PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637018

(AUTONOMOUS) B.Tech. BIOTECHNOLOGY

REGULATIONS 2023 (CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted during the academic year 2023 - 2024 onwards)

CURRICULUM

SEMESTER III

S. No.	Category	Course Code	Course Title	L	T	P	C
Theor	у						
1.	BS	MA23301	Transform Techniques and Partial differential equations	3	1	0	4
2.	PC	BT23301	Cell Biology	3	0	0	3
3.	PC	BT23302	Biochemistry	3	0	0	3
4.	PC	BT23303	Microbiology	3	0	0	3
5.	MC	MC23301	Environmental Sciences and Sustainability	2	0	0	0
Theor	y Cum Laborat	tory		'			
6.	ES	BT23304	Fluid Transport and Mechanical Operations	3	0	2	4
Practi	cal						
7.	PC	BT23305	Biochemistry Laboratory	0	0	4	2
8.	PC	BT23306	Cell and Microbiology Laboratory	0	0	4	2
9.	EE	GE23301	Professional Development I	0	0	2	1
			Total	17	1	12	22

SEMESTER IV

S. No.	lo. Category Code		Course Title	L	T	P	C
Theor	y						-
1.	BS	MA23403	Probability and Statistics	3	1	0	4
2.	PC	BT23401	Heat and Mass Transfer	3	0	0	3
3.	PC	BT23402	Biochemical Process Calculations	3	0	0	3
4.	PC	BT23403	Genetics and Molecular Biology	3	0	0	3
5.	MC	MC23402	Human Values and Gender Equality	2	0	0	0
Theor	y Cum Laborat	ory					
6.	PC	BT23404	Bio Analytical Techniques	3	0	2	4
Practi	cal						
7.	PC	BT23405	Heat and Mass Transfer Laboratory	0	0	4	2
8.	PC	BT23406	Molecular Biology Laboratory	0	0	4	2
9.	EE	GE23401	Professional Development II	0	0	2	1
			Total	17	1	12	22

Approved

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Approved

BOARD OF STUDIES

BIOTECHNOLOGY

AUTONOMOUS

AUTONOMOUS

Ky-Scho

MA	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4										
(Common	to Aero, Agri, E	ME, Biotech, Civil, Chemical, EEE, Food, 1	Pharma, Mech, M	ICT, R	&A)					
COU	RSE OB	JECTIVES									
To en	able the	students to									
1.		p the knowledge series.	of periodic and non-periodic functions and t	heir representation	ons usir	ıg					
2.	acquai	nt the student wit	h Fourier transform techniques used in wide	variety of situati	ions.						
3.	introdu	ice the basic con	cepts of PDE for solving standard partial diff	ferential equation	ıs.						
4.	variou	s situations.	h Fourier series techniques in solving heat f	low problems use	ed in						
5.	develo	p Z transform tec	hniques for discrete time systems.								
UN	I TI	FOURIER SEI	RIES				12				
			ral Fourier series; Odd and even functions; Fries; Parseval's identity; Harmonic Analysis		Statem	ent o	f				
UN	IT II	FOURIER TR	ANSFORMS				12				
			without proof); Fourier transform pair; Somentary functions; Convolution theorem; Pa			orm	-				
UNI	TIII	PARTIAL DIF	FERENTIAL EQUATIONS				12				
typ wit	es of firs	nt coefficients. FOURIER SEF	ntial equations; Lagrange's linear equation fferential equations; Linear partial different RIES SOLUTION TO PARTIAL DIFFER	tial equations of		orde					
		EQUATIONS					87.70				
			l wave and heat equation; Steady state two-	dimensional heat	equation	n.					
000000010	IT V		RMS AND DIFFERENCE EQUATIONS				12				
			properties; Inverse Z-transform; Method m; Solution of difference equations by Z-tra		on ; Re	esidue	9				
				TOTAL PER	IODS	(50				
COU	RSE OU	TCOMES			BT M	APPI	ED				
At th			udents will be able to		(Highe	st Lev	vel)				
COI	classify Fourier		of periodic and non-periodic vibrations w	ith the help of	Apply	ing (F	(3)				
CO2	apply th domain.		rm to convert the function from frequency	domain to time	Apply	ing (K	(3)				

CO3 demonstrate partial differential equations that occur in many engineering applications.	Applying (K3)
CO4 apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	Applying (K3)
CO5 apply knowledge of Z transform to analyse linear time invariant systems.	Applying (K3)

- Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
- 2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, (2018).

REFERENCES

- Erwin Kreyszig , "Advanced Engineering Mathematics", 10th Edition, Wiley Publications, New Delhi, India, 2016.
- 2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, New Delhi (2010).
- 3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
- 4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, 6th Edition, New Delhi, 2012.

CO PO MAPPING:

CO₅

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak PO's PSO's CO's CO1 CO₂ CO₃ CO4



	23301						CE	CLL	BIG	OLC	GY							3		0	1	0	Ì
COU	RSE OB	ECTIVES																					
To ena	ble the s	tudents to																					
1	impart l	knowledge o	n the	e c	ell,	, cyt	oskel	letor	n arc	chite	ctur	e an	d ce	ll ju	nctio	ns.							
2	inculcat	te the mechai	nism	n of	fc	ell p	olife	erati	on,	cont	rol a	nd c	anc	er.									
3	underst	and the basis	s of m	mo	lec	ular	trans	spor	t acı	ross	the 1	men	ıbra	nes.									
4	compre	hend various	s sign	nal	ling	g pat	hway	ys ar	nd th	heir	func	tion	s.										
5	educate	various tech	mique	ies	s to	stud	y cel	lls.						×									
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UNIT Cell fr	V TE	CHNIQUES	cyto	ome	etr	y, M	orph	olog	gy a	and i	dent												
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2. Cooper G, Adams K, "The Cell: A Molecular Approach", 9th Edition, Oxford University Press, 2022.

REFERENCES

- 1. Hardin J, Lodolce J, "Becker's World of the Cell", 10th Edition, Pearson, 2021.
- 2. Simon E, Dickey J, Jane, "Campbell Essential Biology", 6th Edition, Pearson, 2019.
- 3. Alberts B, Hopkin K, Johnson A, Morgan D, Roberts K, Walterp, Heald R, "Essential Cell Biology", 6th Edition, W. W. Norton & Company, 2023.
- 4. Pollard TD, Earnshaw WC, Lippincott-Schwartz J, Johnson G, "Cell Biology", 4th Edition, Elsevier, 2022.

CO/PO MAPPING:

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

			PSO's											
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	+		-	-	-	-	-	2	1	1
CO2	1	1	2	2		2	-	-	-		-	2	1	1
CO3	2	2	3	2	2	1	-	-	-	I L	-	1	1	1
CO4	2	2	3	3	-	2	-	1	-	-	-	1	2	2
CO5	3	3	2	2	2	2	=	1	-	-	-	1	3	2



	3302						RIOC	НЕМІ	STRY					3	0	0	3
			CTIVES														
To en	able t	he stude	ents to														
1	lear	n the fu	ındament	als of l	bio	chemic	cal pro	cesses	and bio	omolec	ules.						
2	und	erstand	the chem	nical ba	oasis	s which	h allow	vs biolo	gical r	nolecu	les to giv	ve rise t	to the pr	rocess			
3	com	prehen	d the stru	icture o	of n	nucleic	acid a	nd thei	r funct	ion.							
4	edu	cate var	ious met	abolic	pat	thways	s of car	rbohydr	ates ar	nd their	interco	nnection	n.				71
5	incu	lcate th	e metabo	olic pat	athw	vays of	f lipids,	, amino	acids	and pr	otein.						
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CO4	illustrate the metabolism of carbohydrates through various anabolic and catabolic pathways.	Applying (K3)
CO5	explore the intermediary metabolism and its regulation in biological functions.	Applying (K3)

- Nelson DL, Lehninger AL, Cox MM, "Lehninger Principles of Biochemistry", 6th Edition, W.H.Freeman and Company, 2017.
- 2. Satyanarayana U, Chakrapani U, "Biochemistry", 5th Edition, Books & Ailled (P), 2020.

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- Rodwell VW, Bender D, Botham KM, "Harper's Illustrated Biochemistry", 31st Edition, McGraw-Hill, 2018.
- 3. Voet D, Voet JG, Pratt CW, "Voet's principles of biochemistry", 5th Edition, John Wiley & Sons Inc., 2018.
- 4. Horton HR, Moran LA, Scrimgeour KG, Perry MD, Rawn JD, "Principles of Biochemistry", 5th Edition, Pearson New International, 2014.

CO/PO MAPPING:

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

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



BT	23303	MICROBIOLOGY		3	0	0	3
cou	IRSE	OBJECTIVES					
To er	nable t	he students to					
1	des	cribe the principles of microbiology to emphasize fundamentals of va	rious n	nicro	bes.		
2	reco	ognize structural organization, morphology and reproduction of micro	bes.				
3	state	the requirements for microbial growth and their lifecycle.					
4	solv	e the problems in microbial infection and their control.					
5	com	prehend the role of microbes in various industries and environment.					
UNIT	ГІ	INTRODUCTION				T	9
Basic	s of	microbial existence; history of microbiology, classification	and	nom	enc	atur	e of
– Lig	ht, daı	isms, microscopic examination of microorganisms, Principles and ap k field, phase contrast, fluorescence and electron microscopes;princi ike Gram staining, acid-fast, capsular staining, flagellar staining.					
UNIT	LII	MICROBES- STRUCTURE AND MULTIPLICATION					9
Struct	tural o	rganization and multiplication of bacteria, viruses, algae and fungi	with	spec	ialm	enti	on of
		of actinomycetes, yeast, mycoplasma and bacteriophages.	en code no en e		0.8340.8140		
UNIT		MICROBIAL NUTRITION, GROWTH AND METABOLISM				-	9
Nutrit	tional	requirements of bacteria; different media used for bacterial culture; gr	outh a	umya	and	d; f	
		quantify bacterial growth; preservation techniques; aerobic and ana					
		f energy for biosynthesis of important molecules.	ciobic	DIGE	nerg	CHC	s and
UNIT	Land to the	CONTROL OF MICROORGANISMS				_	9
		d chemical control of microorganisms; host-microbe interactions; a	nti bac	taria	Lar	y: 6	
		al agents; mode of action and resistance to antibiotics; clinically impo					-
UNIT		INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY	tant iii	icroc	nga	111311	9
		tabolites; secondary metabolites and their applications; preservation	of fo	od. "	d		
		alcohol, vitamin B-12; biogas; bioluminescence; bioremediation					
		sms; biofertilizers and biopesticides; microorganisms and pollution co					s by
						1 2	_
COLL	DSE C	OUTCOMES	`AL P	EKIC	JDS	4	5
At the	ena o	f this course, the students will be able to		MA ghest			
CO1	class	ify microorganisms and its methods of examination.		dersta			K2)
CO2	mult	ne the structural organization of microorganisms and understand the plication process.		dersta	andi	ng (K2)
CO3		rate nutritional requirements of microorganisms and to know their th and metabolism.	r Uno	lersta	andi	ng (K2)
CO4					T description		-
	10000 100	the technology to control of microorganisms.		olyin			
005		ify the use of metabolites and biotechniques for industrial and onmental applications.	I App	olyin	g (K	3)	
				_			

- Pelczar MJ, Chan ECS, Krein NR, "Microbiology", Tata McGraw Hill Edition, New Delhi, India, 2015.
- 2. Prescott LM, Hardy MP, Klein JP, "Microbiology", 8th Edition, McGraw Hill, New York, 2006.

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- Black JG, Black LJ, "Microbiology: principles and explorations", 10th Edition, John Wiley & Sons, 2018
- Ananthanarayan CK, Panikars J, "Textbook of Microbiology", 11th Edition, Orient Longman Private Limited, 2020.
- 3. Alberts B, Heald R, Johnson A, Morgan D, Raff M, Roberts K, Walter P, "Molecular Biology of the Cell", 7th International Student Edition, W.W. Norton & Company, 2022.
- 4. Talaro KP, Chess B, "Foundations in Microbiology", 10th Edition, McGraw-Hill Education, 2018.

CO/PO MAPPING:

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

						PO	's						PS	so's
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1	1		1	-	-	150	-	197	2	1	2
CO2	2	2	1	1	-	-	-	-	-	-	-	2	1	2
CO3	2	2	1	1	-	-	-	_	-	-	-	2	3	3
CO4	3	3	3	2	-	2	1	-1	-	-	14	3	3	3
CO5	3	3	3	2	-	2	1	-		-	-	2	3	2



	MC23301 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY 2 0 0 0
	COURSE OBJECTIVES
	To enable the students to
	establish the knowledge of precious resources of the environment and their various impacts.
	create awareness on ecosystem and biodiversity preserve.
	3 learn scientific and technological solutions to current day pollution issues.
	analyze climate changes, concept of carbon credit and the challenges of environmental management.
T .	5 understand green materials, energy cycles and the role of sustainable urbanization.
	UNIT I ENVIRONMENT AND NATURAL RESOURCES 6
	Definition, scope and importance of Environment. Forest resources: Use and over-exploitation,
	deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and
3	over- utilization of surface and ground water, dams-benefits and problems. Food resources: effects of
	modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural
	resources.
	UNIT II ECOSYSTEMS AND BIODIVERSITY 6
	Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains
	and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems.
	Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity
4	- Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of
	biodiversity.
	UNIT III ENVIRONMENTAL POLLUTION 6
	Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste
	management: Causes - effects - control measures of urban and industrial wastes. Role of an individual
	in prevention of pollution - Electronic waste -Sources-Causes and its effects- Pollution case studies-
	Field study of local polluted site – Industrial/Agricultural UNIT IV SUSTAINABILITY AND ENVIRONMENT 6
	U U U U U U U U U U U U U U U U U U U
	Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change— acid rain -
	ozone layer depletion. Regional and local environmental issues and possible solutions-case studies.
	Concept of carbon credit, carbon footprint. Environmental management in industry-A case study.
	UNIT V SUSTAINABILITY PRACTICES 6
	Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment -
	Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle,
	emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and
	technological change.
	TOTAL PERIODS 30
	TO A TELE PRINCIPO SU

At the	end of this course, students will be able to	BT Mapped (Highest Level)
CO1	find the method of conservation of natural resources	Understanding (K2)
CO2	understand ecosystem and the conservation of biodiversity.	Understanding (K2)
CO3	aware of environmental pollution and interpret its effects.	Understanding (K2)
CO4	apply sustainable development for technological advancement and societal development.	Applying (K3)
CO5	measure the sustainability practices for green energy cycles.	Analyzing (K4)

- 1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
- Gilbert M. Masters, Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

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- 2. C. S. Rao, Environmental Pollution and Control engineering, New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
- 3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., edition, 2020.
- Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 4th Edition, 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	7=	1	-	-	-	2	-	-	1	1	-	-	1	1
CO2	-	2	-	-	1	1	-	1	-	-	-	3 - 8	1	1
CO3	2	-	1	1	-	-	-	2	-0	(=)	-	2	1	1
CO4	-	2	-	-	1	-	3	1	1	-	1	1	3	2
CO5	2	2	-	1	-	-	2	1	-	-	-	1	3	3



BT23	304	FLUID T	ΓRA	ANS	SPO	RT /	AND	D M	ME	CH	ANI	CA	LO	PEI	RA	TIC	NS		3	0	2	4
COUR	SE OBJE	CTIVES			3														1	1		1
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1	impart th	e knowledge	e or	n pro	oper	rties	of fl	luid	ds ai	ınd i	ts flo	ow t	ypes	s.		1			-			
2 ·	understa	nd the engine	eeri	ing o	of fl	luid c	dyna	amic	cs f	for f	low	mea	sure	eme	nts							
3	inculcate	dynamic cha	ara	icter	ristic	es of	fluic	d flo	low	thre	ough	Ве	rnou	ılli's	s ec	quat	ion.					
4	compreh	end the vario	ous	type	es of	f pur	mps	and	d th	neir (chara	acte	risti	cs.								
5	extend k	nowledge on	ı siz	ze re	educt	tion	equi	iipm	nent	t and	d its	ana	lysis	s tec	chn	ique	s.					
UNIT I	1 220000	RODUCTIO																				9
		ids Newton																				
		, Types of flo																				
compre	ssible and	incompressi	sible	e flu	uids	– di	limer	ensic	onal	ıl an	alys	is R	tayle	eigh	m	etho	od and	d B	ucki	ngha	am	s Pi
theorem																						
UNIT I	I FLU	JID DYNAM	MIC	CS ·	4																•	9
Continu	ity equati	on, Bernoulli	li's	equ	atio	n, bo	ound	dary	y la	iyer	cond	litio	n, fe	orm	dr	ag,	skin c	drag	, dra	ig co	effi	cient
-flow th	rough pip	es – pressure	e dr	rop ı	unde	er lan	mina	ar ar	nd t	turb	ulen	t flo	w c	ond	litic	ns -	- maj	or a	nd n	inon	r los	ses.
UNIT I	II FLU	IID FLOW N	ME	EAS	SUR	MEI	NT				-		-			-			7	-		9
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		ter, magnetic																				
	manomet												.,			0101	٠, ٠,	luoc	, un	icic	iiia	and
UNIT I	V PUN	IPING EQU	UIP	PME	ENT	S			-	-			-			- 11						9
Pumps	- types,	selection a	and	d sı	peci	ificat	tions	s, p	pos	sitiv	e di	ispla	acen	nent	t p	um	ps, r	ecii	oroca	ating	. Di	ımp,
		rifugal pumps														5		•			. 1	, ,
UNIT V	ME	CHANICAL	LO	PEI	RAT	TION	NS						-				Contract Con					9
Size red	uction eq	uipment – op	per	ratio	ons a	and t	their	r cla	assi	ifica	tion	, Er	nergy	y an	nd I	oow	er rec	quir	eme	nts.	Lav	s of
		d closed circu																				
		and elevators							on the second									4				,
										Vision V						7	ГОТА	AL I	PER	IOI	os	45
LIST O	F EXPER	RIMENTS	_																			
1.	Determina	ntion of Calib	brat	tion	of R	Rotar	mete	er.				-				-						
2.	Determina	ition of coeffi	ficie	ent o	of di	ischa	arge	ofa	a ve	entu	rime	eter.	6	10,000								-
3.	Determina	tion of coeffi	ficie	ent c	of di	ischa	arge	ofa	a O	Orific	ce m	eter				-						
4. 1	Determina	tion of friction	ion	fact	tor fo	or flo	ow th	thro	ougl	h pi	oes.			_			-				-	
		tion of Berno						0				_	-							-9		
6. (Characteri	stics of centri	rifu	ıgal	pum	nps.			-				V	-				-			•	-
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	9. C	naracter	istics o	t batch	Sedime	entation.								
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						111								
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CO1						ip in flu						Anal	yzing (K4)
CO2	102.070					d measu					ns.	Appl	ying (k	(3)
CO3						mance o				es.		Unde	rstandi	ng (K
CO4						g of pum						Unde	rstandi	ng (K2
CO5	ma	ke use o	of the m	nethods	and me	echanica	l opera	tions of	various	equipn	nent.		ying (K	
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	engi	neering	design.	", Butte	rworth	lson JN -Heinen	nann L	td, 2013						
3.	Bans	sal RK,	"Fluid	Mecha	nics an	d Hydra	aulic M	lachines	3", 5 th ec	lition, I	_axmi I	Publica	tions I	vt. Lt
	New	Delhi,	2017.		15									
4.	Fous	t AS, V	Venzel	LA, CI	ump C	W, Nau	s L, A	nderson	LB, "P	rinciple	s of U	nit Ope	eration	s" Jol
	Wile	y & Sor	ıs, 2 nd e	dition,	2008.									,,,,,,,
CO/P	O MA	PPINC):											
Maj	pping	of Cou	rse Out	come (CO's)	with Pr	ogram	me Out	comes (PO'e)	and De	2000	C.	
						Out	comes	PSO's					me Spi	ecine
O's		(17.	2/3 IIIQ	icates s	trengti	of cor	relatio 's	n) 3-Str	ong, 2-	Mediur	n, 1-W	eak		
	1	2	3	4	5	6	7	8		10			-	sO's
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2.										ls for ge	netic res	search.				
3				nental r												
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LIST	OFI	EXPE	RIME	NTS			N-									
										(theory)				-		
2.	Units	of vo	lume,	weight	, dens	ity an	d con	centrat	ion me	easurem	ent and	their	range	in	biolo	pgica
1	measu	rement	s. Den	ıonstra	tion of	prope	r use o	f volun	ne and	weight	neasure	ement d	evices	1	0.0.0	5.00
3.	Prepar	ation o	fsolut	ions: 1) perce	ntage	solutio	ns, 2) r	nólar s	olutions	, 3) nor	mal sol	utions	20		
4.]	Prepar	ation o	f buffe	er-Bica	rbonate	e and F	BS							-		
5. (Qualita	ative to	ests for	carbo	hydrat	es- dis	tinguis	hing re	educins	g from 1	on-red	ucing s	ngars	and	keto	fron
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6. (Quanti	tative	method	for an	nino ac	id esti	mation	using	ninhyd	lrin- dist	inouish	ing ami	ina fra	i	nino (o a i d
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11. 1	гестрі	Lation (n Case	in from	n milk	V										
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At the	end o	f this c	ourse,	the stu	dents v	vill be	able to)					BT N	MAF	PED	,
COI	acqu	iire me	thods	for bio	chemic	ene le	veic					-			Level	40
CO2				nents in										_	(K3)	
CO3									• 2007/40/00			•	5000	F 1985	(K3)	
005	bion	nolecui	les.	cipies	benine	i the c	luantat	ive and	d quan	titative	estimat	ion of	Anal	yzin	g (K4	+)
CO4	deve	lop the	e applic	cability	of bic	chemi	cal me	thods t	o realis	stic solu	tion		Anal	vzins	(K4	.)
CO/Po	_											-		,	, (_
Мар	ping o	of Cou	rse Ou	tcome	(CO's	s) with	Progr	amme	Outco	omes (P	O's) an	d Prog	ramm	e Sn	ecifi	<u> </u>
						C	utcon	ies PS	O's					- op	CHI	ă
		(1/	2/3 III(neates	streng	gth of PO	'S	ation) .	5-Stroi	ng, 2-M	edium,	1-Wea		no-		
co's	1	2	3	4	5	6	7	8	9	10	11	12	1	PSC		2
COI	3	2	1	1	1	1	-	-	3		1	2	2	-	1	
CO2	3	2	1	2	1	1		-	3		1	1	2		1	
CO3	3	3	2	2	2	I		-	3	1	1	2	3	-	2	
CO4	3	3	3	3	2	1						1				- 7

Approved
BOARD OF STUDIES
BIOTECHNOLOGY

AUTONOMOUS

BT23	306		C	ELLA	AND N	IICRO	BIOL	OGY	LABO	RATOF	RY	0	0	4	2
COU	RSE C	BJEC	TIVES	S								_	1	1	
To en	able st	udents	to												
1	demoi	strate	various	techni	iques to	o learn	the mo	rpholo	gy and	propaga	ation of cells	and r	nicro	bes.	
2	learn t	he stai	ning te	chniqu	es for i	dentifi	cation	of dive	rse cell	types a	nd microorg	anism	s.		
3	descri	be the	prepara	ition of	differe	ent med	dia and	their i	mporta	nces					
4	experi	ment tl	he cultu	uring a	nd isola	ation n	nethods	of mic	croorga	nisms.					
LIST	OF E	XPER	IMEN.	TS											
1.	. Intro	ductio	n, Labo	oratory	Safety	, Use o	of Equi	pment;	Sterili	zation T	echniques				
2.	Mici	oscopy	y – Wo	rking a	nd care	e of Mi	icrosco	pe							
3.	Stair	ning Te	echniqu	ies Sim	ple, Di	fferent	tial- Gr	am's S	taining	, Giems	a, and Leish	man S	Staini	ng.	
4.	Stair	ning fo	r differ	ent stag	ges of 1	nitosis	in Alli	um Ce	pa (On	ion)					
5.	Cult	ure Me	dia-Ty	pes and	d Use;	Prepara	ation o	f Nutri	ent bro	th and a	gar				
6.	Quar	ntificat	ion of 1	microo	rganisr	ns by s	erial d	ilution	method	1.					
7.	Cult	vation	and en	umerat	tion of	micro	organis	ms usi	ng spre	ad plate	method.				
8.	Isola	tion of	micro	organis	sms by	pour p	late me	ethod.							-
9.	Isola	tion of	micro	organis	sms by	streak	plate n	nethod	and sla	nts.					
10	. Culti	vation	and en	umerat	tion of	microc	organis	ms froi	n a giv	en samp	le (air/soil/v	vater).			
					for mi										
									_	— <u> </u>	TOTAL P	ERIC	DDS	60	-
COU	RSE O	UTCO	MES			-								1	
At the	end of	this co	ourse, t	he stud	lents w	ill be a	ble to					B	ТМ	\PPI	ED
COI	accion	the o	dyana	ad tack	nical	inform	etion r	- antaini	na ta	lahanata	ry bio-safet		lighe		-
COI	110000				from pa				O	iaborato	ry bio-saiet	y A	pplyi	ng (F	(د.
CO2					techni	5700				ods.		A	pplyi	no (k	(3)
CO3						E					ne study o		pplyi		
	micro	organi	sms in	the lab	oratory	/ .									,
CO4				is tec	hnique	s of	culturi	ing m	icroorg	ganisms	and medi	a Aı	nalyz	ing (K4)
CO/P	O MA	ration.						(¥)							
200000000000000000000000000000000000000				come ((CO's)	with I	Progra	mmo (Jutcon	nos (PO	s) and Prog		C.		t.
,,,up	ping 0					Ou	tcome	s PSO	's		,		ne s _l	jecii	ic
		(1/2	2/3 indi		strengt O's	h of co	orrelat	ion) 3-	Strong	, 2-Med	lium, 1-Wea	ik			
CO's	1	2	3	4	5	6	7	8	9	10	11	12	P	SO'	2
CQ1	2	2	2	2	2	1	-	-	2	-		3	3	+	1
CO2	2	2	2	2	2	1	-	-	2	-		2	3	+	1
CO3	2.	3	3	3	3	1	-	-	3	4		2	2	1	3
CO4	3	3	3	3	2	2	-	+	3		EDING CO	2	2		3

AUTONOMOUS

	301	PROFESSIONAL DEVELOPMENT I	0	0	2	1
COU	RSE O	DBJECTIVES				
To ena	able th	e students to				
1.	enha	ince and evaluate the student's professional skills and introduce the	function	of c	orpo	rate
	worl	d.				
2.	enha	nce and develop the students behavioral, speaking and listening skills	to face	the in	tervi	ew.
3.	solve	e advance level verbal aptitude tests to get placed in Tier I companies	•			
4.	impr	ove their reasoning skills to get placed in reputed companies.				
UNIT	7	SELF - UNDERSTANDING AND PERSONALITY ENHANCE	EMENT			-
ONII		SKILLS			-	7
Introd	uction	self-exploration; SWOT analysis - Types and barriers; Effective	e comn	nunica	ation	in
workp	lace; L	eadership skills; Decision making - Problem solving; Goal setting -	Critical,	strate	egic a	and
lateral	thinki	ng; JAM level- I; Basic resume building level- I.				
UNIT	II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SK	ILLS			7
Behav	ioural	skills; Time management; Emotional intelligence; Analytical thinking	g- Listeni	ng; L	isten	ing
and he	aring;	Self-introduction; Group discussion - Types and importance, evaluation	ation crit	eria,	do's a	and
don'ts	of GD	; GD Level-1.				
don'ts UNIT		; GD Level-1. QUANTITATIVE APTITUDE				
UNIT	Ш	A SEA HEALTH STOLEN NEXT	ge; Pipes	and o	cister	8
UNIT Numb	III er Syst	QUANTITATIVE APTITUDE	ge; Pipes	and o	cister	8
UNIT Numb	III er Syst Profit a	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average	ge; Pipes	and o	cister	8 ms;
UNIT Number Area; UNIT	III er Syst Profit a	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss.	2002 OR		cister	8
UNIT Number Area; UNIT	III er Syst Profit a	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment;	2002 OR	ıs.		8 ms;
UNIT Number Area; I UNIT Logica	III er Syst Profit a IV al seque	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment;	Direction	ıs.		8 ns;
UNIT Number Area; I UNIT Logica	III er Syst Profit a IV al seque	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES	Direction	ns.	DS	8 ns;
UNIT Number Area; I UNIT Logica	III er Syst Profit a IV al seque	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to	Direction	ns.	DS	8 ns;
UNIT Number Area; I UNIT Logica	III er Syst Profit a IV al seque	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to	Direction TAL PE	ns.	DS	8 ns;
UNIT Number Area; UNIT Logica COUF At the	er Syst Profit a IV al sequence end of	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to the and analyze soft skills to improve the leadership skills. Analogy	Direction TAL PE BT Ma	ns. CRIO apped Leve	DS	8 ns;
UNIT Number Area; UNIT Logica COUF At the CO1 CO2	III er Syst Profit a IV al seque	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to the and analyze soft skills to improve the leadership skills. Analonstrate the behavioral skills through various activities. Appl	Direction TAL PE BT Ma (Highest yzing (K	apped Leve	DS	8 ns;
UNIT Number Area; UNIT Logica COUF	er System Profit a IV all sequence of defined demonstrated and development of the IV and IV a	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to the and analyze soft skills to improve the leadership skills. Analogstrate the behavioral skills through various activities. Appled to the problem solving skills through quantitative aptitude. Appled to the problem solving skills through quantitative aptitude.	Direction TAL PE BT Ma (Highest yzing (Ka)	apped Leve	DS	8 ns;
UNIT Number Area; UNIT Logica COUF At the CO1 CO2 CO3	III er Syst Profit a IV al seque end of defin demo	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to the and analyze soft skills to improve the leadership skills. Analonstrate the behavioral skills through various activities. Apple to the problem solving skills through quantitative aptitude. Apple trate the logical reasoning Skills to solve real world problems. Analons trate the logical reasoning Skills to solve real world problems.	Direction TAL PE BT Ma (Highest yzing (K) ying (K)	apped Leve	DS	8 ns;
UNIT Number Area; I UNIT Logica COUF At the CO1 CO2 CO3 CO4	III er Syst Profit a IV al seque end of defin demo	QUANTITATIVE APTITUDE tem; LCM and HCF; Simple interest and compound interest; Average and loss. LOGICAL REASONING ence; Analogy; Classification; Causes and effect; Making judgment; TO UTCOMES f this course, students will be able to the and analyze soft skills to improve the leadership skills. Analonstrate the behavioral skills through various activities. Apple to the problem solving skills through quantitative aptitude. Apple trate the logical reasoning Skills to solve real world problems. Analons trate the logical reasoning Skills to solve real world problems.	Direction TAL PE BT Ma (Highest yzing (K) ying (K)	apped Leve	DS	8 ns;

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- 2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
- 3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

CO-PO MAPPING:

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

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

						PC)'s						PS	O'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	Ę	1	-	-	-	-	2	-	2	2
CO4	2	1	3	2		3	3	1	-	1	2	-	2	2

BOARD OF STUDIES English

AUTONOMOUS

MA	23403	PROBABILITY AND STATISTICS 3 1	0
(Con	nmon to	Agri, Biotech, Cyber, CSE, CSE(IOT), CSE(AI&ML), AI&DS, IT, Food, Pha	ırma)
COUR	SE OBJ	ECTIVES	
To ena	ble the st	udents to	31175
1.	analyse t	he concept of random variables and probability distribution in designing processes	
2.	different	iate the discrete and continuous two dimensional random variables.	
3.	determin	e the concepts of hypotheses testing, its need and applications.	
		th statistical techniques for designing experiments, analyzing, interpreting and ag research data.	
5.	emphasi	ze the aspects of control charts in quality control.	
UN	ITI	RANDOM VARIABLES	12
varial		netric, Uniform, Exponential, Gamma and Normal distributions; Functions of ra-	
UN Joint regress	IT II distribut sion;	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and L Transformation of random variables; Applications of Central limit theorem	inear
UNI Joint regress indepe	IT II distribut sion;	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and L	inear (for
UNI Joint regress indepe	distribut sion; Till	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and L Transformation of random variables; Applications of Central limit theorem d identically distributed random variables). TESTING OF HYPOTHESIS	inear (for
Joint regress indepe UNI Sample mean,	distribut sion; Till ing distriand differ variance	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and Landsformation of random variables; Applications of Central limit theorem didentically distributed random variables). TESTING OF HYPOTHESIS ibutions - Estimation of parameters; Statistical hypothesis; Large sample test for exerce of means; Small samples - Tests based on t, Chi-square and F distribution and proportion; Contingency table (test for independent), Goodness of fit.	inear (for 12 single ons fo
UNI Joint regress indepe UNI Sample mean mean,	distribut sion; Till ing distribut and diffe	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and L ransformation of random variables; Applications of Central limit theorem d identically distributed random variables). TESTING OF HYPOTHESIS ibutions - Estimation of parameters; Statistical hypothesis; Large sample test for erence of means; Small samples - Tests based on t, Chi-square and F distribution	inear (for 12 single ons for
UNI Joint regress indepe UNI Sampli mean mean, UNI Compl	distribut sion; Till ing distribut and different and diffe	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and Landsformation of random variables; Applications of Central limit theorem didentically distributed random variables). TESTING OF HYPOTHESIS ibutions - Estimation of parameters; Statistical hypothesis; Large sample test for exerce of means; Small samples - Tests based on t, Chi-square and F distribution and proportion; Contingency table (test for independent), Goodness of fit.	inear (for 12 single ons for 12
UNI Joint regress indepe UNI Sampli mean mean, UNI Comple	distribut sion; Till ing distribut and different and diffe	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and Laransformation of random variables; Applications of Central limit theorem didentically distributed random variables). TESTING OF HYPOTHESIS ibutions - Estimation of parameters; Statistical hypothesis; Large sample test for strence of means; Small samples - Tests based on t, Chi-square and F distribution and proportion; Contingency table (test for independent), Goodness of fit. DESIGN OF EXPERIMENTS domized design; Randomized block design; One way and two way classifications-	inear (for 12 single ons for 12 Latir
Joint regress indeper UNI Sample mean, UNI Comple square UNI Control	distribut sion; Till ing distribut and different and different and different and different and design -	TWO - DIMENSIONAL RANDOM VARIABLES tions; Marginal and conditional distributions; Covariance, Correlation and Laransformation of random variables; Applications of Central limit theorem didentically distributed random variables). TESTING OF HYPOTHESIS tibutions - Estimation of parameters; Statistical hypothesis; Large sample test for scrence of means; Small samples - Tests based on t, Chi-square and F distribution and proportion; Contingency table (test for independent), Goodness of fit. DESIGN OF EXPERIMENTS domized design; Randomized block design; One way and two way classifications- 2º factorial design.	inear (for 12 single ons for 12 Latin
Joint regress indeper UNI Sample mean, UNI Comple square UNI Control	distribut sion; Till ing distribut and different and different and different and different and design -	TWO - DIMENSIONAL RANDOM VARIABLES ions; Marginal and conditional distributions; Covariance, Correlation and Laransformation of random variables; Applications of Central limit theorem didentically distributed random variables). TESTING OF HYPOTHESIS ibutions - Estimation of parameters; Statistical hypothesis; Large sample test for erence of means; Small samples - Tests based on t, Chi-square and F distribution and proportion; Contingency table (test for independent), Goodness of fit. DESIGN OF EXPERIMENTS domized design; Randomized block design; One way and two way classifications- 2² factorial design. STATISTICAL QUALITY CONTROL for measurements (X and R charts) - Control charts for attributes (P, C and NP c)	(for single ons for latin

	RSE OUTCOMES end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	assign suitable probability distributions in engineering problems.	Applying (K3)
CO2	apply the concept of discrete and continuous two dimensional random variables.	Applying (K3)
CO3	apply the concept of testing of hypothesis for small and large samples in real life problems	Applying (K3)
CO4	analyse the principles to be adopted for designing the experiments.	Analysing (K4)
CO5	examine statistical data using control chart in quality control	Applying (K3)

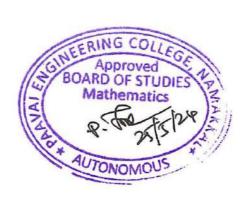
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- 2. Johnson. R.A. and Gupta. C.B., Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7thEdition, 2007.

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- 2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education Asia, 8thEdition, 2007.
- 3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
- 4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

CO PO MAPPING:

Mappi	ing of	Cours					PS	O's		O's) and		mme Spe /eak	cific Ou	tcome
CO's						F	'O's			0			PS	O's
cos	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	127	-	-	141	-	-	4	3	3	3
CO2	3	2	. 3	3	-	-	-	-		-	-	3	3	3
CO3	3	3	3	2	-		-	-	-	-		2	2	3
CO4	3	3	2	2	-	-	-	8 5 8	-	-	-	2	3	3
CO5	3	3	2	3		-	-	-	-	-	-	2	2	3



COU	401	HEAT AND MASS TRANSFER	3 0	0	3
	RSE (DBJECTIVES		الساد	-
To en	able th	ne students to	- m		
1	unde	erstand the principles of Fourier's law of heat conduction and its application	ons in bioproc	esses.	-
2.	class	sify the mechanisms and concepts of heat transfer through convection and	radiation.		
3	gain	knowledge about different industrial heat transfer equipment.			
4	appl	y the principles of mass transfer phenomena in diffusion and distillation of	f biological sy	stems.	
5	buile	the mass transfer phenomena in Liquid-Liquid and Solid-Fluid operation	S.		
UNIT		HEAT TRANSFER - CONDUCTION		T	9
Basic	heat t	ransfer processes - conductors and insulators - conduction - Fourier's lav	w of heat con	duction	n .
		ductivity and thermal resistance - linear heat flow - heat transfer through			
condu	ction.	walls, radial heat flow through cylinders and sphere – solving probler HEAT TRANSFER – CONVECTION AND RADIATION	ns in neat tr		
				1	9
		r - convection - free and forced convection - factors affecting the heat tran			
		convection heat transfer – overall heat transfer coefficient - solving pro			
		eat transfer - concept of black and grey body - monochromatic T	otal emissive	powe	er-
		law – Planck's law - Stefan-Boltzmann's law.			
		HEAT TRANSFER EQUIPMENTS			9
Heat e	exchan	gers - parallel, counter and cross flow- Logarithmic Mean Temperatur	e Difference	- over	all
coeffic	cient o				
TRIBUTE		f heat transfer in shell and tube heat exchanger for bioproducts.			
UNIT	IV	f heat transfer in shell and tube heat exchanger for bioproducts. MASS TRANSFER –DIFFUSION AND DISTILLATION			9
Mass t	transfe	MASS TRANSFER -DIFFUSION AND DISTILLATION	molecular dif	fusion	ir
Mass t	transfe – equ	MASS TRANSFER -DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion - imolar counters diffusion in gases; diffusion coefficients for gases - 1	molecular dif	fusion fusion	ir ir
Mass t gases liquids	transfe – equ s, solid	MASS TRANSFER -DIFFUSION AND DISTILLATION er in bioprocesses – introduction – Fick's law for molecular diffusion -	molecular dif nolecular dif Principle of di	fusion fusion	in in
Mass t gases liquids - flash	transfe – equ s, solid distill	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in distributions and gels; Vapour liquid equilibria – Raoult's law- In ation, differential distillation, steam distillation, Mc.Cabe - Thiele method.	molecular dif nolecular dif Principle of di	fusion fusion stillati	ir ir
Mass t gases liquids - flash UNIT	transfe – equ s, solid distill	MASS TRANSFER – DIFFUSION AND DISTILLATION er in bioprocesses – introduction – Fick's law for molecular diffusion - imolar counters diffusion in gases; diffusion coefficients for gases - 1 ls, biological solutions and gels; Vapour liquid equilibria - Raoult's law- I ation, differential distillation, steam distillation, Mc.Cabe -Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA	molecular dif nolecular dif Principle of di	fusion fusion stillati	in in ion
Mass t gases liquids - flash UNIT L-L ec	transfe - equ s, solid distill V	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – 1 ls, biological solutions and gels; Vapour liquid equilibria – Raoult's law-I ation, differential distillation, steam distillation, Mc.Cabe -Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching 1	molecular dif nolecular diff Principle of di ATIONS Principles; Ac	fusion fusion stillati	in in ion
Mass t gases liquids - flash UNIT L-L ec	transfe equ s, solid distill V quilibr	MASS TRANSFER –DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in ls, biological solutions and gels; Vapour liquid equilibria – Raoult's law-I ation, differential distillation, steam distillation, Mc.Cabe -Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching in Batch and fixed bed adsorption; Drying-Mechanism-Drying curves; Time	molecular dif nolecular diff Principle of di ATIONS Principles; Ac	fusion fusion stillati	in in ion
Mass t gases liquids - flash UNIT L-L ec	transfe - equ s, solid distill V quilibr	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in distributions and gels; Vapour liquid equilibria – Raoult's law- In ation, differential distillation, steam distillation, Mc.Cabe – Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching In Batch and fixed bed adsorption; Drying-Mechanism-Drying curves; Time ryers.	molecular dif nolecular dif Principle of di ATIONS Principles; Ac	fusion fusion stillati	in in ion on on
Mass t gases liquids - flash UNIT L-L ec equilib	transfe - equ s, solid distill V quilibr pria - l uous d	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in distributions and gels; Vapour liquid equilibria – Raoult's law- In ation, differential distillation, steam distillation, Mc.Cabe – Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching In Batch and fixed bed adsorption; Drying-Mechanism-Drying curves; Time ryers.	molecular dif nolecular diff Principle of di ATIONS Principles; Ac	fusion fusion stillati	in in on on
Mass to gases liquids - flash UNIT L-L ecceptible continu	transfer equivalent eq	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – 1 s, biological solutions and gels; Vapour liquid equilibria – Raoult's law- I ation, differential distillation, steam distillation, Mc.Cabe -Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching I Batch and fixed bed adsorption; Drying-Mechanism-Drying curves; Time ryers.	molecular difinolecular difinolecular difinolecular difinolecular difference of displaying and the control of t	fusion fusion stillati	in in on on
Mass to gases liquids flash UNIT L-L econtinu	transfer equition equilibrity	MASS TRANSFER –DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in les, biological solutions and gels; Vapour liquid equilibria – Raoult's law- In ation, differential distillation, steam distillation, Mc.Cabe –Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA ia, Staged and continuous extraction, Solid-liquid equilibria, Leaching In Batch and fixed bed adsorption; Drying-Mechanism-Drying curves; Time regers. TO UTCOMES This course, the students will be able to erate the different heat transfer principles by conduction in biological ms.	molecular difinolecular difinolecular differenciple of dispersions ATIONS Principles; Act of Drying; B	fusion fusion stillati stillat	ir ir on on the
Mass to gases liquids - flash UNIT L-L ecceptible continu	transfer equition equilibrity equilibrity equilibrity equilibrity end of enum system defen	MASS TRANSFER – DIFFUSION AND DISTILLATION or in bioprocesses – introduction – Fick's law for molecular diffusion – imolar counters diffusion in gases; diffusion coefficients for gases – in distributions and gels; Vapour liquid equilibria – Raoult's law- In distribution, differential distillation, steam distillation, Mc.Cabe – Thiele method. MASS TRANSFER – LIQUID-LIQUID AND SOLID-FLUID OPERA dia, Staged and continuous extraction, Solid-liquid equilibria, Leaching in distribution and fixed bed adsorption; Drying-Mechanism-Drying curves; Time regers. TO UTCOMES This course, the students will be able to derate the different heat transfer principles by conduction in biological	molecular difinolecular difinolecular difinolecular difinolecular difference of displaying and the control of t	fusion fusion stillati dsorpti satch a DS el) ng (K1	in in on

CO4	apply the different mass transfer principles in biological systems.	Applying (K3)
CO5	operate the liquid- liquid, solid- liquid equilibria by mass transfer operations.	Applying (K3)

- Geankoplis CJ. "Transport Processes and Separation Process Principles (Includes Unit Operations)".
 Pearson New International, 4th Edition, Pearson Education Limited, 2013.
- 2. Treybal RE. "Mass Transfer Operations", 3rd edition. Mcgraw Hill, 2017.

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- 1. Nag P, "Heat and Mass Transfer". McGraw Hill Education; 3rd edition, 2011.
- 2. Coulson JM. and etal., "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol. I & II. Butterworth Heinman (an imprint of Elsevier), 2004.
- Incropera FP, Dewitt DP, Bergman TL, Lavine AS, "Principles of heat and mass transfer", Wiley India Edition, 2018
- McCabe WL, Smith JC, Harriot P, "Unit Operations of Chemical Engineering", 7th Edition, McGraw Hill, 2021.

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	1	1	1	1	-	-	-	-	-	-	-	•2	1	1	
CO2	2	1	1	1	1	-	_	2	-	241	-	3	1	1	
CO3	3	_2	2	3	1	-	-	-	-	-	-	1	2	3	
CO4	3	3	2	1	-	-	-	-	-	191	-	1	2	3	
CO5	3	2	2	1	-	-	-	-	-	-	-	1	1	1	



BT234	BIOCHEMICAL PROCESS CALCULAT	TIONS	3	0	0	3
COURS	SE OBJECTIVES					
To enab	ble the students to					
1	acquire the knowledge on dimensions and conversion systems.	1				
2	understand the ideal and actual gas equations in process indust	ries.				
3	relate the material balance equations for biochemical processes	calculations.				
4	apply the energy balance equation for bioengineering systems.)				
5	endow the basics calculations pertaining to microbial growth k	inetics.				
UNIT I	BASIC CHEMICAL CALCULATIONS					9
Dimensi	sion - Systems of units-FPS, MKS and SI systems; Conve	rsion from on	e system	to th	e otl	ner;
composi	sition of mixtures and solutions; mass fraction, mass %, mole fr	raction, mole %	%, mass rat	ios, r	nolar	ity,
molality	y, normality, ppm, composition by density.					
UNIT I	II IDEAL AND ACTUAL GAS EQUATIONS					9
Ideal an	nd actual gas equations; Vander Walls, compressibility factor eq	uations, Applic	cation to pu	ire ga	ıs &	gas
mixtures	es; partial pressures, partial volumes; Air-water vapour systems	, Humidity, M	olar Humi	lity,	Relat	ive
Humidit	ity, % Saturation, humid Volume; Humidity chart - wet, Dry	bulb, Dew poi	int tempera	tures	, pH	of
solutions	ns, Vapour pressure.					
UNIT II	III MATERIAL BALANCES				T	9
Material	al balance concept - overall & component; material balance ap-	plications for e	vaporator,	gas a	absor	ber
without	t reaction, Distillation (Binary system), Liquid extraction, solid-li	quid extraction	, drying, c	ystal	lizati	on,
Humidif	ification, Reverse Osmosis separation and Mixing, Material	Balances in 1	Recycle, E	ypas	s Pu	rge
Streams.	s.					
UNIT I	IV ENERGY BALANCES				T	9
General	l energy balance equation for open systems, closed system sens	ible heat calcul	ation, Hear	requ	ired	for
phase ch	change thermo chemistry, application of steam tables, Saturated	and superheat	ed steam a	pplic	ation	in
bioproce	ess, Energy Balances in Recycle, Bypass Purge Streams.					
UNIT V	V BIOCHEMICAL REACTIONS				T	9
Growth	stoichiometry and elemental balances, Respiratory quotient, D	egree of reduc	tion, Elect	on h		es,
				OH U	alanc	
Biomass	s yield, Product stoichiometry, Theoretical Oxygen Demand, Un	steady and stea				
Biomass	s yield, Product stoichiometry, Theoretical Oxygen Demand, Un			eratio	ons.	15
	s yield, Product stoichiometry, Theoretical Oxygen Demand, Un SE OUTCOMES		dy-state op	eratio	ons.	15
COURS			dy-state op	eratio	ons.	15
COURS At the er	SE OUTCOMES end of this course, the students will be able to	ТС	DTAL PER BT MAR (Highest	eration RIOD PPED Leve	ons. OS 4	
COURS At the er	SE OUTCOMES	ТС	DTAL PER BT MAI (Highest	eration RIOD PPED Leve	ons. OS 4	
COURS At the er	SE OUTCOMES end of this course, the students will be able to detail the concepts of dimensional consistency and effective	application of	DTAL PER BT MAR (Highest	PPED Leve	ons. OS 4)

CO4	illustrate general energy balance parameters and apply to open and closed systems.	Applying (K3)
CO5	apply the basics of microbial kinetics, metabolic stoichiometry and energetics in biochemical operations.	Applying (K3)

- 1. Gavhane KA. Introduction to Process Calculations Stoichiometry. Nirali Prakashan; 2012.
- 2. Venkataramani V, Anantharaman N, Begum KM. Process Calculations. PHI Learning Pvt. Ltd.; 2011.

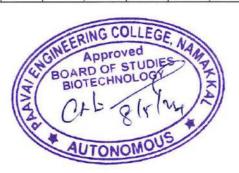
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- 2. McCabe WL, Smith JC, Harriot P, "Unit operations of chemical Engineering" 7th Edn McGraw Hill, 2017.
- 3. Himmelblau DM, "Basic principles & Calculations in Chemical Engineering" 6th edn PHI 2013.
- 4. Narayanan KV, Lakshmikutty B, "Stoichiometry and Process Calculations", PHI Learning, 2016.

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	2	3	2	3	-	2	1	-	-	-	-	1	2	3		
CO2	2	3	2	3	2	2	1	-	-	-	140	1	2	3		
CO3	2	3	2	3	-	2	1	-	-	-:	-	1	2	2		
CO4	2	3	2	3	-	2	1	-	-	-	-	2	3	1		
CO5	2	3	2	3	-	3	1	1	-	-	-	2	2`	1		



	03 GENET	ICS AND MOLECULA	AR BIOLOGY		3 0	0	3
COURS	E OBJECTIVES					-	
To enab	le the students to						
1	acquire basic fundamenta	knowledge in genetics a	nd explore skills in	molecular	biology	7.	
2	emphasize the molecular	nechanism of DNA repli	cation and repair.				
3	understand the structure a	nd function of RNA type	s in prokaryotes and	d eukaryote	S.	V	
4	discuss the concepts of ge	netic code and translation	process in cells.				
5	illustrate the regulation of	gene expression and var	ous types of mutati	ions.			
UNIT I	CLASSICAL GENE	TICS					9
Eukaryo	tic genetics - Mendelian ge	netics, Gene interaction,	Complementation 1	linkage, Re	combin	ation	
and M	omosomal mapping, crossi cCarty. Prokaryotic gen somal validation; Genetic of	etics - Bacterial conj	ugation, transduct				
UNIT I	STRUCTURE OF N	JCLEIC ACIDS AND I	NA REPLICATI	ON			9
of eukar	yotic chromosome – cot va	lue, replication of telome	res in eukaryotes.				_
		RNA and tRNA. Charac				7	
RNA sy Fidelity transcrip	nthesis: Initiation, elonga of RNA synthesis, Inh tion. Basic concepts in	ion and termination of bitors of transcription, RNA world: Ribozyme	RNA synthesis, F Differences in p es, RNA processin	Proteins offorokaryotic	RNA s	ynthe kary	si
RNA sy Fidelity transcrip Alternat	of RNA synthesis, Inh tion. Basic concepts in ive splicing, Poly 'A' tail a	ion and termination of bitors of transcription, RNA world: Ribozyme	RNA synthesis, F Differences in p es, RNA processin	Proteins offorokaryotic	RNA s	ynthe kary	ce si
RNA sy Fidelity transcrip Alternat UNIT I	of RNA synthesis, Inhation, Basic concepts in ive splicing, Poly 'A' tail at TRANSLATION	ion and termination of bitors of transcription, RNA world: Ribozyme Idition and base modifica	RNA synthesis, F Differences in p es, RNA processination.	Proteins off prokaryotic ng: 5'-Cap	andeu	ynthe karyo Splici	ce si oti ng
RNA sy Fidelity transcrip Alternat UNIT I Introductimportar	of RNA synthesis, Inhition. Basic concepts in tive splicing, Poly 'A' tail at TRANSLATION Translation to Genetic code: Elucate, Prokaryotic and euklion of protein synthesis. I	tion and termination of bitors of transcription, RNA world: Ribozyme dition and base modifical dation of genetic code, Caryotic ribosomes. Step	RNA synthesis, F Differences in p s, RNA processination. Codon degeneracy, s in translation:	Proteins off prokaryotic ng: 5'-Cap Wobble hy	andeuping, S	ynthe karyo Splici s and	oti ng
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CO2	elaborate the chemical characteristics of nucleic acids to understand the molecular process.	Understanding (K2)
CO3	illustrate the structure and functions of RNA to know the transcriptional process.	Applying (K3)
CO4	utilize the basic mechanisms of gene expression through translation process.	Applying (K3)
CO5	apply the concept of gene regulation and its significance in prokaryotes.	Applying (K3)

- Malacinski GM, "Friefelders Essentials of Molecular Biology" 4th Edition, Narosa Publications, 2015.
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CO1	3	3	2	1	-	-	-	-	-	-	-	2	3	3	
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	3	
CO3	3	2	2	1		(2)	121	-	-	-	-	2	3	2	
CO4	3	2	2	3	-	(20)	-	-	-	-	1	3	3	2	
CO5	3	2	3	3	3		-	-			1	2	2	3	



MIC2.	3402	HU	AN VALUES AND GI	ENDER EQU	ALITY		2	0	0	0
COUR	RSE OBJ	ECTIVES								
To ena	ble the st	udents to								
1	define d	ifferent types of	uman values and their i	mpact on indi	vidual behav	iour and	d soci	ietal ı	norms	;.
2	apply pr	inciples of pers	al development such as	self-confiden	ce, self-disci	pline, ai	nd res	silien	ce to	
	navigate	modern challe	es effectively.							
3	evaluate	the role of valu	in shaping professiona	l ethics, civic	sense and glo	bal citi	zensl	nip.		
4	examine	the socio-econ	ic factors influencing g	gender inequal	ity and explo	re aven	ues f	or		
7.	empowe	rment and advo	cy.							
5	critically	analyze preval	t issues and challenges	faced by wom	en, including	g gender	r-base	ed vic	olence	2,
	discrimi	nation, and cult	l biases, and propose n	neasures for th	eir eradicatio	on.				
UNIT	I HU	MAN VALUE								6
Value	Educatio	n - Definition,	pes of values; Human	ı values - Ac	ceptance, Co	onsidera	ation.	App	recia	tion
Listeni	ng. Empa	thy, Sympathy	lonesty, Integrity, Wise	dom, Decision	making, Se	If- actu	alizat	tion,	Chara	icte
formati	on towar	ds positive per	nality, Contentment; - 1	Religious Val	ues - Humili	ty, Con	npass	ion,	Gratit	ude
Peace,	Justice, F	reedom, Equali								
UNIT	II PE		VELOPMENT							6
		RSONALITY		nce, Self-disc	cipline; Flex	xibility	-Pec	er p	ressur	
Persona	al Devel	RSONALITY I	VELOPMENT			1853		-		e ·
Persona Sensitiz	al Devel zation to	RSONALITY I opment - Int	VELOPMENT pection, Self-confiden	ty; Modern C	hallenges of	Adoles	scent	Emo	tions	e and
Persona Sensitiz behavio	al Develor zation to or - Comp	RSONALITY I opment - Int	VELOPMENT spection, Self-confident nality; Reliability; Universition, Positive and Ne	ty; Modern C	hallenges of	Adoles	scent	Emo	tions	e and
Persona Sensitiz behavio Physica	al Develor to compare the comp	RSONALITY Intopped on the control of	VELOPMENT spection, Self-confident nality; Reliability; Universition, Positive and Ne	ty; Modern C egative attitud	hallenges of es; Family v	Adoles	scent Self- i	Emo	tions	e and
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Persona Sensitiza behavio Physica UNIT I Profess sense a Social Values UNIT I Gender Healtho Caregiv Sustain	al Development of the control of the	popment - Intervards Gender In	VELOPMENT Spection, Self-confident Proposition, Positive and Note of the second seco	ty; Modern C egative attitud ONAL AND lity, Dedication nics, Moral Le ration and In Equality; Con	hallenges of les; Family volumes, Family volum	Adoles alues; S EVEL orance - orange of orange ora	OPM Com Cond nding n Ind pes:	Emo impro impro peten uct; (g of lia- E Pare	Corpo Relig	6 Civio
Personal Sensitization behavioral Physical UNIT II Profession sense a Social Values UNIT II Gender Healthough Caregiv Sustain UNIT II	al Development of the control of the	popment - Intervards Gender In	VELOPMENT Spection, Self-confidentiality; Reliability; United tition, Positive and Notice and Policy Reform; Control of the Pol	ty; Modern C egative attitud ONAL AND lity, Dedication nics, Moral Legation and Information a	hallenges of les; Family volumes; Family volumes; Family volumes on - Persever eadership, Conternational undition of World allenging Statements of Statement	Adoles alues; S EVELO rance - ode of 0 ndersta fomen intereotypective;	OPM Com Cond nding n Ind pes:	Emo impro impro impro peten uet; (g of Pare e Cha	corpo Relig	6 Civio
Personal Sensitization behavioral Physical UNIT In Profession sense a Social Values UNIT In Gender Healthough Caregiv Sustain UNIT Values	al Development of the control of the	popment - Intervards Gender In	VELOPMENT Spection, Self-confidentiality; Reliability; United tition, Positive and New Edition, Positive and New Edition, Positive and New Edition, Positive and New Edition, Positive and National Integration, Sender-based and Policy Reform; Control of Challenges	ty; Modern C egative attitud ONAL AND lity, Dedication nics, Moral Legration and Information and Information and Information Shifts; the against work ee against work ee against work	hallenges of les; Family volumes, Family volum	Adoles alues; S DEVELO Tance - Tode of O Indersta Tomen intereoty; Developed in the control of the contro	OPM Com Cond nding n Ind pes:	Emo impro impro impro impro peten uct; (g of Pare e Cha	Corpo Relig	6 civic orate ious 6 cism:

	TOTAL PERIODS 30
SE OUTCOMES	
end of this course, the students will be able to	BT MAPPED
	(Highest Level)
discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing (K4)
analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing (K4)
	discuss the concept of human values and their significance in personal and societal development. demonstrate introspective skills to enhance personal growth and self-awareness. recognize the importance of gender equality in promoting a just and equitable society. cultivate a sense of social responsibility and ethical conduct towards achieving national and global development. analyse the challenges faced by women in various spheres and identify

- A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
- 2. Aurther, John. Personality Development. Lotus Press, 2018.

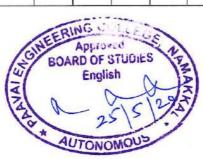
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CO/PO MAPPING:

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

						F	o's						PSO's		
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	-	1	-/-	1	1	1	2	3	2	1	1	3	1	1	
CO2	-	1	-	1	1	1	3	3	2	2	1	1	2	2	
CO3	-	1	-	1	1	1	2	3	1	1	1	3	1	1	
CO4	-	1	-	1	1	1	2	3	2	2	1	2	3	3	
CO5	-	1	-	1	1	1	1	3	2	2	1	3	2	2	



BT23	404		BIO ANALYTICAL TECHNIQUES		3	0	2	4
		BJECTIVES						
To enal		students to						
1	under	stand the basic o	cepts of wave properties and radiation so	ources.				
2	acqui	re knowledge of	e chromatographic methods for the separ	ation of biolog	gical pro	ducts		
3	descri	be the working	chanism of electrophoresis and surface n	nicroscopy.				
4	acqui	e fundamental k	wledge about the light spectrum, absorpt	tion, fluoresce	nce.			
5	illustr	ate the basic wo	ngs and principles of absorption spectros	сору.				
UNIT	I I	NTRODUCTIO	TO SPECTROMETRY					9
Propert	ies of	electromagnetic	adiation- wave properties - components	of optical ins	strument	s – S	ource	es o
radiatio	on – w	avelength select	s - sample containers - filters - detector	rs – signal to i	noise rat	io - s	ource	es o
noise –	Enhar	cement of signa	o noise - types of optical instruments - G	LP-Standard	Operatir	g Pro	cedu	res
		on - record main				.		
UNIT I	II S	EPARATION	ETHODS					9
Genera	l desci	iption of chrom	ography – Band broadening and optimiza	tion of colum	n perfor	manc	e- Li	auic
			omatography – Adsorption chromatograph					_
			Affinity chromatography- principles of					
			s – Applications.					
UNIT I			ESIS AND SURFACE MICROSCOPY	7				9
Electro			, SDS-PAGE, denaturing gradient gel		sis (DG	GE)	cani	
			sitometry, isoelectric focusing - princip					10.50
			bbe microscopes – AFM and STM.	ie, mstrument	ation an	и арр	ncati	OHS
UNIT I			ECTROSCOPY					9
			etry - Measurement of Transmittance	and Absorb	0000	Dagu	2- 1-	7200
			s -Theory of fluorescence and Phos					
			ed absorption spectrometry – IR instrum					
			ntation – applications.	entation – Ap	plication	1S – I	neor	у о
UNIT			ONANCE SPECTROSCOPY AND M.	A CC CDE CTT	101/E	DX		
								9
			ental effects on NMR spectra – cher					
			R- Molecular mass spectra – ion sources					
		alues –instrume	I-Mass imaging- Applications of molecution	cular mass - J	Electron	para	magr	ietic
- CSOHAII	ice- g v	alues –mstrume	ation.	1 == 0				
TICTO	TE EV	DEDIMENTO		10	TAL PE	RIO	os	45
	DISCO (SANTON)	PERIMENTS						
			n experiment using absorption spectrosco	ру.				
		0,000	s law using KMnO4					
3. F	inding	the pKa of 4-nit	phenol using absorption spectroscopy.					

- 4. UV spectra of nucleic acids.
- 5. Estimation of SO4-- by nephelometry.
- 6. Limits of detection using aluminium alizarin complex.
- 7. Paper Chromatography.
- 8. Chromatography analysis using TLC.

	ТО	TAL PERIODS 75
COU	RSE OUTCOMES	
At the	e end of this course, the students will be able to	BT MAPPED (Highest Level)
CO1	detail the functions of electrical and optical components in analytical instruments.	Understanding (K2)
CO2	enumerate the chromatographic techniques to separate, purify and quantify molecules.	Understanding (K2)
CO3	determine the analytes using microscopic and electrophoresis techniques.	Applying (K3)
CO4	Apply spectroscopic techniques to identify, estimate and characterize analytes.	Applying (K3)
CO5	interpret the data to predict unknown compounds using NMR and mass spectroscopy.	Analysing (K4)

- Skoog DA, Holler FJ, Crouch SR. Textbook "principles of instrumental analysis". 6th Edition Cengage learning, 2019.
- 2. Willard HH, Merritt LL, Dean JA, Settle FA, "Instrumental Methods of Analysis", 7th Edition, CBS Publication, New Delhi Reprint, 2004.

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- 3. Haven MC, Tetrault GA, Schenken JR, editors, "Laboratory Instrumentation", 4th Edition, Wiley India Pvt Ltd, 2010.
- 4. Philopose PM, "Analytical Biotechnology", Domihant Publishers and distributors, New Delhi, 2016.

CO/PO MAPPING:

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

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-		-	-	1	-	-	1	2	2
CO2	2	1	3	1	1	-	-		1	-	-	3	2	2
CO3	2	2	3	1	-		-	-	1	-	-	2	3	3
CO4	2	2	3	2	2	-	===	-	1	2000	LIEG	1	3	3
CO5	2	3	3	3	2		-	- /	WEE	Approv	LLEGE	N	3	3

BIOTECHNOLOGIS BIOTECHNOLOGIS

ALITONOMOUS

F	3T2.	3405	4	Н	EAT A	ND M	ASS TI	RANSI	FER LA	ABORA	TORY	,	0	0 4	2	
COI	URS	E OB.	JECT	IVES							-					
Го е	enab	e the s	tudent	s to												
1	stud	y the b	asic pl	henome	na of h	eat and	mass t	ransfer	to deve	elop me	thodolo	gies for	solvin	g prob	lems.	
2	unde	erstand	the in	formati	on, per	forman	ce and	design	of heat	exchan	gers.					
3	deve	elop pr	ocess	for bette	er heat	efficier	icy.			-						
					imental				14.5	w)						
122				IENTS		•			-	11-						
				ection.												
-	2.	Therm	al Con	ductivi	ty -Lag	ged Pip	e.				10					
					ty -meta	Bullion of the San							-			
					nstant	i e e e	iation h	eat.								
	5.	Forced	conve	ection.				(1)(6								
	6.	Double	e pipe	heat ex	changer	-cocu	rrent flo	ow.								
	7.	Double	e pipe	heat ex	changer	· -coun	ter curr	ent flov	N.							
					mixtur											
-	9.	Drying	chara	cteristic	cs of Ro	otary di	ryer.									
	10.	Separa	tion of	f binary	mixtur	e using	Simple	e distill	ation.							
	11.	Extrac	tion of	acetic	acid by	Liquid	l –liquio	d Extra	ction.							
-					-	•					Т	OTAL I	PERIC	ODS	60	
CO	URS	SE OU	TCO	MES	-											
At t	he e	nd of t	his cou	arse, the	e studen	nts will	be able	e to					1 2000	MAPI thest I		
COI	1 6	employ	the ba	asic law	s of he	at trans	fer for	analyse	es of en	gineerin	ng syste	ms.	(Highest Leve Applying (K3			
CO2	2 (determ	ine Ste	efan Bo	ltzman	n cons	tant and	d diffu	sivity c	oefficie	ent for a	analyses	App	lying	(K3)	
		of heat						•		25 m 25 m				I	(1/2)	
CO3					ristics o			0	SATURE STATE OF THE SATURE				* * *	lying		
CO4					ion yiel	d and p	ourity of	r mixtu	res Witi	hout los	S.		Ana	lysing	(K4)	
		MAP			/6	011	'41 D	100000000000000000000000000000000000000	0.4		DO!-\	and Dage		ua Cu	oifia	
Ma	appi	ng of 0	Cours	e Outco	ome (C	O's) w	outco	gramn omes P	ne Outo SO's	comes (PO's) a	and Prog	gramn	ne spe	ecine	
			(1/2/	3 indic	ates str	ength) 3-Str	ong, 2-	Mediur	n, 1-Wea	ak	DC	·O'	
CC)'e	1	2	3	4	5	PO's	7	8	9	10	11	12	1	SO's 2	
CC			3		2	3	1	1	-	2	1	-	2	3	2	
CC		2	11998	3					-	3	-		2	3	3	
		3	2	2	2	1 4 1	1	1	-		1	-	-	0.00	-	
CC		3	3	2	2		2	1	-	2	1	2	3.	2	3	
CC)4	3	3	2	2	3	2	1	-	3	NC CC	LLEGE,	3	2	2	

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BIOTECHNOLOGY

TONOMOUS

COLUE	23406		MO	LECU	LAR B	IOLO	GY LA	BORA	TORY			0 (4	Т
COUR	RSE OBJ	ECTIVES	8											
To ena	ble studer	its to												
1	perfo	rm hands	on exp	erience	in bas	ic mole	cular b	iology to	echniqu	ues.	0000			
2		ss the DN							_					
3	learn	about the	identif	ication	and ch	aracter	ization	of genes	and p	roteins.		-		_
4	impa	rt knowled	dge on	gene is	olation,	electro	ophores	is and a	oplicat	ions of	moleci	ılar bi	ologi	<i>V</i>
LIST (OF EXPE	RIMENT	rs						-				0105.	1000
1.	Good La	boratory I	Practice	es (GLF	P) in Mo	olecula	r Lab.						-	_
2.		ette usage									-			_
3.		on of Rea					lculation	ons.						-
4.		of genom							-					
5.		of genom												
6.		of Plasmi												-
7.		ular RNA												_
		ive analys			95		using	nectron	hotom	2*4				
	Preparatio						using.		notome	eter.				
	Extraction						tion wi	th analis	··					
	Preparatio				dire co	mma	tion wi		alive te	est.	-			
				-					Tmo				1	
OURS	E OUTC	OMES							10	TAL I	ERIO	DS:	60	
	nd of this		e stude	nte will	he able	a to						waren will be		
		eodise, m	c stude.	iits wiii	be able	e 10					200.000	MAP		
201	derive th	e principle	os unda	ulvia a i		, ,								
()	derive the principles underlying in the techniques of molecular biology. (Highest Level) Applying (K3)													
	examine the basic techniques of DNA isolation and manipulation. Applying (K3) Applying (K4)													
002	examine								ion.			lysing	(K4)
CO2 CO3	examine correlate	the techni	iques to	charac	eterize g	genetic	and pr	otein ma	ion. terials.		Ana	lysing lysing		
CO2 CO3 CO4	examine correlate analyse th	the technine molecu	iques to	charac	eterize g	genetic	and pr	otein ma	ion. terials.		Ana		(K4)
CO2 CO3 CO4	examine correlate analyse the protein le	the technine molecutvels.	iques to	charac	eterize g	genetic	and pr	otein ma	ion. terials.		Ana Ana Ana	lysing	(K4)
CO2 CO3 CO4	examine correlate analyse the protein le	the technine molecuvels.	iques to	charac nniques	for ger	genetic ne expr	and procession	otein ma at nuclei	ion. terials. c acids	and	Ana Ana Ana	lysing	(K4))
CO2 CO3 CO4	examine correlate analyse the protein le	the technine molecuvels.	iques to	charac nniques	for ger	genetic ne expr	and procession	otein ma at nuclei	ion. terials. c acids	and	Ana Ana Ana	lysing	(K4))
O/PO	examine correlate analyse tl protein le MAPPING g of Coun	the technine moleculvels. G: rse Outco	iques to	charac nniques O's) wi	for ger	genetic ne expr	and procession	otein ma at nuclei	ion. terials. c acids	and	Ana Ana Ogrami	lysing	(K4))
CO2	examine correlate analyse the protein le MAPPING of Court	the technine molecu vels. G: rse Outco 2/3 indica	iques to ilar tech me (Co	O's) wi	for gen	genetic ne expri gramm mes Ps elation 's	and procession	otein ma at nuclei	ion. terials. c acids	and	Ana Ana Ogrami	lysing lysing me Sp	(K4)))
CO2	examine correlate analyse tl protein le MAPPING g of Coun (1/2)	the technine molecularyels. G: rse Outco 2/3 indica	iques to lar tech me (Co	O's) wi	for generated fo	grammomes Pselation	and pression are Oute SO's 3-Stree	otein ma at nuclei	ion. terials. c acids	and Pro	Ana Ana Ogrami	lysing lysing me Sp	(K4) (K4) ecific))
CO2	examine correlate analyse the protein le MAPPING g of County (1/2)	the technine moleculary tels. G: rse Outco 2/3 indica 3 2	iques to	O's) wi	oterize grant for general for general for general for general for general forms of corresponding forms of the	gramm gramm mes Pselation	and pression are Oute SO's 3-Street	comes (I	ion. terials. c acids PO's) a ledium	and Pro	Ana Ana Ana Ogrami	lysing lysing me Sp 1 3	(K4)) c 2
CO2 CO3 CO4	examine correlate analyse tl protein le MAPPING g of Coun (1/2)	the technine molecularyels. G: rse Outco 2/3 indica	iques to lar tech me (Co	O's) wi	for generated fo	grammomes Pselation	and pression are Oute SO's 3-Stree	comes (I	ion. terials. c acids 'O's) a ledium	and Pro	Ana Ana Ogramicak	lysing lysing me Sp	(K4)) c 2

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BOARD OF STUDIES
BIOTECHNOLOGY

GE23	401	P	PROFESSIONAL DEVELOPMENT II	0	0	2	1
COUF	RSE OB	TECTIVES			1		
To ena	able the s	tudents to					
1.	enhance	e their own beh	navioural skills to survive in corporate world.				
2.	evaluat	e their listening	g and speaking skills to face the interviews in a	successful v	vay.		
3.	solve a	ivance level ve	erbal aptitude tests to get placed in Tier I comp	anies.			
4.	improv	e their reasonir	ng skills to get placed in reputed companies.				
UNIT	I V	VRITING SK	ILLS				7
Email	writing;	Fixing and ca	ncelling appointments; Paper submission for	seminars an	d con	ferer	ces:
			ess management; Body language; Dress code; S				
		g II; JAM level					
UNIT	II P	RESENTATI	ON SKILLS				7
Presen	tation sk	ills - Types a	nd methods of delivering presentation, ways	and metho	ds to	imp	rove
			entation in smaller groups; Situational role pla				
		on level IL; JAI					
UNIT	III Q	UANTITATI	VE APTITUDE - I				8
Simpli	fication;	Time, speed ar	nd distance; Trains; Boats and streams; Ratio a	nd proportio	n; Par	tners	hip;
Percen							
UNIT	IV L	OGICAL RE	ASONING				8
Seating	g arrang	ement; Arithm	netic reasoning; Character puzzle; Syllogism	ns; Matchir	ig de	finiti	ons;
Statem	ents and	arguments.					
				TOTAL P	ERIC	DDS	30
COUR	RSE OUT	COMES					
At the	and afth	is source stude	seete will be able to	BT M	lappe	d	
At the	end of th	is course, stude	ents will be able to	BT M	7.7		
			ents will be able to by development through various activities.		st Lev	rel)	K2)
At the CO1 CO2	interpre	t the personalit		(Highe	st Lev	rel) ling (our consta
CO1	interpre	t the personalit	ty development through various activities.	(Higher Unde	st Lev rstand	rel) ling (ring (K4)
CO1	interpre	t the personalite speaking and the quantitati	ty development through various activities. listening skills to excel in their jobs.	(Higher Unde	st Lev	rel) ling (ring (K4)
CO1	interpre examine develop intervie	t the personalite speaking and the quantitation.	ty development through various activities. listening skills to excel in their jobs.	(Highe Unde	rstanc analyz Apply	rel) ling (ring (K4)
CO1 CO2 CO3	examine develop intervie extend t	t the personalite speaking and the quantitation.	listening skills to excel in their jobs. live skills and analytical skills to face the bilities by scoring exceeded percentage to get	(Higher Unde	rstanc analyz Apply	rel) ling (ring (K4)
CO1 CO2 CO3	examine develop intervie extend t	t the personalite speaking and the quantitation. The reasoning also reputed compared to the person of the person	listening skills to excel in their jobs. live skills and analytical skills to face the bilities by scoring exceeded percentage to get	(Highe Unde	rstanc analyz Apply	rel) ling (ring (K4)
CO1 CO2 CO3	examine develop intervie extend to placed in BOOKS	t the personalite speaking and the quantitation. The treasoning at a reputed comparison.	listening skills to excel in their jobs. live skills and analytical skills to face the bilities by scoring exceeded percentage to get	(Highe Unde	rstanc analyz Apply	rel) ling (ring (K4)

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- 2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
- 3. Word Power Made Easy By Norman Lewis, Wr. Goyal Publications, 2021.

CO-PO MAPPING:

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

CO's	PO's													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	(=)	-	11=	-	() = (-	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

