Revised and Approved syllabus for B.Sc (Bachelor of Science)
Department of Biotechnology

B. Sc. I Year (Semester I) Biotechnology

Paper: Biochemistry & Metabolism (Theory)

Course Objectives:

- To make students aware and to give them the basic knowledge of different macromolecules like carbohydrates, nucleic acids protein which are the basis of existence of the cell?
- Toacquaintstudentswiththeconceptofbioenergeticsandvariousmetabolicprocessestaking place inside the human body.
- Studentscanapplythereactionmechanismsinthedomainsofmetabolism,enzymetechnology, structural biology, molecular biology and bioinformatics

Programme/Class: Certificate	Year:1	Semester:1
Subject: Biotechnology		
CourseCode:B100101T	CourseTitle: Biochemistry& Metabolism	
Course outcomes(COs):		**Bloom's Taxonomy**

▪ **CO1-**DescribethestructureandfunctionofDNAandRNAinthecell	K1,K3
▪ **CO2-**Studentswillgetfamiliarwiththemethodhowgenetic information is transmitted in organism.	K2, K4
▪ **CO3-** Describe the structure of proteins, including the significanceofaminoacidR-groupsandtheirimpactonthe three-dimensional structure of proteins.	K4, K6
▪ **CO4-**Studentswillhaveknowledgeonbiomolecules,likecarbohydrates, lipids, enzymes and coenzymes besides their importance and Classification,forcesstabilizingtheirstructures,writeandrelatetherole of them with day to day life.	K1,k4
▪ **CO5-**Knowtheformationandthebreakdownofdifferent biomolecules and the places where it took place	K2, K5
▪ **CO6-** Various physiological and pathological aspects of by productsofmetabolicpathwaysandtheirregulationsandrelate with various industrial processes.	K3, K2
Credits:4	CoreCompulsory
Max.Marks:25+75	Min.Passing Marks:33
TotalNo.of Lectures-60	

Units	Topic	NoofLectures
I	IntroductiontoBiochemistry:Ahistoricalprospective. Amino acids & Proteins**:** Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape.Different Level of structural organization of proteins.Denaturation and renaturation of proteins. Fibrous and globular proteins.	08
II	Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo&HeteroPolysaccharides,Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions.	07

III	Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.	08
IV	Nucleic acids: Structure and functions:Physical & chemical properties of Nucleicacids, Nucleosides & Nucleotides, purines & pyrimidines,. Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA.	07
	PARTB	
V	Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types & theories, Biocatalysts from extreme thermophilic and hyper thermophilic archaea and bacteria.	08
VI	Role of: NAD^+, $NADP^+$, FMN/FAD, coenzymes A, Thiaminepyrophosphate,Pyridoxalphosphate,lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions.	07
VII	Carbohydrates Metabolism: Reactions, energetics and regulation.Glycolysis:Fateofpyruvateunderaerobicand anaerobic conditions. Pentose phosphate pathway and its significance,	08

VIII	Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron TransportChain, Oxidative phosphorylation. ß-oxidation of fatty acids, Amino acid catabolism	07

SuggestedReadings:

1. Alberts,B.,Johnson,A.,Lewis,J.,Raff,M.,Roberts,K.,&Walter,P.(2014).Molecular Biology of the Cell (6th Ed.). New York: Garland Science
2. Cooper,G.M.,and Hausman,R.E.(2013).TheCell:aMolecularApproach(6th Ed.). Washington: ASM; Sunderland.
3. Karp,G.CellandMolecularBiology.Conceptsandexperiments.JohnHarris,D., Wiley & sons, New York
4. IwasaJ.,MarshalW.Karp'sCellBiology(2018)(8th edition)Wiley&Sons,NY
5. IwasaJ.,MarshalW.Karp'sCellandMolecularBiology.Conceptsand Experiments. (2015) (8th edition) Wiley & sons, New York
6. Watson,J.D.BakerTA,Bell,SPGann,A.Levine,M. LosickR.(2008).Molecular Biology of the Gene (5th ed.). Pearson
7. Lodish,HF.Berk,A.Kaiser,CA,Krieger,M.Bretscher,A.Ploegh,H.Aman,A. Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman
8. GuptaP.K.CellandMolecularBiology2018.5theditionRastogiPublicationIndia.
9. Hartl,D.L.,&Jones,E.W.(1998).Genetics:PrinciplesandAnalysis.Sudbury, MA: Jones and Bartlett.
10. Pierce,B.A.(2005).Genetics:aConceptualApproach.NewYork:W.H.Freeman.
11. Tamarin,R.H.,&Leavitt,R.W.(1991).PrinciplesofGenetics.Dubuque,IA: Wm. C. Brown.
12. Smith,J.M.(1998).EvolutionaryGenetics.Oxford:OxfordUniversityPress Genetics: Principles and Analysis – Hartl and Jones.
13. GardnerEJ,SimmonsMJ,SunstadDP.PrinciplesofGenetics.8thEdition.John Wiley and Sons.
14. SnustandDP,SimmonsMJ.PrinciplesofGenetics.(2016)7thEdition.JohnWiley and Sons.
15. VermaPS,AgarwalVK.CellBiology,Genetics,MolecularBiology,Evolutionand Ecology. (2004). S Chand and Company Ltd.
16. SatyanarayanaU(2020).Biotechnology. Booksand Allied(P) Ltd
17. SinghBD.(2015).Biotechnology:ExpandingHorizons(4thedition).Kalyani Publishers
18. DubeyRC.(2014) ATextbookofBiotechnology(5thedition)SChandandCompany Ltd.
19. □□□□□□□□(2017)□□□□□□□□□□□□□□□□KalyaniPublishers
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21. □□□□□□□□,□□□□□□□□□□□□□□□□□.(2017)KalyaniPublishers
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○Suggestivedigitalplatformsweblinks-ePG-Pathshala,IGNOU&UPRTOUonlinestudymaterial ● https://ocw.mit.edu/courses/find-bytopic/#cat=science&subcat=biology&spec=cellbiology ● https://ocw.mit.edu/courses/find-by-topic/#cat=science&subcat=biology&spec=genetics

Thecandidateshouldhavepassed(10+2)examinationinsciencestreamwithPCB(Physics, Chemistry,Biologyand/orBiotechnology)orPCM(Physics,Chemistry andMaths)orany other science subject.
SuggestedContinuousEvaluationMethods: ● Seminar/Presentationonanytopic oftheabovesyllabus ● Testwithmultiplechoicequestions/shortandlonganswerquestions Attendance
Courseprerequisites:Thecandidateshouldhavepassed(10+2)examinationinsciencestreamwith PCB(Physics,Chemistry,Biologyand/orBiotechnology)orPCM(Physics,ChemistryandMath)or any other science subject.
FurtherSuggestions: ItwidensthescopeforstudentstojoinGovernmentandNon-Governmentorganizationupskillingthe people at different levels as per their socio-economic structure.
Atthe Endofthewhole syllabusanyremarks/suggestions: ……

Programme/Class:Certificate	**Year:1**	**Semester:1**
Subject:Biotechnology		
CourseCode:	Coursetitle(minor-i):Environmental Science (theory)	

Courseoutcomes:	Bloom'staxonomy
CO1-Understandtheimportanceandbecomeawareofthe upcomingenvironmentalissuesandunderstandtheimportanceof natural resources and can work for their conservation	K1, K3
CO2-Gainknowledgeaboutthevariousecosystemsexistingin nature and their importance for conservation of nature.	K4, K5
CO3- Learn about the biodiversity at local, national and globallevelsandtheimportanceofwildlifeconservation.	K2,K6
CO4- Gain knowledge about different types of environmental pollution,theireffectsandcontrolofpollutionforthebenefitof mankind.	K3, K5
CO5-Gainknowledgeaboutthesustainabledevelopment,human rights and emerging environmental issues.	K1, K3
Credits:4	Minor
Max.Marks:25+75	Min.Passing Marks:33

TotalNo.of Lectures-60

Unit	Topic	No.of Lectures
	PARTA	
I	Introductiontoenvironmentalstudies&Ecosystems Multidisciplinarynatureofenvironmentalstudies; Scopeandimportance;Conceptofsustainabilityandsustainable development.	7

II	Whatisanecosystem?Structureandfunctionofecosystem;Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems : Forestecosystem,Grasslandecosystem¸Desertecosystem,Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	8
III	NaturalResources:RenewableandNonrenewableResourcesBiodiversityand Conservation, Land resources and landuse change; Land degradation, soil erosion and desertification, Deforestation: Causes and impacts due to mining, dam building on environment,forests,biodiversityandtribalpopulations,Water:Use and overexploitation of surface and ground water, floods, droughts, conflicts over water (international & interstate). Energy resources: Renewable and non renewable energy sources, useofalternateenergysources,growingenergyneeds,casestudies.	8
IV	Levels of biological diversity : genetic, species and ecosystem diversity;BiogeographiczonesofIndia;Biodiversitypatternsand global biodiversity hot spots Indiaasamegabiodiversitynation;Endangeredandendemicspeciesof India Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlifeconflicts, biologicalinvasions; Conservationof biodiversity:In-situandEx-situconservationofbiodiversity.	7
V	Environmental Pollution & Human Communities and the Environment Environmentalpollution:types,causes,effectsandcontrols;Air,water,soil and noise pollution Nuclearhazardsandhumanhealthrisks Solidwastemanagement:Controlmeasuresofurbanandindustrialwaste Pollution case studies	8
VI	Humanpopulationgrowth:Impactsonenvironment,humanhealthand welfare. Resettlementandrehabilitationofprojectaffectedpersons;casestudies. Disaster management: floods, earthquake, cyclones and landslides. Environmentalmovements:Chipko,Silentvalley,BishnoisofRajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmentalcommunicationandpublicawareness,casestudies(e.g., CNG vehicles in Delhi).	7

VII	Ecosystem and biodiversity services: Ecological, economic,social,ethical,aestheticandInformational value.	8
VII	Sustainabledevelopment,Environmentalethics:Issuesandpossible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, Waste and reclamation.	**7**

SuggestedReadings:

1. Carson,R.2002.*SilentSpring*.HoughtonMifflinHarcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History ofIndia*. Univ. of California Press.
3. Gleeson,B.andLow,N.(eds.)1999.*GlobalEthicsandEnvironment*,London,Routledge.
4. Gleick,P.H.1993.*WaterinCrisis*.PacificInstituteforStudiesinDev.,Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom,MarthaJ.,GaryK.Meffe,andCarlRonaldCarroll.*Principlesof Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine,R.Edward,andPandit,M.K.2013.ThreatsfromIndia'sHimalayadams. *Science,*339:36-•-37.
7. McCully,P.1996.*Riversnomore:theenvironmentaleffectsofdams*(pp.29-•-64).Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum,E.P.,Odum,H.T.&Andrews,J.1971.*FundamentalsofEcology*.Philadelphia: Saunders.

Programme/Class:Certificate	**Year:1**	**Semester:1**
Subject:Biotechnology		
CourseCode:	**CourseTitle(SEC-I):Molecular Diagnostics**	
Courseoutcomes:		Bloom'staxonomy
CO1- Understand the principle, methods & application ofthe diagnostic assays involving biomolecules as biomarkers for diseases affecting lungs, liver, kidney & heart		K3, K3
CO2- Gain knowledge for identification of viral diseaseslike dengue, COVID-19 & non- communicable diseases like diabetesmellitus&cancerwiththeuseofpurifiedantigens or antibodies		K4, K5

CO3-LearnabouttheenzymeImmunoassayslikeELISA,&PCR	K3,K6
CO4-non-enzymaticoneslikeimmunofluorescence,radioimmunoassay& electron microscopy	K3, K4
Credits:4	SEC-1
Max.Marks:60+40	Min.PassingMarks:33

TotalNo.ofLectures-60

Unit	Topic	No.of Lectures
	PARTA	
I	Enzyme Immunoassays: RIAand ELISA, Enzymeimmunoassaysafterimmuneblotting,	7
II	Useofpolyclonalormonoclonalantibodiesinenzymesimmuneassays, Applications of enzyme immunoassays in diagnostic microbiology	8
III	Molecularmethodsinclinicalmicrobiology: Primer, primer designing, PCR, Realtime PCR,	8
IV	ReversetranscriptionPCR, RAPD, RFLP, Nuclearhybridizationmethods.	7
V	Tracertechniques:natureofradioactivity,isotopes,radioactivedecay,α,βand γ radiation	8
VI	Scintillationcounterapplicationofradioisotopesinbiologicalsample	7
VII	Basicprinciple&types–paperchromatography,thinlayerchromatography, column chromatography: gel exclusion, adsorption, ion exchange, affinity. Applicationofchromatographictechnique–separationofbiomolecules,	8
VIII	Electrophoresis–Principle,DNAandRNAgelelectrophoresis,Proteingel electrophoresis – SDS PAGE, native-PAGE, documentation, 2D-electrophoresis, Isoelectric focusing.	**7**

SUGGESTEDREADING

1. PracticalBiochemistry,PrinciplesandTechniques,KeithWilsonandJohnWalker
2. Bioinstrumentation,Webster
3. AdvancedInstrumentation,DataInterpretation,andControlofBiotechnologicalProcesses, J.F.VanImpe,Kluwer Academic
4. AnanthanarayanRandPanikerCKJ.(2005).TextbookofMicrobiology.7th edition (editedby Paniker CKJ). University Press Publication.
5. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnickand Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.
6. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier.
7. JoklikWK,WillettHPandAmosDB(1995).ZinsserMicrobiology.19th edition. Appleton- Centuary-Crofts publication.
8. WilleyJM, SherwoodLM,andWoolvertonCJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.
9. MicroscopicTechniquesinBiotechnology,MichaelHoppert

B.Sc. I Year (Semester I)

BiotechnologyPaper2

BIOCHEMISTRYANDMETABOLISMLAB

Programme/Class: Certificate	**Year:1**	**Semester:1**
Subject:Biotechnology (Practical)		
CourseCode:B100102P	**CourseTitle:BIOCHEMISTRYANDMETABOLISM Lab**	
Courseoutcomes(COs):		**Bloom'staxonomy**
▪ **CO1-**Studentswilllearn,understandandstudytheeffectofpH, temperatureon the activity of salivary amylase enzyme.		K1, K3
▪ **CO2-**Studentswillbeableto studyactivityofanyenzyme underoptimum conditions		K3, K5
▪ **CO3-**Studentswillbestudytheeffectofp H, temperatureontheactivityof salivary amylase enzyme.		K2,K3
Credits:2	**CoreCompulsory**	

Max.Marks:25+75	Min.PassingMarks:40

TotalNo.ofLabPeriods-30(60hours)

	Topic	No.oflab. Periods
	1. IntroductiontoGlasswares/Equipments&Pipetting Method 2. QualitativetestsforCarbohydrates,proteinsand lipids 3. Preparation ofbuffers. 4. Standardizationof pHmeter 5. Tostudyactivityofanyenzymeunderoptimumconditions. 6. To study the effect of pH, temperature on the activity of salivary amylase enzyme. 7. PrinciplesofColorimetry**:** Beer's law	60

SuggestedReadings:

1. Alberts,B.,Johnson,A.,Lewis,J.,Raff,M.,Roberts,K.,&Walter,P.(2014).Molecular Biology of the Cell (6th Ed.). New York: Garland Science
2. Cooper,G.M.,and Hausman,R.E.(2013).TheCell:aMolecularApproach(6th Ed.). Washington: ASM ; Sunderland.
3. Karp,G.CellandMolecularBiology.Conceptsandexperiments.JohnHarris,D., Wiley & sons, New York
4. IwasaJ.,MarshalW.Karp'sCellBiology(2018)(8th edition)Wiley&Sons,NY
5. IwasaJ.,MarshalW.Karp'sCellandMolecularBiology.Conceptsand experiments. (2015) (8th edition) Wiley & sons, New York
6. Watson,J.D.BakerTA,Bell,SPGann,A. Levine,M.LosickR.(2008).Molecular Biology of the Gene (5th ed.). Pearson
7. Lodish,HF.Berk,A.Kaiser,CA,Krieger,M.Bretscher,A.Ploegh,H.Aman, A.Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman
8. GuptaP.K.CellandMolecularBiology2018.5theditionRastogiPublication India.

Thiscoursecanbeopted as an elective by the students of following subjects: Open for all …… ……		

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SuggestedContinuousEvaluationMethods:

Courseprerequisites:Thecandidateshouldhavepassed(10+2)examinationinsciencestreamwithPCB (Physics ,Chemistry, Biology and/or Biotechnology) or PCM (Physics ,Chemistryand Maths)or any other science subject.

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Suggestedequivalentonlinecourses

Further Suggestions:

B.ScIYear(Semester2)BiotechnologyPaper1
MolecularBiologyandGeneticEngineering(Theory)

Programme/Class: Certificate	**Year:1**	**Semester:2**
Subject:Biotechnology		
CourseCode:B100201T	**CourseTitle:MolecularBiologyandGeneticEngineering (Theory)**	

Courseoutcomes:	Bloom'staxonomy
● **CO1-**Studentwillbeabletolearnandunderstandtheimportant discoveriesthatare madeinthe fieldofmolecularbiology.	K1, K3
● **CO2-**Learnkeymolecularеventsthatoccurduringthe DNAreplication,transcription,	K4, K5
● **CO3-**translationandregulationofgeneconcept.	K2,K6
● **CO4-**Studentsgainknowledgeonthefoundationofgenetic engineeringandtheirapplicationsin biological research as well as in biotechnology industries. Tounderstandgeneconcept,plasmids,andwiderangeof techniques,especially modern	K3, K5
● **CO5-**moleculartoolsin diagnosis.	K1, K3
● **CO6-**Studentsacquaintedwithvarioustechniquesofgenetic engineeringandtheirapplicationsin biological research, diagnosticsaswellasinbiotechnologyindustries.	K3, K4
Credits:4	CoreCompulsory
Max.Marks:25+75	Min.PassingMarks:33
TotalNo.of Lectures-60	

Unit	Topic	No.of Lectures
	PARTA	
I	**Geneorganizationandregulation ofgeneexpression:** ● StructureofDNA,TypesofDNA ● Geneorganizationinprokaryotesandeukaryotes, polycistronicgenes,splitgenespromoters,enhancers. ● Regulationofgeneexpression:Prokaryotes:lacand trp operons in E. coli.	7
II	**DNAReplicationandDNApolymerases:** ● Replicationofgeneticmaterialinprokaryotesand eukaryotes ● Abriefdescriptionofinitiationatreplicationorigins	7

	anditscellcycle regulation. ● Structureandfunctionofprokaryoticandeukaryotic DNA polymerases	
III	**TranscriptionandmRNA processing:** ● RNAstructure andtypesofRNA ● Mechanismoftranscriptioninprokaryotesandeukaryotes: transcriptionfactors,structureof prokaryotic andeukaryoticRNApolymerases, initiation, elongationand termination. ● RNA processing: processing of mRNA (Splicing, capping and polyadenylation)	8
IV	**Prokaryoticandeukaryotic translation:** ● Ribosomestructureandassembly,tRNA, aminoacyltRNA synthetases, ● Mechanismofinitiation,elongationandterminationof polypeptides,Fidelityoftranslation,Inhibitorsof translation. ● Posttranslationalmodificationsofproteins.	7
	PARTB	
V	**Vectors:** ● Cloningvectors (plasmids, cosmids, bacterial artificial chromosomesandyeastartificialchromosomes),shuttle vectors, expression vectors	8
VI	**EnzymesusedinDNAmanipulating:** ● Restriction endonuclease ● Ligases ● Polymerases ● Kinases ● Alkalinephosphatases ● ReverseTranscriptase	8
VII	**GenomicLibrary,PCR,Sequencing etc:** ● PreparationandcomparisonofGenomicandcDNA library. ● PCRandits applications. ● DNASequencing. ● Sitedirectedmutagenesis ● Proteinengineeringconceptsandexamples(anytwo).	8

VIII	**MolecularBiologytechniques:** ● DNAisolation(Plasmid/GenomicDNAisolation) ● Blotting(Southern,Northern, Western) ● Electrophoresisofnucleic acidsandproteins ● Genecloning,Screeningandcharacterizationof cloned DNA ● DNA Fingerprinting ● RFLP,RAPD	8

SuggestedReadings:

1. Alberts,B.,Johnson,A.,Lewis,J.,Raff,M.,Roberts,K.,&Walter,P.(2014).Molecular Biology of the Cell (6th Ed.). New York: Garland Science
2. Cooper,G.M.,and Hausman,R.E.(2013).TheCell:aMolecularApproach(6th Ed.). Washington: ASM ; Sunderland.
3. Karp,G.CellandMolecularBiology.Conceptsandexperiments.JohnHarris,D., Wiley & sons, New York
4. IwasaJ.,MarshalW.Karp'sCellBiology(2018)(8th edition)Wiley&Sons,NY
5. IwasaJ.,MarshalW.Karp'sCellandMolecularBiology.Conceptsand experiments. (2015) (8th edition) Wiley & sons, New York
6. Watson,J.D.BakerTA,Bell,SPGann,A.Levine,M. LosickR.(2008).Molecular Biology of the Gene (5th ed.). Pearson
7. Lodish,HF.Berk,A.Kaiser,CA,Krieger,M.Bretscher,A.Ploegh,H.Aman,A.Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman
8. GuptaP.K.CellandMolecularBiology2018.5theditionRastogiPublicationIndia.
9. Hartl,D.L.,&Jones,E.W.(1998).Genetics:PrinciplesandAnalysis.Sudbury, MA: Jones and Bartlett.
10. Pierce,B.A.(2005).Genetics:aConceptualApproach.NewYork:W.H.Freeman.
11. Tamarin,R.H.,&Leavitt,R.W.(1991).PrinciplesofGenetics.Dubuque,IA: Wm. C. Brown.
12. Smith,J.M.(1998).EvolutionaryGenetics.Oxford:OxfordUniversityPress Genetics: Principles and Analysis – Hartl and Jones.
13. GardnerEJ,SimmonsMJ,SunstadDP.PrinciplesofGenetics.8thEdition.John Wiley and Sons.
14. Snustand DP,SimmonsMJ.PrinciplesofGenetics.(2016)7thEdition.JohnWiley and Sons.
15. VermaPS,AgarwalVK.CellBiology,Genetics,MolecularBiology,Evolutionand Ecology. (2004). S Chand and Company Ltd.
16. SatyanarayanaU(2020).Biotechnology. BooksandAllied(P) Ltd
17. Singh BD.(2015).Biotechnology:ExpandingHorizons(4thedition).Kalyani Publishers
18. DubeyRC.(2014) ATextbookofBiotechnology(5thedition)SChandandCompany Ltd.

Thiscourse canbeoptedasanelectivebythe studentsoffollowingsubjects:Openforall
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SuggestedContinuousEvaluationMethods: ● Seminaron anytopic of theabovesyllabus. ● Testwithmultiplechoicequestions/shortandlonganswerquestions. ● Attendance
Courseprerequisites:Thecandidateshouldhavepassed(10+2)examinationinsciencestreamwith PCB(Physics,Chemistry, Biologyand/or Biotechnology)or PCM(Physics,ChemistryandMaths) or any other science subject. ……
Suggested equivalent online courses: IGNOU&Othercentrally/stateoperatedUniversities/MOOCplatformssuchas“SWAYAM”inIndiaandAb road

FurtherSuggestions: ●
Atthe Endofthewhole syllabusanyremarks/suggestions: …… …

Programme/ Class:Cerificate	**Year:1**	**Semester:2**
Subject:Biotechnology		
CourseCode:B100202P	**CourseTitle:GeneticEngineeringLab(Practical)**	

CourseoutcomesCOs:	**Bloom'staxonomy**
● **CO1-**Abilitytopreparedifferentbacterialgrowth media,	K1, K6
● **CO2-**Understandingprincipalsandmethodsofcompetent cellpreparation,restriction Digestion,geneligation,genecloning,andtransformationi. e gene manipulation.	K2, K3
● **CO3-**Learningthemethodofagaroseelectrophoresisfor plasmidandgenomicDNA Separation	K5, K4
● **CO4-**UnderstandingthemethodofPCR	K3,K6

Credits:2	CoreCompulsory
Max.Marks:25+75	Min.PassingMarks:40

TotalNo.oflab.periods-30 (60hours)

Sr.No.	Topic	No.of Lab.periods

1. PreparationofsolutionsforMolecularBiology experiments. 2. Preparationofbacterialgrowthmedium(L.B., 2XYT) 3. Competentcell preparation. 4. TransformationofE.coli.cells(colorselection of transformants – with or without inserts) X – gal and IPTG. 5. IsolationofPlasmidDNAbyalkalinelysis method 6. IsolationofgenomicDNAfrom bacterialcells. 7. Agarosegelelectrophoresisofgenomic DNA& plasmid DNA 8. Concentrationestimationbyagarosegel electrophoresis 9. Preparationofrestrictionenzymedigestsof DNA samples 10. Ligation 12. PCR	60

SuggestedReadings:

1. BrownTA.GenecloningandDNAanalysis:Anintroduction.(2016)7th Edition. Wiley-Blackwell
2. Old,R.W.,Primrose,S.B.,&Twyman,R.M.(2006).PrinciplesofGeneManipulation and Genomics, 7th Edition: Blackwell Publishing.
3. KrebsJE,GoldsteinESandKilpatrickST(2014)Lewin'sGeneXII,Jonesand Barlett Publisher
4. Brown,T.A.(2018).Genomes4.(4thedition)NewYork:GarlandScience Pub.
5. Green,M.R.,&Sambrook,J.(2014)FourthEdition.MolecularCloning:a LaboratoryManual.ColdSpringHarbor,NY:ColdSpringHarborLaboratoryPress.
6. Micklos,DA&Freyer,CA.DNAScience:AfirstcourseinRecombinant DNATechnology (2nd Edition) –Cold Spring Harbor laboratory press, NY
7. Roskam'sJ.RodgersL.(2002).LabRef:AHandbookofRecipes,Reagents,and other reference tools for use at the Bench.Cold Spring Harbor Laboratory Press. USA.
8. BarkerK(2004).AttheBench:AlaboratoryNavigator.ColdSpringHarbor Laboratory Press. USA

1.Suggestivedigitalplatformsweblinks-
Svayam Portal,
http://heecontent.upsdc.gov.in/Home.aspx

Thiscoursecanbeoptedasanelectivebythestudentsoffollowingsubjects:Openforall ……
SuggestedContinuousEvaluationMethods: ● Test ● Presentationalongwith assignment ● Classinteractions
Courseprerequisites:Thecandidateshouldhavepassed(10+2)examinationinsciencestream with PCB(Physics ,Chemistry, Biology and/or Biotechnology) or PCM (Physics ,Chemistry and Maths)or any other science subject. ..... ……

Programme/Class:Certificate	**Year:1**	**Semester2**
Subject:Biotechnology		
CourseCode:	**CourseTitle (SEC-II):Plantandanimalcellculture**	

Courseoutcomes:	Bloom'staxonomy
CO1-acquaintfundamentalsofAnimalcellculture.	K4, K6
CO2-acquaintfundamentalsofPlantcellculture.	K1, K5
CO3- utilize skills of cell culture for development of biomolecules of clinical importanceanddescribetherelevanceofcellcycleregulationsinreferenceto cellular metabolism	K3,K4
CO4-understandthemechanismofcellulardifferentiation.	K2, K4
Credits:4	SEC-II
Max.Marks:60+40	Min.PassingMarks:33

TotalNo.ofLectures-60

Unit	Topic	No.of Lectures
	PARTA	
I	**BasicsofPlanttissue culture** STERILIZATION : Dry heat sterilization, Wet heat or moist heat sterilization (Autoclaving),Filtration,UltravioletRadiation, Introductiontoplanttissue culture,surfacesterilizationofexplants, totipotencyofplantcells (Dedifferentiation, redifferentiation, regeneration of whole plant)	7

II	Nutritional requirements for plant tissue culture: nutrient media – macronutrients and micronutrients, media additives (carbon source, vitamins, amino acids), Plant growth regulators (cytokinins, auxins, gibberellins), PreparationofmediaspeciallyMSMedia,,inoculation,regenerationofplants, Initiation of callus cultures .	8
III	**ApplicationsofPlantTissueCulture**Meristemcultureandproductionof diseasefreeplants,Micropropogationofeliteplantvarieties,viaorganogenesis andsomaticembryogenesis,Embryocultureandembryorescue;	8
IV	Protoplast culture and fusion, Development of somatic hybrids and cybrids and their applications, production of haploids,via Anther and pollen culture,	7
V	Animal Cell Culture Media and Reagents: Types of cell culture media; Ingredients of media; Physiochemical properties; CO2 and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature;	8
VI	Animal Cell Culture Media and Reagents: Antibiotics, growth supplements; Foetalbovineserum;Serumfreemedia;Trypsinsolution;Selectionofmedium and serum.	7
VII	AnimalCellCultureTechniques:Historyofanimal cellculture;Different tissue culturetechniques;Typesofprimaryculture;Chickenembryofibroblast culture;	8
VIII	Secondary culture; Trypsinization; Cell separation; Development of cell lines; Characterization and maintenanceof celllines, stemcells;Commoncellculture contaminants.	**7**

SUGGESTEDREADING

1. 01.PlantBiotechnologybyA.Slater,N.W.ScottandM.R.Fowler(Oxford University press).
2. BiotechnologyinAgriculturebySwaminathan,M.S(Mc.MilllanIndia Ltd).
3. BiotechnologyanditsapplicationstoAgriculture,byCoppingLGand P.Rodgers (British Crop Projection).
4. Plant Biotechnology, by Kung, S.and C.J.Arntzen (Butterworths). Education.
5. MicroscopicTechniquesinBiotechnology,MichaelHoppert
6. Elementsof BiotechnologybyPKGupta(Rastogi&Co).
7. BiotechnologybyKashav.T(WileyEastern Ltd).
8. ConceptsinBiotechnologybyBalasubrahmanianet.al.,(Universitypress).
9. PrinciplesandpracticesofaquaculturebyTVR Pillay.
10. CoastalaquaculturebySanthanam.
11. Fisheriesof IndiabyCBLSrivatsava.
12. MolecularBiotechnologybyGlick.