K2**
CO3	Illustrate various mechanisms that regulate immune responses andmaintainTolerance	**K2**
CO4	ExemplifytheadverseeffectofimmunesystemincludingAllergy,	**K3**
CO5	hypersensitivityandautoimmunity	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

HistoryoftheimmunesystemInnateandAcquiredimmunity.Haematopoiesis.Cellsandorgansof theimmunesystem.

UNITII

Nature & biology of Antigen & super antigens.Haptens, Mitogens, Adjuvants.Humoralresponse – B cell activation and proliferation. Cell mediated immunity – T cell receptorsandits**activation.**

UNITIII

Immunoglobulins – Structure and functions. Antigen – Antibody reactions – Agglutination,precipitation, RIA, ELISA, FACS and Immunopanning. Hybridoma technology & CCA.Organization and expression of immunoglobulin genes.Antibody Engineering & FingerPrinting.

UNITIV

Cytokines: Types and function, Complement- Properties and activation pathways,Classical,Lectin& Alternativepathway.
MajorHistocompatabilityComplex.
Immunological tolerance.Immunity to infectious agents (intra cellular parasites,helminthesviruses).

UNITV

Transplantation immunology.Hypersensitivity and its types.Autoimmunity, Immunesenescence, Cancer immunology, Vaccines.Immunotherapeutics.Immuno enhancingtechnology.

REFERENCES:

1. Kubey,J.1993.ImmunologyFreemanandcompany.
2. Janeway,C.A.,Immuno-biologyPaulTravers1994.
3. SeemiFarhatBasir.,TextBookofImmunologyby.Firstedition.PHILrarningPvtLtd,NewDelhi.
4. MadhaveeLatha,P.,ATextBookofImmunology,FirstEdition.S.Chand&CompanyLtd,NewDelhi.
5. AjoyPaul..TextbookofImmunology
6. Rajasekara pandian M and Senthil kumar B., 2007. Immunology andImmunotechnology.(2007),Panimapublishingcorporation,NewDelhi.

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERV	**V**

CORETHEORYVII	**VII**
PAPERCODE	**21UBT07**
TITLEOFTHEPAPER	**GENETICENGINEERING**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

COURSEOBJECTIVE

The mainobjectivesofthiscourse areto:

1. To gain knowledge about the importance of gene manipulation and genetransfertechnologies
2. To learn the concept of vectors and expression systems and methods ofselection

TounderstandanddescribetheconceptofHybridizationtechnique

COURSEOUTCOME

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledg elevel
CO1	Acquaintwiththevocabularyinvolvedinmolecularcloningstrategiesandtechniquesusedtoprobe DNAforspecificgenesofinterest	**K2**
CO2	ApprehendwiththetoolsandtechniquesinrDNAtechnologyandtypesofVectors	**K2**
CO3	Relate the role of restriction and modifying enzymes in recombinant DNATechnology	**K2**
CO4	ExplorethetechniquesinvolvedinconstructionofgenomicDNAlibraryandcDNAlibrary	**K3**
CO5	Designtheprotocolsforanalyzinggenetransfermethodsandtoexploreknowledgeonhybridizationbasedmarkers	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S

CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNIT-I

History, scope and recent developments in Genetic Engineering; guidelines; Moleculartools in genetic engineering- Restriction enzymes: Endo &Exonucleases, Ligase. Modifyingenzymes- DNA & RNA polymerase, reverse transcriptase, terminal transferase; nucleases(DNases, RNases, S1) T4 polynucleotide kinase, Alkaline Phosphatase and ligase (E.coli&T4).

UNIT-II

Ligation (cohesive & blunt end ligation) – linkers & adaptors.Cloning vectors: plasmid - definition, properties and types. pUC19 & pBR322- phage vectors (λ & M13), Cosmidvectors,Shuttleandexpressionvectors;YAC(S.cerevisiaeasamodel)& BAC(E.coli).

UNIT-III

Screeningandselectionofrecombinants;Genetransfermethods,PCR-Principle,Typesandapplications.

UNIT-IV

Hybridization techniques: Probes(radio active& non radio active), detection. PCR - Principle, Types and applications; Labeling of DNA- Nick translation, Random primingmethod &labelling by primer extension.Construction of genomic & c DNA libraries. Geneexpressioninbacteria,yeast,insects,plant& mammaliancells

UNIT-V

Chromosomesengineering,targettedgenereplacement,geneediting,&silencing.Sitedirected mutagenesis.

References:

1. Primrose,S.B.andTwyman,R.M.,2006.PrinciplesofGeneManipulationandGenomics -7thEdition.BlackwellPublishingCompany.
2. Dubey.R.C.ATextBookofBiotechnology.S.Chand&CoLtd,NewDelhi.
3. BrownT.A.,2008.Genomes.3rdEdition.NewYork:GarlandPublishingCo.NewYork:GarlandScience.
4. TvanR.S.,1997.Recombinantgeneexpressionprotocols.HumanPressInc.,Tokowa
5. Satyanarayana.U,2008.Biotechnology,BooksandAllied(p)Ltd

WEB LINK : (MOOC,SWAYAM,NPTEL) https://www.mooc-list.com/tags/genetic-engineeringhttps://onlinecourses.nptel.ac.in/noc19_bt15/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTER-V	**V**
SBEC-III	**III**
PAPERCODE	**21UBTS03**
TITLEOFTHEPAPER	**NANOBIOTECHNOLOGYANDBIOINFORMATICS**
HOURS/WEEK	**2**
NO.OFCREDITS	**2**

LEARNINGOBJECTIVES

- Tolearntheapplicationofnanobiotechnologyinbiologicalsystem
- Tohelpthestudentstounsderstandaboutnanomaterialandnanomedicines
- Tounderstandaboutapplicationofbioinformatics**COURSEOUTCOME**

Thestudentwilldevelopafundamentalknowledgeof**nanomaterials**.

Course No	CourseOutcome Details	Knowledg elevel
CO1	Thestudentwilldemonstrateabasicunderstandingofthelengthscalethatdefinesnanoformetalandsemiconductormaterials.	**K2**
CO2	Thestudentwilldemonstrateanunderstandingof thechallengesonsafe **nanotechnology**	**K2**
CO3	Astudentwilldevelopafundamentalknowledgeof DNAdatabank,proteindatabank and sequence alingmenttool	**K2**
CO4	Acquireknowledgeonhandlingbiologicaldatabases	**K3**
CO5	Understandthepracticalskillsinsynthesisofnanoparticles	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI:

Nanobiology – concepts, definitions, prospects; nanoparticles – size, shape, properties.Bionanoparticles – nanostarch, nano composites – dendrimers..Types of biomaterials.Biodegradablepolymers.

UNITII:

Methods of nanobiotechnology – Analysis of bimolecular nanostructures by Atomic ForceMicroscopy, Scanning Probe Electron Microscopy. Nanofabrication - lithography. Drugnanoparticles -structure and preparation ,Liposomes, Cubosomes and hexosomes. Lipidbasednanoparticles-liquidnano dispersion,solidliquidnanoparticles**UNITIII:**

Nanotubes, Nanorods, Nanofibers and Fullerenes for nanoscaledrug .Bio nanoelectronics.Applicationsofnanobiotechnologyin medicine,drugdesigningandcancertreatment.Medical,social andethicalconsiderationsofnanobiotechnology.

UNITIV:

Bioinformatics - definition, introduction, history and scope. Databanks – Gen Bank, PDB.Literature DataBanks – PubMed. Biological databases including both proteins and nucleicacids–sequence–EMBL,DDBJ.Structuraldatabases–CATH,SCOP.Specializeddatabase – genomedatabase,EST.

UNITV:

Sequence AlignmentbasedonMatrices (BLOSUMandPAM),toolsfor sequencealignment – BLAST, FASTA. Clustal W. Phylogenetic analysis– WPGMA, UPGMA methods.**WEB LINKS : (MOOC,SWAYAM,NPTEL)**https://www.mooc-list.com/tags/nanotechnology

https://onlinecourses.nptel.ac.in/noc19_bt28/previewhttps://onlinecourses.swayam2.ac.in/cec21_bt04/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERV	**V**
COREPRACTICAL–V	**V**
PAPERCODE	**21UBTP05**
TITLEOFTHEPAPER	**LABINPLANTBIOTECHNOLOGY**
HOURS/WEEK	**3**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVE

The mainobjectivesofthiscourse areto:

 Toteachstudentsthelatesttechniquesandprinciplesin Plant TissueCulture To

givehandson experienceinPlant TissueCulturetechnique

COURSEOUTCOME

Understandingtheconceptsandprinciplesof**Planttissueculture**.

CourseNo	CourseOutcome Details	Knowledgelevel
CO1	**Learning** the techniques of sterilization and monitoring method ofsterilization.	K2
CO2	**Learning** different pathways of **plant** regeneration under in vitro conditions - organogenesisandsomatic embryogenesis	K2
CO3	Techniquesofestablishingcellsuspensionculture	K2
CO4	IsolationofgenomicDNAfromplantmaterials	K3
CO5	Isolationandanalysisofchloroplastfromplantcells	K3

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

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1. PlantTissueCultureMediaPreparation.
2. ExplantPreparation.
3. Establishmentandmaintenanceofcallusculture.
4. Establishmentandmaintenanceofsuspensionculture.
5. Isolationofprotoplastsusingenzymaticmethodandviabilitychecking
6. Syntheticseeds(Entrapmentmethod).
7. IsolationofgenomicDNAfromplant.
8. IsolationofChloroplastfromPlantcell.
9. KitchengardenPreparationandGreenHouseVisit(Demo).
10. Qualitative analysis of Phytochemicals from Crude Plant

Extracts.WEB LINKS

https://www.grin.com/document/265322https://www.springer.com/gp/book/9783642817861

ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
COURSE	B.Sc.Biotechnology
SEMESTERV	V
COREPRACTICAL–VI	VI
PAPERCODE	21UBTP06
TITLEOFTHEPAPER	LAB IN GENETIC ENGINEERING ANDIMMUNOLOGY
HOURS/WEEK	3
NO.OFCREDITS	4

LEARNINGOBJECTIVES

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

The main objectivesofthiscourseareto:

- To teach students the latest techniques and principles in Immunology and geneticengineering

Togivehandsonexperienceinimmunologicaltechniquesandgeneticengineering

COURSEOUTCOMES

On thecompletion ofstudentwillbe

CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

successfulthe course,ableto:

CourseNo	CourseOutcome Details	Knowledge level
CO1	UnderstandthepracticalskillsinImmunology	**K2**
CO2	Acquireskillsingeneticengineering	**K2**
CO3	Examining and analyzing the results involved in immunetechniquesandgenetic engineering	**K2**
CO4	Developing and applying the recent technology involved in diagnostictechniquesofimmunologyandgeneticengineering	**K3**
CO5	Understandskillsintransformationstechniques	**K3**

Mapping with programme

outcomesS-strongM-

mediumL-low

IMMUNOLOGY

1. Preparationofplasmaandserum.
2. Bloodcellanalysis–totalcount,differentialcount.
3. Agglutinationtests:
   a. ABOBloodgrouping.
   b. WIDALtest.
   c. ASOtest.

d. Pregnancytest.

e. RPRtest.

4. Precipitations:

    a. Radialimmunodiffusion.

    b. Doubleimmnodiffusion.

    c. CounterCurrentimmuneelectrophoresis.

5. DOT-ELISA

IIGENETIC ENGINEERING

6. Isolation of plasmid DNA and sizeanalysis.
7. Restrictiondigestion.
8. Ligation.
9. Transformationsofrecombinantsin*E.coli*(Preparationof competentcells).
10. PCRamplification(demo).

SIXTHSE MESTER

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
CORETHEORYVIII	**VIII**
PAPERCODE	**21UBT08**
TITLEOFTHEPAPER	**ANIMALBIOTECHNOLOGY**
HOURS/WEEK	**6**
NO.OFCREDITS	**5**

LEARNINGOBJECTIVES

Toprovideabasicunderstandingofanimalbiotechnologyanditsapplications.

COURSEOUTCOMES

Inthesuccessfulcompletionofthecourse,studentswillbeableto:

Course No	CourseOutcome Details	Knowledg elevel
CO1	To develop an understanding on basic pattern of animal cell cultureandcontrollingcharacters	**K2**
CO2	Acquire knowledgeon handling animal cell culture andtheirapplications	**K2**
CO3	Understandthegenetransfertechnology,transgenicanimalandstemcelltechnology	**K2**
CO4	Emphasizetechniquesonfertilizationinanimalsanditsdevelopment	**K3**
CO5	Highlighttheapplicationsofanimalbiotechnologyinva rious fields	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNIT-I

Animalcellculturemediaandreagents

Animal cell culture basics- Preparation of culture media- Role of carbon dioxide, serum andgrowthfactorsincellculture,Typesofcellculturemedia,Ingredients,Physiochemicalproperties,Antibiotics,growthsupplements,Fetalbovineserum;Serumfreemedia.Conditioned media, othercellculturereagents, Preparation and sterilization of cellculturemediaandother reagents.

UNIT-II

Animalcellculture

Principles of sterile techniques and cell propagation; Primary cell culture, secondary cell culture,continuous cell lines, suspension cultures - Chemically defined and serum free media for cellculture Contamination and eradication, cryopreservation of animal cells -Tissue engineeringandorganotypicculture,Cytotoxicityandviabilityassays.

UNIT-III

Genetransfertechnology

Gene transfer in cells; physical, chemical and biological methods. Production of native andrecombinant proteins in animal cell.Hybridoma technology and its applications- gene targeting,silencingandknock-out.Genetransfertechnologyinanimals.Productionoftransgenicanimals.

UNIT-IV

Fertilizationinanimals

Fertilization in animals: Blastulation, gastrulation, early embryonic development - fate map.Conventional methodsofimprovement ofanimallivestock: artificialinsemination, in vitrofertilization,embryoculture,embryosexing,splittingandcloning.Stemcelltechnology.

UNIT-V

Biotechnologicalapplication

Biotechnology of silk worm - commercial production of silk, Baculovirus in Biocontrol, Integratedpestmanagement.ManipulationofGrowthhormone-somatotropichormone-Thyroidhormone;Manipulationoflactation–Lactogenesis-galactopoiesis-Manipulationofwoolgrowth.

TEXTBOOKS:

1. Freshney.R.I,"Culture of Animal cells:A manualof basic technique",Fifthedition,WileyPublishers,2010.
2. Ramadass.P, "Animal Biotechnology: Recent concepts andDevelopments",MJPPublications,India, 2008.

REFERENCEBOOKS:

1. Rastogi,V.2001.DevelopmentalBiology.1stedition.KedarnathRamnathPublishers.
2. Leach.C.K,InvitrocultivationofAnimalcell,ButterworthandHeinnmammLtd.,1994.

WEB LINKS

https://onlinecourses.nptel.ac.in/noc20_me04/previewhttps://www.blinkcourse.com/Animal-Physiology-p-8983

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
CORETHEORY-IX	**IX**
PAPERCODE	**21UBT09**
TITLEOFTHEPAPER	**PROTEOMICSANDGENOMICS**
HOURS/WEEK	**6**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

Toprovidebetterknowledgeofmolecularprofilingofgenesandproteinsforitsanalysis.

COURSEOUTCOMES

In this **course**, **students** will develop the molecular skills, knowledge about the handling ofinstrumentsfor differentapplications**.**

Course No	CourseOutcome Details	Knowledg elevel
CO1	Knowtheapplicationofproteomicsandgenomics	**K2**
CO2	Acquire knowledgeon DNAsequencingusingPCR	**K2**
CO3	Understandthepurificationof proteins	**K2**
CO4	Acquire knowledgeonmassspectroscopy	**K3**
CO5	Highlight the applications of whole genomeshotegunmethodandblottingtechni ques	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

StudyingtheGenome:GeneticMapping-MarkersforGeneticMapping;RFLP,SSLP-VNTR's,STR's,SNP's;PhysicalMapping-Insituhybridization,SequenceTaggedSites Mapping.

UNITII

Determination of nucleotide sequence: Chemical degradation method,Sanger's dideoxynucleotide synthetic method. Direct DNA sequencing using PCR, Sequencing byconventionalshotgunmethod, Wholegenomeshotgunmethod.

UNITIII

ORF scanning – Codon bias, Exon-Intron boundaries - Exon trapping, Gene location – Southernand Northern blotting hybridization, Zoo blotting. Studying a transcriptome –

Microarray or chipanalysis.

UNITIV

Proteomics-ID–SDS-PAGE,2D-PAGE.Detectionandquantitationofproteinsingels.Proteinstainingtechniques.Affinitypurificationof proteins.

UNITV

BasicsofMassSpectroscopy-MALDI-TOFandESIandtheirapplicationsinproteomics.TandemMS/MSspectrometry.

REFERENCES:

1. **AjoyPaul**.,2011.TextBookofGenetics-fromGenestoGenomes-BooksandAllied(P)Ltd,Kolkata.ThirdEdition,.
2. **Keith Wilson and john Walker**, 2010. Principles and techniques of practical biochemistry-,CambridgeUniversityPress,7thedition. 39
3. **U.Sathayanarayana**,Biotechnology,Booksandallied(p)ltd.,India,2008.
4. **HubertRehn**,2006ProteinBiochemistryandProteomics–,Acadamicpress.
5. **Liebler,HumanaW.,**2002.Introductiontoproteomics:ToolsfornewBiologyCBSpub.

WEBLINKS https://nptel.ac.in/courses/102/103/102103017/

https://www.coursera.org/courses?query=genomics&page=1

(ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
CORETHEORY-X	**X**
PAPERCODE	**21UBT10**
TITLEOFTHEPAPER	**BIOPROCESSANDENZYMETECHNOLOGY**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

Themainobjectives ofthiscourseareto:

1. UnderstoodtheapplicationsofMicrobes
2. KnowaboutFermentation,Microbialproducts,aminoacidssolvents,vitaminsandantibiotics.
3. Understoodtheapplicationsofazospirillum,biopesticides

COURSEOUTCOMES

Onsuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledgelevel

CO1	NarratethescopeandeconomicsofMicrobialBiotechnology	**K2**
CO2	Understandtheneedofmicrobialproductsforthemankind	**K2**
CO3	Think about the innovativeness in the production of new beneficialmetabolites	**K2**
CO4	Examine the learned techniques in production of industrially importantproducts	**K3**
CO5	Understandtheskillsforpreservationofmicroorganisms	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

Narrate the scope and economics of Microbial BiotechnologyUnderstandtheneedofmicrobialproductsforthe mankind

Examine the learned techniques in production of industrially important productsThink about the innovativeness in the production of new beneficial metabolitesUNITI

Historical developments in Fermentation.Screening of industrially important microbes. Strainimprovement. Inoculum development.Media formulation, Sterilization, Types of fermentation.Enzymes& cellimmobilizationtechniques.Preservationof microbes.

UNITII

Stoichiometry of cell growth and kinetics.Batch and continuous culture.Immobilization of Cells& Enzymes. Bioreactor- Design, parts and their function. Types of bioreactors- CSTR, Air lift,Bubblecolumn,Packedbed,Tower.OverviewofDownstreamprocessing– Extra&Intracellularproducts.

UNITIII

Monitoring and control of process variables (Temperature, pH and DO, mass transfer, heattransfer&O_2transfermechanism).Computational controlof fermentors.

UNITIV

Biofertilizers–Azola,Azospirillum,Rhizobium,VAM.Biopesticides,Productionofmicrobialproducts: Enzymes- Amylase, Organic acid- Citric acid, Amino acid- Glutamic acid, Antibiotics-Penicillin,Solvent-Ethanol,Vitamins-RiboflavinandSCP.Mushroomtechnology,

Vermitechnology, Petro corps.Quorum sensing in

bioprocess.Biodyes.UNITV

IndustrialEnzymes: Thermophilicenzymes,Lipases,Proteolyticenzymesinmeat,leather&detergentindustries,EnzymesinFermentationprocess,cellulose&metaldegradingenzymes.
Enzyme Engineering- Designer

enzymes.REFERENCES:

1. **AlexandarN.Glazer&HiroshiNikaido**MicrobialBiotechnology(FundamentalofAppliedMicrobiology)
2. **El–Mans,E.M.T.,andBryce,C.F.A.**2002.FermentationMicrobiologyandBiotechnology.Taylor&Francis group.
3. **A.H.Patel**,2005.IndustrialMicrobiology–MacMillanPublishers.
4. **Satyanarayana.**U,2008.Biotechnology,,BooksandAllied(p)Ltd
P. Ponmurugan, NithyaRamasubramanian and Fredimoses. 2012. Experimental ProceduresinBioprocesstechnologyandDownstreamprocessing.AnjanaBookHouse,Chennai

WEBLINKS

https://www.classcentral.com/course/swayam-principles-of-downstream-techniques-in-bioprocess-3967

https://www.classcentral.com/course/swayam-industrial-biotechnology-

14122https://onlinecourses.nptel.ac.in/noc19_bt31/preview

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
SBEC–IV	**IV**
PAPERCODE	**21UBTS04**
TITLEOFTHEPAPER	**PHARMACUETICALBIOTECHNOLOGY**
HOURS/WEEK	**2**
NO.OFCREDITS	**2**

LEARNINGOUTCOME

Themainobjectives ofthiscourseareto:

- Tomakethestudenttounderstoodtheconcepttherapy.
- ThisPharmacologyisthestudyofinheritedvariationindrugresponse.

Tounderstandthebasicstepsinthedrugresearch,toxicological,pre-clinicalandclinicalstudies

COURSEOUTCOME

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledge level
CO1	Compare and contrast the specific pharmacology of the majorclassesofdrugs,importantdistinctionsamongmembersofeachclass	**K2**
CO2	Understand the medicinal and pharmaceutical importance of drugcompounds	**K2**
CO3	Analyze the fundamentalprinciplesof pharmacokinetics andpharmacodynamics	**K2**
CO4	Acquireskillsintissueengineeringlike;skin,liver,pancreas	**K3**
CO5	Understandthepracticalskillsinproductionofbiologicals	**K3**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI:

History& principle ofpharmacology.Drug names & classification systems.General principle ofdrugaction
– Pharmacokinetics, Pharmacodynamics. Measurement of drug

action.UNITII:

Chemotherapeuticdrugs–ProteinSynthesisInhibitors,Anti-Inflammatory,Antibacterial,Antifungal,Antiviral,Antihelminthic,AnticancerDrugs.

UNITIII:

Productionofbiological–Humaninsulin,HGH,Erythropoietins,IFN,TNF,IL,ClottingfactorVIII.

Synthetic therapy: Synthetic DNA, therapeutic ribozymes, synthetic

drugs.UNITIV:

Prenataldiagnosis:InvasiveTechniques-Amniocentesis,Fetoscopy,Chronic Villi sampling(CVS),
NonInvasiveTechniques–UltraSonography.Diagnosisusingprotein&enzymes

markers, DNA/RNA based

diagnostics.UNITV:

TissueEngineering:Skin,Liver,Pancreas.Recombinantvaccines,Celladhesionbasedtherapy:Integrins, Inflammation.

REFERENCE

1. **S.S.Purohit,Kaknani,Saleja**PharmaceuticalBiotechnology.
2. **MaryJ.Myuk,RichardA.Hoarey,PamalaLippinwittWilliams**Pharmacologyedition.
3. **H.P.Rang,M.M.Pale,J.M.Moore,**ChurchillLivingston.Pharmacology.
4. **Page,Curtis,Sulter,Walker,**HalfmanIntegratedpharmacology.MosbyPublishingCo.
5. **N.Murugesh,**AconciseTextBookofPharmacology.Sixthedition.SathyaPublishers,Madurai.
R.C. Dubey, AText Book of Biotechnology. S.Chand& Co Ltd, New Delhi **WEB**

LINKShttps://www.coursera.org/courses?query=pharmaceutical&page=1https:/

/onlinecourses.swayam2.ac.in/cec20_lb05/preview

(ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
COREPRACTICAL–VII	**VII**

PAPERCODE	**21UBTP07**

TITLEOFTHEPAPER	**LABINANIMALBIOTECHNOLOGY**
HOURS/WEEK	**3**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

At the end of this course the student is expected

toStudytheculturetechniquesoftheanimalcellculture

Toensurethestudentstounderstandabouttheproductionoftransgenicproductsandtheirtherapeutic applications

COURSEOUTCOMES

onthesuccessfulcompletionofthecourse,studentswillbeableto

Course No	CourseOutcome Details	Knowledg elevel
CO1	Understandthepracticalskillsinanimalbiotechnology	**K3**
CO2	Acquiresskillsinanimaltissueculture	**K3**
CO3	Examining and analyzing the results involved in animal tissue culturetechnique	**K4**
CO4	IsolateandanalysegenomicDNAofanimalsamples	**K1**
CO5	Developingskillsinpreparationofanimalcellculturemedia	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

1. Preparationofanimalcellculturemedia.

2. Preparation&sterilizationofbalancedsaltsolutionandDBSS.
3. Disaggregationoftissues–trypsinization.
4. Cultureofchickembryofibroblast(monolayer).
5. Singlecellsuspensionculture.
6. Viabilitytestandcellcounting.
7. Inoculationofvirusandobservation-Demo.
8. ApplicationsofCo2incubator&invertedmicroscope.
9. IsolationofgeneticDNAfromanimaltissue.
10. Applicationofmembranefilter–Demo

WEBLINKS

https://www.mooc-list.com/course/cell-culture-basics-canvasnet

https://nptel.ac.in/courses/102/104/102104059/

(ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
COREPRACTICAL–VIII	**VIII**
PAPERCODE	**21UBTP08**
TITLEOFTHEPAPER	**LAB IN BIOPROCESS TECHNOLOGY ANDENZYMOLOGY**
HOURS/WEEK	**3**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

The mainobjectivesofthecourseisto facilitate:
TheStudentstogainsoundtechnicalknowledgeandhandsonpracticalskillsinvariousaspectsofbioproc

ess Biotechnologyandenzymology

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledge level
CO1	AcquireanoverviewaboutthefundamentalsofBioprocessTechnologyandenzymologytools	**K3**
CO2	Understand the bioprocess skills in industry, agriculture and milkproduction	**K3**
CO3	Isolateandanalyseenzymes	**K4**
CO4	Developskillsinmushroomcultivation	**K1**
CO5	Preparevermicompostforagricultureindustry	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

1. Isolationofindustriallyimportantenzymesinmicroorganism(amylaseandprotease).
2. IsolationofAntibioticProducingMicroorganism.
3. Production&EstimationofBiomass(SCP),Dryweight&Wetweightmethods.
4. ProductionofwineandestimationofAlcohol.
5. Immobilizationofyeastcells&Enzymes.
6. Production&Estimationofcitricacid.
7. Isolationof*Rhizobia*fromRootNodules.
8. DeterminationofTDT&TDP.
9. AssayofAmylaseandProteaseenzyme.
10. Qualitativeanalysis ofmilk

11.MushroomCultivation(Demo).

. 12.Vermicompost

Production(Demo).

WEBLINKS

https://onlinecourses.nptel.ac.in/noc19_bt31/previewhttps://www.classcentral.com/course/swayam-industrial-biotechnology-14122

https://www.classcentral.com/course/swayam-principles-of-downstream-techniques-in-bioprocess-3967

ELECTIVE SUBJECTS

(ForthecandidatesadmittedfromtheAcademicyear2021 –2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERV	**V**
ELECTIVESUBJECT	**PARTIII**
PAPERCODE	**21UBTE01**
TITLEOFTHEPAPER	**MEDICALBIOTECHNOLOGY**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LEARNINGOUTCOME

- Understanding of advantages and hazards of microbial world. Advanced knowledge forgrowth andcontrolmicroorganismsforwealthproduction.
- Togivestudentsasolidfoundation inbiologyandchemistry.
- To develop analytical and critical thinking skills in biological phenomena throughscientificmethods

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

:

Course No	CourseOutcome Details	Knowledg elevel
CO1	Understandtheroleofbiotechnologyinhealthcare	**K3**
CO2	describethepharmingforhumanproteinsandneutraceuticalsanalyzethediagnosis andpredictionof disorders.	**K3**
CO3	Evaluatetherecentdevelopmentsinmedicalbiotechnology	**K4**
CO4	Understandtheroleofbiotechnologyinhealthcare	**K1**
CO5	Developing skills for diagnosis techniques and pharming for humanproteins	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI

Tools of Medical Biotechnology – Biotechnological revolutions- Genomics, combinatorialchemistry, insight into basic biology-Areas of application, Diagnosis and prediction ofdisorders,Limits andapproaches

UNITII

Principle:ELISA,westernblottingimmunoflorescence,flowcytometry

Assays : Proliferation assay (lymphocyte,MTT), Cell cytotoxicity,apoptosis**UNITIII**

Roleofbiotechnologyinhealthcare.Worldwidemarketandworkinmedicalbiotechnology.Vaccine Production-New developments. Biosensors in clinical diagnosis, chiraltechnology,monoclonalantibodiesforimmunotherapy.

UNITIV

PrenataldiagnosisInvasivetechniquesandNon-invasivetechniques– Diagnosisofpathogenicmicrobes:Classicalandmodernmethods-Diagnosisusingproteinandenzymemarkers,DNA/RNAbaseddiagnosis-Molecularmarkers-Microarraytechnology

- genomicandcDNAarrays.

UNTV

Recent developments in medical biotechnology –Pharming for human proteins andnutraceuticals.Tissue engineering and therapeutic cloning, Application of nanotechnology inbiomedical sciences- Green anaosubstances, gene delivery, drug delivery.Nanotechnology inreplacingdefectivecells.

REFERENCEBOOKS

FundamentalsofmedicalbiotechnologybyAparnaRajagopalan,Ukaazpublications.

Medical biotechnology by S.N.Jogdand, Himalaya publicationsMedicalMicrobiology-MackieandMcCartney

Jogdand,S.N.MedicalBiotechnology,HimalayaPublishinghouse,Mumbai,2005.

Click,B.R.andPasternak.MolecularBiotechnology:PrinciplesandapplicationsofrecombinantDNA.ASMPress,2010

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]https://www.toppr.com/guides/biology/biotechnology-principles-and-process/tools-of-biotechnology/ https://www.slideshare.net/aiswaryababunaishu/applications-of-medical-biotechnology

https://byjus.com/biology/application-biotechnology-medicine/

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERV	**V**
ELECTIVESUBJECT	**PARTIII**
PAPERCODE	**21UBTE02**

TITLEOFTHEPAPER	**ENZYMEANDENZYMETECHNOLOGY**

HOURS/WEEK	**5**
NO.OFCREDITS	**4**

COURSESCOPE&OBJECTIVES:

- This course provides the theory and knowledge relevant to the enzymologyprinciplesincludingfundamentalpropertiesofenzymes,enzymecatalyticmechanismsand enzymekinetics.
- Studentswillalsobeintroduced tothetheoryaswellasapplicationsofenzymetechnologyinfood,medical,andhouseholdindustries.
- This course serves to provide an awareness of the current and possible futureapplicationsof enzymetechnologies.CourseOutcomes:

Onthesuccessfulcompletionofthecourse,studentwillbeableto:

Course No	CourseOutcome Details	Knowledg elevel
CO1	Distinguish the fundamentals of enzyme properties,nomenclatures, characteristics andmechanisms	**K3**
CO2	Discussvariousapplicationsofenzymesthatcanbenefithumanlife	**K3**
CO3	Discoverthecurrentandfuturetrendsofapplyingenzymetechnology for the commercialization purpose ofbiotechnologicalproducts.	**K4**
CO4	Thestudentwilldemonstrateanunderstatingofenzymecatalysisandincubation	**K1**
CO5	Developskillsinindustrialandclinicalusesofenzymes	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UnitI-IntroductiontoEnzymes

General introduction and historic background-GeneralTerminology, Nomenclature and Classification of Enzymes.Enzyme units-Kataland IU.Enzyme activity.Protein nature of enzymes and Non protein

enzymes-RibozymesandDNAzymes.CoenzymesandCofactors-Prostheticgroup,

coenzymes involved in different metabolic pathways. Classification of coenzymes.Isozymes,Abzymes,Synzyme

UnitII-EnzymeCatalysis andInhibition

Lockandkey,InducedfitandTransitionstateHypotheses. Mechanism of enzyme catalysis- Serine proteases-Chymotryspin, Lysozyme,Carboxypeptidase A and Ribonuclease.,Proenzymes (Zymogens). ReversibleInhibition- Competitive, Non Competitive, Uncompetitive.Irreversible Inhibition-Suicide inhibition. Examples and Mechanism of various Inhibitions like Penicillin, &Iodoacetamide.

UnitIII-EnzymeKinetics

Factors affecting the enzyme activity- Concentration, pH andtemperature.Michealis-Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat.KineticsofEnzymeInhibition.KineticsAllostericenzymes.

UnitIV-EnzymeOrganisation

Organisation of enzymes in the cell.Enzymes in the cell, localization,compartmentation of metabolic pathways, enzymes in membranes,concentrations.Mechanisms of enzyme degradation, lysosomal and nonlysosomalpathways,examples.

UnitVIndustrialandClinicalusesofEnzymes(AppliedEnzymology)

IndustrialEnzymes-Thermophilicenzymes,amylases,lipases, proteolytic enzymes in meat and leather industry, cellulose degrading enzymes, Metaldegradingenzymes.
Clinical enzymes- Enzymes as thrombolytic agents, Anti-inflamatory agents,streptokinasae, asparaginase, Isoenzymes like CK and LDH. Immobilization ofenzymes, Biosensors. Enzyme Engineering and site directed mutagenesis, Designerenzymes.

TEXTBOOKS:

1. **FundamentalsofEnzymology:NicholasPrice&LewisStevens**
2. **Enzymes : Biochemistry, Biotechnology and Clinical Chemistry-TrevorPalmer 3. Biochemistry text books by Stryer, Voet and Lehninger(RelevantChapters)4.ProteinsbyGaryWalsh**

WEBLINKS

https://onlinecourses.swayam2.ac.in/cec20_bt20/preview
https://nptel.ac.in/courses/102/102/102102033/https://www.mooc-list.com/tags/enzymes

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**
SEMESTERVI	**VI**
ELECTIVESUBJECT	**PARTIII**
PAPERCODE	**21UBTE03**
TITLEOFTHEPAPER	**FOODBIOTECHNOLOGY**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

LEARNINGOBJECTIVES

Themainobjectivesofthe courseisto

Make the students to understood the concept of food colors, food flavoring agents, food sweetners.Acquireabasicunderstandingaboutthefoodengineering operations

COURSEOUTCOME

Onsuccessfulcompletionofthecourse,studentwillbeableto:

Course No	Course OutcomeDetails	Knowledg elevel
CO1	NarratethescopeandeconomicsofFoodBiotechnology	**K3**
CO2	ExaminethelearnedtechniquesinproductionofGeneticallymodifiedfood.	**K3**
CO3	Thinkabouttheinnovativenessintheproductionofnewbeneficialfoodflavoringagents.	**K4**
CO4	Understandtheneedofediblevaccineproductsforthe mankind	**K1**
CO5	Developskillsforclinicandsanitationofprocessplants	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UNITI:

Microorganisms associated with food - bacteria, fungi & yeast. Enzymes in foodpreparation.Food contaminations.Food preservation. Food carcinogens & mutagen(N–nitrosamines,Acrylamide& theirmodeof action)

UNITII

Foodbornediseases.FoodAllergens.Antioxidants.Foodcolors(natural&artificial food colourants). Food flavoring agents.Properties & function of Emulsifiers&Stabilizersinfood.FoodSweeteners– Saccharine,Acesulfane,Aspartame&Sucrolose).

UNITIII:

General principle, plant design, construction, functionality of building, Plant layout.Pestproofing/fumigationmethods.Watersupplytofoodprocessingunit.

UNITIV:

Food engineering operations: Characteristics of food raw materials, preparativeoperations in food industry, cleaning of food raw materials, sorting of foods,gradingoffoods.Sensoryevaluationoffoodquality,qualityfactorsforconsumer

safety. FSSA, HACCP

FDA.UNITV:

Cleaning and sanitation of process plants.Classification & Characterization of wastefromfoodindustry.Treatmentmethodsforsolid& liquidwaste.
Genetically Modified Food – Bovine somatotropin, alpha lactalbumin&lactoferrin inmilk,Ediblevaccine(Choleravaccine–potatoes& HepatitisBvaccine -maize).

REFERENCES:

1. **B.Siva**2011.FoodProcessing&Preservation–PHILearningPvtLtd**.**
2. **D.G.Rao,**2010.FundamentalsofFoodEngineering–PHILearningPvtLtd.
3. **Narang,**FoodMicrobiology
4. **MichaelP.Doyle,Larry.R.**FoodMicrobiology–Fundamentals &Frontiers
5. **Frazier,**FoodMicrobiology
6. **YiuHui&G.Khachatourians,**FoodBiotechnology
7. **ibek, Laramie &Bhunia,** Fundamentals of Food Microbiology, CRC Press**.**

RELATEDONLINECOURSE

https://www.mooc-list.com/tags/food-technology

(ForthecandidatesadmittedfromtheAcademicyear2021–2022onwards)	
COURSE	**B.Sc.Biotechnology**

SEMESTERVI	**VI**
ELECTIVESUBJECT	**PARTIII**
PAPERCODE	**21UBTE03**
TITLEOFTHEPAPER	**ENTREPREURSHIPINBIOTECHNOLOGY**
HOURS/WEEK	**5**
NO.OFCREDITS	**4**

COURSESCOPE&OBJECTIVES:

Students will be able to compost in a limited space and describethe decomposing process. The interested students will get the knowledge ofApiculture andAquaculture.Students willgettheemploymentandtheycangenerateemployments, Theywillalsoturntowardsorganicfarming.Itwillhelptomaintaintheenvironmentpollutionfreeandwillgettheknowledgeofbiodiversity.**CourseOutcome:**Onsuccessfulcompletionofthecourse, student willbeableto:

Course No	CourseOutcome Details	Knowledge level
CO1	Sellthemselvesandtheirideas.	**K3**
CO2	Findproblemsworthsolving.	**K3**
CO3	Createvaluesforbioproducts	**K4**
CO4	Developskillsforpreparationofbiopesticidesandbiofertilizers	**K1**
CO5	Acquiresknowledgeaboutapicultureandaquaculture	**K1**

Mappingwithprogrammeoutcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	M	S	M	L	S	M	S
CO2	S	L	M	M	S	M	L	S	M	S
CO3	S	L	M	M	S	M	L	S	M	S
CO4	S	L	S	S	S	S	L	S	M	S
CO5	S	L	L	L	S	L	S	S	M	S

S-strongM-mediumL-low

UnitI-Apiculture

Importanceandhistoryofapiculture.Differentspeciesofhoneybees.

Morphology, anatomy, colony organization and life cycle.Beekeeping equipment.Social behaviour.Queen rearing.Handling of bee colonies and manipulation for honeyproduction.

UnitII–Aquaculture

Introduction – Importance of Inland fisheries principles and aim offish culture Qualities of culturable fishes. Types of fish culture – mono culture –compositeculture–paddycumfishculture.Fresh waterPrawn culture– Preparationof farm–Reproduction–SeedcollectionandTransport.

UnitIII–Vermicomposting

Vermicomposting : Introduction and Scope. Types of Earthwormand Classification Epigeic, Endogeic, Diageic.Life history of Earthworms(Earthworm Species Eiseniafoetida).Pests and diseases of Earthworms.

DifferentMethodsofVermicomposting:SmallandlargescaleBedmethod,Pit method.

Physico- chemical analysis of vermicompost: Nutrient content of vermicompost andtheirroleinagriculture.

UnitIV–Biofertilizers

Biofertilizers – Introduction, biofertilizers using nitrogen fixing microbes &phosphate solubilization. Cultivation, mass production and inoculation ofRhizobium,

Azotobacter, Azospirillum, Azolla and cyanobacteria, Carrier-based inoculants, methodsofapplication,

UnitV–Biopesticides

Biopesticides – Bacillus thuringiensis, B. sphaericus, B. popilliae,Psuedomonassyringae. Biocontrol- Microbial control of plant pathogens-Trichoderma.BiologicalControl–UseofBaculovirus&NPVvirusinbiologicalcontrol.

References:

K. Shanmugam. 1992. Fishery Biology and Aquaculture, LEO Pathippagam. Chennai.TheTextbookofVermicompost,VermiwashandBiopesticides:Keshavsinghan detalPublisher:BiotechBooks.

Agricultural Microbiology by G.Rangaswamy and Bagyaraj, Prentice Hall India.Bio-fertilizersinAgricultureandForestry,1995,by N.S.SubbaRao.

Honey Bee Biology and Beekeeping, Revised Edition. Wicwas Press, Kalamazoo.PradipVJabde, 1993.

Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture,

AgriculturalPestsandtheirControls.DiscoveryPublishingHouse,NewDelhi.EvaCrane,1999.

WEBLINKS

https://www.mitconbiopharma.com/training/bio-tech-training/certificate-course-in-biofertilizers-biopesticides-production/

https://www.wireless.education/study/basics-of-fertilizers-science-online-course-by-udemy/

https://www.coursera.org/lecture/solid-waste-management/3-10-vermicomposting-of-biowaste-FlljL

https://www.openlearning.com/courses/aquaculture-sta2473-/

MODELQUESTIONPAPERS

(Forthecandidatesadmittedfrom2021–2022onwards)

Third

SemesterFOUNDATIONENGL

ISH–III

Time:Threehours Maximum: 75 marks

PARTA— (15 □ 1 =15marks)

AnswerALLquestions

1. Dr.Kalamtakeanactiveinterestinthefieldof Scienceand————————

(a) Social (b) Arts

(c) Technology (d) Politics

2. ThePrinceorderedto erecthis_____public places andinChurches.

(a) Palace (b) Building

(c) Statue (d) Tower

3. Thestory‘LastLeaf’wassetin————————village.

(a) Greenwich

(b) Hertfordshire

(c) Greenworth

(d) Browmwich

4. RobertBurns was a_____Poet.

(a) English (b) Scottish

(c) French (d) Canadian

5. Thepoem"La Belle SansMerci"isa————————

(a) lyric (b) ballad

(c) epic (d) sonnet

6. Thepoem"TheUnknownCitizen"isa/an _ onthelifeofModernman.

(a) satire (b) comedy

(c) ballad (d) epic

7. saysthathewillmarryMrs.JohnShorrocks.

(a) Ben (b) Slater

(c) Abel (d) George

8. Theplay,'Underfire'takesplaceon (a) 30th May 1824 (b) 13th May1824

(c) 30thMay1842 (d) 31stMay1842

9. The ————————ofPolice doesnotwanttheQueento driveout.

(a) Commissioner(b)

Inspector

(c) Sub-Inspector

(d) ChiefInspector

10. ChoosethecorrectAdjective:How————————eggsareinthebasket?

(a) much(b)many(c)kilo (d)more

11. ChoosethecorrectPreposition:Shethrew himout ————————thehouse.

(a) of(b)off (c)on (d)above

12. Change the following into the indirect speech: Ravi said,"Wecan't playhere."

(a) Ravisaidthattheycouldnotplaythere,

(b) Ravitoldthattheycouldnotplaythere.

(c) Ravitoldthattheycouldplay there

(d) Ravi saidthattheycanplaythere

13. Choosetheappropriatequestion:Itisonlythreehundred(a)Howmuchisthis shirt?

(b) What colouris thisshirt?

(c) Isthisshirtbeautiful?

(d) Doyoulikethis shirt?

14. Choosethe appropriatetagquestion:Poojaisasinger

(a) Isn'tshe? (b) Isshe?

(c) Doesshe? (d) Doesn'tshe?

15. Inagroupdiscussionnever_____whenotherspeak.

(a) listen (b) intervene

(c) bepatient (d) takenotes PART B

— (2 □ 5=10marks)

AnsweranyTWOquestions, outofFive

16. Sketchthecharacterof Sueinthestory"LastLeaf'?

17. Whatisthe central ideaofthe poem"LaBelleDameSans Merci"?

18. WhydoesPrinceAlbertfeel afraid?

19. Write aparagraphontheproverb"AllThatglitters isnot gold".

20. Explaintheterm "GroupDiscussion".PARTC—(5□□

□

10=50marks)

AnswerALLquestions.

21. (a) Describe how KalamappealforcreatingaharmoniousIndia.

Or

(b) Narratethestory of"ThewickedPrince"inyourownwords.

22. (a)Writeacriticalappreciationofthepoem"ARed,RedRose"byRobertBurns.

Or

(b)ExplainthemainmessageofLongFellow's"ThePsalmsofLife:'

23. (a)Bringouttheironyofthetitleandsketchthemoralvaluesof"TheDearDepart ed".

Or

(b) Writeacriticalappreciationoftheplay"Under Fire".

24. (a) Rewrite the following sentences placingadjectives intheirrightpositions:

(i) Theweatheristodayfine.

(ii) Imet a Canadiantallwriter

(iii) Wonderfullotusisaflower

(iv) Goldisametalcostly

(v) MyUncleisa teacherbrilliant.Or

(b) Draft a notice displayed at the entrance of a park, givingdetailsaboutthevisitinghours,costofadmissionticketst oadults and children etc.

25. (a) Frametheappropriatequestionsforthefollowingsentences:

(i) They study in Government ArtsCollege.

(ii) MynameisRaju.

(iii) Shewrites quickly

(iv) HevisitedChennai,yesterday

(v) Rajaismybestfriend.Or

(b) Discuss the topic, "EnvironmentalPollutions".

(For the candidates admitted from 2021–2022 onwards)GENERALMICROBIOLOGY

Time:Threehours Maximum : 75 marks

PARTA —(15 □ 1 =15 marks)

Answer ALLthequestions.

1. AccordingtoPasteur statementswhichoneofthefollowingistrue
   (a) Livingorganismsdiscriminatebetweensteroisomers
   (b) Fermentationisaaerobicprocess
   (c) Livingorganismsdoesn't discriminatebetweenstereoisomers
   (d) Both aand b
2. “I found floating thern earthly particles, some green streaks, spirallywound serpent-wise, and orderly arranged, the whole circumstanceof each of these streaks was about the thickness of a hair on one’shead".....Thesewords areof

(a) Pasteur (b)A.Jenner
(b) Leeuwenhoek(d) Koch

3. Bacterialtransformationswerediscoveredby
   (a) EderbergandTatum
   (b) BeadleandTatum
   (c) Griffith
   (d) Jenner
4. Resolvingpowerofamicroscopeis afunctionof
   (a) Wavelengthof light used
   (b) Numerical apertureoflenssystem
   (c) Refractiveindex
   (d) Wavelengthoflightusedandnumericalapertureoflenssystem
5. Influorescencemicroscopy,whichofthefollowingperformsthefunction of removingalllight except theblue light?
   (a) Exciterfilter(b)Barrierfilter
   (c)Dichroicminor (d)Mercuryarclamp
6. InPhasecontrastmicroscopy,therateatwhichlightentersthroughobject sis
   (a) Constant
   (b) Inverselyproportional totheir refractiveindices
   (c) Directly proportional to their refractiveindices
   (d) Exponentially relatedto their refractiveindices
7. TeichoicacidpresentinGram-positivebacteriacanbindtowhichion?
   (a) Feions (b) Phosphorusions
   (c) Mgions (d) Sulphur ions
8. Bacteria having clusters of flagellaat both polesofcellsare knownas?
   (a) Lophotrichous (b) Peritrichous
   (c) Amphitrichous (d) Monotrichous
9. Poly-beta-hydoxybutyrate(PHB)presentinaerobicbacteriacanserve as?
   (a) a reservecarbonandenergy source
   (b) areservesourceofphosphate
   (c) acceptorofoxygen
   (d) providesbuoyancy
10. WhichofthefollowingisthenutritionalcharacterizationofEscherichiacol i?

(a) Chemotrophic

(b) Organotrophic

(c) Autotrophic

(d) Chemotrophic,Organotrophic,Heterotrophie

11. Whichofthefollowinginstrumentisusedforsterilizingthemediaafterith as been prepared?

(a) Autoclave

(b) LaminarAirFlowChamber(c)

InoculumNeedleIncubator

12. Whichofthefollowingmethodcanbeusedtodeterminethenumberof bacteria quantitatively?

(a) Streak-plate

(b) Spread-plate

(c) Pourplate

(d) Pour-plateandspreadplate

13. Which of the following chemothearpeutic agent is extensively usedbecauseoftheirantibacterialeffcetivenessinawiderangeofbacteri alinfections?(a)arsphenamine

(b) sulfanilamide

(c) sulfonamide

(d) sulfadiazine

14. Whichofthefollowingantibioticsnotinvolvedintheinhibitionofspecifice nzymesystems?

(a) Penicillin

(b) Tetracycline

(c) Sulphonamides

(d) Chloramphenicol

15. Interference mechanism of ciprofloxacin andnorfloxacinis duetotheir actionon(a)

Cellwallsynthesis

(b) Cellmembranesynthesis

(c) DNA Function

(d) ProteinSynthesis

PARTB— (2 □ 5 =10marks)

Answer anyTwoquestions.

16. Describe theexperimentofLouisPasteur forfermentation?

17. Explaindifferentialstaining.

18. Flagellaislocomotoryorganforbacteria.Explain

19. Whatarethemethodsofpreservationofculture?

20. BringoutthegeneralcharacteristicsofAntimicrobialdrug?PARTC—

(5 □ 10 =50 marks) AnswerALLquestions.

21. (a) Give a detailed account on contribution of Leewenhock andLouisPasteur formicrobiology

Or

(b)Explain indetail about biogenesisof microbiology

22. (a)CompareandContrast thecharacteristicsofbrightfieldandDarkfieldmicroscopyOr

(b)Illustratewithneatdiagram,explaintheworkingprinciplesandapplicationofflu orescentmicroscopy.

23. (a) Describe with labelled diagram in words the fluid mosaic model forcellmembrane.

Or

(b) Explainindetailaboutthestructureandflagellamovementinprokaryoticcell .

24. (a)Discussthewayinwhichmicro-organismareclassifiedbasedontheirrequirement for energy andelectron.

Or

(b) Explainhowenvironmentalfactorsaffectingbacterialgrowth.

25. (a)Giveadetailaccountonmechanismofactionofantimicrobialdrugascellwallsynthesisinhibitorwithtwoexamples

Or

(b) CommentonAntibioticsensitivetest

(For the candidates admitted from 2021–2022 onwards)ThirdSemester

Biotechnology

SBEC–DEVELOPMENTBIOLOGY

Time:Threehours Maximum: 75 marks PART A — (15 □ 1 = 15 marks)AnswerALLquestions .

1. Whathappensduringspermatogenesis
   (a) Mitosis
   (b) Meiosis

(c) MitosisandMeiosis

(d) Noneoftheabove

2. Middlepieceofmammalianspermcontains

(a) Centriole (b) Mitochondria

(c) Nucleus andmitochondria

(d) Centrioleandmitochondria

3. Cessationofmenstrualcycleis called as

(a) Ovulation (b) Menopause

(c) Parturition (d) Menarche

4. Whichoftheterm bestsuits formilkproduction

(a) Lactation(b)Parturition(c)Mensuration(d) Ovulation

5. Fertilizationofsperm andovum takesplace in

(a) Ampulla ofoviduct

(b) Isthmusofoviduct

(c) Fimbriaeofoviductd

(d) Uterus

6. Inthe absenceofacrosomethespermcannot

(a) Penetrateintoegg(b) Getenergy

(c) Getfood (d) Swim

7. Thetypesofcleavage foundininsectsis

(a) Holoblastic (b) Discoidial

(c) Superficial (d) Meroblastic

8. How many cleavages are in the16-celled completedstageofan egg?

(a) 12 (b) 8

(c) 4 (d) 3

9. Thefertilizedeggdividesbytheprocessof

(a) Oogenesis (b) Cleavage

(c) Regeneration (d) Invagination

10. Malegametophyteofangiosperms isshedas ————celledpollengrain

(a) Four

(b) Three

(c) Microsporemothercell

(d) Anther

11. Femalegametophyteofangiospermisrepresentedby

(a) Ovule

(b) Megasporemothercell

(c) Embryo sac

(d) Nucleus

12. Embryosacoccurs in

(a) Embryo (b) Axis partofembryo

(c) Ovule (d) Endosperm

13. Lateralrootsoriginated in

(a) Cortex (b) Endodermalcells

(c) Pericycle (d) CorkCambium

14. Theapicalmeristemofroots isfoundin

(a) Taproots (b) Radicals

(c) Adventiousroots (d) All theroots

15. IntercalaryMeristemresultsin

(a) Primary growth

(b) Secondarygrowth

(c) Apicalgrowth

16. Giveanaccountonspermbankingwithitsimportance.

17. Enlistthemaincharacteristicfeaturesofeggandsperm.

(d) N

one of these

PART B

— (2 □ 5 = 10 marks)

Answer any

18. Discussbrieflyaboutcleavage andits patterns.

19. Listout theadvantage anddisadvantageofcrosspollination.

20. WriteanoteonPhyllotaxyanditstypes.

PARTC— (5 10 =50marks) Answer ALLquestions.

21. (a) Discussindetailaboutspermatogenesisinmammals.

Or

(b) Writeanelaborate essayonOogenesisin mammals.

22. (a) Narrate anessay onpostfertilizationevents.

Or

(b) Discussindetailabouttheactivationofspermandeggin mammals.

23. (a) Write an account on distribution of cytoplasmicsubstances inthe egg.

Or

(b) Writeanessayonthehormonalcontrolofmet amorphosis.

24. (a) Distinguish mega sporangium andmicrosporangium.

Or

nelaborate account on leafdevelopment.

(For the candidates admitted from 2021–2022 onwards)SecondSemester

AlliedII– BIOCHEMISTRY–II

(CommonforBiotechnology/Microbiology)

Time:Threehours Maximum : 75 marksPARTA — (15 ×1 =15marks) AnswerALLquestions.

1. Whichoneofthefollowingwill turnred litmus blue?

(a) Vinegar

(b) Bakingsodasolution
(c) Lemonjuice
(d) Softdrinks

2. Abuffersolutioncompriseswhichofthe following?
   (a) A weakacidin solution
   (b) A strongacidin solution
   (c) Aweakbasein solution
   (d) A weakacid andits conjugate basein solution
3. PointouttheoddmanoutinaccordancewiththeHenderson-Hasselbalchequation
   (a) pH= pKa+log{[conjugatebase]/[Acid]}
   (b) pOH=pKb+log{[conjugate acid]/[Base}}
   (c) pH= pKa - log{[conjugateacid]/[Base}}
   (d) pOH=pKb-log{[conjugate base]/[Base]}
4. How manytotal moleculesofATParesynthesized fromADPviaglycolysisof asinglemolecule of glucose?
   (a) 4 (b)38
   (c) 36 (d)5
5. How many molecules of acetyl CoA, an acetyl group attached to‘coenzyme A’, are produced from a single molecule of glucose forparticipationintheKrebscycle?
   (a) 1 (b)2 (c) 3 (d)4
6. Namethepathwayforglucosesynthesisbynon-carbohydrateprecursors?
   (a) Glycogenesis (b) Glycolysis
   (c)Gluconeogenesis (d)Glycogenolysis
7. Which of the following statements about transamination reactions iscorrect?
   (a) Transamination reactions involveATPhydrolysis
   (b) Transaminationreactionsareirreversible
   (c) Transamination reactionsrequireNAD^+or$NADP^+$
   (d) Transaminationreactionsrequirepyridoxal-5'-phophate
8. Whichofthefollowingstatementsabout the ureacycle iscorrect?
   (a) Argininosuccinate is lysed to urea andornithine intheureacycle
   (b) Carbamoylphosphatesuppliesbothofthenitrogenatomsofureain the ureacycle.
   (c) Theformationofurea fromthe ureacycleyieldsenergy.
   (d) Arginineishydrolysedtourea andornithine intheureacycle
9. Whichofthefollowingwouldyieldthemostenergypergramwhenoxidized?
   (a) Starch (b) Glycogen
   (c)Protein (d)Fat

10. Lawofthermodynamicswhichstatesthatenergycanneitherbecreatedn or bedestroyed is
    (a) Thesecondlawofthermodynamics
    (b) Thirdlawofthermodynamics
    (c) Firstlawofthermodynamics(d) Zero-orderkinetics

11. Whichofthefollowingfactorisnotresponsiblefortheactualchange infreeenergy (G)?
    (a) Temperature
    (b) Pressure
    (c) Theinitialconcentrationofreactantandproducts
    (d) pH

12. Whatisthe standardfreeenergy changeofATP?
    (a) Smallandnegative(b) Large andpositive
    (c) Largeandnegative
    (d) Smallandpositive

13. The primary roleoftheparathyroidglandis
    (a) Toregulateserum calciumlevels
    (b) Toregulatemetabolichomeostasis
    (c) To sendahormonalsignaltootherendocrine system
    (d) To receivehormonal signal fromhypothalamus

14. WhichofthefollowingisnotaG-proteincoupledreceptor?(a) Glycinereceptor(b)Adrenergicreceptor
    (c)Glutamatereceptor(d) Muscarinicreceptor

15. Whichoutofthefollowingisnotinvolvedinsignaltransductionby -adrenergicreceptorpathway?
    (a) GTP (b) ATP
    (c)cAMP (d)cGMP

PARTB—(2 5=10marks)AnsweranyTWOquestions out of Five

16. Give anaccountonbasicconceptsofacidity
17. What isthe roleofTCA cycle?
18. Discussoncarboxylationreactionwithexample
19. ListouttheinhibitorsofETC.
20. Discussonthe roleof cAMP inendocrinesystem.

PARTC —(5 10 = 50 marks) Answer ALL thequestions.21.(a) Derivate the Henderson - Hasselbalchequation.Or

(b) Explain the principle and procedure ofaffinitychromatography

22.(a)Recallthestepsinvolvedinglycolysis.Or

(b)Discussongluconeogenesis.23.(a)Explainthe reactionofurea cycle.

Or

(b)Distinguishbetween beta and omegaoxidation.

24.(a)Giveanoverviewofelectrontransportchainwithsequenceof reaction.

Or

(b) Illustrateonuncouplersofoxidativephosphorylation.25.(a)Classif ythe hormones

Or

(b) Highlightthesynergisticandantagonisticeffectofhormoneinteractio ns.

(For the candidates admitted from 2021–2022 onwards)B.A./B.Sc./B.Com./B.B.A.DEGREEEXAMIN ATION,

First Semester

FOUNDATIONENGLISH-I

Time:Threehours Maximum : 75 marks

SECTIONA — (15 marks) I.

Answerthe followingmultiplechoicequestions:

(15 ×1 =15)

1. Howdotheguestsgreeteachotherataweddingat11.00am?(a) Goodmorning(b) Good afternoon
(c) Goodevening (d)Good night

2. Sameerismeetinghisfriend Ram'sfriend,Joseph,atthepost-office.Howwill heintroducehimself?
   (a) Hi!I'mRam'sfriend
   (b) Hello!I'm Sameer
   (c) Excuseme.MayIintroducemyself.IamRam'sfriendSameer
   (d) Hello,howdoyoudo?

3. You are late for a function. Your friend Radha has been waiting forthe past one hour. What will you say when you meet her? (a) Sorry,Radhaformakingyouwaitso long(b)Areyouwaiting?
   (c) Sorry,Radha
   (d) MyfriendRadha iswaiting

4. Whatisyourfavourite subject?
   (a) IlearnEnglish
   (b) Iam studyingEnglish
   (c) Englishismyfavouritesubject
   (d) IshouldlearnEnglish

5. Whatisthe capital ofKerala?
   (a) Cochin (b) Palakkad
   (c) Alapuzha (d)Trivandrum

6. Choose the correct meaning of the following underlined expression.Multiplicationofhumanbeingsresultedinconflictamon

gthemselves.

(a) loving (b) fighting

(c) sharing (d)caring

7. Thevillage people————————goatsandbirdsto GoddessKali.

(a) Cooked (b) Caged

(c) Sacrificed (d)Welcomed

8. Fillin the blankstoformcorrectword:fl_ _h

(a) a, s (b) e,i

(c) a,i (d)a,e

9. TheGianthada ————————garden.

(a) lovely(b)ugly(c)tiny(d)majestic

10. Givethemeaningoftheunderlined word:

_Mypreciouschild,Ilove youandwillneverleave you'.

(a) unworthy

(b) valuable

(c) cheap

(d) popular

11. Rearrangetheletterto formaproperword:

(a) Sagrifice(b)Sacrifice(c)Sakrifise(d)Sacrifi

ze

12. Tomwassentto bringthe————————.

(a) ladder (b) hammer

(c) drill (d)picture

13. Sweetswithexcessgheeandsugarcanbe

_____.

(a) satisfying

(b) nauseating

(c) satiating

(d) fulfilling

14. Squirmingmeans————————.

(a) rolling

(b) keepingstraight

(c) twisting

(d) curving

15. Thepicturewashanged inthe————————.

(a) morning

(b) afternoon

(c) evening

(d) midnight

SECTION—B

II)AnsweranyTWOofthefollowingquestions.

(2 □ 5=10marks)

16. Fillintheblankswithsuitableresponse:

Prakash : Canyoupleasetellmethe roominwhichMr.Rajanis?

Receptionist: ——————————

Prakash : ——————————

Receptionist: Thevisitinghours are5 to 7 pm. Now it is 8

O‘clockPrakash : I‘msorry.——————————

—

Receptionist: —————————— Ican‘t. That‘s against the

rules.Prakash : ——————————

17. Saywhetherthefollowingstatements aretrueorfalse.

(a) Sometinyanimalscalledhumanbeingsamenace.(true/false)

(b) Allthe naturalresources multiplied.(true/false)

(c) Thebranchesoftrees areits limbsthatspread out.(true/false)

(d) ParkesinewasinventedbyBritishchemistAlexanderParkes.(true/false)

(e) The word ‘plastic’ comesfrom Italy.(true/false)

(f) The Giant’sgardenhad peachtrees.(true/false)

(g) EveryoneisnotapreciouschildofGod.(true/false)

(h) ThereareninеCardinalnotes.(true/false)

(i) AuntMariasaidshewouldnotallowthechildrentostandaround.(true/false)

(j) Thetailoftheelephantwaslikeasnake.(true/false)

18. Annotatethe following.

(a) Whenyousawonlysetoffootprints,ItwasthenthatIcarried you.

(b) Willhumanegosacrificetheworld.Tosatiateitslustforpompous homes?

19. Fillintheblankswithsuitablepreposition:

(a) Plasticshavemade life easier——————us.

(b) Anationthathasnohistory————————itsownhasnothinginthis world.

(c) Indiahasgiven————————theworldthestorytellingtradition.

(d) Kalidasa's'Shakuntala'hasbeentranslated ————————manylanguages.

(e) 'Sindhu'————————Sanskritmeansriver.

(f) Indica was written ———————— Megasthenes.

(g) TheAryanswhocame————————BharatcalledtheriverSindu.

(h) Howlonghaveyoubeen ————————thearmy?

(i) Don'tsit ————————thatchair,it isbroken.

(j) Apassengertrainusuallystops————————everysmallstation.

20. Matchthewordsin ColumnAwiththeirmeaning inColumn B.

S.No.	ColumnA	Column B
1	bawl	excited
2	seize	weapon
3	deny	shout
4	spear	refuse
5	eager	pull
6	drill	enough
7	sufficient	machineformakingholes
8	immense	wakeup
9	excel	great orverybig
10	awake	performverywell

SECTION—C (50marks)

21. (a)Readthefollowingpassageandanswerthequestionsthatfollow :(5 □ 10=50)

India's epics – the Ramayan and the Mahabharata – are ranked amongthe best in the world. Kalidasa's _Shakuntala' has been translated inmanyEuropeanlanguages.Indiahasgiventotheworldthestorytelling tradition and it was only from old Sanskrit tales that the Aesop'sfables,theArabianNightsandeventhestoryofCinderellaandtheJac kand the Bean Stalks werederived.

(i) What arethetwogreatepicsofIndia?

(ii) Whowrote Shakuntala?

(iii) Whatarethestoriesthatwerederivedfromtheoldsanskrittales?

(iv) Whatarethefairytalesmentionedinthepassage?

(v) Whatwasthebooktranslatedinmanyeuropeanlanguages?

Or

(b) Answeraboutyourdailyactivities:

(i) Whatisyourfavourite subject?

(ii) Whendoyougetupeveryday?

(iii) Whatdoyouhave for breakfast?

(iv) Whendoyoubreakforlunch?

(v) Howmanyfriendsdoyouhave?

(vi) Whendoesyourcollege-work start?

(vii) How often do you go to movies? (viii)What's yourfavouriteprogramme?

(ix)Doyouhave a'smart'phone?

Whendoyougotobed?

1. (a) How was theselfishGianttransformedtoa kindGiant?

Or

(b) Howdidplastics makelifemucheasier?

2. (a)Givereasonstosaythatthepoem"FootprintsintheSand"ininspirationalandheart- warming. Or

(b) Attemptanessayon the greatnessofIndia.

3. (a) Howandwhyistheearthbecomingan'orbthat'sbald'? Or

(b) Whatdoyoulearnfromthestory—UnclePodgerHangs aPicture‖?

4. (a) Write a letter to the District collector about your ideas ofplantingandprotectingtreesinrural areas.Or

(b) WritealettertoyourfriendsuggestingSwamiVivekananda'sspeechesfor his reading.

(For the candidates admitted from 2021–2022 onwards)B.Sc.DEGREE EXAMINATION,

First

SemesterBiote

chnology

Core I–CELLBIOLOGY (15×1 =15marks)

Time:Threehours Maximum : 75 marks PART AAnswerALLquestions.

——.

(a) Duplication (b) Growthphase

1. Thequantosomeswasdiscoveredby

(a) FrancisCrick (b) Part andPon

(c) Watsonand Crick (d)Jacques Monod

2. Eukaryoticcellscontaining

(a) Truenucleus (b) Definitenucleus

(c) Nucleoid (d)Mesosome

3. Celldivideandproduce

(a) Gogibody (b) Mesosome

(c) Daughtercells (d)Single chromosome

4. Plasmodesmataisfoundin————————

(a) Cellwall (b) Cytoplasm

(c) Nucleus (d)Cell membrance

5. Outermostthinlivingprotectivelayerofanimalcellis————————.

(a) Plasmamembrane(b) Cell wall

(c) Cellbarrier (d)Celllayer

6. Interconnectionsofadjacentcellsthroughtheirplasma membrane are called

(a) Celljunctonsons (b) Microvilli

(c) Beltdesmosomes (d) Hemidesmosomes

8. Whodiscoveredribosome?

(a) Jacqes Monod (b) PartandPon

(c) Palade (d)Franciscrick

9. Thechromosome containstwoidentical’spinallycoiledfilamentsare called as

(a) (a) Chromatid (b) Centrosome

(c) Centromere (d) Chromonemata

(c)

somesareof calledas

a)chromosome b)centrosome

c)mitochondria d)suicidal bag

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12Thestageofmitosisduringwhichthenucleolusdisintegratesandc

hromosomesappearis knownas————————.

(a) Prophase (b)Metaphase

(c) Interphase (d)Anaphase

13Two homologouschromosomespairingiscalled

a) Stemcell (b)Synapsis

(c) Syngamy (d)Spindle

(b) Theprogrammedcelldeathiscalled

a.Apomixis (b)Apoptosis

(c) Autophagy (d)Autolysis

(c) Ciliaandflagella cellularappendages notfoundin

a.Bacteria (b)Virus

(c) Higherplants (d)Higher animals

(d) Whichofhefollowingisnotapartofneuron?

a.Nucleus (b) Dendrite

(c) Synapticcleft (d)Lobe

PARTB—(2 5=10marks)AnsweranyTWOquestions out of Five.

(e) Writeanoteonprokaryotic cell.

(f) Describe aboutthecompositiono bacterialcell wall.

(g) Explainthe structureandfunctionofnucleus.

(h) Explainaboutthecelldivision.

(i) Explaintheflagellarmovements.

PARTC—(5 10 = 50 marks) Answer ALL questionseither(a) or(b).

(j) (a) Explainthe Biogenesistheory oforginingoflife.Or

(b) EnumeratetheEukryoticcellorganization.

(k) (a) Describethefluidmosaicmodelofplasmamemberane.

Or

(b) Giveindetailaccount of Celladhesion.

(l) (a) Explainaboutthefunctionsoflysosome.Or

(b)Write down thestructureand functions of mitochondria.

(m) (a)Explainaboutthekaryokinesisandmitosis.Or

(b) DescribeabouttheG-proteinreceptors.

n)(a) ExplainabouttheAmeoboidmovements.

Or

(b) DescribetheNerveimpulseconduction.

(Forthe candidatesadmittedfrom2021–2022onwards)B.Sc. .

First

SemesterBioc

hemistry

AlliedI–Biochemistry–I(Common for

Biotechnology/Microbiology)

Time:Threehours Maximum : 75

marksPARTA — (15 ×1 =15marks)
AnswerALLquestions.

2. Maltoseisadisaccharide consistof————————.
   (a) Glucoseandfructose
   (b) Glucoseandgalactose
   (c) Glucoseandglucose
   (d) Glucoseandmannose

3. Thefollowingpolysaccharideiscomposedof □ -glycosidicbonds.
   (a) Cellulose (b) Starch
   (c) Glycogen (d)Dextrin

4. Which ofthefollowingis anon-reducingsugar?
   (a) Glucose (b) Lactose
   (c) Sucrose (d) Maltose

5. Whichofthefollowingis anon-essential aminoacid?
   (a) Serine (b) Threonine
   (c) Lysine (d)Histidine

6. Inwhichamino acidimidozole group,anaromaticringfound?
   (a) Lysine (b) Arginine
   (c) Histidine (d)Cysteine

7. Whichbondstabilizesthesecondary structureof aprotein?
   (a) Covalentbond
   (b) Hydrophobicbond
   (c) Hydrogenbond
   (d) Vanderwall'sforces

8. Whichofthefollowingisproducedwiththecombinationofapoenzymean dcoenzyme?
   (a) Enzyme-substratecomplex
   (b) Enzyme-productcpx
   (c) Prostheticgroup
   (d) Holoenzyme

Zymogenisa————————.
   (a) Enzymemodulator
   (b) Vitamin
   (c) Hormone
   (d) Enzymeprecursor

9. Lockandkeytheoryofenzymeactionwasproposedby————————.

(a) Koshland (b) Fischer

(c) Kuhne (d)Arrhenius

10. F

i

n

d

o

21. (a) Describe thestructureandsignificanceof homopolysaccharides.Or

(b) Discuss the structure andfunctions

utthenucleotidepresentonly inRNA

(a) Adenine (b) Thymine

(c)Cytosine (d)Uracil

11. Thewidthofadoublehelixis————————.(a) 30A°(b)34 A°

(c)24A° (d)20 A°

12. The nitrogenous base present in lectin is ————————.

(a) Serine

(b) Choline

(c) Inositol

(d) Ethanolamine

13. Calciumdeficiencyinthebodyoccursintheabsenceof————————.

(a) VitD (b) Vit C

(c) VitA (d)Vit B

14. ThedeficiencyofVitaminB_1resultsinaconditioncalled————————.

(a) Scurvy(b)Chellosis(c)Beriberi(d)Pellagra

15. TheRDAofVit Aforan adultis————————.(a) 1000 Iu

(b) 3000 Iu

(c) 5000 Iu (d)8000Iu

PARTB—(2□ 5=10marks)AnsweranyTWOquestions out of Five.

16. Explain the structure and importance ofdisaccharides.

17. Writenotesonthebondsinvolvedinproteinstructure.

18. Outline the classification of enzymes withexamples.

19. Differentiatesaturatedfattyacidsfromunsaturatedfattyacids.

20. Highlightthesource, RDA,functionanddeficiencydisorderofVitC.

22. (a) Explaintheclassificationofaminoacidsbasedontheirsidechains. A
R
Or
T

(b) Outlinethestructural levelsof organizationofproteins.

23. (a) Writenoteson C

(i) MMequation

(ii) LBplot

Or (

(b) Describebrieflyoncoenzymes andcofactorswithsuitable 5
examples.

10=50marks) Answer ALLquestions.