PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637018 (AUTONOMOUS)

REGULATIONS 2019

(CHOICE BASED CREDIT SYSTEM) B.Tech. BIOTECHNOLOGY

(Applicable to the students admitted during the academic year 2020 – 2021 onwards) CURRICULUM

SEMESTER V

S. No.	CATEGORY	COURSE CODE	COURSE TITLE	L	T	P	C
THEOF	RY						
1	PC	BT20501	Bioprocess Engineering	3	0	0	3
2	PC	BT20502	Plant and Animal Biotechnology	3	0	0	3
3	PC	BT20503	Molecular Biology	3	0	0	3
4	ES	BT20504	Thermodynamics for Biotechnologist	3	0	0	3
5	PE	BT2015*	Professional Elective I	3	0	0	3
PRACT	TCAL					-	
6	PC	BT20505	Bioprocess Engineering Laboratory	0	0	4	2
7	PC	BT20506	Cell and Molecular Biology Laboratory	0	0	4	2
8	EE	EN20501	Career Development Laboratory I	0	0	2	1
			TOTAL	15	0	10	20

SEMESTER VI

S. No.	CATEGORY	COURSE CODE	COURSE TITLE	L	T	P	C
THEOR	Y		Na.				-
1	PC	BT20601	Bioinformatics	3	0	0	3
2	ES	BT20602	Chemical Reaction Engineering	3	0	0	3
3	PC	BT20603	Genetic Engineering	3	0	0	3
4	PC	BT20604	Enzyme Technology	3	0	0	3
5	PE	BT2025*	Professional Elective II	3	0	0	3
6	OE	BT2090*	Open Elective I	3	0	0	3
PRACTI	CAL						
7	PC	BT20605	Bioinformatics Laboratory	0	0	4	2
8	PC	BT20606	Genetic Engineering Laboratory	0	0	4	2
9	EE	EN20601	Career Development Laboratory II	0	0	2	1
			TOTAL	18	0	10	23

Approved

Approved

BOARD OF STUDIES

BIOTECHNOLOGY

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PROFESSIONAL ELECTIVE I

S. No.	CATEGORY	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PE	BT20151	Food Processing and Technology	3	0	0	3
2.	PE	BT20152	Protein Engineering	3	0	0	3
3.	PE	BT20153	Marine Biotechnology	3	0	0	3
4.	PE	BT20154	Biosafety and Hazard Management	3	0	0	3

PROFESSIONAL ELECTIVE II

S. No.	CATEGORY	COURSE CODE	COURSE TITLE	L	T	P	С
1.	PE	BT20251	Biopharmaceutical Technology	3	0	0	3
2.	PE	BT20252	Tissue Engineering	3	0	0	3
3.	PE	BT20253	Forensic Science and Technology	3	0	0	3
4.	PE	BT20254	Artificial Intelligence for Biotechnology	3	0	0	3

OPEN ELECTIVE I (OE)

S. No.	CATEGORY	COURSE CODE	COURSE TITLE	L	Т	P	C
1.	OE	BT20901	Bioenergy and Biofuels	3	0	0	3
2.	OE	BT20902	Agriculture Biotechnology	3	0	0	3



BT20	501		BIOPROCES	S ENGINEE	RING		3	0	0	3
COU	RSE O	BJECTIVES						1		
To en	able the	students to								
1	learn	the basics of bior	eactor engineering	;.						
2	desig	the rheological	parameters and sca	ale-up of fern	nentation pro	ocess.				
3	explo	re the immobilize	d enzyme reactors	using variou	s methods.					
4	under	stand the modelli	ng and stimulation	of bioproces	S.					
5	under	stand the concept	s of recombinant of	ell cultivatio	n.					
UNIT	I	CONFIGURATI	ON OF BIOREA	CTORS					9)
Ideal	reactor	s and their char	acteristics Fed-ba	tch cultivati	on, Cell re	cycle cult	ivation,	Cell	recy	ycle
cultiv	ation in	wastewater treat	ment, two-stage c	ultivation Pa	cked bed rea	actor, airli	ft reactor	intro	oduc	tion
to flui	dized b	ed reactor bubble	column reactors.							
UNIT	II II	BIOREACTOR	SCALE – UP						9	j
Regin	ne anal	ysis of bioreacto	or processes, oxy	gen mass tr	ansfer in b	ioreactors	- micro	bial	oxy	gen
demai	nds; me	thods for the dete	ermination of mas	s transfer coe	efficients; m	ass transfe	er correla	tions	s. Sc	ale-
up cri	teria for	bioreactors base	d on oxygen transf	er, power con	nsumption, a	and impelle	er tip spe	ed.		
UNIT	III I	BIOREACTOR	CONSIDERATIO	ON IN ENZY	ME SYSTI	EMS			9	,
Analy	sis of fi	lm and pore diffu	sion effects on kin	etics of imm	obilized enz	yme reacti	ons; forn	nulat	ion c	of
dimen	sionless	groups and calcu	ulation of effective	ness factors.	Design of in	mmobilize	d enzyme	e reac	ctors	_
			nembrane reactors							
UNIT	IV N	ODELLING A	ND SIMULATIO	N OF BIOP	ROCESSE	S			9	
Study	of struc	tured models for	analysis of various	s bioprocess -	- compartme	ental mode	ls, mode	ls of	cellu	ılar
			gle cell models, pl							
			steady and transier							
UNIT	VF	ECOMBINANT	CELL CULTIV	ATION					9	
Differ	ent hos	t-vector system f	or recombinant c	ell cultivatio	n strategies	and advar	ntages. E	c. coi	li, ye	east
			ces cerevisiae, Ar						000000	
			cultivation, proce							_
systen										
						TOTA	L PERI	ODS	5 4:	5
COUI	RSE OU	TCOMES								
At the	end of	this course, the st	udents will be able	e to			BT MA	PPE	D	
CO1	descri	ne various bioros	ctor configurations	and ancest's	n mode-		(Highest	Leve	el)	2)
CO2			of bioreactor for s				Understa			2)
CO ₂							Applying	755.753	1334	
COS		the engineering n	nethods of enzyme	reactors for	evaluation of	10	Analysin	ıg (K	4)	
	CHECK	veness factors.								

CO4	utilize modelling approaches and simulation concepts for bioprocess	Applying (K3)
	estimations.	
CO5	illustrate bioreactor considerations for the development of recombinant	Understanding (K2)
	products.	
	no ovec	

- 1. Shuler ML, Kargi F, DeLisa MP, "Bioprocess Engineering", 3rd Edition, Prentice Hal, 2017.
- 2. Doran PM, "Bioprocess Engineering Principles", 2ndEdition, Elsevier Science, 2013.

REFERENCES

- 1. Niazi SK, Brown JL, "Fundamentals of Modern Bioprocessing", Taylor and Francis, 2017.
- 2. Moser A, "Bioprocess Technology: Kinetics and Reactors", Springer Verlag, 2012.
- 3. Bailey JE, Ollis DF, "Biochemical engineering fundamentals", McGraw-Hill, 2018.
- 4. Blanch HW, Clark DS, "Biochemical Engineering", 3rd edition, CRC Press, 2021.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PO	O's						PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2	/ <u>-</u>	1	-	-	-	-	10	-	3	3	1
CO2	3	3	3	3	2	1	-	1	-	-	1	2	2	3
CO3	3	3	3	3	2	1	-	1	-	-	1	1	2	2
CO4	3	3	3	2	2	1	-	-	-	-	-	2	2	3
CO5	1	1	2	2	1	i=) -	2	-	-	-	3	3	1



B120	502	PLANT AND	ANIMAL BIOTECH	NOLOGY		3	0	0	3
		BJECTIVES					. 1		
To enal	ble the	students to							
1	unde	rstand the basic principles	of plant tissue culture.						
2	knov	the current scope and lim	ts to its industrial applic	cation.					
3	expl	in implications of modern	methods of genetic mod	lification for	r plant indus	stries.			
4	unde	rstand the animal tissues, a	nimal cell culture and its	s application	n in research	1.			-
5	appl	the knowledge for genetic	research to produce the	erapeutic pro	oducts.				
UNIT I	I	NTRODUCTION TO PL	ANT TISSUE CULTU	RE				1	9
Introdu	ction,	History, Applications of Pl	nt tissue culture, Labora	atory faciliti	es and oper	ations	s, Nu	tritic	on
mediun	n comp	osition and preparation, St	rilization Techniques as	nd Types of	culture.				
UNIT I	II N	ICROPROPAGATION,	INVITRO PRODUCT	ION OF H	APLOIDS	AND	Ü	1	9
		OMATIC HYBRIDIZAT							
Micro	propag	ation techniques- differen	t methods, Haploid pl	lants -gener	ation, signi	fican	ce, r	neth	od
Protopla	ast pre	paration, isolation, purific	tion, viability and cultu	ıring, somat	ic hybridiza	ation-	tech	niqu	ies
		een, methods of verification							
UNIT I	II I	RANSGENICS FOR CR	OP IMPROVEMENT	AND MET	ABOLITE			T	
	-							7	
	nic pla	nt generation, Agrobacter						of ge	
transfer, transger	enic pla , selection		sgenics in crop impr	ovement, t	erminator s	seed	tech	of ge	ene
transfer, transger high yie	enic plants, selection	nt generation, Agrobacteri tion and screening, tran molecular farming, Cell st ine, Molecular farming.	sgenics in crop impresserving spension culture, secon	ovement, to	erminator s	seed	tech	of genological	ene gy o
transfer, transger high yie UNIT I	enic plants, selection in the selection	nt generation, Agrobacteric tion and screening, transmolecular farming, Cell strine, Molecular farming.	sgenics in crop impressed in crop impressed in culture, secon	ovement, to	erminator s	seed etion,	tech selec	of genological	gy of
transfer, transger high yie UNIT I Backgro	enic plants, selection in the selection	nt generation, Agrobacteric tion and screening, transmolecular farming, Cell scine, Molecular farming. TRODUCTION TO AN Advantages, Limitations.	sgenics in crop impressed in c	URE Environm	erminator solite produc	seed etion,	selec	of genological properties of the control of the con	gy o
transfer, transger high yie UNIT I Backgro Prolifera	enic planes, selection in the selection	nt generation, Agrobacterication and screening, transmolecular farming, Cell scine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential	sgenics in crop impressed in crop impressed in culture, secon MAL TISSUE CULTUAPPlication, Culture Equipment's, Aseptic 1	URE Environm Technique.	erminator solite productions. Dent, Cell	Adhemical	tech select	of genological perting	gy 9 Cellies
transfer, transger high yie UNIT I Backgro Prolifera Balance	enic planes in elding V II pund, ation, ed Salt	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me	sgenics in crop impressed in c	URE Environm Technique.	erminator solite productions. Cell Physicocher cult	Adhemical	tech selection esion Pro-	of genological perting	gy 9 Cel ies
transfer, transger high yie UNIT I Backgro Prolifera Balance Tissue,	enic planes in elding V II Dound, ation, ed Salt	nt generation, Agrobacterication and screening, transmolecular farming, Cell scine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential	sgenics in crop impressed in crop impressed in culture, secon materials and materials	URE Environm Technique. Media, Pr	erminator solite production. Cell Physicocher cimary Cult	Adhemical	tech selection esion Pro-	of genological perting	gy 9 Cel ies
transfer, transger high yie UNIT I Backgro Prolifera Balance Fissue, Cryopre	enic planes in elding V II Dound, ation, ed Salt Steps eservat	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me involved in primary cell	sgenics in crop impressed in c	URE Environm Technique. Media, Promortalizar	erminator solite production. Cell Physicocher cimary Cult	Adhemical	tech selection esion Pro-	of genological points of the second points of the s	gy 9 Cel ies
transfer, transger high yie UNIT I Backgro Prolifera Balance Cissue, Cryopre	enic planes in elding V II Dound, ation, steps eservat	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me involved in primary cell on, Preservation, Cell bank RANSGENIC ANIMALS.	sgenics in crop impressed in crop impressed in culture, secon male and male	URE Environm Technique. EMedia, Pr Immortalizar and Embryo	nent, Cell Physicocher rimary Cult tion of cell Transfer.	Adhemical ure:	esion Pro Isola	of genological position of the control of the contr	9 Cellies of
transfer, transger high yie UNIT I Backgro Prolifera Balance Tissue, Cryopre UNIT V Methodo	enic planes, selections in elding V III Dound, ation, eld Salt Steps eservat T I Toology,	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me involved in primary cell on, Preservation, Cell bank RANSGENIC ANIMALS.	MALTISSUE CULTUAPPLICATION Application, Culture Equipment's, Aseptic Tia, Serum, Serum-Free culture, Cell Lines, I s, In Vitro Fertilization and AND GENE THERAI thod, Microinjection metappers and control of the contr	URE Environm Technique. Media, Pr Immortaliza and Embryo PY ethod, In vi	erminator solite production. Cell Physicocher rimary Cult tion of cell Transfer.	Adhemical ure:	tech seleccion Pro Isola ss. N	portion (continue)	9 Cellies of
transfer, transger high yie UNIT I Backgro Prolifera Balance Tissue, Cryopre UNIT V Methodo	enic planes in elding V II Dund, ation, ed Salt Steps eservat T Toology, syste	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Meinvolved in primary cell on, Preservation, Cell bank RANSGENIC ANIMALS. Embryonic Stem Cell mein, Retrovirus vector system.	MALTISSUE CULTI Application, Culture Equipment's, Aseptic To a culture, Cell Lines, I s, In Vitro Fertilization and AND GENE THERAIT hod, Microinjection mem, Adenovirus vector	URE Environm Technique. e Media, Pr Immortalizar and Embryo PY ethod, In vir	erminator solite production. Cell physicocher cell tion of cell transfer.	Adhomical ure:	tech selection Pro Isola ss. N	of geomological period	9 Cellies of
transfer, transger high yie UNIT I Backgro Prolifera Balance Tissue, Cryopre UNIT V Methodo delivery system,	enic planes in elding V II Dound, ation, ed Salt Steps eservat T Tology, syste Herpe	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me involved in primary cell on, Preservation, Cell bank RANSGENIC ANIMALS.	MALTISSUE CULTI Application, Culture Equipment's, Aseptic To a culture, Cell Lines, I s, In Vitro Fertilization and AND GENE THERAIT hod, Microinjection mem, Adenovirus vector	URE Environm Technique. e Media, Pr Immortalizar and Embryo PY ethod, In vir	erminator solite production. Cell physicocher cell tion of cell transfer.	Adhomical ure:	tech selection Pro Isola ss. N	of geomological period	9 Cellies of
transfer, transger high yie UNIT I Backgro Prolifera Balance Tissue, Cryopre UNIT V Methodo delivery system,	enic planes in elding V II Dound, ation, ed Salt Steps eservat T Tology, syste Herpe	nt generation, Agrobacterition and screening, transmolecular farming, Cell strine, Molecular farming. TRODUCTION TO AN Advantages, Limitations. Differentiation. Essential Solutions, Complete Me involved in primary cell on, Preservation, Cell bank RANSGENIC ANIMALS. Embryonic Stem Cell me in, Retrovirus vector systems is simplex virus vector systems.	MALTISSUE CULTI Application, Culture Equipment's, Aseptic To a culture, Cell Lines, I s, In Vitro Fertilization and AND GENE THERAIT hod, Microinjection mem, Adenovirus vector	URE Environm Technique. e Media, Pr Immortalizar and Embryo PY ethod, In vir	erminator solite production. Cell physicocher cell tion of cell transfer.	Adhomical ure: I line	tech selection Pro Isola ss. N	portion ction ction detection detect	9 Cellies of

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At the	end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	describe the theoretical knowledge in molecular, biochemical and plant sciences for plant biotechnology.	Understanding (K2)
CO2	relate the need of various physiochemical conditions in plant tissue culture.	Applying (K3)
CO3	choose the recent methodologies of plant tissue and cell culture to develop a whole plant.	Applying (K3)
CO4	apply the in vitro techniques to make animal tissue culture.	Applying (K3)
CO5	explore the basic research ideas into various interdisciplinary domains.	Applying (K3)

- 1. Murthy BRC, Sai VST, "Botany-Plant tissue culture and its biotechnological applications", Venkateswara Publications, 2017.
- 2. Ramadass P, "Animal Biotechnology: Recent concepts and developments", MJP Publishers, 2019.

REFERENCES

- 1. Razdon MK, Introduction to Plant Tissue Culture, 3rd Edition, Oxford and IBH Publishing Company,2019
- 2. Glick BR, Pasternak JJ, "Molecular Biotechnology- Principles and Applications of recombinant DNA", ASM Press, Washington, 2010.
- 3. Pullaiah T, Subba Rao MV, "Plant Tissue culture" 2nd Edition, Scientific Publishers, New Delhi,
- 4. Snustad DP, Simmons MJ, "Principles of Genetics", John Wiley and Sons, U.K. 5th Edition, 2012.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific **Outcomes PSO's**

				PC)'s								PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1	1	3	2	1	1	1	-	-	2	3	2
CO2	3	3	2	2	2	1	_		-	-	-	3	3	2
CO3	3	3	3	3	3	1	_	1	1	2	-	1	3	3
CO4	3	3	3	3	3	3	-	-	-	-	-	1	2	3
CO5	3	3	3	3	3	1	1	1	1	-	1	2	2	2



BT205	03	MOLECULAR BIOLOGY		3 0	0	3
COURS	E OBJECTIVES		<u> </u>			
To enabl	e the students to					
1	acquire basic fun	amental knowledge and explore skills in molecu	ular biology.			
2	emphasize the mo	ecular mechanism of DNA replication and repa	air.			
3	understand gene	gulation in transcription in prokaryotes and euk	karyotes.			
4	discuss the regula	on of gene expression in translation and protein	n synthesis.			
5	illustrate the prine	ples of cell division and cell cycle.				
UNIT I	CHEMISTR	OF NUCLEIC ACIDS				9
Introduct	tion to nucleic aci	s: Nucleic acids as genetic material, Structure a	and physicocher	mical p	rope	ties
DNA: W DNA str Quadrup	Vatson and Crick ructure, Conforma le helix, Reversib	and structural qualities of 3',5'-Phosphodieste odel, Chargaff's rule, X-ray diffraction analy onal variants of double helical DNA, Hogster denaturation and hyperchromic effect. Tert	ysis of DNA, F een base pairin	orces g, Tri	stabil ole he	izes lix,
supercoil	ling.					
UNIT II Overviev Meselsor	DNA REPLIC w of Central dogm and Stahl experi	ATION AND REPAIR Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for a replication of DNA replication.	fragments, Prote	eomics	plicat of D	NA
UNIT II Overview Meselsor replication prokaryo circle me	DNA REPLICATION OF Central dogment and Stahl experience, Fidelity of Distinct and eukaryotic ode of replication	Organization of prokaryotic and eukaryotic ch	fragments, Proton, Overview of ukaryotes. D-lo	eomics diffe	plicat of D rences	ion: NA in
UNIT II Overview Meselsor replication prokaryo circle me	DNA REPLICATION OF Central dogment and Stahl experience, Fidelity of Distinct and eukaryotic and eukaryotic ode of replicationsms.	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki fa replication, Inhibitors of DNA replication DNA replication, Telomere replication in endutagens, DNA mutations and their mechan	fragments, Proton, Overview of ukaryotes. D-lo	eomics diffe	plicat s of D rences d roll	ion: NA in ling pair
UNIT II Overviev Meselsor replicatio prokaryo circle me mechanis	DNA REPLICATION OF CENTRAL PROPERTY OF CENTRAL	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in endingers, DNA mutations and their mechanisms.	fragments, Proton, Overview of ukaryotes. D-lonism, various	difference of difference and types	plicat s of D rences d rol of re	ion: NA s in ling pair
UNIT II Overview Meselsor replicatio prokaryo circle me mechanis UNIT II	DNA REPLICATION OF CENTRAL PROPERTY OF CENTRAL	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in endingers, DNA mutations and their mechanisms. TION RNA, rRNA and tRNA. Characteristics of programs.	fragments, Proton, Overview of ukaryotes. D-lonism, various	eomics f differ pop an types	plicat s of D rences d roll of re	ion: NA ingling pair
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr	DNA REPLICATION OF CENTRAL DESCRIPTION OF CENTRAL DESCRIPTION OF THE PROPERTY	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in endutagens, DNA mutations and their mechanisms. TION RNA, rRNA and tRNA. Characteristics of professional procession and termination of RNA synthesis.	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha	eomics f differ pop an types ncer se	plicat s of D rences d rol of re	ion: NA ingling pair ces. esis,
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr	DNA REPLICATION OF CENTRAL CONTROL CONTROL OF CENTRAL CONTROL CONTR	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in endutagens, DNA mutations and their mechanisms. DNA replication in the Mutagens, DNA mutations and their mechanisms. TON RNA, rRNA and tRNA. Characteristics of professional procession and termination of RNA synthesisms, Inhibitors of transcription, Differences in	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of the prokaryotic	eomics f difference and types from types fro	plicat s of D rences d rol of re	NAs in ling pair
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript	DNA REPLICATION OF CENTRAL CONTROL CONTROL OF CENTRAL CONTROL OF CENTRAL CONTROL OF CENTRAL CONTROL OF CENTRAL CONTROL CONTROL	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in endutagens, DNA mutations and their mechanisms, DNA mutations and their mechanisms, replication and termination of RNA synthesisms, Inhibitors of transcription, Differences in the sign of the RNA world: Ribozymes, RNA processors in RNA world: Ribozymes, RNA processors.	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of the prokaryotic	eomics f difference and types from types fro	plicat s of D rences d rol of re	NA in ling pair
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript Alternati	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP OF TRANSCRI	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanisms. DNA replication in end Mutagens, DNA mutations and their mechanisms. TION RNA, rRNA and tRNA. Characteristics of professional procession and termination of RNA synthesisms, Inhibitors of transcription, Differences in the post of the process	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of the prokaryotic	eomics f difference and types from types fro	plicat s of D rences d rol of re	ion: NA s in ling pair ces. esis, otic ng-
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript Alternation	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP OF TRANSCRI	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanisms, DNA mutations and their mechanisms, representation of RNA synthesisms, Inhibitors of transcription, Differences in the ots in RNA world: Ribozymes, RNA process tail addition and base modification.	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enhals, Proteins of In prokaryotic essing: 5'-Cap	eomics f differ pop an types ncer so RNA s and e	plicat s of D rences d rol of re	ion: NA NA s in ling pair ces. esis, otic ng-
UNIT II Overview Meselsor replicatio prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript Alternati UNIT IV	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP OF TRANSCRI	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanisms. DNA replication in end Mutagens, DNA mutations and their mechanisms. TION RNA, rRNA and tRNA. Characteristics of professional procession and termination of RNA synthesisms, Inhibitors of transcription, Differences in the post of the process	fragments, Protein, Overview of ukaryotes. D-lounism, various moter and enhances, Proteins of the prokaryotic essing: 5'-Captacy, Wobble hy	eomics differ opp and types neer so RNA s and e ping,	plicat s of D rences d rol of re equen synthe ukary Splici	ion: NA s in ling pair 9 ces. esis, otic ng-
UNIT II Overview Meselsor replication prokaryo circle monechanis UNIT II Structure RNA syr Fidelity transcript Alternation UNIT IV Introduct importan	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP CE	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanisms. DNA mutations and their mechanisms, INA, rRNA and tRNA. Characteristics of professional procession of transcription, Differences in the state of the process of the pr	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of land prokaryotic essing: 5'-Cappacy, Wobble hypon: Initiation, land	eomics f differ pop an types ncer se RNA s and e ping, pothes Elonga	plicat s of D rences d rol of re equence synthe ukary Splici is and tion	ion: NA s in ling pair 9 ces. esis, otic ng-
UNIT II Overview Meselsor replication prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript Alternati UNIT IV Introduct importan terminati	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP OF TRANSCRI	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanisms. DNA mutations and their mechanisms are provided in the process of transcription, Differences in the process of transcription, Differences in the process of transcription and termination. DN end and termination of transcription.	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of land prokaryotic essing: 5'-Cappacy, Wobble hypon: Initiation, land	eomics f differ pop an types ncer se RNA s and e ping, pothes Elonga	plicat s of D rences d rol of re equence synthe ukary Splici is and tion	ion: NA s in ling pair 9 ces. esis, otic ng-
UNIT II Overview Meselsor replicatio prokaryo circle me mechanis UNIT II Structure RNA syr Fidelity transcript Alternati UNIT IV Introduct importan terminati	DNA REPLICATION OF CENTRAL STATE OF TRANSCRIP OF TRANSCRI	Organization of prokaryotic and eukaryotic chent, bi-directional DNA replication, Okazaki for A replication, Inhibitors of DNA replication DNA replication, Telomere replication in end Mutagens, DNA mutations and their mechanters. TON RNA, rRNA and tRNA. Characteristics of professional procession of transcription, Differences in the site of transcription, Differences in the site of transcription. To Note: Elucidation of genetic code, Codon degenerated eukaryotic ribosomes. Steps in translation tessis. Inhibitors of protein synthesis. Posttranscriptions.	fragments, Protein, Overview of ukaryotes. D-loanism, various moter and enha s, Proteins of land prokaryotic essing: 5'-Cappacy, Wobble hypon: Initiation, land	eomics f differ pop an types ncer se RNA s and e ping, pothes Elonga	plicat s of D rences d rol of re equence synthe ukary Splici is and	ion: NA s in ling pair 9 ces. esis, otic ng- 1 its

cell cycle - Cell cycle check points, molecules and mechanisms of cell cycle regulation. Cell cycle modulators.

	TO	OTAL PERIODS 45
COUI	RSE OUTCOMES	
At the	end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	articulate the composition, structure and characteristics of nucleic acids	understanding (K2)
CO2	describe the chemical and molecular processes that occur in and between cells.	Understanding (K2)
CO3	discuss about gene organization and control mechanisms of the ger expression for transcription process.	e Applying (K3)
CO4	utilize the basic mechanisms of gene expression through translation process.	n Applying (K3)
CO5	employ the mechanisms of cell division to understand molecular event	s. Applying (K3)

TEXT BOOKS

- Friefelder, George Malacinski M, "Essentials of Molecular Biology" 4th Edition, Narosa Publications, 2015.
- 2. Robert Weaver F, "Molecular Biology" 4th edition, Tata McGraw-Hill, 2011.

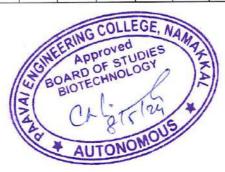
REFERENCES

- 1. Cooper GM, Hausman RE, "The Cell: A Molecular approach", 7th Edition, 2015.
- 2. Krebs JE, Goldstein ES, Kilpatrick ST, "Lewin's Essential GENES XII", 12th Edition 2017.
- 3. Nelson DL, Cox MM, "Lehninger Principles of Biochemistry", 6th Edition, 2017.
- 4. Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P, "Molecular Biology of the cell", 6th Edition, 2014.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

	PO's													PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3	3	2	1	1	1	-	-	-		i.	2	3	3	
CO2	3	3	2	2	1	1	-	-	-	•	-	2	2	3	
CO3	3	2	2	1	1	1	-	-	-	-	-	2	3	2	
CO4	3	2	2	3	2	1	-	-	-		1	3	3	2	
CO5	3	2	3	3	3	1		-	-	-	1	2	2	3	



	0504		MODYNAMICS FOR BIOTECHNOLOGIST 3	0	0	3
		BJECTIVES				
To ena	able the	e students to				
1	introd	luce the basic the	ermodynamic relations and properties of fluids.			
2	under	stand the thermo	dynamic properties of various solutions.			
3	apply	the thermodynan	mics to phase equilibria in single, multi-component systems.			
4	use th	e thermodynami	cs calculations in single and multiple chemical reactions.			
5	comp	ute the thermody	namic principles in microbial growth and product formation.			
UNIT	I	THERMODYN	AMIC LAW AND PROPERTIES OF FLUIDS		9)
Zeroth	Law	of Thermodyna	mics, First Law of thermodynamics, a generalized balance	equat	ion	and
conser	rved qu	antities, Volume	etric properties of fluids exhibiting non ideal behavior; residu	al pr	opert	ies;
estima	tion of	thermodynamic	properties using equations of state; calculations involving ac	tual	prope	erty
exchar	nges; M	laxwell's relation	ns and applications; Second law of thermodynamics.			
UNIT	II S	OLUTION TH	ERMODYNAMICS		9)
Partial	molar	properties; cor	ncepts of chemical potential and fugacity; ideal and non-ide	al so	olutio	ons;
	pis and	applications of	excess properties of mixtures; activity coefficient; composi	tion	mod	els;
		equation.	excess properties of mixtures; activity coefficient; composi	tion	mod	els;
	-Duhem			tion		
Gibbs- UNIT	-Duhem	n equation. PHASE EQUIL	IBRIA		9)
Gibbs- UNIT Criteria	Duhem	n equation. PHASE EQUIL	IBRIA VLE calculations for binary and multi component systems;		9)
Gibbs- UNIT Criteria	Duhem III P a for p oria and	PHASE EQUILIDATE PHASE PHASE EQUILIDATE PHASE	IBRIA VLE calculations for binary and multi component systems;		9	uid
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CO3	calculate thermodynamic parameters involved in biochemical reactions.	Applying (K3)
CO4	analyze the equilibrium criteria for various reaction systems.	Applying (K3)
CO5	demonstrate the capability to analyze the energy conversion performance in applications in biological systems.	Applying (K3)

- Smith JM, Van Ness HC, Abbot MM, "Introduction to Chemical Engineering Thermodynamics", 8th Edition, Tata McGraw-Hill, 2019.
- 2. Narayanan KV, "A Text Book of Chemical Engineering Thermodynamics", 2nd Edition, PHI, 2013.

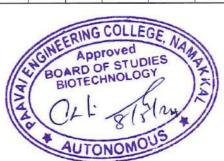
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- 1. Elliott, "Introductory Chemical Engineering Thermodynamics", Pearson India, 2014.
- 2. Sandler SI, "Chemical and Engineering Thermodynamics", John Wiley, 2020.
- 3. Elias Franses I, "Thermodynamics with Chemical Engineering Applications", Cambridge University Press, 1st edition, 2014.
- 4. Kevin Dahm D, Donald Visco P, "Fundamentals of Chemical Engineering Thermodynamics" Routledge, Taylor and Francis Group, 2015.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

							PO's						PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	-	-	-	-	-		-	2	3	3
CO2	3	3	3	1	-	-	-	-	-	-	-	2	3	3
CO3	2	2	2	1	-	-	-	-	-	-	-	1	1	2
CO4	2	2	2	2	-	-	_	-	-	-	-	1	1	3
CO5	1	2	1	2	-	-	-	-	-	(E)	-	2	2	3



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COURS	SE OBJI	ECT	IVES											
To enab	le studer	ts to												
1	interpre	t the	enzyn	ne kine	etics.									
2	perform	the	immol	bilized	enzyn	ne tech	niques.							
3	identify	the	growtł	kinet	ics of b	acteria	ı.							
4	analyze	the	produc	tivity	in a bio	oreacto	r for th	ne give	n meta	bolite.				
LIST O	FEXP	RIN	IENT	S										
1. E	nzyme k	ineti	cs – D	etermi	nation	of Mic	haelis	- Ment	en par	ameters	•			
2. E	nzyme a	ctivit	y – Ef	fect of	Temp	erature	and D	eactiva	ation K	Cinetics.	183			
3. E	nzyme a	ctivit	y – Ef	fect of	pH.									
4. E	nzyme ii	nmo	bilizat	ion – C	Gel enti	rapmer	nt.							
5. E	nzyme ii	nmo	bilizat	ion –C	ross-li	nking.								
6. E	nzymatie	con	versio	n in Pa	icked t	ed Co	lumn.							
7. G	Growth o	f B	acteria	. – Es	stimatio	on of	Bioma	ass, C	alculat	ion of	Specific (Growt	h Rate	, Yield
C	Coefficie	nt.						1.0						
8. C	ptimizat	ion b	y Plac	kett B	urman	Design	n.							
9. C	ptimizat	ion t	y Res	ponse	Surface	e Meth	odolog	y.				1		
10. E	stimatio	of l	KLa –	Dynar	nic by	differe	nt met	hods.						
	ė.										TOTAL	PER	RIODS	60
COUR	SE OUT	CO	MES									/// // // // // // // // // // // // //		
At the e	end of th	s co	urse, tl	ne stud	ents w	ill be a	ble to					1 35500	MAPP	
001		• - 1			d cha	ua ataul	ration	of.	nn/n/m	es for	practical		ghest Lo	
	investiga applicati		kinetic	s and	i Cha	racteri	Zation	01	cuzym	es 10t	practical	Allo	nyzmg	(124)
	evaluate		rowth	kineti	cs of m	nicroor	ganism	ıs.				Eva	luating	(K5)
CO3	optimize	med	ium fo	rmula	tion in	biopro	cess in	dustry	with b	oetter ef	ficacy.	App	olying (K3)
CO4	create m	ather	natical	mode	ls for r	nicrob	ial grov	wth.				Eva	luating	(K5)
) MAPP													
				come (CO's)	with I	Progra	mme (Outcoi	mes (PC	O's) and Pr	ograi	mme S _I	oecific
		ours	e Oute			Ou	itcome	s PSO	's		O's) and Predium, 1-W		,	
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		ours	e Oute			Ou h of co	itcome rrelat	s PSO	's			eak ·	PS	SO's
Марр	ing of C	ours (1/2	e Oute	cates s	trengt	Ou h of co	rrelat PO's	es PSO ion) 3-	's Stron	g, 2-Me	dium, 1-W	eak •	P5	SO's 2 3
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COs CO1	ing of C	(1/2 2 3	3 3	4 3	trengt 5 3	Ou h of co	rtcome orrelat PO's 7	s PSO ion) 3-	's Stron	g, 2-Me	11 3	12 3	P5	80's 2 3

Approved
Approved
BOARD OF STUDIES
BIOTECHNOLOGY

AUTONOMOUS



BT2	0506	1	CEL	LAND	MOL	ECUI	LAR B	IOLO	GY L	ABOR	ATORY	0	0 .	4 2
COUL	RSE OI	BJECT	TIVES											
o ena	ible stu	dents t	o					2.54						
1 ·	interpo	olate th	ne hand	s-on ex	cperim	ent in	basic n	nolecul	ar biol	ogy tec	hniques.			
2	exerci	se the	DNA is	solation	ı techr	iques.								
3	relate	the ide	entifica	tion an	d chara	acteriza	ation o	f gene	and pro	otein.				
4	descri	be the	commo	n appl	ication	is of ea	ch met	thodolo	ogy in l	biologi	cal research.			
LIST	OF EX	PERI	MENT	S										
1.	Micro	scopy-	– Work	ing an	d care	of Mic	roscop	e, phas	se cont	rast and	l fluorescen	t mic	roscopy	7
2.	Identif	ication	n of cel	ls by C	iemsa	Staini	ng Tec	hnique	s.					
3.	Identif	ication	n of cel	ls by L	eishm	an Stai	ning T	echniq	ues					
4.	Mitosi	s in or	nion roo	ot tip.							,			
5.	Separa	tion o	f Perip	heral B	lood N	Aononi	ıclear (Cells fi	om blo	ood.				
6.	Isolati	on of I	DNA fr	om pla	nt cell	s.								
7.	Isolati	on of I	Plasmic	I DNA	from 1	oacteria	al cell.							
8.	Quant	itative	analys	is of is	olated	genom	ic DN	A using	gspect	rophoto	meter.			
9.	Extrac	tion o	f protei	ns fron	n plant	or ani	mal tis	sue an	d confi	rmatio	with qualit	tative	test.	
10.	Chron	nosom	e staini	ng and	Karyo	typing	(Dem	o).					-	
											TOTAL P	PERI	ODS	60
COU	RSE O	UTCO	MES	T		-								
At the	end of	this co	ourse, t	he stud	ents w	ill be a	ible to			-			вт ма	
										C 11	1 . 1	7/2/	Highes	
CO1	exami molec		120000000000000000000000000000000000000	iples 1	ınderl	ying 11	n the	technic	ques o	f cell	biology an	id A	Applyin	g (K3)
CO2			asic te	chnique	es of D	NA is	olation	and m	anipula	ation.		A	nalysii	ng (K4
CO3											interpret th	ne A	Analysii	ng (K4
	results													
CO4	1000		c techn oteins l		nvolve	d in an	alysis	of gene	e expre	ssion a	t nucleic	P	Analysi	ng (K4
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				come (CO's)	with 1	Progra	mme (Outcor	nes (Po	O's) and Pr	ogra	mme S	pecific
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COI	2	2	2	2	-	1	1	1	22	1	2	2	3	3
CO2	3	3	3	3	-	1	1	1	2	1	2	2	2	2
CO3		3	3	3	1	2	1	1	2	1	3	3	3	2
CO4		3	3	3	1	2	1	1	-	1	3	2	3	2
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AUICNOMOUS



EN20:	501	CAREER DEVELOPMENT LABORATORY	(I	0	0	2	1
COUI	RSE OBJ	ECTIVES					
To ena	able studer	nts to					
1.	enhance	their Writing Skills.					
2.	evaluate	their Presentation Skill to face the corporate world.					
3.	solve th	ne quantitative aptitude problems and improve their Mental al	oility.				
4.	improve	e their reasoning skills.					
UNI	TI	WRITING SKILLS				T	7
Writin	g Skills: T	The Essentials of Writing; The Importance of Structure; Type	s of Writing- Co	ommo	n N	lista	kes
in Wri	ting.						
Activi	ties: Emai	il Writing; Paragraph writing; Report Writing; Story Writing	- Story Telling S	Sessio	n: 2	- JA	λM
Sessio	n 1						
UNI	T II	PRESENTATION SKILLS & GROUP DISCUSSION				T	
		Discossion				1	7
Presen	tation Sk		entation; Ways	to in	npro	ove	85
		ills: Types of Presentation; Methods of Delivering Prese			100		the
Presen	tation – P				100		the
Presen GD- E	tation – P valuation	lills: Types of Presentation; Methods of Delivering Preservesentation Aids- Group Discussion: Introduction –Types & Criteria – Do's & Don'ts of GD.	Importance; Wl	ny GE); T	ypes	the of
Presen GD- E Activi	tation — P valuation ties: Prese	ills: Types of Presentation; Methods of Delivering Preservesentation Aids- Group Discussion: Introduction –Types &	Importance; Wl	ny GE); T	ypes	the of
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Presen GD- E Activi Profile UNI	valuation – P valuation ties: Prese Session I	ills: Types of Presentation; Methods of Delivering Preservesentation Aids- Group Discussion: Introduction –Types & Criteria – Do's & Don'ts of GD. entation Session I; Group Discussion Session I; Role Play Sess I; Company Profile Analysis Session II.	Importance; Wi	ny GD	D; T	ypes sona	the of lity
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CO3	problems based on quantitative aptitude	Applying (K3)
CO4	reveal their logical and verbal reasoning by scoring the expected	Analyzing (K4)
	percentage to get placed in reputed companies	

- 1. Agarwal, R.S. "Objective General English", S.Chand & Co.2018.
- 2. Agarwal, R.S. "Objective General English", S.Chand&Co.2016.

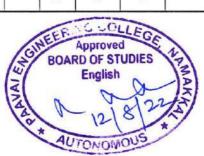
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- 2. Word Power Made Easy By Norman Lewis, Wr. Goyal Publications. 2016.
- Johnson, D.W. Reaching out Interpersonal Effectiveness and self-actualization. Boston: Allyn and Bacon.2019.
- 4. Infosys Campus Connect Program students' guide for soft skills.2015.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

							PO's						PSC)'s
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	1
CO3	3	2	2	2	84	-	1	-	-	-	2	140	2	2
CO4	2	1	3	2	-	3	3	1	-	1	2	-	2	2



	0601	BIOINFORMATI	ICS	3 0	0 3
COL	JRSE O	BJECTIVES			
To e	nable the	students to			
1	provide	knowledge on biological databases, sec	quence analysis, evolutionar	ry analy	sis and
	applica	tions of bioinformatics.			
2	underst	and biological data resources, algorithms and	alignment tools.		
3	outline	the principle of phylogenetic methods.			
4	explain	the bioinformatics core concepts for structura	al analysis.		
5	illustra	e the application in the analysis of biological	data.		
UNI	TI	SIOLOGICAL DATABASES			9
Intro	duction	to Bioinformatics and Computational Biolo	ogy, Biological sequences,	Classifica	ition of
		abases - Sequence Databases, Structure Da			
		d applications- Microarray, Metabolic pathy			0700
form					
UNI	TII	EQUENCE ANALYSIS		-	9
Sequ	ence Ali	gnment- Homology vs Similarity, Similarity	vs Identity. Types of Seque	ence align	ment -
		Multiple sequence alignment, Global align		_	
		leedleman wunsch and Smith and waterm			
		fultiple Sequence Alignment- Application of		1000	
		Scoring function. Database Similarity Search STA, PHI BLAST, PSI BLAST, BLAST algo		ent Searc	h Too
UNI		IOLECULAR PHYLOGENY	oriunm.		1
					9
		Basics, Molecular clock theory, Ultrametric			lists.
		sed methods-Maximum Parsimony. Meth-	ods of evaluating phyloge	Same a partition of the contract	MA,NJ,
DOOLS		in alder if in a		enetic m	MA,NJ,
	T TT N	jackknifing.		enetic m	MA,NJ, ethods-
UNI		IACROMOLECULAR STRUCTURE AN			MA,NJ, ethods-
UNI' Gene	predict	IACROMOLECULAR STRUCTURE ANd on, Conserved domain analysis, Protein st	tructure visualization, Predic	ction of	MA,NJ, ethods-
UNIT Gene secon	predict	IACROMOLECULAR STRUCTURE ANd on, Conserved domain analysis, Protein stacture, Tertiary structure prediction- Homolog	tructure visualization, Predic gy modeling, Threading, Ab-i	ction of	MA,NJ, ethods-
UNIT Gene secon Valid	predict	on, Conserved domain analysis, Protein stacture, Tertiary structure prediction- Homolog the predicted structure using Ramachandra	tructure visualization, Predic gy modeling, Threading, Ab-i	ction of	MA,NJ, ethods-
UNIT Gene secon Valid struct	predict dary stru lation of ture align	IACROMOLECULAR STRUCTURE ANd on, Conserved domain analysis, Protein structure, Tertiary structure prediction- Homolog the predicted structure using Ramachandra ment.	tructure visualization, Predic gy modeling, Threading, Ab-i	ction of	MA,NJ, ethods-
UNIT Gene secon Valid struct	e prediction of lation of ture align	IACROMOLECULAR STRUCTURE AND On, Conserved domain analysis, Protein structure, Tertiary structure prediction- Homolog the predicted structure using Ramachandra ment. PPLICATIONS	tructure visualization, Predic gy modeling, Threading, Ab-i un plot, steriochemical prope	etion of initio pre- erties, Str	MA,NJ, ethods- g protein diction. ructure-
UNITED CONTROL OF THE PROPERTY	e prediction dary structure align TV A duction t	on, Conserved domain analysis, Protein structure, Tertiary structure prediction- Homolog the predicted structure using Ramachandra ment. PPLICATIONS o Systems Biology and Synthetic Biology,	tructure visualization, Predic gy modeling, Threading, Ab-i un plot, steriochemical prope Microarray data analysis, D	etion of initio pre- erties, Str	MA,NJ, ethods- g protein diction. ructure- g puting,
UNITY Gene secon Valid struct UNITY Introd Bioin	e prediction of lation of ture align TV A duction to	IACROMOLECULAR STRUCTURE AND on, Conserved domain analysis, Protein structure, Tertiary structure prediction- Homolog the predicted structure using Ramachandra ment. PPLICATIONS o Systems Biology and Synthetic Biology, approaches for drug discovery, Applications	tructure visualization, Prediction of Bioinformatics in	etion of initio pre- erties, Str	9 protein diction. ructure-
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COU	RSE OUTCOMES	
At the	e end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	apply computational based solutions for biological perspectives	Applying (K3)
CO2	make use of bioinformatics tools for analysing data sequence	Understanding (K2)
CO3	assign the evolutionary relationship between the organisms	Applying (K3)
CO4	determine the macromolecule's structure prediction methods	Applying (K3)
CO5	process the applications of bioinformatics approach for drug discovery, genomics and proteomics.	Applying (K3)

- 1. Lesk, Arthur, "Introduction to bioinformatics", Oxford university press, 2019.
- 2. Su, Andreas D. Baxevanis, BF Francis Ouellette Chen. "Bioinformatics", John Wiley & Sons, 2020.

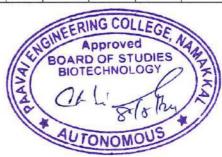
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- 2. Mount DW, "Bioinformatics Sequence and Genome Analysis", Cold Spring Harbor, Laboratory Press, 1st Edition, 2004.
- 3. Durbin R, Eddy S, Krogh A, Mitchison G, "Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids", Cambridge University Press, 2013.
- 4. Xinkun Wang, "Next Generation Sequencing Data Analysis", CRC Press, 2016.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PC	's						PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	-	1=2	-	-	-	-	-	2	1	1
CO2	2	1	1	1	1	-	-	-	-		-	3	1	1
CO3	3	2	2	3	I	-	-	-	-	:-	-	1	2	3
CO4	3	3	2	1	-	-	-		525	14	-	1	2	3
CO5	3	2	2	1	2	-		-	-	-	-	1	1	1



BT2	0602	C	HEMICAL REACTION ENGINEERING	3	3	0	0	3
COU	RSE O	BJECTIVES				-		
To ena	able the	students to						
1	impar	t the basic conce	epts in reaction kinetics.					
2	devel	op knowledge fo	or design of ideal reactors.					
3	under	stand the practic	al aspects of non-ideal flow.					
4	discus	ss the intermolec	ular and covalent catalysis in gas-liquid read	ctions.				
5	apply	the reaction eng	ineering principles in biological systems.					
UNIT	I	CINETICS OF	HOMOGENOUS REACTIONS					9
Conce	ntratio	and temperatur	re dependent term of rate equation; searchir	ng for mechani	sm; p	rec	licta	bility
of read	ction ra	ite from theory;	Interpretation of batch reactor data; consta	ant volume and	vari	abl	e vo	olume
batch	reactor	; temperature an	d reaction rate; development of rate equat	ions for differ	ent h	om	oge	neous
reactio	ns (up	to second order	reactions both reversible and irreversible rea	actions).				
UNIT	II F	REACTOR DES	SIGN				T	9
Ideal l	batch r	eactors; steady	state MFR and PFR; holding time for fl	ow systems; I	Desig	n f	or s	single
reactio	ns; per	formance equati	ions for single reactors; size comparison of	single reactor	s – N	1FF	۷ vs	PFR
for firs	t and s	econd order reac	tions; multiple reactor systems with graphic	al comparison.				
UNIT	III N	NON-IDEAL FI	LOW					9
RTD;	Conver	sion in non-idea	al flow reactors; Compartment Models; Dis	spersion Mode	l; Tar	ıks	-in-	series
Model	s; Conv	ection Models;	earliness of mixing, segregation and RTD.					
UNIT	IV C	GAS – LIQUID	REACTION					9
Reactiv	vity – (Coenzymes – Pro	oton transfer - metal ions - Intra molecular	reactions - Co	valen	t ca	ataly	/sis –
Catalys	sis by c	organized aggreg	ates and phases. Inclusion complexation.					
UNIT	VE	HOCHEMICA	L REACTION SYSTEMS					9
Biorea	ctor Sy	stems Definition	ons; Differences and similarities betwee	en chemical	and	bic	rea	ctors;
Classif	ication	of bioreactors;	Reactor configurations; Description of a c	onventional bi	oreac	tor	wi	th all
aspects	s; Desi	gn equations for	enzyme reactors; batch growth of micros	organism; Desi	gn ec	lua	tion	of a
plug flo	ow read	tor; Estimation	of kinetic parameters.					
				TOTAL PI	ERIO	DS	4	5
COUR	SE OU	JTCOMES					-	
At the	end of	this course, the s	tudents will be able to	BT MAI	PED			
100				(Highest	Leve	1)		
CO1			omogeneous reactions	Applying	g (K3))		
CO2			pects for different ideal reactors	Applying	(K3))		
CO3	demor	strate non-ideal	flow in chemical reactors	Understa	nding	g (K	(2)	
CO4		is the reactivity	in gas liquid reaction	Applying	(K3))		
			ochemical reaction systems					

- 1. Levenspiel O, "Chemical Reaction Engineering", John Wiley, 3rd Edition, 2021.
- 2. Fogler HS, "Elements of Chemical Reaction Engineering", Prentice Hall of India, 6th Edition, 2020.

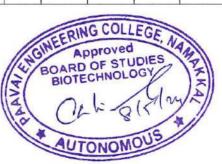
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- 2. Froment GF, Bischoff KB, "Chemical Reactor Analysis and Design", John Wiley and Sons, 3rd Edition, 2010.
- 3. Himadri Roy Ghatak, Reaction Engineering Principles, CRC Press, 2018.
- Mikkola JP, Salmi TO, Warna JP, "Chemical Reaction Engineering and Reactor Technology", 2nd Edition, Routledge Taylor & Francis Group, 2019.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PO'	s			•			PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	3	-	-	0. m .	-	-	-	-	1	2	1
CO2	3	2	3	1		-		-	•		:=:	1	3	1
CO3	3	3	3	1	-	-	-	-	-	-	-	1	3	1
CO4	3	3	1	1	~ ·	-	-	-	-	-	-	3	1	2
CO5	3	1	1	3	12	-	-	_	<u>u</u>	-	-	3	1	3



BT20603		3	0	0	3
COURSE	OBJECTIVES				
Γo enable t	he students to	¥			
1 unde	erstand the basics of Recombinant DNA.				
2 expl	lain the heterologous expression of cloned genes in different hosts.		-		
3 learn	n the fundamentals of recombinant DNA technology and DNA manipulation	techr	ique	s.	
4 appl	ly the fundamentals of genome organization in the development of genetic ma	aps.			_
	oloy the application of genetic engineering in various fields.				
UNITI	BASICS OF RECOMBINANT DNA TECHNOLOGY			-	9
Manipulatio	on of DNA - Restriction and Modification enzymes, Design	of	linke	rs	and
	naracteristics of cloning and expression vectors based on plasmid and bacter				
	yeast and mammalian system, Prokaryotic and eukaryotic host system				
	ant DNA in to host cells and selection methods.	,	mac	duci	.101
UNIT II	DNA LIBRARIES				9
N. O. (252.07), 20074	on of genomic and cDNA libraries, Artificial chromosomes – BACs and YAC	20.0	1,		-5
	creening of DNA libraries using nucleic acid probes and antisera.	.s, C	шоп	10801	па
				-	0
UNIT III	SEQUENCING AND AMPLIFICATION OF DNA	DCD.	4 E	DD(9
UNIT III Maxam Gil Allele speci	SEQUENCING AND AMPLIFICATION OF DNA lbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested I ific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Co	lony	PCR	, sin	CR
UNIT III Maxam Gil Allele speci cell PCR, F mutagenesis	SEQUENCING AND AMPLIFICATION OF DNA lbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested I ific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Co Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beaccis.	lony	PCR	, sin	CR.
UNIT III Maxam Gil Allele speci cell PCR, R mutagenesis UNIT IV	SEQUENCING AND AMPLIFICATION OF DNA lbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested I ific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Co Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacces. ORGANIZATION AND STRUCTURE OF GENOMES	olony ons.	PCR Site	direc	CR igle tec
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Maxam Gil Allele speci cell PCR, F mutagenesis UNIT IV Organizatio genome seq Genetic ma Hybridizatio annotation. UNIT V	SEQUENCING AND AMPLIFICATION OF DNA lbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested I ific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Co Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beaccess. ORGANIZATION AND STRUCTURE OF GENOMES on and structure of genomes, Genome sequencing methods, Conventional quencing methods, Next generation sequencing technologies, Ordering the graps and Physical maps, STS content-based mapping, Restriction Enzyme on mapping, Radiation Hybrid Maps, Optical mapping. ORF finding	al ar eenon Fing	PCR Site of	direction	CR igle getec
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CO2	produce the commercially important recombinant proteins.	Applying (K3)
CO3	aware of gene and genome sequencing techniques to amplify and analyze DNA.	Applying (K3)
CO4	identify modern tools and techniques for manipulation and analysis of genomic sequences.	Understanding (K2)
CO5	illustrate research methodologies employing genetic engineering techniques.	Applying (K3)

- 1. Old RW, Primrose SB, Twyman RM, "Principles of Gene Manipulation, An Introduction To Genetic Engineering", 7th Edition, Wiley-Blackwell, 2006.
- Primrose SB, Twyman RB, "Principles of Gene manipulation and Genomics", 7th Edition, Wiley-Blackwell, 2014.

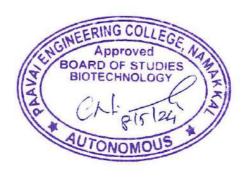
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- 2. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol 152, Academic Press.
- Green MR, Sambrook J, "Molecular Cloning: A Laboratory Manual", 4th Edition, CSHL Press, 2012.
- 4. Brown TA, "Gene Cloning and DNA analysis: An introduction",8th Edition, Wiley Blackwell, 2020.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

	PO's									PSO's				
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	2	1	1	-	1	-	-	-	3	3	3
CO2	3	3	3	2	2	2		2	1	-	97	2	3	3
CO3	3	3	3	3	2	1	-	2	-	-	5. -	3	3	3
CO4	1	i	1	2	1	1	-	1	-	-		3	3	3
CO5	3	3	3	3	3	1	-	2	1	2	1	3	3	3



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1	intr	oduce the basic r	echanism of enzyme a	ction.					
2	lear	n the kinetics of	nzymatic reaction.						
3	und	erstand the conce	ots of enzyme immobil	lization and biosens	ors.				
4	defi	ne the characteri	ation and purification	of enzymes.					
5	gair	knowledge on b	otransformation and th	ne applications of en	zymes .				
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substra	ate cor	nplex formation	chanisms of enzyme ac specificity of enzym ntropy in catalysis						
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CO4	develop ideas on processing, production and purification of enzymes at an industrial scale	Applying (K3)
CO5	comprehend the biotransformation applications of enzymes	Applying (K3)

- Palmer T, Bonner PL, "Enzymes: biochemistry, biotechnology, clinical chemistry", Horwood Publishing Ltd; 2014.
- Faber K, "Biotransformations in organic chemistry: a textbook", Berlin, Heidelberg: Springer-Verlag, 2018.

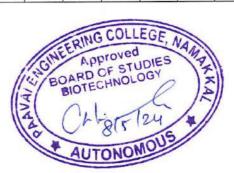
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- 4. Punekar NS, "Enzymes", Springer, 2018.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PO'	S						PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	-	-	-	-	-	-	-	3	3	3
CO2	1	1	1	2	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	.=		-	-	2	2	3	3
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4	deve	lop ski	lls in th	e analy	sis and	interpr	etation	of varie	ous <i>in s</i>	ilico teo	chnique	s.			
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O/PO Mappin	MAP	PING Course	Outco			Outco	omes Pa	SO's	comes (
O/PO Mappin	MAP	PING Course (1/2/3	Outco	ites str	ength	of corre	omes Pa elation	SO's) 3-Stre	ong, 2-1	Mediun	n, 1-W	/eak	P	SO's	;
O/PO Mappin	MAP	PING Course	Outco			Outco of corr	omes Pa	SO's		Mediun	n, 1-W	/eak	P	SO's	2
O/PO Mappin CO's	MAP	PING Course (1/2/3	Outco	ates str	ength 5	PO's	omes Parelle P	8 1	9 -	Mediun	11 2	/eak 12 2	P 1 3	SO's	2 3
CO4 O/PO	MAP	PING Course (1/2/3) 2	Outco 3 indica 3	4 2	ength 5	Outco of corre PO's	omes Page elation	SO's) 3-Stre	ong, 2-1	Mediun	n, 1-W	/eak	P	SO's	2

Approved
BOARD OF STUDIES
BIOTECHNOLOGY

UTONOMOUS

EN2060)1	CAREER DEVELOPMENT LABORATORY	A II 0 0	2 1
COURS	SE OBJ	ECTIVES		
To enab	le stude	nts to		
1.	enhan	ce their skills to manage stress to survive in corporate world		
2.	evalua	te their Interview skills		
3.	solve	the quantitative aptitude problems and improve their problem	n-solving skills	
4.	improv	re their reasoning skills to get placed in reputed companies		
UNIT	I	Resume Writings		7
Resume	Writing	Skills; Curriculum Vitae & Resume; Things to do while wr	riting a Resume ;Mistal	ces and
Activiti	es: Corp	; Cover Letter: General Guidelines - The Content - Stress Mar orate Resume Building Session I ;JAM Session: Level III; R	Role Play Session (Indiv	
UNIT		pany Profile Analysis Session III; Personality Profile Analysis INTERVIEW SKILLS	is Session III	
		Introduction- Before the Interview – During the Interview		7
Session; UNIT	Corpora III	entation Session: Level II- Group Discussion Session: Level ate Resume Building Session II QUANTITATIVE APTITUDE		8
Permuta	tion & C	Combination; Probability: Dice; Colours, Coin Cards; Partner	ership ;Ages; Calendars	3
UNIT	IV	LOGICAL REASONING -I		8
Making & Argur		ents; Matching Definitions; Cause & Effect- Directions; Sy	llogism; Analogy; Stat	ements
		(E) malpas (SA)	TOTAL PERIODS	30
COURS	SE OUT	COMES		
At the en	nd of thi	s course, students will be able to	BT Mapped (Highest Level)	
CO1	demon	strate the interpersonal skills in Group Discussions	Analyzing (K4)	
CO2	enhanc	e their etiquettes	Applying (K3)	
CO3	practic	e skills related to their thinking ability	Applying (K3)	
CO4		heir logical and verbal reasoning by scoring the expected age to get placed	Analyzing (K4)	

- Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand& Co Ltd, new delhi.2015.
- 2. Agarwal, R.S. "Objective General English", S.Chand&Co.2016.

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- 2. Word Power Made Easy By Norman Lewis , Wr. Goyal Publications. 2016.
- Johnson, D.W. Reaching out Interpersonal Effectiveness and self actualization. Boston: Allyn And Bacon. 2019.
- 4. Infosys Campus Connect Program students' guide for soft skills.2015.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

	PO's													
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	2
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	2
CO3	3	2	2	-	_	1	-	-	-	-	2	-	2	2
CO4	2	3	3	2	-	3	3	1		1	2	-	2	2



BT2	0151	FOOD PROCESSING AND TECHNOLOGY	3	0	0 3
COL	JRSE O	BJECTIVES			
To e	nable the	e students to			
1	lear	n about the various food constituents and its role in influencing food prope	erties.		
2	und	erstand the different types of additives and its functional role.			
3	arti	culate the various microbes associated with food.			
4	rela	te the role of microorganisms in food processing and diseases.			
5	cust	tomize different food processing and preservation techniques.			
UNI	ΓI	FOOD, ENERGY AND LAWS			9
Cons	tituents	of food - carbohydrates, lipids, proteins, water, vitamins and minerals, di	ietary sour	ces, ro	le and
funct	ional pr	operties in food, contribution to organoleptic and textural characteristics.	Inspection	– Mic	robia
Indic	ators of	product quality - Indicators of food safety -Microbiological safety of foo	ds - contro	strate	gies -
Haza	rd Analy	ysis Critical Point System (HACCP concept) - Microbiological criteria.			-
UNI	LII	FOOD ADDITIVES			9
Class	ification	n, intentional and non-intentional additives, functional role in food proces	ssing and p	reserv	ation
		nts - natural and artificial; food flavours; enzymes as food processing aids.			
UNIT	гш	MICROORGANISMS ASSOCIATED WITH FOOD			9
Bacte	eria, yea	sts and molds - sources, types and species of importance in food proces	ssing and p	reserv	ation
ferme	ented foo	ods and food chemicals, single cell protein.			
UNIT	ΓIV	FOOD BORNE DISEASES			9
Class	ification	n - food infections - bacterial and other types; food intoxications and po-	isonings- b	acteria	al and
non-b	acterial	; food spoilage - factors responsible for spoilage, spoilage of vegetabl	e, fruit, m	eat, po	ultry
		other food products.		· · · · · · · · · · · · · · · · · · ·	
UNIT	ΓV	FOOD PRESERVATION			9
Princ	iples in	volved in the use of sterilization, pasteurization and blanching, the	rmal death	curv	es of
		ms, canning; frozen storage-freezing characteristics of foods, micro			
tempe	eratures,	factors affecting quality of foods in frozen storage; irradiation preservation	n of foods.		
		TO	TAL PERI	ODS	45
COU	RSE O	UTCOMES			
At the	e end of	this course, the students will be able to	BT MAPI	PED	
		29	(Highest]	Level)	
CO1	defend	the basic concepts of food constituents present in food and	Understan	ding (l	(2)
	micro	organisms involved in food processing			
CO2	detail	the various food additives in food processing applications	Understan	ding (]	(2)
COZ					
CO3	emplo	y microorganisms in the foods processing to understand the principles in	Applying	(K3)	

CO4	acquire the knowledge of factors causing spoilage and infections in food	Applying (K3)
	products	
CO5	investigate the methods and principles of food preservation techniques.	Applying (K3)

- 1. Coultate TP, "Food-The Chemistry of its Components", 2nd edition, Royal society, London, 2017.
- 2. Sivasanker B, "Food processing and preservation", Prentice-Hall of India Pvt. Ltd. New Delhi, 2010.

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- 2. Frazier WC, Westhoff DC, "Food Microbiology", 5th Ed., McGraw-Hill book Co., New York, 2017.
- Goyal MR, Mishra SK, Birwal P, editors. Food Processing and Preservation Technology: Advances, Methods, and Applications. CRC Press; 2022.
- 4. Fellows PJ, "Food Processing Technology: Principles and practice", 5th Edition, Wood head Publishing limited, 2016.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

					10	PO's							PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	(-	-	-	-		-	-	1	-	3
CO2	3	2	2	2	-	-	-	-	-	-		1	1	3
CO3	3	1	2	2	-	-	-	-	-	7=6	-	1	1	3
CO4	3	2	2	1	25	-		-	-	-	9.50	2	1	3
CO5	3	2	2	1	100	-	-	-	-	-	-	2	2	3



BT20	152		PRO	TEIN EI	NGINE	ERIN	IG				3	0	0	3
COUF	RSE C	DBJECTIVES												
To ena	ble th	e students to												
1	stud	y the importance	of protein b	iomolecu	ules.									
2	lear	n about the differen	ent types in	protein s	tructure).								
3	unde	erstand the folding	g mechanisr	n in the t	tertiary s	structu	ire of	proteir	ıs.					
4	22	ess the binding ar			0									
5	infe	r the immunoglob	ulins, enzyr	nes and t	their cor	mmerc	cial ap	plicati	ons.					
UNIT	I	BONDS, ENERG	GIES, BUIL	DING E	BLOCK	S OF	PRO	TEIN	S					9
Covale	ent, Io	nic, Hydrogen, C	Coordinate, l	hydropho	obic and	l Van	der wa	alls int	eraction	ıs in p	orote	ein s	truct	ure.
Interac	tion v	with electromagn	etic radiatio	on and e	lucidation	on of	prote	in stru	cture. A	Amino	aci	ids a	and t	heir
molecu	ılar pı	operties, Chemic	al reactivity	in relati	ion to po	ost-tra	ınslati	onal m	odificat	tion (i	nvo	lvin	g am	ino,
carbox	yl, hy	droxyl, thiol, imi	dazole grouj	ps).										
UNIT	II I	PROTEIN ARCI	HITECTU	RE										9
Primar	y str	ucture: peptide	mapping, p	peptide	sequenc	eing -	auto	mated	Edma	n me	thod	l ar	nd n	nass
spectro	scopy	, High-throughp	ut protein :	sequenci	ng setu	p Sec	condar	y stru	cture: A	Alpha	, be	ta a	ınd 1	оор
structu	res a	nd methods to	determine	Super-se	econdary	y stru	icture:	Alph	a-turn-a	alpha,	be	ta-tı	ırn l	beta
(hairpi	n), be	eta-sheets, alpha-	beta-alpha,	topology	y diagra	ams, ı	ıp and	d dow	n and	ГІМ І	barro	el s	truct	ures
nucleot	tide b	inding folds, pred	iction of sul	ostrate bi	inding s	ites.								
UNIT	III	TERTIARY ST	RUCTURI	E										9
Tertiar	y stru	cture: Domains,	folding, der	naturation	n and re	enatur	ation,	overv	iew of	metho	ods t	to d	etern	nine
3D stru above a		s. Quaternary stru s	ucture: Mod	ular natu	ure, forn	nation	of co	mplex	es. Con	nputer	exe	ercis	e on	the
UNIT	IV	DNA-BINDING	AND ME	MBRAN	NE PRO	TEIN	NS							9
DNA-b	oindin	g proteins: proka	ryotic trans	cription	factors,	, Heli	x-turn	-Helix	motif i	in DN	JA t	oind	ing,	Trp
Repres	sor, E	ukaryotic transcr	iption factor	s, Zn fin	ngers, he	elix-tu	rn hel	ix mot	ifs in ho	omeoc	dom:	ain,	Leuc	cine
zippers	. M	embrane protei	ns: Genera	al char	acteristi	ics,	Transı	membr	ane se	egmen	ıts,	pr	edict	ion,
bacterio	orhod	opsin and Photos	ynthetic read	ction cen	iter.									
UNIT	VI	MMUNOGLOB	ULINS AN	D ENZY	YMES								T	9
Immun	oglob	ulins: IgG Ligh	t chain and	d heavy	chain	archi	tecture	e, abz	ymes a	nd E	nzyı	mes	: Sei	rine
proteas	es, ur	nderstanding cata	lytic design	by engi	ineering	tryps	in, ch	ymotry	psin ar	nd ela	stas	e, s	ubstr	ate-
assisted	d catal	lysis other comme	ercial applic	ations. C	Compute	er exer	cise o	n the a	bove as	pects.				
		SAT MAKET	##						TOTA	AL PI	ERIC	OD:	S	45

RSE OUTCOMES	
end of this course, the students will be able to	BT MAPPED (Highest Level)
articulate the various interactions in protein makeup.	Understanding (K2)
acquire different levels protein structure to understand protein function.	Applying (K3)
determine the role of functional proteins at tertiary structure levels.	Applying (K3)
compute protein sequence data and binding pattern of proteins.	Applying (K3)
employ the latest application of protein science in their research.	Applying (K3)
	acquire different levels protein structure to understand protein function. determine the role of functional proteins at tertiary structure levels. compute protein sequence data and binding pattern of proteins.

- 1. Branden CI, Tooze J, "Introduction to protein structure", Garland Science, 2012.
- 2. Whitford D, "Proteins: structure and function", John Wiley & Sons, 2013.

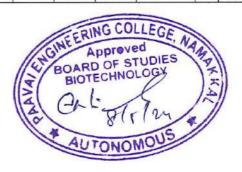
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- 2. Liebler DC, "Introduction to Proteomics", Humana Press, 2002.
- 3. Voet D, Pratt CW, Voet JG, "Voet's principles of biochemistry", John Wiley & Sons, 2018.
- Haggerty LM, "Protein Structure: Protein Science and Engineering", Nova Science Publications, 2012.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PO's	3						PSC)'s
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	280	-		-	-	-	-	2	2	2
CO2	1	1	2	1	-	•		-	-	-	=	2	2	3
CO3	1	1	2	1	-	-	-	-	1	-	:: = (2	2	2
CO4	3	3	3	3	1	-	-	9 7 .	1	1.5	1077.0	3	3	3
CO5	2	2	3	2	-	Har	-	24	2	-	721	3	3	3



BT201		MARINE BIOTECHNOLOGY 3 0 0											
	SE OBJECTIVES					-	1						
To enat	ole the students to	9											
1	understand the abioti	ic and biotic components of the marine ecos	system.			-							
2	learn the important n	narine organisms.					-						
3	elucidate the bioreme	ediation and biodegradation concepts in mar	rine.	•									
4	study the important of	compounds of marine and their applications.			7771								
5.	analyze the marine fi	shery resources and aquaculture techniques	utilized fo	r mass cu	ıltiva	tion							
UNIT I		N TO MARINE ENVIRONMENT					9						
World o	oceans and seas – ocea	n currents - physical and chemical propertie	es of sea w	ater – ab	iotic	and							
		ogical divisions of the sea – history of mari											
	food chain and food v			0.0000		cui							
UNIT I	I IMPORTANT M	ARINE ORGANISMS					9						
Phytopla	anktons – zoo plankto	ons – nektons – benthos – marine mammal	s – marine	algae r	nana	row							
		and adaptation – intertidal zone – fauna and		aigae –i	nang	iove	5 -						
UNIT II		RONMENTAL BIOTECHNOLOGY	a mora.	7			0						
Marine r		dicators (marine micro, algae) – biodegrada	tion and h				9						
	ouling and corrosion.	meno, algaey – blodegrada	alon and b	·	шоп								
UNIT I		RMACOLOGY											
		ge factors in seafood; Toxins influencing fo	1 11	0' 1	- 11		9						
		ticals, Medicinal compound from marine fl					ns,						
UNIT V		nts, Sea food processing and Preservation; I	reezing ai	nd cold st	orage	ì. 							
			2001				9						
mportan	n or coastar aquacum	ture – marine fishery resources – comm	on fishing	crafts a	nd g	ears	-						
iquararii	design and constructi	ion, Bioremediation in Aquaculture system,											
201100	\$1500	WCONNY LABOUR	TOTA	AL PERI	ODS	4	5						
27 (23)	E OUTCOMES												
At the en	d of this course, the st	udents will be able to		BT MAI									
	abarata tha physical a	1111		(Highest Understa			2)						
COI el	abbiate the physical at	nd biological nature of the marine environm	ICIII.			111							
		nd biological nature of the marine environment.				(K	2)						
CO2 de	escribe the important n	nicroorganisms in the marine environment.		Understa	nding								
CO2 de	escribe the important n stinguish the causes of chnologies.	nicroorganisms in the marine environment. f marine pollution, impacts and managemen	nt		nding								
CO2 de CO3 di tec CO4 ex	escribe the important n stinguish the causes of chnologies. plore the active ingree	nicroorganisms in the marine environment.	nt	Understa	nding	(K.							
CO2 de CO3 di tec CO4 ex ap	escribe the important nation of the causes of the cause of the ca	nicroorganisms in the marine environment. f marine pollution, impacts and managemen	r	Understa Understa	nding nding (K3)	(K.							

*

- 1. Munn CB, "Marine microbiology: ecology & applications", CRC Press, 2019.
- 2. Levinton JS, "Marine Biology: Function, Biodiversity, Ecology", 5th edition Oxford University Press, 2017.

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- 2. Kim SK, ed. "Springer Handbook of marine biotechnology", Berlin/Heidelberg, Germany: Springer,
- 3. Gautam NC, "Aquaculture Biotechnology", Shree Publishers and Distributors. 2007.
- 4. Gal YL, Ulber R, Antranikian G, "Marine Biotechnology (Vol. 96)", 2005.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

	PO's													
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
COI	1	1	1	1	-	-	1	-	-	-	-	2	2	2
CO2	1	1	1	1	-	-	1	2	-	2	-	2	2	2
CO3	1	1	1	1	-		. 1	-	-	-	-	2	2	2
CO4	3	2	2	1	-	-	2	-	-		-	2	1	3
CO5	2	3	2	1	5 <u>4</u>	-	2 ·	3-11	-	-	-	2	1	3



COU	0154	BI	IOS	SAFE	ГҮА	ND HA	ZAK	D MAN	AGEN	IENT		3	0	0	3
		BJECTIVES	D.												
To en		e students to													
1	outlin	e the safety pr	roce	edures	and p	rotocol	s for i	ndustrial	hazar	d ident	ificatio	on and as	sessm	nent.	
2		re the awarene			- 5			_	lelines	•					
3	asses	s the risk analy	ysis a	and th	ne stri	ngency	requir	rements.							
4	recog	nize the applic	cable	le lega	l requ	irement	ts to o	btain aut	horiza	tions.					
5	audit	about the biori	risk n	manag	gemer	it progra	am.								
UNIT	ri i	NTRODUCT	LION	N											9
Need	for sat	ety in industr	ries;	; Safe	ty Pr	ogramn	nes –	compon	ents a	nd rea	ilizatio	n; Poten	tial h	azar	ds -
extren	ne oper	ating condition	ns, to	toxic c	hemi	cals; saf	fe han	dling.							
UNIT	II (QUALITY CE	HEC	CKS											9
Imple	mentati	on of safety pr	roce	edures	– pe	riodic ir	nspect	ion and	replace	ement;	Accide	ents –ide	ntific	ation	and
prever	ntion; p	romotion of in	ndust	strial s	afety.										
UNIT	III	RISK ANALY	YSIS	S											9
Overa	ıll risk a	nalysisemerg	rgenc	cy pla	nning	g-on site	and o	off-site e	merge	ncy pla	anning	, risk ma	nager	nent	ISC
14000	, EMS	models case s	studi	lies. Q	uanti	tative ri	isk ass	sessment	– гар	id and	compr	ehensive	risk	anal	ysis
Risk d	due to ra	adiation, explo	osion	n due t	to ove	er pressi	ure, je	t fire-fire	e ball.						P0. II
UNIT	IV	SAFETY AUD	DITS	`S										T	9
Hazar	d ident	ification safety	ty au	udits,	check	clist, wl	hat if	analysis	, vulne	erabilit	y mod	els even	t tree	ana	lysis
fault ti	ree ana	lysis, Hazan pa	ast a	accide	nt ana	ılysis Fi	ix bore	ough-Me	xico-N	/ladras	- Vizag	g Bopal a	nalys	is.	21
UNIT	V	HAZARDOUS	S OI	PERA	OITA	NS								T	9
Hazop	o-guide	words, param	neter	ers, de	rivati	on-caus	ses-co	nsequenc	ces-rec	omme	ndation	1-coarse	Hazo	p st	udy-
case st	tudies-p	oumping syster	m-re	eactor-	-mass	transfe	r syste	em.							
							a syste								
							1 3/30				TOT	AL PER	TOD	S	45
COUL	RSE O	UTCOMES								NE	ТОТ	AL PEF	TOD	S	15
- 12 10 10 10 10 10 10 10 10 10 10 10 10 10		UTCOMES this course, the	ne stu	tudents	s will	be able					тот	AL PER			45
At the	end of	this course, the					to				ТОТ	BT MA	PPE	D vel)	
At the	end of	this course, the	ts of	f biosa	ıfety g	guidelin	to es.				тот	BT MA (Highest Underst	PPE st Lev	D vel) ng (K	
At the	end of articul	this course, the	ts of try sa	f biosa	ifety g	guideline	to es. qualit	y check.				BT MA (Higher Underst	PPE st Lev andin	D vel) og (K	
CO1 CO2 CO3	articul recogn	this course, the ate the insights nize the industrate the possibil	ts of try sa ilities	f biosa safety p	fety g protoc	guideline cols for alysis fo	to es. qualit	y check.	fety as		ent.	BT MA (Higher Underst Applyin Analysi	PPE st Lev andin ng (K.	D vel) ng (K 3)	
At the	articul recogn	this course, the ate the insights nize the industrate the possibil the knowledge	ts of try sa ilities	f biosa safety p	fety g protoc	guideline cols for alysis fo	to es. qualit	y check.	fety as		ent.	BT MA (Higher Underst	PPE st Lev andin ng (K.	D vel) ng (K 3)	
At the CO1 CO2 CO3 CO4	end of articul recogn correla apply measu	this course, the ate the insights nize the industrate the possibil the knowledge	ts of try sa ilities e of	f biosa safety p es of ri	fety g protocisk and ing pr	guideling cols for alysis for rinciples	to es. qualit or indu	y check. ustrial sa laborator	fety as		ent.	BT MA (Higher Underst Applyin Analysi	APPE st Lev candin ng (Ka ng (Ka	D vel) ng (K 3) (4)	
At the CO1 CO2 CO3 CO4 CO5	end of articul recogn correla apply measu	this course, the ate the insights nize the industrate the possibil the knowledge res.	ts of try sa ilities e of	f biosa safety p es of ri	fety g protocisk and ing pr	guideling cols for alysis for rinciples	to es. qualit or indu	y check. ustrial sa laborator	fety as		ent.	BT MA (Higher Underst Applyin Analysi	APPE st Lev candin ng (Ka ng (Ka	D vel) ng (K 3) (4)	
At the CO1 CO2 CO3 CO4 CO5 TEXT	articul recogn correla apply measu illustra	this course, the ate the insights nize the industrate the possibil the knowledge res.	ts of try sa ilities e of	f biosa safety p es of ri worki	protocolsk and ing protocolsk and ing protocolsk and ing protocolsk and ing protocolsk and indicated and indic	guideline cols for alysis for rinciples	es. quality or indu	y check. ustrial sa laborator	fety as	ng all s	ent.	BT MA (Higher Underst Applyin Analysi Applyin	PPE st Lev candin ng (K. ng (K. ng (K.	D vel) ng (K 3) (4)	

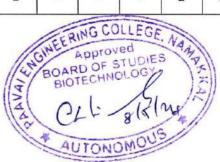
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CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

		4		720000			PO's		_6/				PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	2	-	2	1	2		-	-	1	1	3
CO2	3	3	3	3	-	3	1	2	-	-	-	1	1	3
CO3	3	2	1	2	=	3	-	42	-	-	-	1	2	3
CO4	3	1	2	2	-	3	1	2	-	-	-	2	2	3
CO5	3	2	2	2	_	3	1	2	-	-	-	2	3	3



BT2										3		0	1
		JECTIVES	3										
To ena	able the s	tudents to											
		ong foundat											
2	relate the	physicoche	emical p	roperties	s, pharma	cology ar	nd the fo	ormulatio	on of con	nmonl	y us	ed	
	biopharn	naceuticals.											
3	develop	and monitor	the dru	g prepara	ation acco	ording to	the norr	ns.					
		ze various n											
5	associate	the deeper	underst	anding of	f applicat	tion of bio	technol	logy tool	s in the v	world o	of m	edic	ine
UNIT	I IN	TRODUCT	TION										9
and re	gulatory				23					heir us	ses;	econ	OF
UNIT	rang lanes	RUG ACTI											9
	anism o acokinet	f drug a	ction;	physico-	-chemical	l princip	oles of	drug	metabo	olism;	rac	lioac	tiv
UNIT	III RI	CILATO											
100		GULATU	RY PR	ACTICE	ES								9
		uring pract	ices (G	MP); Go	od clinic							- 0	GI
	rugs and		ices (G	MP); Go	od clinic							- 0	GI
The D	rugs and	uring pract	ices (G Act, 194	MP); Go	od clinica dule M ar							- 0	GI pe
The D validat UNIT Dosag	rugs and tion. IV DI e form de	Cosmetics A RUG DOSA esign: Need	Act, 194 GE AN	MP); God 0; Sched D DELI	od clinica dule M ar IVERY	nd Y; App	erations	s monito	oring qua	design	ontro	lid d	GI pe
The D validat UNIT Dosag forms:	rugs and tion. IV DI powder powder ermal drugs	Cosmetics A	GE AN for dos capsul system;	MP); God 0; Sched D DELI age form es and ta	od clinical dule M are IVERY as, General ablets; Secutical in	al consider emisolidenserts: sup	erations dosage	in Dosa forms:	ge form	design	; So	lid d	GI pe
The D validat UNIT Dosag forms:	rugs and tion. IV DF e form de powder ermal drugs; Steri	Cosmetics A RUG DOSA esign: Need s, granules,	GE AN for dos capsul system;	MP); God 0; Sched D DELI age form es and to Pharmace	od clinical dule M are IVERY as, General ablets; Secutical in	al consider emisolidenserts: sup	erations dosage	in Dosa forms:	ge form	design	; So	lid d	GI pe
The D validat UNIT Dosag forms: transde solutio UNIT	rugs and tion. IV DF e form de powder ermal drugs; Steril	Cosmetics A RUG DOSA esign: Need s, granules, ag delivery s e dosage for	GE AN for dos capsul system; pa	D DELI age form es and ta Pharmac renteral (od clinica dule M ar IVERY as, Genera ablets; So ceutical in	al conside emisolid nserts: sun s), Biolog	erations dosage ppositor	in Dosa forms: ries and ecine).	ge form ointment	design ts, cre	; So ams	ol; ty	GI pe
The D validat UNIT Dosage forms: transde solutio UNIT Variou	rugs and tion. IV DF e form de powder ermal drugs; Steril V BF es categories	Cosmetics A RUG DOSA esign: Need s, granules, g delivery s e dosage for	GE AN for dos capsul system; pa	D DELI age form es and ta Pharmac renteral (od clinica dule M ar IVERY as, Genera ablets; So ceutical in	al conside emisolid nserts: sun s), Biolog	erations dosage ppositor	in Dosa forms: ries and ecine).	ge form ointment	design ts, cre	; So ams	ol; ty	GI pe
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The D validat UNIT Dosag forms: transde solutio UNIT Variou hormo	rugs and tion. IV DF e form de powder ermal drugs; Steril V BF es categornes and te	Cosmetics A RUG DOSA esign: Need s, granules, g delivery s e dosage for OPHARMA ories of th	GE AN for dos capsul system; pa	D DELI age form es and ta Pharmac renteral (od clinica dule M ar IVERY as, Genera ablets; So ceutical in	al conside emisolid nserts: sun s), Biolog	erations dosage ppositor	in Dosa forms: ries and ecine).	ge form ointment inserts; I	design ts, cre Liquid	; So ams dos	and and anntib	GI per solution of the solutio
The D validat UNIT Dosage forms: transde solutio UNIT Variou hormo	rugs and tion. IV DF e form de powder ermal drugs; Steril V BF is categornes and the end of the en	Cosmetics A RUG DOSA esign: Need s, granules, ag delivery s e dosage for OPHARMA ories of the ciologicals. CCOMES is course, the	GE AN for dos capsul system; prms: pa	MP); Godon (Control of the Control o	IVERY as, General ablets; Secutical in (injections)	al consider emisolidenserts: sup s), Biolog	erations dosage ppositor gics (vac	in Dosa forms: ries and ecine).	ge form ointment inserts; I	design ts, cre Liquid	; So ams dosass, a	ol; ty	GI glos for iot
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The D validat UNIT Dosage forms: transde solutio UNIT Variou hormo	rugs and tion. IV DE e form de powder ermal drugs; Sterii V BE us categornes and the end of the review to the tion.	Cosmetics A RUG DOSA esign: Need s, granules, ag delivery s e dosage for OPHARMA ories of the ciologicals. CCOMES is course, the	GE AN for dos capsul system; rms: pa ACEUT rerapeut dosage	MP); Godon (Control of the Control o	IVERY as, General ablets; Societical in (injections) vitamins	al consider emisolidenserts: suppose s, laxative manufacture	erations dosage ppositor gics (vacues, ana	in Dosa forms: ries and ecine).	ge form ointment inserts; I	design ts, cre Liquid ceptive	; So ams dosass, a	and and anntib	GI pe
The D validat UNIT Dosage forms: transde solutio UNIT Variou hormo COUF At the	rugs and tion. IV DE e form de powder ermal drugers; Sterie V BE end of the review to clarify the steries and the steries are steries and the steries are steries and the steries are ste	Cosmetics A RUG DOSA esign: Need s, granules, g delivery s e dosage for OPHARMA ories of the biologicals. CCOMES is course, the	GE AN for dos capsul system; rms: pa ACEUT rerapeut dosage okinetic	MP); Godon (Control of the Control o	IVERY as, General ablets; So ceutical in (injections) vitamins be able to ad their mers of drugers	al consider emisolidenserts: suppose s, laxative manufacture	erations dosage ppositor gics (vacues, ana	in Dosa forms: ries and ecine).	ge form ointment inserts; I	design ts, cre Liquid ceptive BT M. (Highe	r; So ams dosass, a	and and age for antibooks PED Level ding	GI pe
The D validat UNIT Dosag forms: transde solutio UNIT Variou hormo COUF At the	rugs and tion. IV DF e form de powder ermal druger erman	Cosmetics A RUG DOSA esign: Need s, granules, ag delivery s e dosage for OPHARMA ories of the iologicals. CCOMES is course, the the different the pharmaco the princip the various of	GE AN for dos capsul system; parms: parms: parms: parms: dosage dosage okinetic oles of dosage okinetic oles oles oles oles oles oles oles oles	MP); Godon (Control of the Control o	IVERY as, General ablets; Some countries of druce and their mers of druce and	al consider emisolided inserts: suppose solutions, laxative manufactures in the m	erations dosage ppositor ves, and	in Dosa forms: ries and ecine).	ge form ointment inserts; I	design ts, cre Liquid ceptive AL PE BT M. (Highe Unders	r; So ams dos.	and and and and another body by the body b	glos gformiot (K

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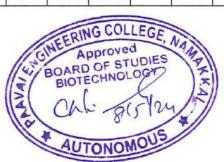
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CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

						PO'	S						PSO's	9
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	-	-	1	-	-	-	-	2	2	2
CO2	1	1	3	1	-	-	1	-	-		-	2	2	2
CO3	3	2	2	1	-	-	1	520	-	-	-	1	3	3
CO4	2	2	3	2	-	-	1	-	-	-	2	2	3	2
CO5	2	2	2	1	1		1	-	-	-	2	2	3	2



BT202	52		TIS	SSUE EI	NGINE	ERING			3	0	0	3
COURS	SE O	BJECTIVES										
To enab	le the	students to	W-12-									
1	defin	ne the fundamen	tals of tissi	ie engine	eering a	nd tissue	repairing.					
2	relat	te the tissue arch	itecture in	tissue en	gineerii	ng for var	ious applic	eations.				
3	class	sify the major co	mponents	of tissue	engine	ered scaff	olds.					
4	appl	y the basic conce	ept behind	tissue er	ngineeri	ng focusi	ng on the s	tem cells.				
5	cate	gorize the applic	ation of tis	sue engi	neering	to world	wide diseas	ses.				
UNIT I	I	NTRODUCTIO	ON									9
Introduc	tion	to tissue engine	ering: Bas	ic defini	ition; cu	rrent sco	pe of dev	elopment;	use ir	ther	apeu	itics,
cells as	the	rapeutic agents,	, cell nun	nbers a	nd grov	vth rate:	, measure	ement of	cell	chara	cteri	stics
morphol	ogy,	number viability	y, motility	and fund	ctions. N	Aeasuren	ent of tiss	ue charact	eristic	s, app	eara	ince,
cellular	comp	onent, ECM con	mponent, m	echanica	al measu	rements	and physic	al properti	es.			
UNIT II	r I	TISSUE ARCHI	ITECTUR	E								9
Tissue t	ypes	and Tissue comp	ponents, T	issue rep	pair, En	gineering	wound he	aling and	seque	nce o	fev	ents.
Basic w	ound	healing Applica	ations of g	rowth fa	ctors: V	EGF/ang	giogenesis,	Basic pro	pertie	s, Ce	ll-M:	atrix
and Cell	-Cell	Interactions, tele	omeres and	l Self-rer	newal, C	Control of	cell migra	tion in tiss	sue eng	gineer	ing.	
UNIT II	I E	BIOMATERIAI	LS									9
Biomate	rials:	Properties of b	oiomaterials	s, Surfac	e, bulk	mechan	ical and b	iological 1	oropert	ies. S	Scaff	òlds
and tiss	sue e	engineering, Tyl	pes of bi	iomateria	als, bio	logical	and synth	etic mate	rials,	Biop	olyn	iers,
Applicat	ions	of biomaterials, l	Modification	ons of B	iomateri	als, Role	of Nanote	chnology.				
UNIT I	V E	BASIC BIOLOG	GY OF ST	EM CE	LLS					-		9
Stem Ce	ells:	Introduction, he	matopoieti	c differe	entiation	pathwa	y Potency	and plast	cicity of	of ste	m c	ells,
sources,	emb	ryonic stem cell	ls, hemato	poietic a	and mes	enchyma	l stem cel	ls, Stem (Cell m	arker	s, F	ACS
analysis,	Diff	erentiation, Sten	n cell syst	ems- Liv	ver, neu	ronal ste	m cells, T	ypes and	source	s of s	stem	cell
with cha	racte	ristics: embryoni	ic, adult, ha	aematopo	oetic, fe	tal, cord	olood, plac	enta, bone	marro	w, pr	imor	rdial
germ cel	ls, ca	ncer stem cells in	induced ple	uripoten	it stem c	ells.						
UNIT V	(CLINICAL APP	PLICATIO	NS								9
Stem ce	II the	erapy, Molecular	r therapy,	In vitro	organo	genesis,	neurodege	nerative d	isease	s, spi	nal	cord
injury, h	eart o	disease, diabetes.	, burns and	d skin ul	cers, m	uscular d	ystrophy, o	orthopaedi	c appl	icatio	ns, S	Stem
cells an	d Ge	ene therapy Phy	ysiological	models	s, issue	enginee	red therap	ies, produ	ict ch	aracte	erizat	tion,
compone	ents, s	safety, efficacy. l	Preservatio	n –freez	zing and	drying. I	Patent prote	ection and	regula	tion (of tis	sue-
engineer	ed pr	oducts, ethical is	ssues.									
								TOTA	L PEI	RIOI	S	45

COUF	RSE OUTCOMES	
At the	end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	articulate the basic components of tissue engineering and tissue repairing	Understanding (K2)
CO2	explain the components of the tissue architecture	Understanding (K2)
CO3	identify the properties and broad applications of biomaterials	Applying (K3)
CO4	illustrate the stem cell characteristics and their relevance in medicine	Applying (K3)
CO5	examine the role of tissue engineering and stem cell therapy for clinical applications	Analysing (K4)

- 1. Palsson BO, Bhatia SN, "Tissue Engineering", Pearson Education India, 2016.
- 2. Meyer U, Meyer T, Handschel J, Wiesmann HP, "Fundamentals of Tissue Engineering and Regenerative Medicine", Springer Science and Business Media, 2009.

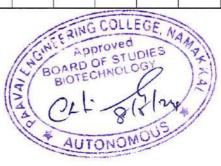
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- 2. Gorodetsky R, Schäfer R, "Stem cell-based tissue repair" RSC Publishing, 2011.
- Lanza R, Verfaillie C, Weissman I, West MD, Blau H, Gearhart J, Hogan B, Melton D, Moore M, Pedersen R, Thomas ED, editors. Handbook of stem cells, two-volume set: volume 1-Embryonic stem cells; volume 2-Adult and fetal stem cells. Elsevier, 2004.
- 4. Lanza R, Gearhart J, Hogan B, Melton D, Pedersen R, Thomas E, Thomson J, Gearhart IW, "Essential of Stem Cell Biology", Elsevier Academic Press, 2nd Edition, 2014

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					PO'	S							PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	3	2	-	-	-	-	-	-	3	2	2
CO2	2	3	2	3	2	-	-			-	-	3	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	3	2	2
CO4	3	3	2	3	2	-	(80)	-	-	-	-	3	2	2
CO5	3	3	2	3	2	-		-	-	-	-	3	2	2



BT2	0253	FORENSIC SCIENCE AND TECHNOLOGY	3	0	0	3	}
COU	RSE OI	BJECTIVES					
To en	able the	students to					
1	explai	n the methods and principles of forensic investigations.					
2	unders	stand how forensic science can be applied in criminal investigations.					
3	apply	basic scientific principles of ballistics in forensic science.		9000			
4	exami	ne the crime scenes using various patterns analysis.					
5	utilize	molecular analysis techniques for the identification of suspects.					
UNIT	I	NTRODUCTION TO FORENSIC SCIENCE				9	
Introd	luction t	o Crime Laboratories, Responsibilities of the Forensic Scientist, Secu	ring and	Sea	irch	ing t	he
Crime	Scene,	Recording and Collection of Crime Scene Evidence, Document Exam	nination,	Eth	ics	and	
Integr	ity.						
UNIT	TII D	DISCOVERY AND RECOVERY OF HUMAN REMAINS				9	
The A	utopsy	and Handling of a Dead Body, The Stages and Factors of Decompo-	sition, d	eter	min	ing t	he
Age a	nd Prov	enance of Remains, Asphyxia, Gunshot Wounds, Bite Marks.					
UNIT	III B	ALLISTICS				9	
Types	, applic	eation, forensic ballistic procedures (internal, external and ter	minal	oalli	stic	s) a	nc
identi	fication	of firearms, Available ballistic databases.					
UNIT	IV P	ATTERN ANALYSIS				9	
Huma	n Tissu	es, Body Fluids and Waste Products, Fingerprints, Hair, Teeth,	Blood,	Det	ecti	ng t	he
Preser	nce of B	lood, Bloodstain Pattern Analysis, Forensic anthropology, Paleontolog	gy, Tox	colo	ogy.		
UNIT	'V F	INGER PRINTING AND RAPD IN FORENSICS				9	
Mitoc	hondrial	, DNA, DNA Finger Printing- RFLP. STR Genotyping issues, VNT	RS and	STR	ξ, m	t DN	ΙA
analys	sis, Iden	tification of suspects. RAPD in Forensics, Study of Kinnship by	DNA I	rofi	ling	, Ca	ise
Studie	es.						
		TOTA	L PER	IOD	S	45	
COU	RSE OU	JTCOMES					
At the	end of	this course, the students will be able to	BT M	IAP	PE	D	_
			(High				
CO1	explair	the principles of forensic science to infer forensic investigation.	Unde	rstaı	ndin	ıg	
CO2	figure	evidence with proper methods of investigation through biological	(K2) Unde	rstai	ndin	ıg	
	sample		(K2)			C	
CO3	investi	gate the concepts, principles, and significance of ballistics in forensic	THE CONTRACT OF SELECTION OF SE	ing	(K.	3)	
CO4	the cri	se the knowledge of various patterns analysis in forensics to examine me scenes.		ing	(K.	3)	_
CO5	discove dispute	er the role of molecular based techniques in forensics to analyse es.	Apply	ving	(K.	3)	

- 1. Lincoln PJ, Thomson J, "Forensic DNA Profiling Protocols", Humana Press, 2011.
- 2. Rudin N, Inman K, "An Introduction to Forensic DNA Analysis", 2nd Ed. CRC Press. 2002.

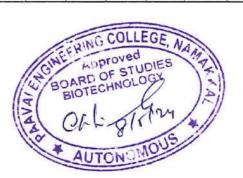
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						I	'O's		- 0				PS	O's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1	-	-	-	-	-	-	1	3	3
CO2	2	1	1	2	1	84	-	-	20	-	-	1	1	3
CO3	2	2	1	1	1	-	1 1 1	-	-	-	-	2	2	2
CO4	1	1	1	1	1	-	-		•	-	-	1	2	2
CO5	3	1	1	1	1	-	-	-	-	-	-	1	1	1



BT20	254	15	AKTIFIC	CIAL IN	TELLIGI	NCE FO.	R BIOT	ECHNO	DLOGY	Y	3	0	0	3
COU	RSE	OBJEC	TIVES											
To en	able t	he stude	nts to											
1	infe	er the co	ncepts of	artificia	l intelligend	ce.								
2	exte	end the	knowledge	e repres	entation.									
3	rela	ite the e	kpert syste	ems in a	rtificial inte	elligence.								
4	cho	ose the	methods o	of solvin	g problems	using arti	ficial inte	elligence	е.					
5	ideı	ntify the	concepts	of expe	rt systems a	ınd machir	ne learnii	ng on va	rious ap	pplicat	tions.			
UNIT	I	INTRO	DUCTIO	N TO A	AI AND PR	ODUCTI	ON SYS	STEMS						9
strateg Proble Depth	gies. em so first	Problem lying n and B	n charact nethods –	eristics, Probler , Const	Production Production graphs, I	n system Matching,	charact	teristics g and H	-Speci Ieuristic	ialized c func	l produ	ction Hill (syst Climb	tem- ing-
UNIT			ESENTA		DE L'MON	LEDCE								
predic	ate c	alculus,	nowledge	on, Use	ntation, Kn	owledge r					0.000			
predic Structs UNIT Know Forwa	ate cured ruled ruledge	knov represen represe	nowledge Resolution of k VLEDGE Intation -P Rule value	inowled INFEF Production approximately read approximately rea	ntation, Kn e of predic ge.	owledge recate calcu	lus, Kno	owledge d systen	repres	entation	on usin	ng otl	her lo	n to ogic 9
predic Structon UNIT Know Forwa Netwo	ate cured rured rured ruledge rd chork-De	KNOV representation representations, empster	nowledge Resolution of k VLEDGE ntation -P Rule valu — Shafer t	on, Use inowled INFEF Production are appro- theory.	ntation, Kn e of predic ge. RENCE	owledge recate calcu	lus, Kno	owledge d systen	repres	entation	on usin	ng otl	her lo	n to ogic 9 ing, sian
UNIT Know Forwa Netwo	III ledge rd ch	KNOV represe aining, empster	Resolution of k VLEDGE Intation -P Rule valu - Shafer t	INFEF Production appro- theory.	ntation, Kn e of predic ge. RENCE on based sy bach, Fuzz	owledge recate calcu	ilus, Kno ime base ing – Cer	d system	n. Infer	entation rence - Bayes	on usin - Backv	ward	chain Baye:	n to ogic 9 ing, sian
UNIT Know Forwa Netwo UNIT Experi	III ledge rd chork-Do	KNOV represe anining, empster EXPE	Resolution of k VLEDGE Intation -P Rule valu - Shafer t CRT SYST	INFEF Production appro- cheory. FEMS Te of ex	ntation, Kn e of predic ge. RENCE	owledge recate calcu	ame base	d system	n. Inferactors,	rence - Bayes	- Backy Sian The	ward eory	chain Baye:	n to ogic 9 ing, sian 9
UNIT Know Forwa Netwo UNIT Expert	III ledge rd chork-Do	KNOV represe aaining, empster EXPE	Resolution of k VLEDGE Intation -P Rule valu — Shafer t CRT SYST Trehitectur ics. Typic	INFER Production appro- cheory. FEMS Te of example of e	ntation, Kn e of prediction ge. RENCE on based sy bach, Fuzz	owledge recate calculate calculate calculate yetem, France	ame base ag – Cer of expert	d system tainty f	n. Inferactors,	rence - Bayes	- Backy Sian The	ward eory	chain Baye:	n to ogic 9 ing, sian
UNIT Know Forwa Netwo UNIT Expert knowl UNIT Mainta Virtua Care S	III ledge rd chork-De rd chork-De rd chork-De rd chork-De rd	KNOV representationing, empster EXPF ems - A Heurist AI FO g medicates, Me n Analy	Resolution of k VLEDGE Intation -P Rule valu - Shafer t CRT SYST Irchitectur ics. Typic OR HEAL Il records dication M	INFEF Production are appropriate appropria	ntation, Kn e of prediction ge. RENCE on based sy oach, Fuzz pert system t systems – RE AND I her data, denent, Drug f AI in Pha	owledge recate calculate calculate calculate calculates, Francisco, Francisco	of expert DART, 2 RIAL AP itive job	d systems tainty for systems XOON, PLICA s, Treat	represent Inferior in Expert TIONS	rence - Bayes owledg system sesign,	Backy Backy Bian The Beachy Bian The Bian Shells Digital	ward ward eeory	chain Bayes n - M	n to ogic 9 ing, sian 9 leta 9 ion, alth
UNIT Know Forwa Netwo UNIT Expert knowl UNIT Mainta Virtua Care S	III ledge rd chork-De rd chork-De rd chork-De rd chork-De rd	KNOV representationing, empster EXPF ems - A Heurist AI FO g medicates, Me n Analy	Resolution of k VLEDGE Intation -P Rule valu - Shafer t CRT SYST Irchitectur ics. Typica OR HEAL al records dication M sis. Applie	INFEF Production are appropriate appropria	ntation, Kn e of prediction ge. RENCE on based sy oach, Fuzz pert system t systems – RE AND I her data, denent, Drug f AI in Pha	owledge recate calculate calculate calculate calculates, Francisco, Francisco	of expert DART, 2 RIAL AP itive job	d systems tainty for systems XOON, PLICA s, Treat	represent Inferior in Expert TIONS	entation rence - Bayes owledg system sesign, alth M	Backy Backy Bian The Beachy Bian The Bian Shells Digital	ward eeory isitions.	chain Bayes n - M sultat nd He	n to ogic 9 ing, sian 9 leta 9 ion, alth
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CO3	formalize a given problem in the language/framework of different ai method	Applying (K3)
CO4	develop an understanding of knowledge inference and expert systems	Applying (K3)
CO5	develop an understanding of knowledge inference and expert systems	Applying (K3)
	formulate AI based solutions for industrial and healthcare applications	

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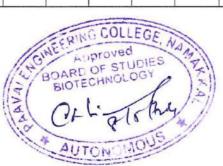
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						PO	's						PSO'	s
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1	-	1	1	-	-	1	1	3	3
CO2	2	1	1	2	1	-	2	1	-	-	1	1	1	3
CO3	2	2	1	1	1	-	1	1	_	-	1	2	2	2
CO4	1	1	1	1	1	-	2	2	-	-	1	1	2	2
CO5	3	1	1	1	1	•	2	1	-	-	1	1	1	1



BT209	01 BIOENERGY AND BIOFUELS		3	(0	3		
COURS	SE OBJECTIVES							
To enabl	le the students to	110						
1	explore the scope of biofuels for newer generation.							
2	describe the expertise in the technology of ethanol production							
3	outline existing conventional fuels and strive them towards sustainable	e develop	ment					
4	interpret the concept, advantages and limitations of fuels obtained from	n biologic	cal sou	rce	s			
5	utilize bolster green technology for various applications							
UNIT I	I INTRODUCTION							
Cellulosi	c Biomass availability and its contents. Lignocellulose as a chemi	cal resou	rce. P	hys	sical	and		
chemical	pretreatment of lignocellulosic biomass. Cellulases and lignin degradi	ng enzym	ies.					
UNIT II	ETHANOL				T	9		
Ethanol a	as transportation fuel and additive; bioethanol production from carboh	ydrates; e	nginee	erin	g str	ains		
for ethan	ol production from variety of carbon sources to improved productivity.							
Contract of the Contract of th	I BIODIESEL				-			
UNIT III	BIODIESEL				1	9		
	y and Production Processes; Vegetable oils and chemically production	cessed bi	ofuels	; E	Biodi	200		
Chemistr						esel		
Chemistr composit	ry and Production Processes; Vegetable oils and chemically production					esel		
Chemistr composit	y and Production Processes; Vegetable oils and chemically pro- ion and production processes; Biodiesel economics; Energetics of a greenhouse gas emissions Expanding biodiesel production.					esel		
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Chemistr composit effects on UNIT IV Biodiesel	y and Production Processes; Vegetable oils and chemically pro- ion and production processes; Biodiesel economics; Energetics of a greenhouse gas emissions Expanding biodiesel production.	biodiese	epts,	Bio	buta	esel and 9 nol,		
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	PO's													PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
COI	2	3	3	2		1	3	1	-	-	1	1	2	3	
CO2	2	3	3	3	2.5	1	2	1		-	1	1	2	2	
CO3	3	3	3	3	25	1	2	2	.52	E STATE OF THE STA	2	1	2	3	
CO4	3	2	2	2		1	1	1	1	-	1	1	1	1	
CO5	2	2	2	2	-	1	1	1	1	-	1	1	1	2	



COUR	902	A	GRICULTURE	BIOTECHNOLOG	Y	3	0	0	3
	SE OBJECTI	VES							L
To enal	ble the students	to				(.•)			0150
1	define the co	ncepts of	genomic markers	, and crop improvem	ent with eth	ical values.			
2	relate the kno	owledge i	n the plant metabo	olic pathways.					
3	develop gene	tically m	odified crops for	pest management.					
4	select softwa	re tools in	n plant genome str	udy.					
5	identify the b	oioethics a	and global issues i	n agriculture sector.					1000
UNIT I	INTROD	UCTION	1					9)
History	and scope of a	gricultur	al biotechnology-	maps, markers and c	comparative	genomics, c	loni	ng ge	ne
				model- Gene disco					
	ry from orfeon			2					
UNIT I	I METABO	DLISM I	N CROPS			N.		9)
General	strategy for pl	ant metal	oolic engineering-	case studies: engine	ering of prin	nary metabo	lic r	athw	av
				gineering of novel m					
UNIT I			MENT BIOTECH			-	-	9)
Pest dis	covery and de	velopmer	nt – case studies-	development of tar	get specific	pesticides-	pest	1	
				nprovement of biolog			p - 0.	10101	
UNIT I		Annual Property	CS IN AGRICU					9	
Plant ge	enome initiativ	1.01	4 3 5 5 5 5						
	monite mittativ	es- AGI,	TIGR, ESSA, LI	IS- Plant ontology-	plant pathog	en genome	SPO	nenci	
				IS- Plant ontology-					ng
fungal				S- Plant ontology-					ng
fungal AGMAF	plant pathoge RKNET.	en datab		l information reso				GOR	ng (A
fungal AGMAF UNIT V	plant pathogo RKNET. BIOETHI	en datab	ease- agricultura	l information reso	urces – F	AO, AGR	IS-A	GOR	ng:
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fungal AGMAF UNIT V Values o	plant pathogo RKNET. BIOETHI of bioethics- Et	en datab	ease- agricultura	ES sues (ELSI) - climati	urces – F	AO, AGR	ffec	GOR 9 t -glo	ng:
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fungal AGMAF UNIT V Values of warming	plant pathogo RKNET. BIOETHI of bioethics- Et g – population of	ICS AND hical, Logdensity- in	oase- agricultura OGLOBAL ISSU gical and Social is mpact on biosphe	ES sues (ELSI) - climatire.	urces – F	AO, AGR	ffec	9 t -glo	ng:
fungal AGMAF UNIT V Values of the cours At the er	plant pathogork RKNET. / BIOETHI of bioethics- Et g – population of BE OUTCOMI	ICS AND hical, Log density- i	pase- agricultura OGLOBAL ISSU gical and Social is mpact on biosphe dents will be able	ES sues (ELSI) - climatire.	urces – F	reenhouse e L PERIOD . BT MAP (Highest	ffec S PEI Lev	9 t -glo 45	ng (A
fungal AGMAF UNIT V Values of warming COURS At the er	plant pathogork RKNET. BIOETHI of bioethics- Et g – population of this cours relate the agriculation of the properties	ICS AND hical, Log density- i	ogen agricultura OGLOBAL ISSU gical and Social is mpact on biosphe dents will be able	ES sues (ELSI) - climati re. to	ic change –g	reenhouse e	ffec S PEI Lev	9 t -glo 45	ng (A
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CO3	2	1	1	1	1	-	1	7-	-	-	-	3	2	3	
CO4	3	1	3	3	3	-	1	-	-	-	2	2	3	2	
CO5	1	1	2	1	1	-	1	3	-	-	2	3	2	2	

