



### Manipal School of Life Sciences

Manipal Academy of Higher Education, Manipal

## **Outcomes Based Education (OBE) Framework**

## Four Year Full Time Undergraduate Program B.Sc. Biotechnology (Honours)

2023





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#### 1. NATURE AND EXTENT OF THE PROGRAM

#### B.Sc. Biotechnology (Honours) Degree Program:

B.Sc. Biotechnology (Honours) is an undergraduate program covering the broad aspects of various areas of biotechnology to help choose a career in Life Sciences research and development. The main focus of the program is to gain basic knowledge in biotechnology through lectures and hands-on training, culminating in an extended research project work.

#### **Duration of the Program:**

The duration of the study of the B.Sc. (Honours) degree shall extend over a total period of four academic years divided into eight semesters of 6 months (4 odd semesters and 4 even semesters) each from the date of commencement of study for courses comprising the curriculum. The student has to carry out project work in the last three semesters of the program (18 months).

Medium: The medium of instruction and examination in the program shall be in English.

#### Eligibility:

**Qualification:** Pass in 10+2, A-Level, IB, American 12 grade or equivalent with English, Biology, Chemistry, and Physics or Biotechnology or Mathematics or any other Life Sciences subjects as optional subject and a minimum of 55% marks taken together in Biology, Chemistry, and Physics or Biotechnology or Mathematics or any other Life Sciences subject.

Candidates who have successfully completed six semesters of B.Sc. Biotechnology program with CGPA 7 and above are eligible to continue for 7<sup>th</sup> and 8<sup>th</sup> semesters of B.Sc. Biotechnology (Honours) program.

Courses covered include different areas of biotechnology, including genetics, molecular biology, cell biology, bioinformatics, biophysics, and business studies. Training on contemporary courses with state-of-the-art facilities.

Meritorious graduates gain postgraduate admissions in various fields in life sciences, health sciences, business administration, bioinformatics, systems biology and such, in India and abroad. A Postgraduate degree helps in better career prospects.

MANIPAL SCHOOL OF LIFE SCIENCES MANIPAL (A constituent unit of MAHE, Manipal)



#### 2. <u>PROGRAM EDUCATION OBJECTIVE (PEO)</u>

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for **B.Sc. Biotechnology (Honours) program** are as follows.

PEO No	Education Objective
PEO 1	Students will be able to use their fundamental concepts and technical competence
	in Biotechnology as and when required to achieve professional excellence.
PEO 2	Students will demonstrate strong and well defined practical knowledge in different
	areas of Biotechnology, including genetics, molecular biology, cell biology,
	bioinformatics, biophysics, and business studies.
PEO 3	Students will be able to practice the profession with a highly professional and
	ethical attitude, strong communication skills, and effective professional skills to
	work in a team with multidisciplinary approval.
PEO 4	Students will be able to use interpersonal and collaborative skills to identify, assess,
	and formulate problems and execute the solution in closely related issues in the
	Biotechnology domain.
PEO 5	Students will be able to imbibe the culture of research, innovation,
	entrepreneurship, and incubation.
PEO 6	Students will be able to participate in a lifelong learning process for a highly
	productive career and will be able to relate the concepts of Biotechnology towards
	serving the cause of the society.





#### 3. <u>GRADUATE ATTRIBUTES:</u>

S No.	Attribute	Description
1	Disciplinary Knowledge	Knowledge of Biotechnology theories. Acquiring knowledge of different dimensions of the Biotechnology domain, learning various techniques of biotechnology and other related areas of studies such as bioinformatics, biophysics, and business studies.
2	Understanding different subsets of Biotechnology	Different areas of Biotechnology including genetics, molecular biology, cell biology, biochemistry, bioinformatics, biophysics, and business studies.
3	Measurable Skills and Industry-ready Professionals	Strengthening the abilities of a learner by skills, gaining knowledge of the present scenario of the Biotechnology industry and training.
4	Effective and Influencing communication	Effective and Influencing communication ability to share thoughts, ideas and applied skills of communication in its various perspectives like written communication, speech communication etc.
5	Leadership readiness/ Qualities	To make learners fluent in multiple facets of leadership. Creating the ability & enhancing the qualities to be an efficient leader. Cultivating key characteristics in learners, to be visionary leaders who can inspire the team to greatness.
6	Critical/ Reflective thinking & language efficiency	Critical/ Reflective thinking ability to employ critical and reflective thinking along with the ability to create the sense of awareness of one self and society.
7	Technologically Efficient Professional	Capability to use various biotechnology techniques and tools.
8	Ethical Awareness	As a biotechnologist, one has to understand the importance of ethical values and its application in professional life.
9	Lifelong Learning	Every graduate to be converted into lifelong learner and consistently update himself or herself with current knowledge, skills and technologies. Acquiring Knowledge and creating the understanding in learners that learning will continue throughout life.
10	Research-related Skills	A sense of inquiry and investigation for raising relevant and contemporary questions, synthesizing and articulating.
11	Cooperation/ Team work	Building a team, motivating and inspiring the team members to work up with cooperation to their utmost efficiency.





#### 4. **QUALIFICATIONS DESCRIPTORS**

#### 1. Demonstrate

- a systematic, extensive and coherent knowledge and understanding of an academic field of study as a whole and its applications, and links to related disciplinary areas/courses of study; including a critical understanding of the established theories, principles and concepts, and of a number of advanced and emerging issues in the field of Biotechnology;
- (ii) Procedural knowledge that creates different types of professionals related to the Biotechnology industry, including research and development, teaching and government and public service;
- (iii) Professional and communication skills in the domain of Biotechnology
- 2. Demonstrate comprehensive knowledge about materials, including current research, scholarly, and/or professional literature, relating to essential and advanced learning areas pertaining to the Biotechnology field of study, and techniques and skills required for identifying problems and issues related.
- 3. Demonstrate skills in identifying information needs, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, analysis and interpretation of data using
- 4. Methodologies as appropriate to the course(s) for formulating evidence based solutions and arguments
- 5. Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems and issues relating to the chosen field of study.
- 6. Communicate the results of studies undertaken in an academic field accurately in a range of different contexts using the main concepts and techniques of the Biotechnology studies
- 7. Address one's own learning needs relating to current and emerging areas of study, making use of research, development and professional materials as appropriate, including those related to new frontiers of knowledge.
- 8. Apply one's disciplinary knowledge and transferable skills to new/unfamiliar contexts and to identify and analyse problems and issues and seek solutions to real-life problems.



## 5. <u>PROGRAM OUTCOMES</u>: After successful completion of B.Sc. Biotechnology (Honours) program, students will have:

PO No	Attribute	Competency
PO 1	Disciplinary knowledge	Capability of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study.
PO 2	Communication Skills	Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
PO 3	Critical thinking	Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
PO 4	Problem solving	Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
PO 5	Analytical reasoning	Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
PO 6	Research-related skills	A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.
PO 7	Cooperation/Team work	Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
PO 8	Scientific reasoning	Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Reflective thinking:	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.
PO 10	Information/digital literacy	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO 11	Self-directed learning	Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PO 12	Multicultural competence	Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.







PO 13	Moral and ethical	Ability to embrace moral/ethical values in conducting one's life, formulate a								
	awareness/reasoning	position/argument about an ethical issue from multiple perspectives, and use								
		ethical practices in all work. Capable of demonstrating the ability to identify								
		ethical issues related to one's work, avoid unethical behavior such as								
		fabrication, falsification or misrepresentation of data or committing								
		olagiarism, not adhering to intellectual property rights; appreciating								
		environmental and sustainability issues; and adopting an objective, unbiased								
		and truthful actions in all aspects of work.								
PO 14	Leadership	Capability for mapping out the tasks of a team or an organization, and setting								
	readiness/qualities	direction, formulating an inspiring vision, building a team who can help								
		achieve the vision, motivating and inspiring team members to engage with								
		that vision, and using management skills to guide people to the right								
		destination, in a smooth and efficient way.								
PO 15	Lifelong learning	Ability to acquire knowledge and skills, including "learning how to learn," that								
		are necessary for participating in learning activities throughout life, through								
		self-paced and self-directed learning aimed at personal development, meeting								
		economic, social and cultural objectives, and adapting to changing trades and								
		demands of the workplace through knowledge/skill development/reskilling.								



#### 6. COURSE STRUCTURE, COURSEWISE LEARNING OBJECTIVE, AND COURSE OUTCOMES (COs)

#### FIRST YEAR:

	Semester: 1					Semester: 2							
Course Code	Course Title	L	Т	Ρ	С	Course Code	Course Title	L	Т	Ρ	С		
BBT 101	Basics of Biotechnology	3	-	-	3	BBT 102	Cell Biology	3	-	-	3		
BBT 103	Biology-I	3	-	-	3	BBT 104	Biochemistry	3	-	-	3		
BBT 105	Biology-II	3	-	-	3	BBT 106	Environmental Science	3	-	-	3		
BBT 107	Chemistry	3	-	-	3	BBT 108 (or) BBT 110	(or)		-	-	3		
BBT 109	Computer Science	3	-	-	3	BBT 112	Cell Biology	-	-	4	2		
BBT 111	Biology-I	-	-	2	1	BBT 114	Biochemistry	-	-	4	2		
BBT 113	Biology-II	-	-	2	1	BBT 116	Environmental Science	-	-	4	2		
BBT 115	Chemistry	-	-	2	1	BBT 118 (or) BBT 120	Physics (or) Advanced Chemistry	-	-	2	1		
BBT 117	Computer Science	-	-	2	1	BBT 122	Seminar/Journal Club	-	1	-	1		
BBT 119	Seminar/Journal Club	-	1	-	1								
	Total	15	1	8	20		Total	12	1	14	20		

#### SECOND YEAR:

	Semester: 3					Semester: 4						
Course Code	Course Title	L	т	Р	С	Course Code	Course Title	L	т	Р	С	
BBT 201	Genetics	3	-	-	3	BBT 202	Biostatistics	3	-	-	3	
BBT 203	Molecular Biology	3	-	-	3	BBT 204	Pharmacology & Pharmacogenomics	3	-	-	3	
BBT 205	Microbiology	3	-	-	3	BBT 206	Plant Biotechnology	3	-	-	3	
BBT 207	Biophysics	3	-	-	3	BBT 208	Bioinformatics	3	-	-	3	
BBT 209	Genetics	-	-	4	2	BBT 210 (or) BBT 212	Immunology (or) Cell & Tissue Engineering	3	-	-	3	
BBT 211	Molecular Biology	-	-	4	2	BBT 214	Pharmacology & Pharmacogenomics	-	-	2	1	
BBT 213	Microbiology	-	-	4	2	BBT 216	Plant Biotechnology	-	-	2	1	
BBT 215	Biophysics	-	-	2	1	BBT 218	Bioinformatics	-	-	2	1	
BBT 217	Seminar/Journal Club	-	1	-	1	BBT 220 (or) BBT 222	Immunology (or) Cell & Tissue Engineering	-	-	2	1	
						BBT 224	Seminar/Journal Club	-	1	-	1	
	Total	12	1	14	20		Total	15	1	8	20	





#### THIRD YEAR:

	Semester: 5			Semester: 6										
Course Code	Course Title	L	т	Р	с	Course Code	Course Title	L	т	Ρ	с			
BBT 301	Microbial Biotechnology	3	-	-	3	BBT 302	Tutorial/Seminars/							
BBT 303	Developmental Biology	3	-	-	3		Journal Club	-	4	-	4			
BBT 305	Advanced Genomics	3	-	-	3									
BBT 307	Nanobiotechnology	3	-	-	3	BBT 399	Research Project/ Submission of							
BBT 309	Research Methodology	3	-	-	3		dissertation/	-	-	32	16			
BBT 311	Microbial Biotechnology	-	-	2	1		Submission of manuscript							
BBT 313	Developmental Biology	-	-	2	1									
BBT 315	Advanced Genomics	-	-	2	1									
BBT 317	Nanobiotechnology	-	-	2	1									
BBT 319	Seminar/Journal Club	-	1	-	1									
	Total	15	1	8	20		Total	-	4	32	20			

#### FOURTH YEAR

Semest	ter: 7	Semester: 8											
Course Code	Course Title	L	т	Ρ	с	Course Code	Course Title	L	т	Р	С		
BBT 401	Laboratory Rotation	-	-	8	4	BBT 402	Tutorials/Seminars	-	8	-	4		
BBT 403	Tutorials/Seminars/Journal Club		4	-	4		/Journal Club						
BBT 405	Research Project work progress report I submission/presentation	-	-	24	12	BBT 499	Research Project work /Submission of manuscript	-	-	32	16		
	Total	-	4	32	20		Total	-	4	32	20		

Name of the Progra	m:	B.Sc. Biotechnology (Honours)					
Course Title:		Basics of Biotechnology (Theory)					
Course Code: BBT 1	01	Course Instructor: Course In-charge					
Academic Year: 202	23 Onwards	Semester: I Year, I Semester					
No of Credits: 3		Prerequisites: Admission to B.Sc. program					
Synopsis:							
	biotechnology	and its impact on the living system and environment. Further, to understand					
	the role of mo	odern technology, bioethics, good practices and biosafety, and its impact on					
	society with in	nproved productivity.					
Course Outcomes (	COs): On :	successful completion of this course, students will be able to					
CO 1:	Def	ne the various components of biotechnology, discuss the scope and					
	application and explain the concept of biotechnology for society (C1, C2, C3)						
CO 2:	Exp	ain the importance of biotechnological tools and its impact on agricultural					
	pro	ductivity and environment (C2, C3, C4)					





CO 3:													•	-	, food C2, C3,
CO 4:						import ptance			afety as	pects,	comm	ercial p	otentia	l of GM	Os and
Mappin	g of CO	s to P	Os				<u>, ,</u>								
COs	PO 1			PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PO 13	PO 14	РО 15
CO 1	×														
CO 2	×														
CO 3	×				×										
CO 4	×		×												
Course															
Content		Cc	ompeten	cies										No of	Hours
Unit 1:															
Introduo		•	Define	various	s compo	onents	of biot	echnolo	ogy and	their	import	ance (C	1, C2,	4	
Biotech	nology		C3)												
			Illustra					•				0, .			
		•	Demon (C2, C3		various	recoml	oinant l	DNA an	d genoi	me sec	quencir	ng techr	niques		
Unit 2:			(02, 03	)											
Biotech	nology	•	Interpr	et the	focus a	rea of a	agricult	ural bio	otechno	ology (	plants	and an	imals)	6	
and Plar	υ,		and for							-07 (			/		
		•	Compa					and its	impact	on ag	ricultur	al and	forest		
			produc				1		1	- 0					
Unit 3:		I	•	7 (											
Biotech	nology	•	Outline	the m	ajor so	urce of	marin	e orgar	nisms fo	or food	d produ	uction,	major	6	
and			factors		-			-			-		-		
environ	ment		tools.	(C1, C2	, C3)	-					-		-		
Unit 4:															
Biotech	nology	•	Infer t	he pot	ential	role o	f mode	ern teo	hnolog	y for	the p	roducti	on of	6	
and hea	lth		recomb	oinant r	nedicin	e (horn	nones,	vaccine	s and c	ther p	roteins	s) (C2, C	(4)		
		•	Apply t	he imp	erative	role of	molecu	ular bio	logy me	ethods	for for	ensic so	cience		
			(C3)	-											
Unit 5:															
Bioproc	essing	•	Explain	the ro	e of fei	rmenta	tion bic	techno	logy fo	r large	scale p	product	ion of	4	
			metabo	olites/e	nzymes	s for co	mmerc	ial appl	ication	(C2, C	5)				
Unit 6:															
Biotech	nology	•	Outline	the er	merging	g role o	f nano	techno	logy on	food	techno	logy ar	nd the	6	
for futu	re		safety (	(C2)											
Unit 7:															
Intellect	tual	•	Explain	the re	gulatio	ns of in	tellectu	ual prop	perty ri	ghts ir	n bioteo	chnolog	gy and	3	
Property	y Rights	5	its appl	ication	(C2, C3	3)									
		•	Illustra	te the	rules a	nd regu	ulation	for pat	ent fili	ng and	l furthe	er proc	essing		
			(C2)												
		•	Explain	the bio	osafety	and m	anagen	nent of	biotec	hnolog	gical pro	oducts	(food,		
			medici	ne and	industr	y) (C2,	C3)								
Unit 8:															





	Demonstrate th microbes, plan	•		ind conta	inment system for GN	AOs 6			
Biotechnology • E and Society • C	Give an outline	on commercial		-	d disadvantages (C2, India and their impac	-			
	agricultural grov								
Learning strategies, co	intact hours an								
Learning strategy		Contact ho	ours		ent learning time (Hr.	s)			
Lecture		45		135					
Seminar									
Small Group Discussion									
Self-directed learning (									
Problem Based Learnin									
Case Based Learning (C	.BL)								
Clinic									
Practical									
Revision									
Assessment		05		-					
TOTAL		50		135					
Assessment Methods:				-	-				
Formative:				Summa					
Class tests					essional examination				
Assignments/presenta	tions			End sen	nester examination				
Quiz									
C									
Nature of assessment		CO 1	CO	2	CO 3	CO 4			
Sessional Examination		Х	Х						
Quiz									
Assignment/Presentat		Х	Х		Х	Х			
End Semester Examina		X	Х		X	X			
Laboratory examinatio		NA	NA	A Contraction of the second se	NA	NA			
Feedback Process		Semester Feed							
Reference Material	<ul> <li>Hall.</li> <li>Introduction</li> <li>Inc.</li> <li>Molecular Society of</li> <li>Biotechno</li> <li>Biotechno</li> <li>Elements of</li> <li>Biotechno</li> <li>Kalyani Pu</li> <li>Plant Bior Publishers</li> </ul>	on to Plant Bio Biology and B Chemistry. logy (2nd ed.) logy from A to of biotechnolo logy-Expanding blishers, New technology. B , New Delhi.	technology iotechnolog - 2001 - Reł Z, (2nd ed. gy- P. K. Gu g Horizons- Delhi. B.D. Singh,	(2nd ed.) gy (4th ec ) - 1998 – pta, Rasto B.D. Sing 2015 (r	ed.) - 2001 – Shuler N – 2002 – Chawla HS d.) - 2001, - Walker Jf CH (University of Mich Bains W - Oxford Uni ogi publications.\ h, 2004 (revised and evised and reprinte printed, 2020); Kalya	- Science Publishers M, Rapley R - Royal higan). versity Press. d reprinted, 2019); ed, 2019); Kalyani			





Name of	the Pi	rogram	:		B.Sc	. Biote	chnolog	gy (Hon	ours)						
Course T	itle:				Biol	ogy-I (T	heory)								
Course C	Code: B	BT 103			Cou	rse Inst	ructor:	Course	e In-cha	rge					
Academ	ic Year	: 2023	onwa	rds	Sem	Semester: I Year, I Semester									
No of Cr	edits:	3			Prerequisites: Admission to B.Sc. program										
Synopsis	5:				this course are to acquaint the students with animal classification and taxonomic										
		•			ngdom. To provide fundamental knowledge on the characteristics oppreciate the variability in relation to their morphology, anatomy										
									elation	to thei	r morpl	nology,	anatom	ıy, beh	aviour
			· ·	ions of d											
Course C	Dutcon	nes (CO	s):		uccessful completion of this course, students will be able to										
CO 1:				Learn th C2)	e basis	e basis of animal taxonomy, classification, and binominal nomenclature (C1									
CO 2:				Learn th	e gene	ral cha	racteris	tics of	protozo	oa, Paro	ameciu	m repro	oductio	n (C1, (	C2)
CO 3:				Underst											
CO 4:				Know th C2)	e majo	r Non-o	chordat	e phylu	um and	able to	disting	guish ur	nique ch	naracte	ers (C1,
CO 5:				Know th				-			-				
CO 6:			T	Know th	•	υ,		al struc	ctures/l	ife cycl	e of rep	present	ative sp	ecime	n from
				each an	imal ph	ıyla (C1	, C2).								
Mapping	-		1												
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	РО 12	РО 13	РО 14	РО 15
CO 1	×		×		×										
CO 2	×														
CO 3	×				×										
CO 4	×														
CO 5	×		×												
CO 6	×														
Course o	onten	t and ou	utcom	les:											
Content			Со	mpetenc	ies	S								No o <u>.</u> Hour	
Unit 1:															
Animal o	lassifi	cation		Jndersta species c				ciples,	binomia	al nom	enclatı	ıre, bic	ological	4	
Unit 2:															
Animal evolutio	body n	, plar		Describe deuteros				symme	etry, c	oelom,	proto	ostome	s, and	3	
Unit 3:							1							1	
Protozoa	a			Jndersta			ribe tl	ne gen	eral ch	naracte	ristics,	Param	necium	2	
Unit 4:			ſ	eproduc		I, UZ)								1	
Non-cho	rdator	- 1	lln	derstand	h and d	escribo	the go	neral d	haracto	ristics ·	and clas	ssificati	on	12	
Non-cho	uales			Porifera:			-					sincati	UII	12	
				Cnidaria:				•	-	in ∩h4	olia Pla	tvhelm	inthes <sup>.</sup>		
				asciola ł					-			cyneini	minico.		
				Vematod			-	-		adupt					
Unit 5:								(C1, C2	-1					1	
Non-cho	rdates	-11	Un	derstand	h hne	escrihe	the øe	neral cl	haracte	ristics	and clar	ssificati	on	9	
	. aates			aci stant	. unu u	230/100	510 80					Juncati			





	Anne	lida: Met	tamer	ism iı	n Anne	lida								
	_			-	-									
	<ul> <li>Arthropoda: Vision in Arthropoda</li> <li>Mollusca: Torsion in gastropods, Lamellidens internal anatomy</li> <li>Echinodermata: water vascular system in starfish (C1, C2)</li> </ul>													
				-	•			•						
Unit 6:	- Lonin	ouermat			Joculai	Systemme		-/						
Chordates-I	Understar	d and de	escribe	e the	gener	al character	istics and clas	sification	8					
					-	n frog, parei			-					
				•		• •	and migratior	in fishes						
		Reptilia: Amniotic egg, identification of common poisonous snakes,												
		poison apparatus and mechanism of biting, Jacobson's, and pit organs												
	(C1, C2)													
Unit 7:									•					
Chordates-II	Understan	d and de	escribe	e the	gener	al character	istics and clas	sification	7					
	<ul> <li>Aves: flight adaptations, flightless birds</li> </ul>													
	• Mamma	Mammalia: dentition in mammals, adaptive radiation (C1, C2)												
Learning strategies, co	ntact hours a	and stud	ent le	arnir	ng time	9								
Learning strategy														
Lecture			45				135							
Seminar														
Small Group Discussion	(SGD)													
Self-directed learning (S	SDL)													
Problem Based Learnin	g (PBL)													
Case Based Learning (C	BL)													
Clinic														
Practical														
Revision														
Assessment			05				-							
TOTAL			50				135							
Assessment Methods:														
Formative:						native:	_							
Class tests						onal examin								
Assignments/presentat	ions				End s	emester exa	amination							
Quiz														
<b>NA</b>														
Mapping of assessmen	t with COs	<u> </u>		<u> </u>		CO 2	CO 4							
Nature of assessment		CO 1		CO 2		CO 3	CO 4	CO 5	CO 6					
Sessional Examination		X			X	X	NI A	NI A						
Quiz	<b>a</b> n	NA			IA V	NA	NA	NA	NA					
Assignment/Presentatio		X			X	X	X	X	X					
End Semester Examinat		X			X	X	X	X	X					
Laboratory examination		NA			IA 	NA	NA	NA	NA					
Feedback Process		-Semest							<b>.</b> .					
Reference Material	-					•	natomy, Func	tion, Evolutio	n, Boston,					
	Massachu	setts, Mo	cGraw	/-Hill,	1998.									





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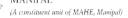
Name of	the Pi	rogram	:		B.Sc	. Biotec	hnolog	y (Hon	ours)						
Course T					Biol	ogy-II ('	Theory)	)							
Course C	Code: B	BT 105			Cou	rse Inst	ructor:	Course	e In-cha	rge					
Academ	ic Year	: 2023	onwai	rds	Sem	Semester: I Year, I Semester									
No of Cr	edits:	3			Prer	equisit	es: Ad	missio	n to B.S	c. prog	gram				
Synopsis	5:	1. Th	is mod	lule help	s to un	o understand the knowledge obtained in basic courses of Bo									
			•			nental knowledge of plant morphology, taxonomy, anatomy									logy &
		bioche	mistry	and pat	hology										
						fundamental forms of flora and their diversity.									
Course C	Outcon	nes (CO				ssful completion of this course, students will be able to									
CO 1:				Outline			-			-		-			
CO 2:													ologica	al adap	tations
			collectio	-						-					
CO 3:				Learning	-									· ·	
CO 4:				Explain				of pla	nt ana	itomy,	repro	ductive	biolo	ogy and	រ crop
				improve											
CO 5:					and illustrate the plant metabolite identification and product scale up										
				•		s and the role of defence mechanism and pathogenesis in plants and devise s to identify, confirm and combat plant pathogens									
													1.00		
CO 6:					s the nature of explants and the proliferation capacities for different plant s and impact of various growth regulators (both endogenous and exogenous)										
				•											nous)
Manain				along w	long with organogenetic and somatic embryogenic potentials										
Mapping COs	PO 1		PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
COS	PO 1	P0 2	PU 3	PO 4	PU 5	P0 6	P07	PU 8	POg	10	11	12	13	14	15
CO 1	×	×								10	11	12	15	14	15
CO 2	×	×													-
CO 3	×	×													-
CO 4	×	x		×											-
CO 5	×	×		~	<u> </u>										+
CO 6	×	x			1					×					+
Course c			utcom	es:	L	I	I	I	I		L	1	-		
Content														No of I	Hours
Unit 1:	· · ·														
Introduc	tion	• De	efine a	and explain fundamental principles of plant biology –Parts of plants										4	
	and concepts (C1, C2														
in Botan	,				tanding the types of plants and its evolution (C2,C4)										
				anding the types of classification (C2, C4)											
				J				•	. ,						





Adorphology & productive ycles <ul> <li>Provide an outline of the morphological diversity of flora (C2)</li> <li>Explain the micro and megasporogenesis (C2, C5)</li> <li>Illustrate the types of embryo in higher plants (C2)</li> <li>Explain the plant anatomical features and identification of the same (C2, C5)</li> <li>Identification of architectural variations in different plant parts (C2, C5)</li> <li>Identification of architectural variations in different plant parts (C2, C5)</li> <li>Explain the process of Water absorption (C2, C5, C6)</li> <li>Demonstrate transpiration and Guttation in plants (C2)</li> <li>Outline the mechanism of water and solute transport (C2)</li> <li>Init 4:</li> <li>List Photosynthetic events in plants (C1)</li> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation - Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C2)</li> <li>Explain the process and importance of Kreb's Cycle (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Explain the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define Respiration and Cascades involved (C1, C2, C5)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Explain the functions of plant growth reg</li></ul>		$^{(0)}\mathcal{P}_{RD} \otimes \mathcal{V}^{\mathcal{V}}$ (Deemed to be University under Section 3 of the UGC Act, 1956)	
Unit 2:       Arophology &       Provide an outline of the morphological diversity of flora (C2)       4         Arophology &       Explain the micro and megasporogenesis (C2, C5)       4         ycles       Illustrate the types of embryo in higher plants (C2)       5         >       Identification of architectural variations in different plant parts (C2, C5)       4         undamentals       Define the fundamentals of plant water relations (C1, C2, C5)       4         f Plant       Explain the process of Water absorption (C2, C5, C6)       4         bit 3:       Demonstrate transpiration and Guttation in plants (C2)       0         outline the mechanism of water and solute transport (C2)       0       0         bit 4:       List Photosynthetic events in plants (C1)       7         Discuss light reactions and distinguish qualitative and quantitative photosynthetic efficiency (C2)       7         i Hustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)       10       10         i Hustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)       2       Explain the process and importance of Kreb's Cycle (C2,C5)       7         Illustrate the primary glycolytic metabolism in plants (C2)       Explain the process and importance of Kreb's Cycle (C2,C5)       7         Int 5:       Illustrate the synthesis of ATP and Energy Utilization and dissipation (C			
Adorphology & productive ycles <ul> <li>Provide an outline of the morphological diversity of flora (C2)</li> <li>Explain the micro and megasporogenesis (C2, C5)</li> <li>Illustrate the types of embryo in higher plants (C2)</li> <li>Explain the plant anatomical features and identification of the same (C2, C5)</li> <li>Identification of architectural variations in different plant parts (C2, C5)</li> <li>Identification of architectural variations in different plant parts (C2, C5)</li> <li>Define the fundamentals of plant water relations (C1, C2, C5, C6)</li> <li>Demonstrate transpiration and Guttation in plants (C2)</li> <li>Outline the mechanism of water and solute transport (C2)</li> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation- Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understate the primary glycolytic metabolism in plants (C2)</li> <li>Explain the role of mitochondrial functions during respiratory processes (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define nastic movements in plants (C1)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define astic movements in pl</li></ul>		• Understanding the evolution of floral life forms and their adaptations (C2, C4)	
eproductive       • Explain the micro and megasporogenesis (C2, C5)       • Illustrate the types of embryo in higher plants (C2)         • Explain the plant anatomical features and identification of the same (C2, C5)       • Identification of architectural variations in different plant parts (C2, C5)         Init 3:       • Define the fundamentals of plant water relations (C1, C2, C5, C6)       • Demonstrate transpiration and Guttation in plants (C2)         • Dutine the mechanism of water and solute transport (C2)       • Outline the mechanism of water and solute transport (C6)       • Explain the fundamentals of Carbon oxidation - Photorespiration (C6)         • List Photosynthetic events in plants (C1)       • Discuss light reactions and mechanism of Electron transport (C6)       • Explain different Photosynthetic plant types (C2, C5)         • Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)       • Explain the fundamentals of Carbon oxidation - Photorespiration (C6)       • Understanding the factors influencing photosynthesis and law of limiting factors (C6)         • Unit 5:       • Define Respiration and the types involved (C1,C2)       7         • Illustrate the primary glycolytic metabolism in plants (C2)       • Explain the process and importance of Kreb's Cycle (C2,C5)       7         • Define nastic movements in plants (C1)       • Explain the role of mitochondrial functions during respiratory processes (C2,C5)       7         • Define nastic movements in plants (C1)       • Explain the phases of growth in plants (C2,C5)       1	`Unit 2:		
undamentals <ul> <li>Define the fundamentals of plant water relations (C1, C2, C5)</li> <li>Explain the process of Water absorption (C2, C5, C6)</li> <li>Demonstrate transpiration and Guttation in plants (C2)</li> <li>Outline the mechanism of water and solute transport (C2)</li> <li>Juit 4:</li> <li> <ul> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation - Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> </ul>               7         <ul> <li>Tesplain the process of AIP and Energy Utilization and dissipation (C2)</li> <li>Explain the process of internal and external growth factor regulations (C2, C5)</li> <li>Demonstrate the synthesis of AIP and Energy Utilization and dissipation (C2)</li> <li>Explain the process of forwth in plants. (C2, C5)</li> <li>Demonstrate the synthesis of AIP and Energy Utilization and dissipation (C2)</li> <li>Explain the phases of growth in plants. (C2, C5)</li> <li>Illustrate the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2, C5)</li> <li>Define growth regulators and Cascades involved (C1, C2, C5)</li> <li>Explain the functions of plant diseases (C2)</li> <li>Explain the dissification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2, C5)</li> <li>Explain the classi</li></ul></li></ul>	Morphology & reproductive cycles	<ul> <li>Explain the micro and megasporogenesis (C2, C5)</li> <li>Illustrate the types of embryo in higher plants (C2)</li> <li>Explain the plant anatomical features and identification of the same (C2, C5)</li> </ul>	4
if Plant       • Explain the process of Water absorption (C2, C5, C6)       • Demonstrate transpiration and Guttation in plants (C2)         • Outline the mechanism of water and solute transport (C2)       • Dutline the mechanism of water and solute transport (C2)         Init 4:       • List Photosynthetic events in plants (C1)       • Discuss light reactions and mechanism of Electron transport (C6)         • Explain different Photosynthetic plant types (C2, C5)       • Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)         • Explain the fundamentals of Carbon oxidation - Photorespiration (C6)       • Understanding the factors influencing photosynthesis and law of limiting factors (C6)         Unit 5:       • Define Respiration and the types involved (C1,C2)       7         * Illustrate the primary glycolytic metabolism in plants (C2)       • Explain the process and importance of Kreb's Cycle (C2,C5)         • Demonstrate Cxidative phosphorylation (C2)       • Explain the role of mitochondrial functions during respiratory processes (C2,C5)         • Define nastic movements in plants (C1)       • Explain the process of internal and external growth factor regulations (C2)         • Explain the functions of plant growth regulators (C2,C5)       • Define growth regulators and Cascades involved (C1, C2, C5)         • Illustrate the epidemiology of plant diseases (C2)       • Explain the functions of plant growth regulators (C2,C5)         • Define growth regulators and Cascades involved (C1, C2, C5)       • Explain the functions of	Unit 3:		
Intervention <ul> <li>List Photosynthetic events in plants (C1)</li> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation- Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the types involved (C1,C2)</li> <li>Explain the primary glycolytic metabolism in plants (C2)</li> <li>Demonstrate Oxidative phosphorylation (C2)</li> <li>Explain the process and importance of Kreb's Cycle (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the role of mitochondrial functions during respiratory processes (C2,C5)</li> <li>Unit 6:</li> <li>Plant growth</li> <li>Define nastic movements in plants (C1)</li> <li>Explain the phases of growth in plants. (C2,C5)</li> <li>Illustrate the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define growth regulators and Cascades involved (C1, C2, C5)</li> <li>Define growth regulators and Cascades involved (C1, C2, C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explai</li></ul>	Fundamentals of Plant Physiology	<ul> <li>Explain the process of Water absorption (C2, C5, C6)</li> <li>Demonstrate transpiration and Guttation in plants (C2)</li> </ul>	4
<ul> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation- Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting factors (C6)</li> <li>Understanding the process and importance of Kreb's Cycle (C2,C5)</li> <li>Demonstrate Oxidative phosphorylation (C2)</li> <li>Explain the role of mitochondrial functions during respiratory processes (C2,C5)</li> <li>Define nastic movements in plants (C1)</li> <li>Explain the phases of growth in plants. (C2,C5)</li> <li>Illustrate the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define growth regulators and Cascades involved (C1, C2, C5)</li> <li>Define growth regulators of cascades involved (C1, C2, C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> </ul>	Unit 4:		
Junit 5: <ul> <li>Define Respiration and the types involved (C1,C2)</li> <li>Illustrate the primary glycolytic metabolism in plants (C2)</li> <li>Demonstrate Oxidative phosphorylation (C2)</li> <li>Explain the process and importance of Kreb's Cycle (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the role of mitochondrial functions during respiratory processes (C2,C5)</li> <li>Define nastic movements in plants (C1)</li> <li>Explain the phases of growth in plants. (C2,C5)</li> <li>Illustrate the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> <li>Define growth regulators and Cascades involved (C1, C2, C5)</li> <li>Define the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> <li>Explain the symptoms (C2,C5)</li></ul>	Photosynthesi s	<ul> <li>Discuss light reactions and mechanism of Electron transport (C6)</li> <li>Explain different Photosynthetic plant types (C2, C5)</li> <li>Illustrate and distinguish qualitative and quantitative photosynthetic efficiency (C2)</li> <li>Explain the fundamentals of Carbon oxidation- Photorespiration (C6)</li> <li>Understanding the factors influencing photosynthesis and law of limiting</li> </ul>	7
Illustrate the primary glycolytic metabolism in plants (C2)       Illustrate the primary glycolytic metabolism in plants (C2)         Demonstrate Oxidative phosphorylation (C2)       Explain the process and importance of Kreb's Cycle (C2,C5)         Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)       Explain the role of mitochondrial functions during respiratory processes (C2,C5)         Unit 6:       •         Plant growth       • Define nastic movements in plants (C1)         • Explain the phases of growth in plants. (C2,C5)       • Illustrate the process of internal and external growth factor regulations (C2)         • Explain the functions of plant growth regulators (C2,C5)       • Define growth regulators and Cascades involved (C1, C2, C5)         • Define growth regulators and Cascades involved (C1, C2, C5)       • Explain the mechanism of defences and types in plants (C2,C5)         • Define the epidemiology of plant diseases (C2)       • Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)         • Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)	Unit 5:		
Jnit 6:       • Define nastic movements in plants (C1)       4         • Explain the phases of growth in plants. (C2,C5)       4         • Illustrate the process of internal and external growth factor regulations (C2)       5         • Explain the functions of plant growth regulators (C2,C5)       6         • Define growth regulators and Cascades involved (C1, C2, C5)       6         Plant       • Illustrate the epidemiology of plant diseases (C2)       6         • Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)       6         • Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)       6	Plant Respiration	<ul> <li>Illustrate the primary glycolytic metabolism in plants (C2)</li> <li>Demonstrate Oxidative phosphorylation (C2)</li> <li>Explain the process and importance of Kreb's Cycle (C2,C5)</li> <li>Demonstrate the synthesis of ATP and Energy Utilization and dissipation (C2)</li> <li>Explain the role of mitochondrial functions during respiratory processes</li> </ul>	7
Plant growth       • Define nastic movements in plants (C1)       4         • Explain the phases of growth in plants. (C2,C5)       • Illustrate the process of internal and external growth factor regulations (C2)       4         • Explain the functions of plant growth regulators (C2,C5)       • Define growth regulators and Cascades involved (C1, C2, C5)       6         • Junit 7:       • Illustrate the epidemiology of plant diseases (C2)       6         • Explain the mechanism of defences and types in plants (C2,C5)       6         • Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)       6         • Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)       6	Unit 6:		
<ul> <li>Illustrate the epidemiology of plant diseases (C2)</li> <li>Explain the mechanism of defences and types in plants (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> </ul>	Plant growth	<ul> <li>Explain the phases of growth in plants. (C2,C5)</li> <li>Illustrate the process of internal and external growth factor regulations (C2)</li> <li>Explain the functions of plant growth regulators (C2,C5)</li> </ul>	4
<ul> <li>Illustrate the epidemiology of plant diseases (C2)</li> <li>Explain the mechanism of defences and types in plants (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for abovementioned pathogens (C2,C5)</li> </ul>	Unit 7:		
Jnit 8:	Plant Pathology	<ul> <li>Explain the mechanism of defences and types in plants (C2,C5)</li> <li>Explain the classification and mode of infection of Viral bacterial, fungal and nematode plant pathogens (C2,C5)</li> <li>Explain the symptoms, Identification, and control measures for above-</li> </ul>	6
	Unit 8:		







				"Spired BY LA" (De	emed to be University under Section 3	o, ine e de rita, 1990,			
Defence	Define the defe				5	5			
mechanism in	<ul> <li>Explain the type</li> </ul>								
plants	Illustrate the me		•	-					
	Explain the pote	••			iting pathogei	ns (C2,C5)			
	Discuss the met	abolite armo	oury in plants	(C1, C2, C5)					
Unit 9:									
Secondary	Illustrate the me	etabolite net	works in plan	ts (C2)		4	1		
metabolites in	• Explain the class	sification and	d pathways of	metabolites	(C2,C5)				
plants	• Explain the relev	vant ones an	d their functi	onal roles in p	plants (C2,C5	)			
	• Explain the med	icinal and ph	ytochemical	efficacy of pla	nt metabolite	es (C2,C5)			
Learning strateg	ies, contact hours a	nd student	learning time						
Learning strateg	У		Student le	earning time	(Hrs)				
Lecture		45			135				
Seminar									
Small Group Dis	cussion (SGD)								
Self-directed lea	rning (SDL)								
Problem Based I	earning (PBL)								
Case Based Lear	ning (CBL)								
Clinic									
Practical									
Revision									
Assessment		05	05 -						
TOTAL		50			135				
A a a a a a mar b A a	the de.								
Assessment Me	thoas:			Summativ					
Formative:					e: examination				
Class tests	acontations					ion			
Assignments/pro Quiz	esentations				ster examinat				
Quiz									
Mapping of asse	essment with COs								
Nature of assess		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Exami	nation	Х	x	x	x				
Quiz			х		x		x		
Assignment/Pre	sentation	Х		х					
End Semester Ex		Х	х	х	x	х	x		
Laboratory exan		NA	NA	NA	NA	NA	NA		
Feedback Proce		d-Semester I	Feedback				•		





Reference Material	• A Stock Book of Biology Vol. I - 2002 - M Sudhakar Rao, - Geetha Publishers, Mysore.
	<ul> <li>Biological Science (3rd Ed.) - 2002 - Taylor DJ, Green NPO, Stout GW - Cambridge University Press.</li> </ul>
	<ul> <li>Biological Science (3rdEd) - Taylor DJ, Green NPO, Stout GW 2002 - Cambridge University Press.</li> </ul>
	• Biology –2002- Chakroborty DP, National Council of Educational Research & Training, India.
	• Fundamentals of Plant Physiology - 1977 - Jain VK, - S Chand Publishers, New Delhi.
	<ul> <li>Introduction to principles of Plant Taxonomy – 1991 – VV Sivarajan,</li> </ul>
	<ul> <li>Plant Physiology – 1992 - Salisbury FB, Ross CW - Wadsworth Publishers, UK.</li> </ul>
	<ul> <li>Plant Physiology (5th Ed.) – 2010 - Taiz L, Zeiger E Sinauer Associates.</li> </ul>

Name	of the F	rogran	n:		В	.Sc. Bio	techno	logy (H	onours	)					
Course	Title:				С	hemistı	ry (The	ory)							
Course	Code:	BBT 10	7		C	ourse li	nstruct	or: Cou	rse In-c	harge					
Acade	mic Yea	r: 202	3 onwa	ards	S	emeste	r: I Yea	r, I Sen	nester						
No of 0	Credits:	3			Prerequisites: Admission to B.Sc. program										
Synops	sis:	The c	objectiv	es of tl	of this course are to acquaint the students with general chemistry principles. This										
		cours	se intro	duces v	ces with the following areas in chemistry: inorganic, organic and physical.										
Course	Outco	mes (C	Os):	On suc	successful completion of this course, students will be able to										
CO 1:				Define	acid ar	acid and bases based on various concepts and its limitations, identify conjugate									
					base pairs, Applications of HSAB concept (C1, C2, C3)										
CO 2:				Under	stand	the role	e of m	ietals i	n biolo	gy. D	escribe	physic	ochem	ical pro	operties,
				chemi	cal read	ctions o	f oil an	d deter	mine th	ne phy	sicoche	mical p	roperti	es (C1,	C2)
CO 3:							•		υ,		•				dynamic
				proper	ties. D	Describe	e the r	ate, o	rder of	reac	tion, e	xpressio	on for	rate c	onstant,
					termination of order of reaction and Arrhenius equation (C1, C2, C3)										
CO 4:				• •									n of hyd	droniun	n ions in
						ion (salt									
CO 5:						he Gree	en Cher	nistry a	nd QSA	AR with	n some	applica	tions ir	n biotec	hnology
				(C1, C2											
CO 6:					Recognise enantiomers, diastereomers or meso compounds, discuss the resolution of										
				racem	racemic mixtures (C1, C2, C3)										
	ng of C														
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO 15
										10	11	12	13	14	
CO 1	×														
CO 2	×														
CO 3	×														
CO 4	×			×											
CO 5	×			×											
CO 6	×														
	conter	nt and o													
Conten			Сотр	oetencie	S									No	of Hours
Unit 1:			1												
Acids a	ind Base	es			ne acids and bases based on various concepts(Arrhenius, Lux Flood, 6										
				ris, lipids and elaborate on its composition and function (C1, C2, C3)											
			• Exp	lain the	in the concept of conjugate acid base pair (C1, C2)										





	$^{97}$ $^{97}$ $^{97}$ $^{97}$ $^{10}$ $^{10}$ $^{10}$ (Deemed to be University under Section 3 of the UGC Act, 1956)	
	Summarise the Pearsons HSAB concept and its applications (C1)	
Unit 2:		
Bioinorganic Chemistry	<ul> <li>What is the physiological significance of cooperative binding of oxygen by haemoglobin? (C1)</li> <li>Outline the fixation of atmospheric nitrogen to form ammonia (C1, C2)</li> <li>List the metalloenzymes and its biological importance (C1)</li> <li>Name the bioactive substances containing metals (C1)</li> </ul>	3
Unit 3:		
Thermodynamics	<ul> <li>Define heat capacity and terms associated with thermodynamics (C1)</li> <li>Define first &amp; second law of thermodynamics (C1, C2)</li> <li>Discuss Joule Thomson effect and its application (C1, C2, C3)</li> <li>Explain the concept of entropy and its significance (C1, C2, C3)</li> <li>Explain the significance of Gibbs free energy and relationship with Helmholtz free energy (C1, C2, C3)</li> </ul>	5
Unit 4:		I
Ionic Equilibria	<ul> <li>Discuss Henderson's equation and preparation of buffer solution(C1, C2)</li> <li>Discuss the hydrolysis of salt and outline the expression for the pH of hydrolysed salt solution (C1, C2, C3)</li> </ul>	6
Unit 5:		
Chemical Kinetics	<ul> <li>Define law of mass action, rate of reaction, order and molecularity of reaction(C1, C2)</li> <li>Define half-life of the reaction(C1, C2)</li> <li>Find the order of the reaction by various methods (C1, C2, C3)</li> <li>Explain the effect of temperature on reaction rate (C1, C2, C3)</li> </ul>	7
Unit 6:		1
Oils, Fats & Waxes	• Define acid value, saponification value, iodine value, Polenske value, Reichert-Meissl value, acetyl value (C1, C2)	3
Unit 7:		
QSAR	<ul> <li>What is structure activity relationships (SAR) and quantitative structure activity relationships (QSAR) (C1)</li> <li>List QSAR parameters – Physiochemical parameters lipophilicity –Electronic parameters, Steric parameters(C1)</li> <li>Show the effect of electronic and steric parameters on lipophilicity (C2)</li> </ul>	3
Unit 8:		
Stereochemistry of organic compounds	<ul> <li>Define Optical isomerism-elements of symmetry, chirality, enantiomers, optical activity enantiomers, Diastereomers threo and erythro meso compounds (C1)</li> <li>List the properties of enantiomers (C1)</li> <li>Label molecules as enantiomers, diastereomers or meso compounds (C1)</li> <li>What is resolution of enantiomers? Discuss any three methods. (C1 &amp; C6)</li> <li>Explain different nomenclature systems of stereoisomers (relative and absolute configuration, sequence rules, D&amp;L, R&amp;S) (C2)</li> <li>What is Geometrical isomerism? Explain cis-trans, E-Z, syn-anti configurations with examples. (C1 &amp; C2)</li> </ul>	6
Unit 9:		<i>c</i>
Green Chemistry	<ul> <li>Define green chemistry (C1)</li> <li>Discuss 12 principles of green chemistry (C1, C2)</li> </ul>	6





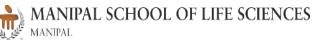
	(Aqueous photochemi enzymatic tr	phase re cal reaction ansformation	tion with at lea eactions, soli ons, Phase tra ions & reaction shortcomings	d state ( ansfer cataly is in ionic liqu	solventless) vst catalysed uids) (C2)	reactions,		
Learning strategies, o				<u>er caen nice</u>	100 (01)			
Learning strategy			Contact hours		Studer	nt learning tin	ne (Hrs)	
Lecture			45		135	te rearring en	(110)	
Seminar			10					
Small Group Discussion	on (SGD)							
Self-directed learning								
Problem Based Learn								
Case Based Learning	÷ · ·							
Clinic	( <b>-</b> )							
Practical								
Revision								
Assessment			05		_			
TOTAL			50		135			
Assessment Methods	5:							
Formative:				Summa	tive:			
Class tests					al examinatio	n		
Assignments/present	ations		End semester examination					
Quiz								
Mapping of assessme	ent with Cos							
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	
Sessional Examination		X	X	X				
Quiz								
Assignment/Presenta	tion		x		x	х		
End Semester Examin		х	x	х	x	х	х	
Laboratory examinati	on	NA	NA	NA	NA	NA	NA	
Feedback Process		-Semester			1	1 1		
Reference Material			Drganic Chemis	try. Pearson	Education, 20	007.		
	<ul> <li>Clayden, University</li> <li>Sanghi R Narosa Pu</li> <li>Tomasz, Applicatio</li> <li>Puri B R Publishing</li> </ul>	J. Greeves, Press. & Srivats Iblishing Ho P. Jerzy, L Ins, 1st Edit , Sharma, g Co, 2019.	Ava, M.M, Gr ava, M.M, Gr ouse, 2003. Mark T. R tion, Springer, 1 LR and Patha dynamics for C	en, S. Organ een Chemis ecent Advar 2010. mia, MS. Pr	ic Chemistry try-Environm nces in QSA inciples of P	,(Second Edit ent friendly R Studies, M hysical Chem	alternatives, 1ethods and	

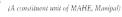
Name of the Program:	B.Sc. Biotechnology (Honours)
Course Title:	Computer Science (Theory)
Course Code: BBT 109	Course Instructor: Course In-charge
Academic Year: 2023 onwards	Semester:   Year,   Semester
No of Credits: 3	Prerequisites: Admission to B.Sc. program





Synop	sis:		Windo	ows an	•	x and	fundame I introd		-	-		-				
Course	Outco	mas ICI					npletior	of this	COURSE	stude	onte wil	l ha ahl	e to			
COUISE CO 1:	Outco		05].							-				1 (2 (	.3)	
CO 1:					e use of different operating systems like Windows and Linux (C1, C2, C3) ze application software like Microsoft Office Word, PowerPoint, Excel (C1,C2)											
CO 2:						web pages (C2, C3)										
CO 3:							cripts for sequence feature extraction (C2, C3)									
	ng of C	Os to P	06		inulate	I LINE 3		n seque				011 (C2,	(5)			
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO	
COS	101	F0 2	103	F04	105	700	107	100	103	10	11	12	13	14	15	
CO 1	X					Х				X	11	12	15	14	15	
CO 2	X		Х	Х		Λ		х		X						
CO 3	X		,,,					X		X						
CO 4	X									X						
	e conter	nt and o	outcom	es:												
Conter							Compet	encies						No of H	ours	
Unit 1							0011100								00.10	
Introdu		to c	ompute	er. ba	asic u	nits,	• Unde	rstand	the bas	ic part	s of cor	nputer	(C1)	6		
	are and		•	•			onac	- scana		ie part		npater	(01)	-		
	nt type				-  - · · · · · ·	,										
Unit 2				-												
Windo		d Lin	ao xu	erating	syste	ems.	• Learn	the o	peratio	n of o	peratir	ng syste	ems.	10		
	ation of		•	-					of applic		-		,			
Unit 3		- 1- 1			-							00 (01)	, =,			
	soft Offi	ce appli	ication	tools: E	xcel. W	ord.	• Unde	rstand	the	data	docu	menta	tion	9		
Power		00 app.			,,	,	analysis, and presentation (C1, C2)									
Unit 4																
	usage of	F HTMI	tags, de	signing	y webpa	ages	• Understand the concepts in web designing							10		
	line for				5		<ul> <li>Onderstand the concepts in web designing and internet applications (C2, C3)</li> </ul>									
Unit 5																
Scripti		nguage	- PF	RI Co	ncents	of	f • Formulate PERL scripts for feature extraction 10									
	ming la															
• •	types,		•													
	ors, fi															
	ing, stri		-		•											
	-	-	-	-		dent l	earning	time					1			
	ng strat	-	_				ontact h				Stu	dent le	arnina	time (H	rs)	
Lecture	-	~/				4					135		2			
Semina																
	Group D	iscussio	on (SGD	))												
	rected l			<u>.</u>												
	m Base	-		L)												
	ased Le			,												
Clinic			<u>,</u> /													
Practic	al															
Revisio																
Assess						0	5				-					
							-									







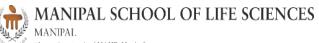
TOTAL		50		13	5	
Assessment Methods	:					
Formative:			Su	immative:		
Class tests			Se	essional examination	ation	
Assignments/presenta	ations		Er	nd semester exa	mination	
Quiz						
Mapping of assessme	nt with COs					
Nature of assessment		CO 1	CO 2	C	03	CO 4
Sessional Examination		Х	Х		х	
Quiz		NA	NA		NA	NA
Assignment/Presentat	ion	Х	Х		х	x
End Semester Examina	ation	Х	Х		х	x
Laboratory examination	on	NA	NA	I	NA	NA
Feedback Process	• End	-Semester Feedback	(			
Reference Material		for Beginners. 1985	-	•		
		ion to Computers: Fu		s of Computer S	ciences. 1	986. Subramaniam
	-	AcGraw Hill Publishir	•	auitha Dalamaun		ubliching Llouge (D)
	• Introducti Ltd.	ion to Computer Scie	ence. 2015. S	avitha Balamura	all, vikas P	ublishing House (P)
		DEDL for Diginforms	ntice 2001 T		v Dublicati	0.05
		PERL for Bioinforma			•	
		Fundamentals: Arch	nitecture and	d Organization (	3rd Eds.).	2000. Ram B., New
	J	national Publishers.		1000 Th	A D	
		e complete referenc	ce (2nd Eds.)	. 1999. Thoma:	5 A. Powel	I, The McGraw-Hill
	Companie	2S.				

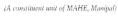
Name of	f the P	rogram	<b>:</b>		B.Sc.	Biotec	hnolog	y (Hon	ours)							
Course T	itle:				Biolo	gy-l (Pı	ractical	)								
Course (	Code: E	3 <b>BT 11</b> 1	L		Cours	se Instr	uctor:	Course	In-cha	rge						
Academ	ic Year	: 2023	onwar	ds	Seme	ster: l	Year, I	Semes	ter							
No of Cr	edits:	1			Prere	quisite	es: Adm	nission	to B.Sc	. progr	am					
Synopsis	<b>s:</b>	The ob	jectives	of this	course	e are to	acqua	int the	studen	ts with	morph	nologica	al diffe	rences b	between	
		organis	sm and	their a	adaptat	ion to	enviro	nment;	to acc	quire sk	to to	use dis	secting	g micros	cope to	
		mount	differe	nt bod	y parts	of Dro	sophild	; to ur	Idersta	nd the	anator	ny of r	eprodu	uctive sy	stem of	
		lower o	organisi	ns; to l	know a	bout th	ne mod	el orga	nisms a	and its (	uses.					
Course C	Dutcon	nes (CC	)s):	At t	he end	of the	course	studer	it shall	be able	e to:					
CO 1:				Den	nonstra	ite the	basic	knowle	owledge and skills of identifying and classifying the							
				mus	eum sp	n specimens based on morphological characters (P1, P2)										
CO 2:				Obt	ain skil	l relate	d to ma	aintaini	ng the	Drosop	<i>hila</i> (P	1)				
CO 3:				Den	nonstra	te the	skills i	n mou	nting <i>L</i>	Drosoph	<i>ila</i> wir	ng, egg	, and	identific	ation of	
				mal	e and f	emale	fly (P2,	P3)								
CO 4:				Disp	olay kno	owledg	e abou	t the us	e of m	odel or	ganism	is and t	heir id	entificat	ion (P2)	
CO 5:				Den	nonstra	ite the	skills to	o dissed	t the re	eprodu	ctive sy	/stem c	of Dros	ophila (I	P2, P3)	
CO 6:				Den	nonstra	ite vert	ebrate	dissect	tions us	sing on	line too	ols (P1,	P2)			
Mapping	g of CC	)s to PC	Ds													
COs	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO	PO	PO 15	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
CO 1	×															
CO 2	×															





									-	1	-		
CO 3 ×													
CO 4 ×		×											
CO 5 ×													
CO 6 ×						×							
Course content and outcomes:													
Content	Compet	tencies									No of Hours		
Unit 1:													
Museum specimens	To unde	erstand	l the ta	xonom	ic level	and m	orphol	ogy (P1	, P2)		6		
Unit 2:													
Drosophila maintenance	To colle male ar				ophila	flies ar	nd to b	e able	to ide	entify	2		
Unit 3:													
Mounting of egg, larvae, wing,	Learn to	o use di	issectio	on micro	oscope	and m	ount e	gg, win	g, sex o	comb	2		
sex comb of Drosophila	of Dros	ophila (	(P2, P3)	)									
Unit 4:													
Dissection of reproductive Skills to dissect male and female <i>Drosophila</i> reproductive system													
system of Drosophila using dissection microscope (P2, P3)													
Jnit 5:													
Model organisms Learn to identify and understand the use of model organisms (P2)													
Unit 6:										<u> </u>			
Culture and mounting of	To dete	ect and	identi	fy the I	Parame	cium,	Culturi	ng of F	Parame	cium	4		
Paramecium	(Protoz			•				0					
Unit 7:			, ,										
Vertebrate dissections	Explain online/		-			-	•		-	-	4		
Unit 8:	,					0	,	0 /	, ,	,			
Visit to animal house	To uno breedir						s of I	aborat	ory ar	nimal	2		
Learning strategies, contact hour		-		-	, , ,								
Learning strategy		1	ict houi				Stud	lent led	arnina	time (I	lrs)		
Lecture				-					<u> </u>				
Seminar													
Small Group Discussion (SGD)													
Self-directed learning (SDL)													
Problem Based Learning (PBL)													
Case Based Learning (CBL)							1						
Clinic							1						
Practical		30					90						
Revision													
Assessment		07					_						
TOTAL		37					90						
		57					50						
		1				I							
Assessment Methods:													
Assessment Methods: Formative:				Su	ummat	ive:							
					ummat essiona		ination						
Formative:				Se		l exam							







Mapping of assessme	nt with COs	5											
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6						
Sessional Examination		Х	х	х	х								
Quiz		NA	NA	NA	NA	NA	NA						
Assignment/Presentat	ion	Х	NA	NA	х	NA	NA						
End Semester Examina	Semester Examination												
Laboratory examination	on	Х	х	х	х	х	х						
Feedback Process	• Ei	nd-Semester	Feedback										
Reference Material													

Name	of the P	rogran	n:		В.	B.Sc. Biotechnology (Honours) Biology-II (Practical)											
Course					Bi	ology-l	l (Pract	ical)									
Course	Code:	BBT 11	3		Co	ourse In	structo	or: Cour	se In-c	harge							
Acade	mic Yea	r: 2023	onwa	rds	Se	mester	: I Year	, I Sem	ester								
No of (	Credits:	1			Pr	erequis	sites: /	Admissi	ion to E	B.Sc. pr	ogram						
Synops	sis:	This I	module	e helps t	o gain	knowle	dge in	basic co	ourses o	of Bota	iny. It a	ims to	provide	e funda	mental		
		know	/ledge	of plant	morph	ology, t	taxonor	ny, ana	itomy, j	physio	ogy &	biocher	nistry a	ind pat	hology;		
		and t	o unde	erstand	the fun	dament	tal form	ns of flo	ra and	their d	iversity	/.					
Course	Outco	mes (C	Os):	On suc	cessful	comple	tion of	this co	urse, st	udents	s will be	e able t	0				
CO 1:				Outline	e the m	ethods	for plar	nt ident	ificatio	n using	g morp	hologic	al traits				
CO 2:				Demor	stratio	n of var	ious m	ethods	to und	erstand	d the m	orphol	ogical a	adaptat	ions		
CO 3:				Learnir	ng met	hods to	o unde	rstand	the bi	ochem	ical an	d phys	iologica	al proc	ess via		
				anaton	atomy. Conclude the role of physiology in deciphering plant efficiencies.												
CO 4:				Explain	plain the fundamentals of plant anatomy, reproductive biology and crop												
					rovement strategies												
CO 5:					uss and illustrate the various anatomical differences in plant tissues Learning to												
					ablish chromosome numbers in plants												
CO 6:					scuss the nature of cellular architecture and exclusive features Comparative												
				analysi	alysis of monocot vs dicot tissues and their differences and oddities												
	ng of CO																
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO		
										10	11	12	13	14	15		
CO 1	×	×													_		
CO 2	×	×													_		
CO 3	×	×													_		
CO 4	×	×		×													
CO 5	×	×											-				
CO 6	×	X								×							
	conter	nt and o	outcon	-											_		
Conten				Comp	oetencie	es								No o	f Hours		
Unit 1:				-1													
Study of	of micro	scope			-	he part		-						2			
Estimation of resolution power of various microscopes (C5)										us mic	roscop	es (C5)					





		ne types of microscopes and g plant parts (C6)	respective utility in	
Unit 2:				
Microscopic observation of	Classify the	types of dicot and monoco	t leaves and their	4
transverse section of a dicot	adaptational v	variations (C2, C4)		
& Monocot leaf	• Estimate and o	compare the performance of d	icot & monocot plant	
		on their anatomical features (C		
Unit 3:				
Microscopic observation of	<ul> <li>Classify the</li> </ul>	types of dicot and monoc	ot stem and their	4
transverse section of a	-	variations (C2, C4)		
dicot & Monocot stem	<ul> <li>Estimate and of</li> </ul>	compare the performance of di	cot & monocot plant	
		on their anatomical features (C		
Unit 4:		× .	, ,	
Microscopic observation of	• Classify the	types of dicot and monoco	ot roots and their	4
transverse section of a		variations (C2, C4)		
dicot & Monocot root		compare the performance of di	cot & monocot plant	
		their anatomical features (C5,		
Unit 5:		(	,	1
Study of effect of quality of	Demonstrate	and analyze the photosynthet	ic rates in plants with	4
light on photosynthesis		t quality (C2, C4)		
Unit 6:				L
Study of effect of quantity	• Explain & Der	monstrate and analyze the pl	notosynthetic rates in	2
of light on photosynthesis		spect to light quantity (C2, C4)	•	
Unit 7:				
Study of plasmolysis using	Illustrate an	d analyze the plasmolysis in	tensity in plant cells	2
potato cylinders		olution tonicity's (C2, C4)	, ,	
Unit 8:	I			L
Observation of	• Analyze the tra	anspiration rates in plants at di	fferent environmental	4
transpiration using	-	d compute the results (C4, C5)		
Ganong's potometer				
Unit 9:	•			
Mitosis in Allium cepa &	• Explain, discus	ss and demonstrate the mitotic	stages in Allium cepa	4
Meiosis in plants	roots and com	pute the active mitotic index	(C2, C6)	
	• Explain, discus	ss and demonstrate the meioti	c stages in plants and	
	estimate the a	active meiotic index (C2, C6)		
Learning strategies, contact	hours and studen	t learning time		
Learning strategy		Contact hours	Student learning time	e (Hrs)
Lecture				
Seminar				
Small Group Discussion (SGD	)			
Self-directed learning (SDL)				
Problem Based Learning (PBL	_)			
Case Based Learning (CBL)				
Clinic				
Practical		30	90	
Revision				
Assessment		07	-	
TOTAL		37	90	
		1	1	





Assessment Methods:		
Formative:	Summative	e:
Class tests	Sessional e	xamination
Assignments/presentations	End semes	ter examination
Quiz		

#### Mapping of assessment with COs

		1	-	- 1			
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination		х	х	x	х		
Quiz							
Assignment/Presentation		х				x	
End Semester Examination							
Laboratory examination		х	х	x	х	x	х
Feedback Process •	End	-Semester F	eedback				
• • • • • •	Biologica Universit Biologica Universit Biology – India. Fundame Introduct Plant Phy	I Science (3 y Press. I Science (3 y Press. -2002- Chakr entals of Plar tion to princ ysiology – 19	rd Ed.) - 20 rdEd) - Tayl roborty DP, I nt Physiology iples of Plant 192 - Salisbur	02 - Taylor E or DJ, Greer National Cour / - 1977 - Jain t Taxonomy - ry FB, Ross CV	DJ, Green NP n NPO, Stout	O, Stout GW GW 2002 tional Resear d Publishers, ivarajan, th Publishers	

Name of	f the Pr	ogram	:		В	Sc. Bio	techno	logy (H	onours	)					
Course 7	Title:				C	hemist	ry (Prac	tical)							
Course 0	Code: B	BT 115			С	ourse l	nstruct	or: Cou	rse In-o	harge					
Academ	ic Year:	2023	onwar	ds	S	emeste	r: I Yea	r, I Sem	nester						
No of Cr	edits:	1			Р	rerequi	sites:	Admiss	sion to	B.Sc. p	rogram				
Synopsis	s:	This	practic	al cours	se intro	duces a	ind pro	vides kı	nowled	ge and	technic	cal skills	s in che	mistry.	
Course (	Outcom	es (CO	s):	On suc	cessfu	l compl	etion of	f this co	ourse, s	tudent	s will be	e able t	0		
CO 1:				List an	d illust	rate the	e basic ı	method	ls in ne	utralisa	ition tit	rations	(P1, P2	2)	
CO 2:				Estima	te the	he hardness of given sample of water (P1, P2)									
CO 3:				Demo	nstrate	the syr	thesis	of salicy	ylic acio	lusing	ethyl sa	alicylate	e (P1,F	°2)	
CO 4:				Demo	onstrate precipittion titration with its applications (P1, P2)										
CO 5:				Estima	te the	amoun	t of ace	tone ar	nd vitan	nin C u	sing rec	lox titra	ation (P	P1, P2)	
CO 6:				Applic	ations	of neut	ralisatio	on titrat	tion suc	h as fii	nding th	ne purit	ty of giv	/en san	nple of
				acetic	acid, e	stimatir	ng the a	mount	of glyc	ne (P1	, P2)				
Mappin	g of CO	s to PO	S												
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
											15				
CO 1	×			×											
CO 2	×			×											
CO 3	×							×							





CO 5       ×			1	1	r		r		r	SpiRED BY	,			he UGC Act, 195			1
COG 6         x <td>CO 4</td> <td></td>	CO 4																
Course content and outcomes:         No of Hours           Content         Competencies         No of Hours           Acid-base         Tit attions         -         -         To list three uses for acid-base titrations.(P1)         2           Acid-base         To describe the difference between an "endpoint" and an "equivalence point" in an acid-base titration.(P1)         2           Unit 2:         Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration.(P2)         4           Sample of water         • Compare hard water and soft water (P1, P2)         4           Demonstrate the concept of complexometric titration (P1, P2)         4           Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)         4           Mit 3:         • Define the alkali hydrolysis (P1)         4           Precipitation titration and tete reaction involved in the hydrolysis of methyl salicylate by Hydrolysis         • Define the alkali hydrolysis (P1)         4           Preparation of Salicylic acid         • Define redox titration (P1)         • Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)         • Write the reaction for oxidation of vitamin C (P2)         • Write the reaction for oxidation of vitamin C (P2)         • Define redox titration (P1, P2)         • Determination of the p2)         • Write the reaction between acetone and iodine (P1, P2)         4 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>									×								
Content         Competencies         No of Hours           Unit 1:         -         -         To list three uses for acid-base titrations.(P1)         2           Acidimetry, Alkalimetry         -         To describe the difference between an "endpoint" and an "equivalence point" in an acid-base titration. (P1)         2           • Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration. (P2)         4           Unit 2:         • Compare hard water and soft water (P1, P2)         4           • Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration (P1, P2)         4           • Explain the concept of complexometric titration (P1, P2)         • Explain the concept of complexometric titration using Fajan's method and mohrs method (P1, P2)         4           • Define the alkali hydrolysis (P1)         • Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)         4           • Unit 4:         • Define the alkali hydrolysis (P1)         • How the theoretical yield is calculated? (P1, P2)         4           • Preparation of Salicylic acid         • Define the acid in involved in the hydrolysis of methyl salicylate (P1, P2)         4           • Unit 5:         • Define the acid in involved in the hydrolysis of methyl salicylate (P1, P2)         • With the reaction for oxidation of vitamin C (P2)         4           • Yor dox titration wit									×								
Unit 1: <ul> <li>Acid-base titrations</li> <li>Acid-base titrations.(P1)</li> <li>To list three uses for acid-base titrations.(P1)</li> <li>To describe the difference between an "endpoint" and an "equivalence point" in an acid-base titration. (P1)</li> <li>Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration. (P2)</li> <li>Unit 2:</li> <li>Estimation of total</li> <li>Compare hard water and soft water (P1, P2)</li> <li>Explain the concept of complexometric titration (P1, P2)</li> <li>Explain the concept of complexometric titration (P1, P2)</li> <li>Unit 3:</li> <li>Precipitation tirration and its application in determining the chloride content of given water (P1, P2)</li> <li>Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)</li> <li>Unit 4:</li> <li>Preparation of Salicylic acid from methyl salicylate (P1, P2)</li> <li>How the theoretical yield is calculated? (P1, P2)</li> <li>Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)</li> <li>Write the reaction for oxidation of vitamin C (P2)</li> <li>Unit 5:</li> <li>To determine ascorbic acid</li> <li>Define redox titration (P1)</li> <li>Write the reaction for oxidation of vitamin C (P2)</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Unit 6:</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Explain the concept of back titration(P1, P2)</li> <li>Unit 7:</li> <li>Determination of the assess the purity of given sample of acetic acid (P1, P2)</li> <li>Explain the concept of back titration. (P2)</li> <li>Unit 7:</li> <li>Determination of gilycine.</li> <li>Explain the conce</li></ul>			t and or	utcome		-											
Acid-base       titrations       -       To list three uses for acid-base titrations.(P1)       2         Acidimetry, Alkalimetry       -       To describe the difference between an "endpoint" and an "equivalence point" in an acid-base titration. (P1)       2         Unit 2:       -       Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration. (P1, P2)       4         Sample of water       -       Demonstrate the chelation reactions of metal ions (P1, P2)       4         Unit 3:       -       Demonstrate the cheloride content of given water (P1, P2)       4         Other of water       -       Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)       4         Unit 4:       -       Define the alkali hydrolysis (P1)       4         Preparation of Salicylic acid       -       Define the alkali hydrolysis (P1)       4         Hydrolysis       -       Define redox titration (P1, P2)       4         Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)       -       Write the reaction for oxidation of vitamin C (P2)       4         Unit 5:       Define redox titration (P1)       -       Define redox titration (P1, P2)       4       -         Unit 6:       Define redox titration (P1, P2)       Define redox titration (P1, P2)       - <td< td=""><td></td><td></td><td></td><td></td><td>Compe</td><td>etencies</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>   </td><td>No of H</td><td>ours</td></td<>					Compe	etencies	5									No of H	ours
Acidimetry, Alkalimetry <ul> <li>To describe the difference between an "endpoint" and an "equivalence point" in an acid-base titration. (P1)</li> <li>Explain, by using chemical equations, the chemical change(s) that occur during a strong acid/strong base titration. (P2)</li> </ul> Unit 2: <ul> <li>Estimation of total hardness of the given sample of water</li> <li>Demonstrate the chelation reactions of metal ions (P1, P2)</li> <li>Explain the concept of complexometric titration (P1, P2)</li> <li>Explain the concept of complexometric titration (P1, P2)</li> <li>Unit 3:</li> <li>Precipitation titration and its application in determining the chloride content of given water (P1, P2)</li> <li>Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)</li> <li>Write the reaction involved in the hydrolysis of methyl salicylate (P1)</li> <li>How the theoretical yield is calculated? (P1, P2)</li> <li>Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)</li> <li>Write the reaction for oxidation of vitamin C (P2)</li> <li>Determine ascorbic acid (Vitamin C) concentration</li> <li>Write the reaction for oxidation of vitamin C (P2)</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Explain the concept of iodometric titration. (P2)</li> <li>Determination of the precontion barbies of primary standard (P1, P2)&lt;</li></ul>								-									
Estimation       of       total hardness       • Compare hard water and soft water (P1, P2)       4         hardness       of the given sample of water       • Demonstrate the chelation reactions of metal ions (P1, P2)       4 <b>Unit 3:</b> • Precipitation titration and its application in determining the chloride content of water       • Analyse the chloride content of given water (P1, P2)       4 <b>Unit 4:</b> • Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)       4         Preparation of Salicylic acid from methyl salicylate by Hydrolysis       • Define the alkali hydrolysis (P1)       4         How the theoretical yield is calculated? (P1, P2)       • Write the reaction involved in the hydrolysis of methyl salicylate (P1)       4         Unit 5:       • Define redox titration (P1)       • Write the reaction for oxidation of vitamin C (P2)       4         Vitamin C) concentration by a redox titration with N bromosuccinamide       • Define redox titration (P1)       4         Unit 6:       • Determine the vitamin C concentration in the given sample (P1, P2)       4         Unit 7:       • Determine the concept of back titration(P1, P2)       • Write the reaction between acetone and iodine (P1, P2)       4         Unit 7:       • Determine the quantity of given sample of acetic acid (P1, P2)       • Explain the concept of iodometric titration. (P2)       2         Unit 8: <t< td=""><td>Acidime</td><td></td><td></td><td></td><td>• To "equ • Expl</td><td>describ uivalenc ain, by</td><td>e the ce poin<sup>-</sup> using c</td><td>differer t" in an a hemical</td><td>nce be acid-ba equati</td><td>tween se titra ons, th</td><td>an" ation. ( e cher</td><td>(P1) nical c</td><td>change</td><td></td><td>an</td><td>2</td><td></td></t<>	Acidime				• To "equ • Expl	describ uivalenc ain, by	e the ce poin <sup>-</sup> using c	differer t" in an a hemical	nce be acid-ba equati	tween se titra ons, th	an" ation. ( e cher	(P1) nical c	change		an	2	
hardness of the given sample of water       • Demonstrate the chelation reactions of metal ions (P1, P2)         sample of water       • Explain the concept of complexometric titration (P1, P2)         Unit 3:       • Analyse the chloride content of given water (P1, P2)         Precipitation titration and its application in determining the chloride content of water       • Analyse the chloride content of given water (P1, P2)         Unit 4:       • Define the alkali hydrolysis (P1)       4         Preparation of Salicylic acid from methyl salicylate by       • Define the alkali hydrolysis (P1)       4         Hydrolysis       • Define the alkali hydrolysis (P1)       4         Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)       • Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)         Unit 5:       • Define redox titration (P1)       • Write the reaction for oxidation of vitamin C (P2)       4         • Determine the vitamin C concentration in the given sample (P1, P2)       • Write the reaction between acetone and iodine (P1, P2)       4         Unit 6:       • Determine the concept of iodometric titration. (P2)       • Write the reaction between acetone and iodine (P1, P2)       4         Determination of the amount of Acetone by       • Assess the purity of given sample of acetic acid (P1, P2)       • Write the reaction between acetone and iodine (P1, P2)       2         Unit 7:       • Determination of the prec																	
Precipitation titration and its application in determining the chloride content of water <ul> <li>Analyse the chloride content of given water (P1, P2)</li> <li>Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)</li> <li>Demonstrate the precipitation titration using Fajan's method and mohrs method (P1, P2)</li> <li>Unit 4:</li> <li>Preparation of Salicylic acid from methyl salicylate by</li> <li>How the theoretical yield is calculated? (P1, P2)</li> <li>Demonstrate the technique to find the melting point of sample (P1, P2)</li> <li>Define redox titration (P1)</li> <li>Write the reaction for oxidation of vitamin C (P2)</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Unit 6:</li> <li>Unit 6:</li> <li>Unit 7:</li> <li>Determination of the amount of Acetone by</li> <li>Explain the concept of back titration (P1, P2)</li> <li>Explain the concept of given sample of acetic acid (P1, P2)</li> <li>Demonstrate to prepare standard solutions of primary standard (P1, P2)</li> <li>Demonstrate to prepare standard solutions of primary standard (P1, P2)</li> <li>Write the reaction between glycine and formaldehyde(P1, P2)</li> <li>Write the reaction between glycine and formaldeh</li></ul>	hardnes sample o	s of	the		• Dem	nonstra	te the c	chelatior	n reacti	ons of	metal	•		<u>?)</u>	2	1	
its application in determining the chloride content of water Unit 4: Preparation of Salicylic acid from methyl salicylate by Hydrolysis (P1) Hydrolysis Preparation of Salicylic acid (P1, P2) Hydrolysis Preparation of Salicylic acid (P1, P2) Hydrolysis Preparation of Salicylic acid (P1, P2) Hydrolysis Preparation of Salicylic acid (P1, P2) Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2) Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2) Unit 5: To determine ascorbic acid (Vitamin C) concentration by a redox titration with N- bromosuccinamide P2) Unit 6: Determination of the amount of Acetone by explain the concept of back titration(P1, P2) Mite the reaction between acetone and iodine (P1, P2) Explain the concept of iodometric titration. (P2) Determination of the percentage purity of Acetic acid (P1, P2) Determination of glycine. Estimation of glycine. Estimation of glycine. Estimate the quantity of glycine present in given solution (P1, P2) Write the reaction between glycine and formaldehyde(P1, P2) Write the reaction between glycine and formaldehyde(P1, P2) Write the reaction between glycine and formaldehyde(P1, P2) Write the reaction between glycine and iodine value (P1, P2) Write the reaction between glycine and iodine value (P1, P2) Write the reaction between glycine and iodine value (P1, P2) Write the reaction between glycine and iodine value (P1, P2) Write the reaction between glycine and iodine value (P1, P2) 2 (2) Unit 9: Determination of i Acid value and iodine value (P1, P2) Subar in Biodine value of the glycine resent in given solution (P1, P2) Subar in glycine value of the glycine the significance of acid value and iodine value (P1, P2) Preparation between the significance of acid value and iodine value (P1, P2) Preparation of i) Acid value in the significance of acid value and iodine value (P1, P2)		+:	:+		• • •		.1.1. 2					D4 D7				1	
Preparation of Salicylic acid from methyl salicylate by Hydrolysis <ul> <li>Define the alkali hydrolysis (P1)</li> <li>How the theoretical yield is calculated? (P1, P2)</li> <li>Write the reaction involved in the hydrolysis of methyl salicylate (P1)</li> <li>Demonstrate the technique to find the melting point of sample (P1, P2)</li> <li>Unit 5:</li> <li>To determine ascorbic acid (vitamin C) concentration by a redox titration with N- bromosuccinamide</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Determine the vitamin C concentration in the given sample (P1, P2)</li> <li>Determination of the amount of Acetone by lodoform method</li> <li>Explain the concept of back titration. (P2)</li> <li>Explain the concept of iodometric titration. (P2)</li> <li>Explain the concept of iodometric titration. (P2)</li> <li>Determination of the percentage purity of Acetic acid by titration method.</li> <li>Assess the purity of given sample of acetic acid (P1, P2)</li> <li>Demonstrate to prepare standard solutions of primary standard (P1, P2)</li> <li>Write the reaction between glycine and formaldehyde(P1, P2)</li> <li>Explain the significance of acid value and iodine value (P1, P2)</li> <li>Explain the significance of acid value and iodine value (P1, P2)</li> <li>Explain the significance of acid value and iodine value (P1, P2)</li> <li>Explain the significance of acid value and iodine value (P1, P2)</li> <li>Explain the</li></ul>	its determi	applica ning t	ation he chl	in	• Dem	nonstra	te the p	orecipita	-					hod ar		÷	
from methyl salicylate by       + How the theoretical yield is calculated? (P1, P2)         Hydrolysis       • Write the reaction involved in the hydrolysis of methyl salicylate (P1)         • Write the reaction involved in the hydrolysis of methyl salicylate (P1)       • Write the reaction involved in the hydrolysis of methyl salicylate (P1, P2)         Unit 5:       • Define redox titration (P1)       • Virite the reaction for oxidation of vitamin C (P2)       • Determine the vitamin C concentration in the given sample (P1, P2)         by a redox titration with N-bromosuccinamide       • Unit set the reaction for oxidation of vitamin C (P2)       • Determine the vitamin C concentration (P1, P2)       • Determine the vitamin C concentration (P1, P2)         • Unit 6:       • Unit set the concept of back titration(P1, P2)       • Write the reaction between acetone and iodine (P1, P2)       • Write the reaction between acetone and iodine (P1, P2)         • Unit 7:       • Obtemonstrate to prepare standard solutions of primary standard (P1, P2)       • Demonstrate to prepare standard solutions of primary standard (P1, P2)       2         Unit 8:       • Estimate the quantity of glycine present in given solution (P1, P2)       • Write the reaction between glycine and formaldehyde(P1, P2)       2         Unit 9:       • Demonstrate the experiment for the analysis of oil (P1, P2)       • Write the reaction between glycine and iodine value (P1, P2)       2         Unit 9:       • Demonstrate the experiment for the analysis of oil (P1, P2)       • Explain	Unit 4:																
Unit 5:       • Define redox titration (P1)       4         (vitamin C) concentration by a redox titration with N-bromosuccinamide       • Write the reaction for oxidation of vitamin C (P2)       4         • Determine the vitamin C concentration in the given sample (P1, P2)       • Determine the vitamin C concentration in the given sample (P1, P2)       4         • Unit 6:       • Illustrate the concept of back titration(P1, P2)       4         • Write the reaction between acetone and iodine (P1, P2)       • Write the reaction between acetone and iodine (P1, P2)       4         • Lodoform method       • Explain the concept of iodometric titration. (P2)       • Explain the concept of given sample of acetic acid (P1, P2)       2         • Determination of the percentage purity of Acetic acid by titration method.       • Assess the purity of given sample of acetic acid (P1, P2)       2         • Demonstrate to prepare standard solutions of primary standard (P1, P2)       • Write the reaction between glycine and formaldehyde(P1, P2)       2         • Unit 8:       • Estimate the quantity of glycine present in given solution (P1, P2)       2       2         • Unit 9:       • Demonstrate the experiment for the analysis of oil (P1, P2)       2         • Determination of i) Acid value ii) lodine value of the given sample of oil/fat.       • Demonstrate the experiment for the analysis of oil (P1, P2)       2	from m	ethyl s			<ul> <li>How</li> <li>Writ (P1)</li> <li>Dem</li> </ul>	the the the re the re	eoretic eactior	al yield i n involve	is calcu ed in th	e hydro	olysis	of me			te	1	
To determine ascorbic acid (vitamin C) concentration by a redox titration with N- bromosuccinamideDefine redox titration (P1)4 <b>Unit 6:</b> Determination of the amount of Acetone by lodoform method• Illustrate the concept of back titration(P1, P2) • Write the reaction between acetone and iodine (P1, P2) • Explain the concept of iodometric titration. (P2)4 <b>Unit 7:</b> Determination of the percentage purity of Acetic acid by titration method.• Assess the purity of given sample of acetic acid (P1, P2) • Demonstrate to prepare standard solutions of primary standard (P1, P2)2 <b>Unit 8:</b> Estimation of i) Acid value ii) lodine value of the given sample of oil/fat.• Demonstrate the experiment for the analysis of oil (P1, P2) • Explain the significance of acid value and iodine value (P1, P2)2	llnit 5.				(1 1)	12)											
Determinationofthe amountIllustrate the concept of back titration(P1, P2) • Write the reaction between acetone and iodine (P1, P2) • Explain the concept of iodometric titration. (P2)4Unit 7: Determination• Assess the purity of given sample of acetic acid (P1, P2) • Demonstrate to prepare standard solutions of primary standard (P1, P2)2Unit 8: Estimation of glycine.• Estimate the quantity of glycine present in given solution (P1, P2) • Write the reaction between glycine and formaldehyde(P1, P2)2Unit 9: Determination of i)• Demonstrate the experiment for the analysis of oil (P1, P2) • Explain the significance of acid value and iodine value (P1, P2)2	To deter (vitamin by a red bromose	C) co ox titra	oncentration wi	ration	<ul><li>Writ</li><li>Determination</li></ul>	e the re	eaction	for oxic	lation o		-	-	n sam	ple (P		1	
amount of Acetone by lodoform method• Write the reaction between acetone and iodine (P1, P2) • Explain the concept of iodometric titration. (P2)Unit 7: Determination of the percentage purity of Acetic acid by titration method.• Assess the purity of given sample of acetic acid (P1, P2) • Demonstrate to prepare standard solutions of primary standard (P1, P2)2Unit 8: Estimation of glycine.• Estimate the quantity of glycine present in given solution (P1, P2) • Write the reaction between glycine and formaldehyde(P1, P2)2Unit 9: Determination of i) Acid value ii) lodine value of the given sample of oil/fat.• Demonstrate the experiment for the analysis of oil (P1, P2) • Explain the significance of acid value and iodine value (P1, P2)2																	
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percentage purity of Acetic acid by titration method.Demonstrate to prepare standard solutions of primary standard (P1, P2)Unit 8:Estimation of glycine.• Estimate the quantity of glycine present in given solution (P1, P2) • Write the reaction between glycine and formaldehyde(P1, P2)2Unit 9:Determination of i) Acid value ii) lodine value of the given sample of oil/fat.• Demonstrate the experiment for the analysis of oil (P1, P2) • Explain the significance of acid value and iodine value (P1, P2)2		nation	of	tha	• ^ ~ ~ ~	cc tha	ourity c	of given	comple	oface	ticaci	d (D1	יכם		-	)	
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Write the reaction between glycine and formaldehyde(P1, P2) Unit 9: Determination of i) Acid value ii) lodine value of the given sample of oil/fat.	Unit 8:																
Determination of i) Acid value ii) lodine value of the given sample of oil/fat.• Demonstrate the experiment for the analysis of oil (P1, P2)22• Explain the significance of acid value and iodine value (P1, P2)		on of g	lycine.				•		• •		-			-	2) 2	2	
value ii) lodine value of the significance of acid value and iodine value (P1, P2) even sample of oil/fat.	Unit 9:																
	value ii)	Iodine	value o	of the				•			•	-				2	
	Unit 10:																





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To check the purity of giv			recrystallizatio	-		• •	1, P2) 2	
sample			ng point of give		• • •	•		
			g point of giver		ple (P1, F	P2)		
Learning strategies, cont	act hours a	and studen						
Learning strategy			Contact hours	;		Student	learning time	? (Hrs)
Lecture								
Seminar								
Small Group Discussion (S	GD)							
Self-directed learning (SD	L)							
Problem Based Learning	PBL)							
Case Based Learning (CBL	.)							
Clinic								
Practical			30			90		
Revision								
Assessment			07			-		
TOTAL			37			90		
Assessment Methods:								
Formative:					Summa	ative:		
Class tests					Session	al examinati	on	
Assignments/presentatio	ns				End ser	nester exami	ination	
Quiz								
Mapping of assessment v	with COs							
Nature of assessment		CO 1	CO 2	(	CO 3	CO 4	CO 5	CO 6
Sessional Examination		х	х		х	х		
Quiz								
Assignment/Presentation		х	х		х	х	х	х
End Semester Examination	n							
Laboratory examination		х	х		х	х	х	x
Feedback Process	• E	nd-Semeste	er Feedback					
Reference Material	•Vogel's	Textbook (	of Practical Or	ganic	Chemis	try. London	: Longman	Scientific &
	Technic	al, 1989.						
	<ul> <li>Practica</li> </ul>	l Organic Cl	hemistry: FG M	ann.	BC Saund	lers. New Yo	k Longmann.	

Name of	the P	rogram	า:		В.	Sc. Biot	echnol	ogy (Ho	onours)						
Course Ti	itle:				Co	mpute	r Scienc	e (Prac	tical)						
Course C	ode: l	BBT 11	7		Co	urse In	structo	r: Cour	se In-cł	narge					
Academi	ic Yea	r: <b>202</b> 3	s onwa	rds	Se	mester	: I Year	, I Semo	ester						
No of Cre	edits:	1			Pr	erequis	ites: A	dmissio	on to B.	Sc. Pro	gram				
Synopsis	:	This p	oractica	al course	e provio	des kno	wledge	and sk	ills in co	ompute	er scien	ce			
Course O	Outcor	nes (CC	Ds):	On suc	On successful completion of this course, students will be able to										
CO 1:				Operate Linux and Windows operating systems (C1, P7)											
CO 2:				Make u	use of N	1icrosof	ft applic	ation s	oftware	e such a	as Word	l, Excel,	Power	Point (F	2, P4)
CO 3:				Design	web pa	ages an	d online	e forms	(P1, P4	,P7)					
CO 4:				Write a	and exe	cute Pe	rl scrip	ts for b	iologica	l seque	ence da	ta analy	ysis (P1	,P2)	
Mapping	g of CC	)s to P	Os												
COs P	PO 1	PO 2	PO 3	<i>PO</i> 4	PO4 PO5 PO6 PO7 PO8 PO9 PO PO PO PO PO PO PO							PO			
										10	11	12	13	14	15
CO 1	Х														





<u> </u>	V		V	V	V					V					
CO 2 CO 3	X X		X	Х	Х					X X					
CO 3	X			х	х	x		X		X					
		at and a	outcom		Λ	^		^		^					
Conten		it anu	outcom	25.	(	Compet	oncios							No of	Hours
Unit 1:					Ľ	Joinper	encies							100 Uj I	10015
		(stoms)	: Wind	0.00	and	Domo	nctrati	on of O		cont i		of Oc	and	9	
Linux,		llation		pplicat				ronment						5	
			imands,	ipplicat		(P1, P	-	onnent	withten	may	comme	inu pi	ompt		
Unit 2:	-		innanas,			(1 ±, 1	<u> </u>								
Micros		Office:	Word	l. Ex	cel, 🛛	Form	ulas, fur	nctions, d	lifferent	types	of funct	ions	nsert	7	
PowerF		5111001		., _,	001)			aw figur				10113,1	noere		
Unit 3:						0									
HTML a		b Desi	gn			Desig	ning the	e web pag	ges, crea	ting oi	nline fo	rms(P	2. P3)	7	
Unit 4:		(	5			2 00.0			500) 0. 00.				_,,	I	
PERL						Form	ulate P	ERL scrip	ots for f	eatur	e extra	ction	from	7	
								quences (							
Learnin	ng strat	egies.	contact	hours	and stu				( / -/	,				1	
Learnin	-						ontact h				Stude	ent lec	irning	time (Hr	s)
Lecture	-												<u> </u>	•	
Semina	ır														
Small G	Group D	iscussi	on (SGD	)											
Self-dir				-											
Probler	n Base	d Learr	ning (PBI	_)											
Case Ba	ased Le	arning	(CBL)												
Clinic															
Practica	al					30	C				90				
Revisio	n														
Assessr	nent					07	7				-				
TOTAL						37	7				90				
Assessi	ment N	/lethod	s:												
Format									Summa						
Class te									Session						
Assignr	nents/	present	tations						End ser	neste	r exami	natio	า		
Quiz															
	-		ent with	n COs											
Nature						CO 1			0 2	_	CO 3	3		CO 4	ļ
Session	ial Exar	ninatio	n			X			X		X				
Quiz	. /-					NA			NA	_	NA			NA	
Assign					-	Х			х	_	Х			Х	
End Ser										_					
Laborat				-		X	ار د بالد		х		Х			Х	
Feedba			•				edback								
Refere	nce Ma	iterial	(P) L	td.				cience. 2 matics. 2						-	House





• Computer Fundamentals: Architecture and Organization (3rd Eds.). 2000. Ram B., New Age International Publishers.

- HTML: The complete reference (2nd Eds.). 1999. Thomas A. Powell, The McGraw-Hill Companies.
- W3School ( https://www.w3schools.com/)

Course Title:         Seminar/Journal Club           Course Code: BBT 119         Course Instructor: Course In-charge           Academic Year; 2023 onwards         Semester: I Year, I Semester           Synopsis:         This course will include an allotment of an individual seminar topic related to the semester courses. This will enhance students' knowledge base and expose them to how to present information clearly and concisely. Students will also learn how to compile the literature database information.           Course Outcomes (COS):         On successful completion of this course, students will be able to           CO 1:         Express thoughts and ideas effectively           CO 2:         Demonstrate the ability to listen carefully and react           CO 3:         Apply one's views and present complex information clearly and concisely to different groups           CO 4:         Conclude on information           CO 5:         Define the problem in a concise maner           CO 6:         Adopt challenging tasks; students will also learn how to compile and interpret data           Mapping of COs to POs         PO 4         PO 5         PO 6         PO 7         PO 8         PO 9         PO         PO<	Name o	f the Pi	rogram	:			B.Sc. Biotechnology (Honours)											
Academic Year:       2023 onwards       Semester:       I Year, I Semester         No of Credits:       1       Prerequisites:       Admission to B.Sc. program         Synopsi::       This course will include an allotment of an individual seminar topic related to the semester courses. This will enhance students' knowledge base and expose them to how to present information clearly and concisely. Students will also learn how to compile the literature database information.         Course Outcomes (COS):       On successful completion of this course, students will be able to         C0 1:       Express thoughts and ideas effectively         CO 2:       Demonstrate the ablifty to listen carefully and react         CO 3:       Apply one's views and present complex information clearly and concisely to different groups         CO 4:       Conclude on information         CO 5:       Define the problem in a concise manner         CO 6:       Adopt challenging tasks; students will also learn how to compile and interpret data         Mapping of COs to POs       PO 1       PO 2       PO 3       PO 4       PO 5       PO 6       PO 7       PO 8       PO 9       PO							Semin	ar/Jou	rnal Clu	ıb								
Academic Year:         2023 onwards         Semester:         I Year, I Semester           No of Credits:         1         Prerequisites:         Admixision to B.Sc. program           Synopsis:         This course will include an allotment of an individual seminar topic related to the semester courses. This will enhance students' knowledge base and expose them to how to present information.         Course Outcomes (COS):         On successful completion of this course, students will be able to           C0 1:         Express thoughts and ideas effectively         CO 2:         Demonstrate the ability to listen carefully and react           C0 3:         Apply one's views and present complex information clearly and concisely to different groups         CO 4:         Conclude on information           C0 4:         Conclude on information         Conclude and interpret data         Adopt challenging tasks; students will also learn how to compile and interpret data           Mapping of COs to POs         CO 1         ×         Conclude and interpret data         Conclude and interpret data           C0 4         ×         Conclude and interpret data         Conclude and interpret data         Conclude and interpret data           C0 5         ×         Conclude and interpret data         Conclude and interpret data         Conclude and interpret data           C0 1         ×         Conclude and conclude and interpret data         Conclude and conclude and conclude and c	Course	Code: B	BT 119				Cours	e Instru	ictor: C	ourse l	n-char	ge						
Synopsis:       This course will include an allotment of an individual seminar topic related to the semester courses. This will enhance students' knowledge base and expose them to how to present information.         Course Outcomes (COs):       On successful completion of this course, students will also learn how to compile the literature database information.         Course Outcomes (COs):       On successful completion of this course, students will be able to         C0 1:       Express thoughts and ideas effectively         C0 2:       Demonstrate the ability to listen carefully and react         C0 3:       Apply one's views and present complex information clearly and concisely to different groups         C0 4:       Conclude on information         C0 5:       Define the problem in a concise manner         C0 6:       Adopt challenging tasks; students will also learn how to compile and interpret data         Mapping of COs to POS       PO 1       PO 2       PO 3       PO 4       PO 5       PO 6       PO 7       PO 8       PO 9       PO       PO <td< td=""><td>Academ</td><td>ic Year</td><td>: 2023</td><td>onwa</td><td>rds</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Academ	ic Year	: 2023	onwa	rds													
courses. This will enhance students' knowledge base and expose them to how to present information.         course information.           Course Outcomes (COS):         On successful completion of this course, students will also learn how to compile the literature database information.           CO 1:         Express thoughts and ideas effectively.         Demonstrate the ability to listen carefully and react.           CO 3:         Apply one's views and present complex information clearly and concisely to different groups.           CO 4:         Conclude on information         Conclude on information a concise manner.         Conclude on information.           CO 5:         Define the problem in a concise manner.         Adopt challenging tasks; students will also learn how to compile and interpret data.           Mapping of CV         PO z         PO z         PO z         PO z         PO	No of C	redits:	1				Prere	quisites	: Admi	ission t	o B.Sc.	prog	gram					
Information         Information           Course Outcomes (COS):         On successful completion of this course, students will be able to           CO 1:         Express thoughts and ideas effectively           CO 2:         Demonstrate the ability to listen carefully and react           CO 3:         Apply one's views and present complex information clearly and concisely to different groups           CO 4:         Conclude on information           CO 5:         Define the problem in a concise manner           CO 6:         Adopt challenging tasks; students will also learn how to compile and interpret data           Mapping of COS to POS           CO 1         ×         PO 7         PO 8         PO 9         PO         PO </td <td>Synopsi</td> <td>s:</td> <td>This c</td> <td>ourse</td> <td>will inc</td> <td>lude ar</td> <td colspan="11">n allotment of an individual seminar topic related to the semester</td>	Synopsi	s:	This c	ourse	will inc	lude ar	n allotment of an individual seminar topic related to the semester											
information.         Course Outcomes (COS):       On successful completion of this course, students will be able to         CO 1:       Express thoughts and ideas effectively         CO 2:       Demonstrate the ability to listen carefully and react         CO 3:       Apply one's views and present complex information clearly and concisely to different groups         CO 4:       Conclude on information         CO 4:       Conclude on information         CO 5:       Define the problem in a concise manner         CO 5:       PO PO         <			course	es. Th	is will e	enhance	students' knowledge base and expose them to how to present											
Course Outcomes (COs):         On successful completion of this course, students will be able to           CO 1:         Express thoughts and ideas effectively			inform	nation	clearly a	and cor	cisely.	Studen	ts will a	ilso leai	rn how	to co	ompile th	e litera	ture da	ıtabase		
CO 1:       Express thoughts and ideas effectively         CO 2:       Demonstrate the ability to listen carefully and react         CO 3:       Apply one's views and present complex information clearly and concisely to different groups         CO 4:       Conclude on information         CO 5:       Define the problem in a concise manner         CO 6:       Adopt challenging tasks; students will also learn how to compile and interpret data         Mapping of COs to POS       PO 1       PO 2       PO 3       PO 4       PO 5       PO 6       PO 7       PO 8       PO 9       PO       P			inform	nation														
Demonstrate the ability to listen carefully and react         Apply one's views and present complex information clearly and concisely to different groups         CO 3:       Apply one's views and present complex information clearly and concisely to different groups         CO 4:       Conclude on information         CO 5:       Define the problem in a concise manner         CO 6:       Adopt challenging tasks; students will also learn how to compile and interpret data         Mapping of Cos to POS         CO 1       PO 2       PO 4       PO 6       PO 7       PO 8       PO       PO <th co<="" td=""><td>Course</td><td>Outcon</td><td>nes (CO</td><td>s):</td><td>On succ</td><td>cessful o</td><td colspan="11">completion of this course, students will be able to</td></th>	<td>Course</td> <td>Outcon</td> <td>nes (CO</td> <td>s):</td> <td>On succ</td> <td>cessful o</td> <td colspan="11">completion of this course, students will be able to</td>	Course	Outcon	nes (CO	s):	On succ	cessful o	completion of this course, students will be able to										
Apply one's views and present complex information clearly and concisely to different groups         CO 3:       Conclude on information         Conclude on information         CO 4:       Conclude on information         CO 4:       Conclude on information         CO 5:       Define the problem in a concise manner         CO 6:       Adopt challenging tasks; students will also learn how to compile and interpret data         Mapping of COs to POs       PO																		





Assessment		(	01		-		
TOTAL		:	16		45		
Assessment Methods:							
Formative:				Summat	ive:		
Assignments/presentat	ions			-			
Mapping of assessmen	t with COs						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination		NA	NA	NA	NA		
Quiz		NA	NA	NA	NA	NA	NA
Assignment/Presentation	on	х	х	х	х	х	х
End Semester Examinat	tion	NA	NA	NA	NA	NA	NA
Laboratory examination	า	NA	NA	NA	NA	NA	NA
Feedback Process	• End	-Semester I	eedback				
Reference Material	Reference b	ooks and Jo	ournals articles	s related to th	e seminar to	pics	

Name of	the Pr	ogram:				B.Sc. Biotechnology (Honours)										
Course T	ïtle:					Cell Bi	ology (	Theory	)							
Course C	Code: B	BT 102				Course	e Instru	ctor: C	ourse li	n-char	ge					
Academ	ic Year:	2023	onwar	ds		Semes	ster: I Y	ear, II S	Semeste	er						
No of Cr	edits:	3				Prerec	quisites	: Qualit	fied I se	emeste	er as pe	r unive	rsity gı	uideline	es	
Synopsis	::		-		s of this course are to acquaint the students with basic structure of cell and its											
		•		•	provide fundamental knowledge on the structure and function of cell											
		-			erstand the functions cell division, process of cell cycle regulation, protein ss various theories of origin of life, evolution with discussion on evidences											
												discus	sion or	ı evider	nces	
Course C	Dutcom	es (COs	s):			the cou										
CO 1:						erences					-					
CO 2:						discuss				<u> </u>		their fu	nctions	5 (C1, C	2)	
CO 3:						he proc			-		-					
CO 4:					•		•								nd the	
						etween										
CO 5:						-	rize an	d com	pare v	arious	types	prima	ry tissu	ies and	d their	
				functio	• •											
CO 6:					lerstand the various theories of origin of life, evolution and appraise evidences											
				suppor	ting it	t the with (C2, C3)										
Mapping																
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO	
<u> </u>										10	11	12	13	14	15	
CO 1	×															
CO 2 CO 3	×		×													
	×		×													
CO 4	×		×													
CO 5 CO 6	×		×													
CO 6 Course c		and cu														
	ontent	anu ou			ncios									No of I	Jours	
Content				mpeter	icles									NO Of I	Jours	





Unit 1:									
Basic organization of	Compariso	n betweer	n bac	teria, plan	t. ar	nd animal	cells (C1, C2)		3
the cell					, -				-
Unit 2:									
Structure and functions	Describe t	ne Golgi.	plasr	na membr	ane	. iunction	al complex,	nucleus.	19
of cell organelles	mitochond	•	•				• •	sosomes,	
	peroxisom		•		•			,	
Unit 3:	perentee			,	.,		-, -,		
Protein sorting and	Explain the	signal sec	uen	ce, protein	sort	ting to org	anelles (End	oplasmic	5
transport		-	•	•			and the s		5
	pathways (			,	Pe			,	
Unit 4:	[ [ ] ] ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [	,,							
Cell division and Cell	Understand	d the phas	ses o	f cell cycle	Ce	ll cycle ch	eck points, o	ell cycle	6
cycle	regulation			i cen eyere	,	ii eyele eli		ch eyere	0
cycle	-	the Mito	sis-	Mechanis	m	molecula	r organizati	ion and	
							in animals a		
	cells				, -1				
		<b>1echanism</b>	ם , n	iring and	svn	aptonema	al complex,	crossing	
	over, signif		•	-					
Unit 5:	,			(- ) -0					
Histology	Explain the	e type, st	ructi	ure. and f	unct	tion of e	pithelial, cor	nnective.	5
	muscular a						,		•
Unit 6:					,				
Origin of life and	Describe th	e theories	s and	l experime	nts d	on the ori	gin of life, th	eories of	7
Evolution				•			eory, Neo-Da		
							n molecular e		
	(C1, C2, C3			•					
Learning strategies, conta	act hours and	d student	learı	ning time				•	
Learning strategy				ntact hours			Student	learning tii	me (Hrs)
Lecture			45				135		
Seminar									
Small Group Discussion (S	GD)								
Self-directed learning (SD									
Problem Based Learning (									
Case Based Learning (CBL)	-								
Clinic									
Practical									
Revision									
Assessment			05				-		
TOTAL			50				135		
Assessment Methods:			1				I		
Formative:						Summat	tive:		
Class tests							al examinatio	n	
Assignments/presentation	าร						ester exami		
Quiz									
Mapping of assessment w	vith COs					I			
					T			1	- r
Nature of assessment		CO 1		CO 2		CO 3	CO 4	CO 5	CO 6



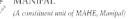




Sessional Examination		Х	х	х								
Quiz		NA	NA	NA	NA	NA	NA					
Assignment/Presentation	า	Х	х	х	х	х	х					
End Semester Examination	on	Х	х	х	х	х	х					
Laboratory examination	nation NA NA NA NA NA											
Feedback Process	• End	End-Semester Feedback										
Reference Material	Roberts, F Lodish H Molecula Ross MH, biology, E Karp G, C Sons, 201	and Peter Wa , Kaiser CA, r Cell Biology Pawlina W. Baltimore ME ell and Moleo 0.	alter Molecul Krieger M, S , WH Freema Histology: A D, Lippincott cular Biology	ar Biology of Scott MP, Br an 2007. text and atla Wiliams & W - Concepts ar	the Cell, Gar etscher A, P s: with corre ilkins, 2006 nd experimer	rgan, Martin land Science Ploegh H, Ma elated cell an hts, 2010, Joh arning, 2008.	, 2007. atsudaira P, d molecular n Wiley and					

Name o	of the P	rogran	า:		В.	Sc. Biot	techno	logy (H	onours	)						
Course	Title:				Bi	iochemi	istry (T	heory)								
Course	Code: E	3BT 10	4		Co	ourse In	structo	or: Cou	rse In-c	harge						
Academ	nic Year	: 2023	3 onwa	rds	Se	emester	r: I Yea	r, II Sen	nester							
No of C	redits:	3			Pr	rerequis	sites: Q	ualifie	d I sem	ester a	is per ι	iniversi	ity guid	elines		
Synopsi	is:				troduces and provides knowledge in field of biochemistry. To provide insight into the d metabolism of biomolecules, fundamental knowledge about the enzymes and											
					o understand the mechanism of electron transport chain and acid base balance.											
Course	Outcon	nes (CO	Os):		n successful completion of this course, students will be able to											
CO 1:				Explain	plain the chemistry of carbohydrates and lipids (C1, C2, C3, C4, C6)											
CO 2:				Explain	the pro	ocess of	fmetab	olism o	of carbo	hydra	tes and	lipids	(C1, C2	, C3 <i>,</i> C4	, C5, C6)	
CO 3:				Discuss												
CO 4:				•		•	•					embran	e and i	underst	and the	
					ransport mechanism via cell membrane. (C1, C2, C4)											
CO 5:					lassification of enzymes and the role of metal ions and coenzymes in activity of nzymes, understand the regulation mechanism and factors affecting the enzyme											
								egulatio	on med	hanisn	n and t	factors	affecti	ng the	enzyme	
				activity												
CO 6:					escribe the function and role of vitamins in normal physiology and disease (C1, C2,											
			_	C3, C4)												
Mappin	<u> </u>														2015	
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	РО 12	РО 13	PO	PO 15	
CO 1										10		12	13	14		
CO 1 CO 2	×	×	×													
CO 2 CO 3	×	×	×	×							+					
CO 3	×	×	×	^												
CO 4 CO 5	×	×	×													
CO 5	×	×	×	×												
Course															<u> </u>	
Content													Λ	o of Hc	nurs	
Unit 1:																
Jint I.																







	$^{33p}\eta_{RED} \ll ^{55^{5}}$ (Deemed to be University under Section 3 of the UGCAct, 1955	5)
Chemistry of carbohydrates	<ul> <li>Classify carbohydrates and list its isomeric forms (C1, C2)</li> <li>Distinguish between reducing and nonreducing, aldoses and ketoses, homo and heteropolysaccharides (C1, C4)</li> <li>Elaborate on the composition of homopolysaccaharides and heteropolysaccharides (C1, C2, C6)</li> <li>Explain the reactions of carbohydrates –osazone formation, glycosidic linkage, reduction and oxidation of monosaccharides (C1, C2, C3, C4)</li> </ul>	4
Unit 2:		
Chemistry of lipids	<ul> <li>Classify lipids and elaborate on its composition and function (C1, C2, C4)</li> <li>Functions, composition and characteristics of cholesterol and prostaglandins(C1, C2)</li> <li>Functions, composition and characteristics of monounsaturated fatty acids and polyunsaturated fatty acids(C1, C2)</li> </ul>	3
Unit 3:		
Membrane structure and transport across membranes	<ul> <li>Explain the fluid mosaic model of membranes (C1, C2)</li> <li>Functions and characteristics of membrane proteins (C1, C2, C4)</li> <li>Explain facilitated diffusion with examples (C1, C2)</li> <li>Explain active transport with examples (C1, C2)</li> </ul>	3
Unit 4:		
Enzymes	<ul> <li>Classify enzymes with a note on its EC numbering system (C1, C2)</li> <li>Importance of cofactors, metal ions and coenzymes in activity of enzymes(C1, C2, C3)</li> <li>Explain the regulations and mechanism of enzyme activity(C1, C2, C3, C4)</li> <li>What is diagnostic enzymology? (C1, C2)</li> </ul>	7
Unit 5:		
Metabolism of carbohydrates	<ul> <li>Explain digestion and absorption of carbohydrates(C1, C2, C3)</li> <li>Explain the reaction of glycolysis. Add a note on its regulation and energetics(C3, C4, C5)</li> <li>Discuss in detail Krebs cycle and its amphibolic role (C1, C2, C3, C4, C5, C6)</li> <li>Explain gluconeogenesis and its regulation( C2, C3, C4)</li> <li>Explain glycogen metabolism and disorder associated with it (C1, C2,C3, C4, C5, C4, C5, C6)</li> <li>Discuss the significance of pentose phosphate pathway? (C1, C2, C3, C4)</li> <li>Explain galactose metabolism (C1, C2, C3)</li> </ul>	6
Unit 6:		_
Metabolism of lipids	<ul> <li>Discuss beta oxidation and fatty acid synthesis(C1, C2, C6)</li> <li>Define ketone body metabolism and ketoacidosis (C1)</li> <li>What are the functions of serum cholesterol? (C1)</li> <li>Classify lipoproteins with a note on its composition and function (C1, C2)</li> </ul>	6
Unit 7:		
ETC and Oxidative phosphorylation	<ul> <li>What are high energy compounds? (C1)</li> <li>Explain components of electron transfer chain (C1, C2)</li> <li>Define chemiosmotic hypothesis (C1)</li> </ul>	6
	Discuss ATPase complex (C1, C2)	
Unit 8:	Discuss ATPase complex (C1, C2)	





	<b>D</b> : 1						(01	
	• Discuss the ro	-	and kidney ii	n maintainin	g acid b	ase bala	nce (C1,	
	C2, C3, C4, C5	-	<b>\</b>					
	<ul> <li>What is anion</li> </ul>	gap? (CI	)					
Unit 9:						<u> </u>		7
	<ul> <li>Classify vitam vitamins (C1,</li> <li>What are the</li> </ul>	C2)						7
	vitaminosis w	ith respec	ct to vitamin <i>i</i>	A? (C1, C2, C	3 <i>,</i> C4)			
	<ul> <li>What are the</li> </ul>	ne source	es, requirem	ents, funct	ion, de	ficiency	, hyper	
	vitaminosis w	ith respec	ct to vitamin l	D? (C1, C2, C	3, C4)			
	<ul> <li>What are the</li> </ul>		•				, hyper	
	vitaminosis w	-						
	<ul> <li>What are the</li> </ul>					ficiency	, hyper	
	vitaminosis w				3 <i>,</i> C4)			
Learning strategies,	contact hours a	nd stude						
Learning strategy			Contact hour	S			nt learning	time (Hrs)
Lecture			45			135		
Seminar	(2.2.2.)							
Small Group Discussi								
Self-directed learning								
Problem Based Learn								
Case Based Learning	(CBL)							
Clinic								
Practical								
Revision								
Assessment			05			-		
TOTAL			50			135		
Assessment Method	s:							
Formative:						mative:		
Class tests					-		mination	
Assignments/present	tations				Ends	semeste	r examinati	on
Quiz								
Manning of arrest	ant with CO-							
Mapping of assessm Nature of assessmen		CO 1	<u> </u>	60.3		1		CO 6
Sessional Examinatio		CO 1	CO 2	CO 3		74	CO 5	CO 6
	111	Х	X	X	X			
Quiz Assignment/Presenta	ation	v	V				V	
End Semester Exami		x	X	X	X		X	X
		x NA	X NA	X NA	X NA		X	X NA
Laboratory examinat Feedback Process			r Feedback	INA	IN/	١	NA	INA
Reference Material	• Biochem 1180-250	stry: D Vo 24.	oet and JE Vo					ns.ISBN:978-1-
		nthan 6 <sup>th</sup>						ekumari and K ii. ISBN 978.93-





Biochemistry: JM Berg, JLT Tymoczko an	d L Stryer, 7 <sup>th</sup> edition 2012, WH Freeman and
Co., New York.ISBN.13:978-1-4292-7635	-1.
Biochemistry : U Satyanarayana and U C	nakrapani 5 <sup>th</sup> edition, 2019, Books & Allied Pvt
Ltd., Kolkata. ISBN.13 : 978-8131236017	

Name o	of the P	rograr	n:		B.Sc.	Biotec	y (Hon	ours)							
Course	Title:				Envir	onmer	tal Scie	ence (T	heory)						
Course	Code: I	3BT 10	6		Cour	se Instr	uctor:	Course	in-char	ge					
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Course	Outcor	nes (C	Os):	On suc		•									
CO 1: Define environment, its scope and explain the human-environment in actural resources and sustainable development (C1, C2, C3)													intera	ctions,	
natural resources and sustainable development (C1, C2, C3)															
CO 2: Explain the various environmental issues and the measures for												or cons	erving		
biodiversity and resources (C1, C2, C4)															
CO 3: Define environmental pollution, describe its health impact (C1, C2, C3)												+: /0	2 (2)		
CO 4:Explain climate change and different environmental management practices (CCO 5:List and describe the various national and international environmental legislic															
CO 5:								s natio	nar and	intern	ational	enviro	nment	ai iegis	ations
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Human	s and E	Inviro	nment	– man-e	environ	ment i	nteract	ions	Descri	ibe his	torical	contex	xt of	4	
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agricult	ure; E	Emerge	ence d	of city	-states;	Grea	it anc	ient	envirc	nment	: (C1, C2	2)			
civilizat	ions a	nd t	he env	vironme	nt; M	iddle	Ages	and	Discus	s the i	nternat	ional ef	fforts		
Renaiss						•			to	safe	guard	ea	arth's		
environ		•		-					envirc	onment	and re	sources	s (C1,		
exploita					-	-	-		C2)						
of environmentalism (Anthropocentric and eco-centric															
perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World															
Commis						•									
concept					nent;	κιο 50	TITTIT	anu							
	subsequent international efforts)														
Unit 2:															





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Natural Resources and Sustainable Development - Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable; major types of biotic resources, microbes as resource; water resources; soil and mineral resources; energy resources; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs	<ul> <li>Explain concept of natural resources, types, distribution and use with specific reference to India, factors affecting availability of natural resources and their conservation and management (C1, C2, C3)</li> <li>Define sustainable development and describe its goals, targets, challenges and global strategies (C1, C2, C4)</li> </ul>	6
Unit 3: Environmental Issues: Local, Regional and Global - Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change.	<ul> <li>Explain the environmental issues of concern (C2, C3)</li> <li>Explain the concepts of spatial and temporal scales and their importance (C1, C2, C3)</li> <li>List and describe the sectoral effects on the local, regional and global environmental issues (C1, C2, C3)</li> </ul>	6
Unit 4: Conservation of Biodiversity and Ecosystems - Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristicsforests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; gender and conservation. Unit 5:	<ul> <li>Define concepts of ecosystem, biodiversity and conservation (C1, C2)</li> <li>Describe the main types of ecosystems and their distribution in India and the world (C1, C2, C4)</li> <li>Discuss factors impacting biodiversity loss and ecosystem degradation in India and the world (C1, C2, C4)</li> <li>Explain conservation of biodiversity and major conservation strategies taken in India (C2, C3)</li> </ul>	6
Unit 5: Environmental Pollution and Health - Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and	• Discuss different types (air, water, soil, chemical, thermal, radioactive and noise), causes, adverse effects and control of pollution (C1, C2, C3)	6





sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems		
Unit 6:		
Climate Change: Impacts, Adaptation and Mitigation - Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions- past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and <i>Intended Nationally</i> <i>Determined Contributions</i> (INDCs); Climate justice.	<ul> <li>Explain climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture (C2, C3)</li> <li>Explain methods of mitigating climate change effects including carbon neutrality, renewable energy resources (C2, C3)</li> </ul>	6
Unit 7: Environmental Management - Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.	• Discuss importance of environmental laws and regulations	5





Environmental management system: ISO 14001 Life cycle analysis; Cost-benefit analysis Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme	<ul> <li>Explain the impact of environmental management systems</li> <li>Describe life cycle and cost benefit analyses, environmental audit, impact and risk assessments.</li> <li>Explain pollution control, waste management principles including 3R concept, sustainability, ecolabeling/ecomark scheme</li> </ul>	
Unit 8	I	_
<b>Environmental Treaties and Legislation</b> - An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non-binding measures; Conference of the Parties (COP); Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1972; The Water (Prevention and Control of Pollution) Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements	<ul> <li>Explain how nations work together for the environment</li> <li>Describe the global treaties and agreements towards environmental safeguards</li> <li>Describe Indian laws and regulations for environment</li> </ul>	6





Lecture       45       135         Seminar				ime	ent learn	and stu	ntact hours	Learning strategies, co							
Seminar       Small Group Discussion (SGD)         Self-directed learning (DL)       Problem Based Learning (PBL)         Case Based Learning (CBJ)       Case Based Learning (CBJ)         Clinic       Practical         Practical       Case Based Learning (CBJ)         Revision       Case Based Learning (CBJ)         Clinic       Summative:         TOTAL       50         Assessment       05         Formative:       Summative:         Class tests       Sessional examination         Assignments/presentations       End semester examination         Quiz       Sessional examination         Assignment/Presentation       x         Assignment/Presentation       x         Assignment/Presentation       X         Assignment/Presentation       X         Assignment/Presentation       NA         NA       NA         Peedback Process       End-Semester Feedback         Reference Material       Fisher, Michael H. (2018) An Environmental History of India- From Earliest Twenty-First Century, Cambridge University Press         Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmento Oxford University Press         Headrick, Daniel R. (2020) An Environmental History of the World- Humankir Role in the Community of Life, 2nd Edition. Routledge<	g time (Hrs)														
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<ul> <li>Feedback Process</li> <li>End-Semester Feedback</li> <li>Fisher, Michael H. (2018) An Environmental History of India- From Earliest Twenty-First Century, Cambridge University Press</li> <li>Headrick, Daniel R. (2020) Humans versus Nature- A Global Environme Oxford University Press</li> <li>Hughes, J. Donald (2009) An Environmental History of the World- Humankin Role in the Community of Life, 2nd Edition. Routledge</li> <li>Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural R Environmental Economics. Pearson Education</li> <li>Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 200 University Press</li> <li>John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd I Publisher (ELBS)</li> <li>Singh, J.S., Singh, S.P. &amp; amp; Gupta, S.R. 2006. Ecology, Environment a</li> </ul>	x														
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<ul> <li>Environmental Issues 6th Edition, Routledge</li> <li>William P. Cunningham and Mary A. (2015). Cunningham Environmenta global concern, Publisher (Mc-Graw Hill, USA)</li> </ul>	onmental History, nankind's Changing ural Resource and D 2000. Edinburgh , 3rd Edition, Weir nent and Resource Perspectives on mental Science: A	<ul> <li>Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to Twenty-First Century, Cambridge University Press</li> <li>Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental Hist Oxford University Press</li> <li>Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Chan Role in the Community of Life, 2nd Edition. Routledge</li> <li>Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource Environmental Economics. Pearson Education</li> <li>Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinbut University Press</li> <li>John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, V Publisher (ELBS)</li> <li>Singh, J.S., Singh, S.P. &amp; amp; Gupta, S.R. 2006. Ecology, Environment and Resour Conservation. Anamaya Publications <u>https://sdgs.un.org/goals</u></li> <li>Harper, Charles L. (2017) Environment and Society, Human Perspectives Environmental Issues 6th Edition, Routledge</li> <li>William P. Cunningham and Mary A. (2015). Cunningham Environmental Scienc global concern, Publisher (Mc-Graw Hill, USA)</li> <li>Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Ox</li> </ul>													

MANIPAL SCHOOL OF LIFE SCIENCES MANIPAL



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(A constituent unit of MAHE, Manipal)

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http://dx.doi.org/10.2139/ssrn.3311406

Name	of the F	Program	า:		B.Sc.	Biotec	hnolog	y (Hono	ours)							
Course	e Title:				Phys	ics (The	eory)	-								
Course	Code:	BBT 10	8		Cour	se Insti	ructor:	Course	In-char	ge						
Acade	mic Yea	r: 2023	3 onwa	rds	Sem	ester: I	Year, II	Semes	ter							
No of 0	Credits:	3			Prerequisites: Qualified I semester as per university guidelines											
Synops	sis:	The c	bjecti	ve of thi	f this course is to acquaint the students with basic Physics principles- to provide											
		funda	amenta	al knowl	owledge of vectors, scalars, mechanics, electricity, magnetism, superconductor,											
		semio	conduc	tor prop	properties etc. To understand the functions of the optics and their applications.											
Course	Outco	mes (CO	Os):	On suc	n successful completion of this course, students will be able to											
CO 1:				Solve t	he prot	olems o	f vector	<sup>.</sup> analys	is inclu	ding ad	dition,	subtrac	tion an	d		
				multipl	Itiplication (C2, C3)											
CO 2:				Explain	lain the various optical phenomenon including interference, diffraction,											
				polariz	ation (C	C2, C5)										
CO 3:				Explain	olain electricity and magnetism through various classical laws and experiments										nts	
				(C2, C5												
CO 4:				•	ompare types of semiconductors and their applications in electronics devices											
				includi	ng, dioc	des, trai	nsistors	, ampli	fiers, re	ctifiers	etc (C4	1)				
CO 5:				Explain	the co	nductiv	ity of so	olids ind	cluding	super o	conduct	ors (C2	, C6)			
CO 6:				Explain	the ba	sic prin	ciple of	BCS th	eory, N	leissne	r effect	(C2, C5	)			
Mappi	ng of C	Os to P	Os													
COs	PO 1	PO 2	PO 3	PO 4         PO 5         PO 6         PO 7         PO 8         PO 9         PO         PO         PO         PO         PO         PO										PO		
										10	11	12	13	14	15	
CO 1	×															
CO 2	×															
CO 3	×															
CO 4	×				×											





CO 6       x	CO 5	×									×						
Content         Competencies         No of Hours           Unit 1:         Introduction to mechanics         • Identify scalars, vectors, co-ordinate systems (C3) • Solve for sum, difference and product of vectors (C3, C5)         3           Unit 2:         • Explain interference using Young's experiment (C2, C5) • Interpret thin film interference and band width of interference fringes (C2, C4) • Explain Newtor's rings, Michelson interferometer (C2, C6)         4           Unit 3:         • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5) • Interpret traunhoffer diffraction at single silt (C2, C4) • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)         4           Unit 4:         • Illustrate basics of polarization and applications and applications of electricity and magnetism, principles of electricity and magnetism; principles of electron microscope (CRO), Aston mass spectrograph, Electron microscope (C2, C4, C5)         8           Unit 6:         • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)         8           • Compare the motion of electrons in electric & magnetic fields (C4) • Explain the working principles of Hall Effect, cathode ray oscilloscope (CRO), Aston mass spectrograph, Electron microscope (C2, C4, C5)         6           Unit 6:         • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)         6           • Durit he basic																	
Unit 1: <ul> <li>Introduction to</li> <li>Identify scalars, vectors, co-ordinate systems (C3)</li> <li>Solve for sum, difference and product of vectors (C3, C5)</li> </ul> 3         Unit 2: <ul> <li>Explain interference using Young's experiment (C2, C5)</li> <li>Introduction to</li> <li>Intergret trianges (C2, C4)</li> <li>Explain Newton's rings, Michelson Interferometer (C2, C6)</li> </ul> 4         Unit 3: <ul> <li>Introduction to</li> <li>Introduction to</li> <li>Introduction at single slit (C2, C4)</li> <li>Explain Diffraction grating and its dispersive and resolving powers (C2, C5)</li> <li>Unit 4:</li> </ul> <ul> <li>Illustrate Fresnel &amp; Fraunhoffer diffraction (C2, C5)</li> <li>Intergret Fraunhoffer diffraction (C2, C5)</li> <li>Intergret Fraunhoffer diffraction (C2, C5)</li> <li>Introduction to</li> <li>Introduction grating and its dispersive and resolving powers (C2, C2)</li> <li>Unit 4:</li> </ul> <ul> <li>Introduction to explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)</li> <li>Compare types of polarized lights (C4)</li> <li>Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)</li> <li>Compare the motion of electrons in electric &amp; magnetic fields (C4)</li> <li>Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)</li> <li>Outine the basic principles of transformer and LCR resonance (CR0), Aston</li></ul>	Course	conte	nt and	outc	om	es:											
Introduction to       • Identify scalars, vectors, co-ordinate systems (C3)       3         mechanics       • Solve for sum, difference and product of vectors (C3, C5)       4         Introduction to       • Explain interference using Young's experiment (C2, C5)       4         interference       • Explain Newton's rings, Michelson interferometer (C2, C6)       4         Unit 3:       • Explain Newton's rings, Michelson interferometer (C2, C6)       4         Unit 4:       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         interpret trannhoffer diffraction at single slit (C2, C4)       • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 4:       • Illustrate basics of polarization (C2, C5)       • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)         Unit 5:       • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Blot-Savart's law (C2, C5)       8         Unit 6:       • Explain Faraday's laws of electrons an electric & magnetic fields (C4)       • Explain the working principles of Hall Effect, cathode ray oscilloscope (CBO), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 6:       • Explain Faraday's laws of electromagnetic induction, sel	Content	t			C	ompete	encies									No oj	f Hours
mechanics       • Solve for sum, difference and product of vectors (C3, C5)         Unit 2:         Introduction to interference phenomenon       • Explain interference using Young's experiment (C2, C5)       4         Introduction to interference phenomenon       • Explain Newton's rings, Michelson interferometer (C2, C6)       4         Unit 3:       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         Introduction to diffraction phenomenon       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         Sasics of polarization and applications       • Illustrate basics of polarisation (C2, C5)       4         • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       • Compare types of polarized lights (C4)         • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C5)       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       6         Unit 6:       • Explain Faraday's laws of electrons microscope (CR0), Aston mass spectrograph, Electron microscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 7:       • Explain Maxwell's equations (C2, C4)       • Explain Maxwell's	Unit 1:																
Unit 2:       Explain interference using Young's experiment (C2, C5)       4         Introduction to interference phenomenon       • Explain interference using Young's experiment (C2, C5)       4         Unit 3:       • Explain Newton's rings, Michelson interferometer (C2, C6)       4         Unit 4:       • Interpret Fraunhoffer diffraction (C2, C5)       4         Basics of polarization and applications       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         Unit 5:       • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 5:       • Explain protect and half wave plates (C2, C4)       • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       4         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Introduction to electricity and magnetism, principles of electron microscope       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Unit 6:       • Explain faraday's laws of electron microscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 7:       • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C3)       6         Unit 7:       • Outline the lasic principles of semiconductors (C2, C5)       • Outline the basic principles of	Introdu	ction t	0		•	Identif	y scala	rs, vect	ors, co-	ordinat	e systei	ms (C3)				3	
Introduction to interference phenomenon       • Explain interference using Young's experiment (C2, C5)       4         Interpret thin film interference and band width of interference fringes (C2, C4)       • Explain Newton's rings, Michelson interferometer (C2, C6)         Unit 3:       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         Introduction to diffraction phenomenon       • Illustrate Fresnel & Fraunhoffer diffraction at single slit (C2, C4)       4         Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 4: Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5) • Explain Diffraction grating and working principles of Half-Shade Polarimeter (C2, C6)       4         Unit 5: Introduction to electricity and magnetism, principles of electron microscope       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Unit 6: Introduction to Faraday's law and applications; Maxwell's equations       • Explain Faraday's laws of electrona in electric & magnetic fields (C4) • Explain the working principles of transformer and LCR resonance circuits, electrodynamics (C2, C4)       6         Unit 6: Introduction to Faraday's law and applications; Maxwell's equations       • Identify energy bands in solids (C3) • Outline the basic principles of transformer and LCR resonance circu	mechar	nics			•	Solve f	or sum	, differe	ence an	d produ	uct of v	ectors	(C3, C5	)			
interference phenomenon       • Interpret thin film interference and band width of interference fringes (C2, C4) • Explain Newton's rings, Michelson interferometer (C2, C6)         Unit 3:       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5) • Interpret Fraunhoffer diffraction at single slit (C2, C4) • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 4:       • Illustrate basics of polarisation (C2, C5)       • Illustrate basics of polarisation (C2, C5) • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 4:       • Explain forewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4) • Compare types of polarized lights (C4) • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       8         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5) • Compare the motion of electrons in electric & magnetic fields (C4) • Explain the working principles of Hall Effect, cathode ray oscilloscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 6:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5) • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C3)       6         Unit 7:       • Identify energy bands in solids (C3) • Fermi concept, types of semiconductors (C2, C5)       6         Salics of solids and working principle of sem	Unit 2:																
phenomenon       fringes (C2, C4)         • Explain Newton's rings, Michelson interferometer (C2, C6)         Unit 3:         Introduction to         diffraction phenomenon         • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)         Unit 4:         Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5)         • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       4         • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       4         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         • Compare the motion of electrons in electric & magnetic fields (C4)       • Explain Faraday's laws of electron microscope (CRO), Aston mass spectrograph, Electron microscope (CRO), Aston mass spectrograph, Electron microscope (CRO), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 7:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)       6         • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C4)       6         • Explain Maxwell's equations (C2, C3)       6         • Outline the relationship between band gap, conductivity and temperature in semiconductors (C2, C4)       6         • Explain M	Introdu	ction t	0		•	Explair	interf	erence	using Y	oung's	experin	nent (C	2 <i>,</i> C5)			4	
• Explain Newton's rings, Michelson interferometer (C2, C6)           Unit 3:           Introduction to diffraction phenomenon         • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5) • Interpret Fraunhoffer diffraction at single slit (C2, C4) • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)         4           Basics of polarization and applications         • Illustrate basics of polarization (C2, C5) • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4) • Compare types of polarized lights (C4) • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)         4           Unit 5:         • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5) • Compare the motion of electrons in electric & magnetic fields (C4) • Explain the working principles of Hall Effect, cathode ray oscilloscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)         8           Unit 6:         • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5) • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C4) • Explain Maxwell's equations (C2, C3) • Unit et relationship between band gap, conductivity and temperature in semiconductors (C2, C4) • Outline the relationship between band gap, conductivity and temperature in semiconductors (C2, C4) • Demonstrate the transistor as R.C coupled amplifier, diode as a full wave rectifier (C2, C5)						•			erferer	nce and	band v	vidth o	f interf	erence			
Unit 3:       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5)       4         Introduction to       • Interpret Fraunhoffer diffraction at single slit (C2, C4)       4         Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5)       4         Basics of polarization and applications       • Illustrate basics of polarized lights (C4)       4         Explain Drewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       6       4         Unit 5:       • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       8       8         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Unit 6:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Introduction to electron microscope (CRO), Aston mass spectrograph, Electron microscope (CRO), Aston mass spectrograph, Electron microscope (C2, C4, C5)       6         Unit 6:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)       6         Maxwell's equations;       • Uthen the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C4)       6         • Explain Maxwell's equations (C2, C4)       • Explain Maxwell's equations (C2, C5)       6         • Dutine the rel	phenon	nenon				-											
Introduction to diffraction phenomenon       • Illustrate Fresnel & Fraunhoffer diffraction (C2, C5) • Interpret Fraunhoffer diffraction at single slit (C2, C4) • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)       4         Unit 4:       Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5) • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4) • Compare types of polarized lights (C4) • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       4         Unit 5:       Introduction to electricity and magnetism, principles of electron microscope       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5) • Compare the motion of electrons in electric & magnetic fields (C4) • Explain the working principles of Hall Effect, cathode ray oscilloscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)       8         Unit 6:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5) • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C3)       6         Unit 7:       • Explain Maxwell's equations (C2, C3)       6         Basics of solids and working principle of semiconductors (C2, C5) • Outline the relationship between band gap, conductivity and temperature in semiconductors (C2, C4)       6         Unit 8:       • Identify energy bands in solids (C3) • Fermi concept, types of semiconductors (C2, C4) <t< td=""><td></td><td></td><td></td><td></td><td>•</td><td>Explair</td><th>Newt</th><th>on's rin</th><td>gs, Mic</td><td>helson i</td><td>interfer</td><td>omete</td><td>r (C2, C</td><td>26)</td><td></td><td></td><td></td></t<>					•	Explair	Newt	on's rin	gs, Mic	helson i	interfer	omete	r (C2, C	26)			
diffraction phenomenon       • Interpret Fraunhoffer diffraction at single slit (C2, C4)       • Explain Diffraction grating and its dispersive and resolving powers (C2, C5)         Unit 4:       Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5)       4         Basics of polarization and applications       • Illustrate basics of polarisation (C2, C5)       4         Description       • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       4         Unit 5:       • Compare types of polarized lights (C4)       • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       8         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         electricity and magnetism, principles of Hall Effect, cathode ray oscilloscope (CR0, Aston mass spectrograph, Electron microscope (C2, C4, C5)       8         Unit 6:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)       6         Naxwell's equations       • Explain Maxwell's equations (C2, C3)       6         Unit 7:       • Explain Maxwell's equations (C2, C3)       6         Basics of solids and working principles of semiconductors (C2, C5)       • Outline the relationship between band gap, conductivity and temperature in semiconductors (C2, C4)       6         Unit 8:       • Identify energy																	
• Explain Diffraction grating and its dispersive and resolving powers (C2, C5)         Unit 4:         Basics of polarization and applications       • Illustrate basics of polarization (C2, C5)       4         • Explain Brewster's law, birefringence (double refraction), Nicol prism, quarter and half wave plates (C2, C4)       • Compare types of polarized lights (C4)         • Explain optical activity and working principles of Half-Shade Polarimeter (C2, C6)       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         Unit 5:       • Explain the electricity and magnetism using Coulomb's law, Gauss law, Ampere's law, Biot-Savart's law (C2, C5)       8         • Compare the motion of electrons in electric & magnetic fields (C4)       • Explain the working principles of Hall Effect, cathode ray oscilloscope (CR0), Aston mass spectrograph, Electron microscope (C2, C4, C5)       8         Unit 6:       • Explain Faraday's laws of electromagnetic induction, self and mutual inductance (C2, C5)       6         • Outline the basic principles of transformer and LCR resonance circuits, electrodynamics (C2, C4)       6         • Explain Maxwell's equations of solids and working principles of semiconductors (C2, C5)       6         • Outline the relationship between band gap, conductivity and temperature in semiconductors (C2, C4)       6         • Dutine the relationship between band gap, conductivity and temperature in semiconductors (C2, C4)       6         • Explain Terraday fore												-	-			4	
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wave rectifier (C2, C5)	•••		ors			•		-									
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Learning strategies, co	ntact hours a		-									
Learning strategy			ontact hours			-	t learning t	time (Hrs)				
Lecture		45	5			135						
Seminar												
Small Group Discussion												
Self-directed learning (												
Problem Based Learnin	g (PBL)											
Case Based Learning (C	BL)											
Clinic												
Practical												
Revision												
Assessment		05	5			-						
TOTAL	50 135											
Assessment Methods:												
Formative:	Summative:											
Class tests	Sessional examination											
Assignments/presentat	ions				End semest	er examin	ation					
Quiz												
Mapping of assessmen	t with COs			1			1					
Nature of assessment		CO 1	CO 2	C	O 3 C	04	CO 5	CO 6				
Sessional Examination		×	×	×								
Quiz		NA	NA	N.	A N	A	NA	NA				
Assignment/Presentation	on	×	NA	×	Ν	A	×	NA				
End Semester Examinat	tion	×	×	×	×		×	×				
Laboratory examination	n	NA	NA	N.	A N	IA	NA	NA				
Feedback Process	• End	-Semester Fe	edback									
Reference Material	-	-	-			vis. Univer	sity Physic	s-International				
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		-				James. Fl	indamenta	l of Analytical				
	<ul> <li>Chemistry, Canada, Nelson Education, 1996</li> <li>Basavaraju SP. Engineering Physics, Bangalore, Subhash Book Stores, 2018</li> </ul>											
		ојуон. вю-Рг	iysics and BIO	-Pr	iysical Chem	istry, Calci	itta Acade	mic Publishers,				
	<ul><li>2007.</li><li>Halliday, David., Resnick, Robert., Walker, Jearl. Fundamental of Physics, New Jersey,</li></ul>											
		David., Resni		l b v	iker, jeari. Fi	unuament	ai OI Priysi	Ls, new Jersey,				
		•	•	: E.	undamental	of Optics	Now Vork	McGraw – Hill,				
	<ul> <li>Jenkins, F</li> <li>2001.</li> </ul>	Taticis A., WI	nite, naivey E	гі	unuamental	or optics,	INCW TUIK,	iviculaw – niil,				
	2001.											

Name of the Program:	B.Sc. Biotechnology (Honours)
Course Title:	Advanced Chemistry (Theory)
Course Code: BBT 110	Course Instructor: Course In-charge
Academic Year: 2023 onwards	Semester: I Year, II Semester
No of Credits: 3	Prerequisites: Qualified I semester as per university guidelines





Synopsis	5:	dete	This course introduces and provides knowledge in chemistry techniques such as spectroscopy detection and estimation of elements. The course discusses structure and properties of proteins. es (COs): On successful completion of this course, students will be able to												
Course (	Dutcom	nes (CO	s): 0	n succe	ssful co	mpleti	on of th	nis cour	rse, stu	dents	will be a	able to			
CO 1:			Ex	kplain t	he wo	rking p	orinciple	e and	applica	tions	various	spect	roscopi	ic tech	niques
			(N	IMR, IR	spectro	oscopy,	micro	wave sp	pectros	copy) (	C1, C2,	C3, C4	)		
CO 2:			Ex	kplain th	ne tech	niques	of polyı	merisat	ion, fab	oricatio	on of sc	affolds	and ch	aracter	isation
				ethods											
CO 3:				iscuss tl	•		,	•			,				
			-	-		-	-		•	-	-	anic co	mpour	nd (C1,	C2, C3,
				4) Discu										1.1	
CO 4:				iscuss t			•				•		ce bon	d theo	ry and
<u> </u>	nomenclature of coordination compounds (C1, C2, C3, C4) Discuss the titrimetric methods of analysis (C1, C2)														
CO 5:		Explain the chemistry and structures of proteins (C1, C2, C4)													
CO 6:	( 00			kplain ti	ne cher	nistry a	na stru	ctures	of prot	eins (C	.1, C2, C	_4)			
Mappin				001	PO 5	DO C	PO 7	PO 8	PO 9						00
COs	PO 1	PO 2	PO 3	PO 4	P05	PO 6	P07	PU 8	P09	PO	PO	PO	РО 13	PO 14	PO 15
CO 1	×													14	15
CO 2	×														
CO 3	×														
CO 4	×			^											
CO 5	×														
CO 6	x		×	×											
Course		and or													
Content			petenci										No	o of Ho	urs
Unit 1:														<b>j</b>	
Spectros	sigos	• Exp	olain th	ne prino	ciple of	NMR	spectro	.vgoza	IR spe	ectrosc	opv. m	icrowa	ve 11		
Techniq	ues	spe • Dis • Dis • Def	ectrosco cuss th cuss th fine chi	opy (Ca ne applie ne applie rompho ne solve	1, C2) cations cations ore, aux	of NM of UV s cochror	R spect spectro ne, che	roscop scopy ( mical s	y (C1, C C1, C2, hift (C1	2, C3, C3, C4 , C2)	C4)				
Unit 2:															
Unit 2:Biomaterials• Classify polymers based on the structure, origin response to heat (C1, C2) • Discuss the techniques of polymerisation (C1, C2, C3) • Find the number average molecular weight and weight average molecular weight (C1, C2) • Explain the fabrication of scaffold (C1) • Discuss the characterisation of scaffolds (C1, C2)8															
Unit 3:		2.5						()	1						
Elemental analysis separation methods• Outline the reactions involved in the detection of nitrogen, sulphur and halogens from the Lassaignes extract (C1, C2, C3) • Estimate the percentage of nitrogen, carbon, hydrogen, sulphur and halogens in the given organic compound (C1, C2, C3, C4) • Discuss the various purification techniques such as steam distillation and chromatographic techniques(C1, C2)7Unit 4:															





Feedback Proce	ss • E	nd-Semester F		ouch SR.				
Laboratory exan		NA	NA	NA		NA	NA	NA
End Semester Ex		х	х	х		х	х	х
Assignment/Pres		x	х	x x		х	х	х
Quiz								х
Sessional Examin	nation	х		х				
Nature of assess		CO 1	CO 2	CO S	3	CO 4	CO 5	CO 6
	essment with COs					_		
Quiz								
Assignments/pro	esentations				End	semester e	xamination	
Class tests					Sess	sional exam	nation	
Formative:					Sum	nmative:		
Assessment Me	thods:							
TOTAL			50			135		
Assessment			05			-		
Revision								
Practical								
Clinic								
Case Based Lear	ning (CBL)							
Problem Based I	earning (PBL)							
Self-directed lea								
Small Group Dise	cussion (SGD)							
Seminar			-					
Lecture	/		45			135		
Learning strateg			Contact ho			Stu	dent learnir	ng time (Hrs)
Learning strateg	ies, contact hours				•1			
	• Discuss the det	-						
Important Biomolecules	(C4) • Explain reaction	ns, synthesis ი	f amino acid	s (C1. C2	2)			
Properties of	• Discuss primar	y, secondary,	tertiary and	quatern	nary s	structure of	protein	
Structure and	Recall the struct						9	J
Unit 6:								
	<ul><li>(potentiometric</li><li>Comparison of</li></ul>	c titration, con	ductometric	titratior	ns) (C	C1, C2)	method	
Analytical methods	<ul> <li>Explain the p precipitation,</li> </ul>	•				ons (neutra trumental		1
Unit 5:								
chemistry	C4) • List the limitation C2, C3, C4)	ons of valence	bond theory	of coor	dinat	ion compou	nds (C1,	
Bioinorganic	• Explain the val	-						
and	• Discuss the bio				•	• •		
Compounds	<ul> <li>Define ligand, or</li> <li>Summarise the</li> </ul>		-	ation cor	ทุธอน	unds (C1. C2	)	





Kalsi PS. Spectroscopy of Organic Compounds (6th ed.), New Age International, 2007.
Puri BR, Sharma LR, Kalia KC. Principles of Inorganic Chemistry (33rd ed.), Vishal Publications, 2001.
Bruice PY, Essential Organic Chemistry (7th ed.), Pearson Education, 2007.
Gowariker VR, Viswanathan NV, Sreedhar J, Polymer Science, New Age International, 1986.

Name	of the P	rograr	n:		B.S	c. Biote	echnolo	ogy (Ho	nours	)						
Course	Title:	-			Cel	l Biolog	gy (Pra	ctical)								
Course	Code:	BBT 11	.2		Cou	urse Ins	structo	r: Cour	se In-c	harge						
Acader	nic Yea	r: 2023	3 onwa	rds	Ser	nester	I Yea	ar, II Se	meste	r						
No of C	credits:	2			Pre	requisi	ites: Qu	ualified	l sem	ester as	per u	niversi	ty guide	elines		
Synops	is:	This	practic	al cour	se help	os to ui	ndersta	nd the	funda	mental	knowl	edge a	nd too	s and	oractical	
		appl	ications	s of Cel	l Biolog	SY										
Course	Outco	nes (C	Os):	On	On successful completion of this course, students will be able to											
CO 1:					Observation of streaming movement (cyclosis) of chloroplast in the protoplasm											
				of	of Hydrilla leaf (P1, P2, P3, P4)											
CO 2:				Un	Understanding the structure of animal cell and determining the size of the cells											
				P2,	P2, P4, P6, P8)											
CO 3:				Un	derstar	nding a	nd estir	nating	the va	rious ty	pes of <b>\</b>	WBCs i	n blood	(P1, P2	2, P4, P5,	
					P8)											
CO 4:				Un	derstar	nding a	nd stuc	lying th	e vario	ous pha	ses and	d struct	ture cel	l divisio	on	
						3, P4, F	-									
CO 5:									arious	changes	s occur	in RBC	Cs and s	tudy o	f PBMCs	
					-	P1, P3.										
CO 6:					earning and understanding various tissues of human body. (P1, P2, P3, P4, P6,											
				P8,	P11)	'11)										
Mappi	-										_	_	_			
Cos	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 15	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
CO 1	×	Х		X		Х		X								
CO 2	X	Х		Х		Х		Х								
CO 3	×	Х	X	X			х	×								
CO 4	X	Х	~	Х	Х	Х		X			X					
CO 5	×	Х	X	X		Х		×		Х						
CO 6	×		X	X		Х		×								
Course		t and	outcom	ies:		a a cta	-i							A/	6110	
Conten					Cor	npeten	cles							INO 0j	f Hours	
Unit 1:		- 20		tion -	t o		L	£				1		4		
Prepara				uon C					-	move			-	4		
chlorop	JIASC IN	nyurill	alear			nloropi 4, P6, P		ne prot	opiasm	n of Hyd	irilla le	af (P1,	rz, r3,			
Unit 2:																
Study	of a ty	pical	animal	cell <i>i.e</i>	e. • U	nderst	anding	the str	ucture	of anii	nal ce	II (P1, I	P2, P4,	4		
Human	buccal	mucos	sa cell		Р	6 <i>,</i> P8)										
Unit 3:																
Measu	ring the	size o	f cells		• E:	stimati	on of si	ze of tl	ne cells	6 (P1, P	2, P3, F	P4, P7,	P8)	8		
Unit 4:																





				480 B . (D4	emed to be University under Sectio	15 0, 112 0 0 0 1 0 , 1 5 0 ,	
Study of polymorphic nuclei in		standing and		-		types of	8
human blood cells and differential	WBCs i	in blood (P1,	P2, P4	, P5 P6)			
counting of WBCs							
Unit 5:	1						
Squash preparation of meiosis -		standing and			•		8
Poekilocerus pictus testis	structu	re cell divisio	on (P1,	P2, P3,	P4, P6, P8,	P10)	
Unit 6:	1						
Effect of hypotonic, hypertonic and		ng and unde		ling var	ious change	s occur in	8
isotonic medium on cells (RBCs)	RBCs (I	P1, P3. P4, P6	, P8)				
Unit 7:	I						
Isolation of PBMC from blood using	• Study of	of the PBMCs	s from	blood	(P1, P4, P6, P	8, P9)	8
gradient centrifugation technique							
Unit 8:	1						
Principles of tissue fixation and		ng and und		-		tissues of	12
staining.	human	n body (P1, P2	2, P3, I	P4, P6,	P8, P11)		
Identification of histological							
sections of mouse tissue (intestine,							
liver, kidney and testes)							
Learning strategies, contact hours an	nd student						<i>(</i> , , )
Learning strategy		Contact hou	rs		Studen	t learning ti	me (Hrs)
Lecture							
Seminar							
Small Group Discussion (SGD)							
Self-directed learning (SDL)							
Problem Based Learning (PBL)							
Case Based Learning (CBL)							
Clinic							
Practical		60			180		
Revision							
Assessment		07			-		
TOTAL		67			180		
Assessment Methods:							
Formative:				Summ			
Class tests					nal examinat		
Assignments/presentations				End se	mester exan	nination	
Quiz							
Mapping of assessment with COs		1					
Nature of assessment	CO 1	CO 2	CO	) 3	CO 4	CO 5	CO 6
Sessional Examination	Х	X		Х	X		
Quiz							
Assignment/Presentation	Х				X		
End Semester Examination							
Laboratory examination	Х	Х		Х	Х	Х	Х
Feedback Process	-Semester	Feedback					
Reference Material• Cell BioloDr. V K Ag		ics, Moleculai	r Biolo	ogy, Evo	lution and E	cology by Dr	. P S Verma





٠	Lichtenthaler	1987.	Chlorophylls	and	carotenoids:	Pigments	of	photosynthetic
	biomembrane	s. Met	hods of Enzym	ology	r, 148, 350-382	2.		

Name of the Program:					B.Sc. Biotechnology (Honours)										
Course T	itle:				Bi	Biochemistry (Practical)									
Course C	ode: B	BT 114			Co	ourse In	structo	or: Cou	rse In-o	charge					
Academi	c Year:	: 2023 c	onward	ls	Se	mester	: I Yea	r, II Sei	nester						
No of Cr	edits:	2			Pr	erequis	requisites: Qualified I semester as per university guidelines								
Synopsis	:	This pr	actical	course	introd	oduces and provides knowledge and technical skills in Biochemistry.									
Course C	)utcom	es (CO	s):			sful con	•			-					
CO 1:				•	•	e Norma	-								
						tion (pe									-
CO 2:					tify the given carbohydrate sample, to differentiate monosaccharide and										
						charide, reducing sugar and non-reducing sugar, aldohexoses and hexoses (P1, P2, P3, P4)									
CO 3:				Dem	nonstra	stration of protein precipitation reactions and the process of identifying									
					given protein sample (P1, P2, P3, P4)										
CO 4:				To e (P1,		e and q	luantify	glucos	e by D	initrosa	alicylic	metho	d, GOD	-POD m	ethod
CO 5:						te and	quanti	ifv pro	teins	bv Biu	ret me	ethod a	and Fo	lin – Lo	owrv's
					hod (P			1 10.0		,			•	_	, -
CO 6:				Ana	lysis o	f kidnev	y functi	ioning <sup>·</sup>	To esti	mate t	he uric	: acid, ı	urea ar	nd crea	tinine
				cont	ent in	unknov	wn sam	ple (P1	, P2)						
Mapping	of CO	s to PO	s						-		-				
Cos	РО	РО	РО	РО	РО	PO	PO	РО	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×							×							
CO 2	×							×							
CO 3	×					×		×							
CO 4	×					×		×							
CO 5	×					×		×							
CO 6	×					×		×							
Course c	ontent	and ou	itcome	s:										Nie of I	1
Content						ompete	ncies							No of H	iours
Unit 1:	tion to	Diacha	mictor	prostia		Ever la '		المالية		بحديما ام		<b>af</b>		0	
Introduc – Norma			-	-	ai   •	Explair				• •		or nor	mal,	8	
preparat		•		10115			and pe			-		tions .	icing		
preparat						Explair	rsons e	•					Build		
Unit 2:	.on unt				1	nenue	30113 8	quation	13 (F I)	· <i>∠</i> j					
Analysis	of nrot	eins: co	olor rea	ctions	•	Demor	nstrate	the col	or rear	rtions	f prot	oinc (D1	P2	8	
						P3, P4						-113 (F 1	., T <b>∠</b> ,	<u> </u>	
Unit 3:															
Precipita	tion re	actions	of pro	teins	•	Illustra P2)	ite the	precipi	tation	reactio	ns of p	roteins	(P1,	4	
Unit 4:					1	,									
Reaction	s o	f m	onosac	charide	s, •	Identif	y the g	iven ca	rbohyd	lrate sa	mple	(P1, P2	)	8	
disaccha	disaccharides & polysaccharides						. 0		, -		•				





		$\sqrt{S_{PIR_{ED} \ W^{1}}} (Deemed to be U)$	niversity under Section 3 of the UGC Act, 1956)						
	red • Illu	<ul> <li>Demonstrate the reactions to classify the sugar into reducing sugar and non-reducing sugar (P1, P2)</li> <li>Illustrate the reactions to classify the monosaccharide into aldoses and ketoses (P1, P2)</li> </ul>							
Unit 5:									
Identification of unknown carbohydrate		ntify the carbohydrate by quali P3, P4)	tative analysis(P1,	4					
Unit 6:									
Estimation of reducing sugar by Dinitro-salicylic acid method		alyse the reducing sugar conter nple by Dinitro-salicylic acid methods and the second se		4					
Unit 7:	1								
Glucose estimation by glucose oxidase method	san	alyse the reducing sugar conter nple by glucose oxidase and D) method (P1, P2)		4					
Unit 8:									
Estimation of proteins by Biuret method	by • Inte	strate the quantity of protein o Biuret method (P1, P2) erpret the importance of a otein levels (P1, P2)		4					
Unit 9:									
Estimation of proteins by Folin	• Illu	strate the quantity of protein o	funknown sample	4					
Lowry's method		Folin Lowry's method (P1, P2)	·						
Unit 10:	- /								
Estimation of blood urea by urease method	san • Inte	strate the quantity of blood nple by urease method (P1, P2) erpret the importance of abn h respect to renal function test	ormal urea levels	4					
Unit 11:		•							
Estimation of creatinine by Jaffe's method		strate the quantity of plasr known sample by Jaffe's metho		4					
Unit 12:	•								
Estimation of uric acid by Caraway's method	uni • Inte	monstrate the quantity of se known sample by Caraway's me erpret the significance of ab ntent with respect to renal func	ethod (P1, P2) normal uric acid	4					
Learning strategies, contact house and		t loovning time							
Learning strategies, contact hours and	studen		Chudantlan	ine o (11:)					
Learning strategy		Contact hours	Student learning t	ime (Hrs)					
Lecture									
Seminar									
Small Group Discussion (SGD)									
Self-directed learning (SDL)									
Problem Based Learning (PBL)									
Case Based Learning (CBL)									
Clinic		<u></u>	100						
Practical		60	180						
Revision		07							
Assessment		07	-						

d' (A constituent unit of MAHE, Manipal)



TOTAL			67			180					
Assessment Methods:			·								
Formative:					Summativ	e:					
Class tests					Sessional e	examina	xamination				
Assignments/presenta	tions	ons End semester examination									
Quiz											
Mapping of assessmen	nt with	COs									
Nature of assessment		CO 1	CO 2	CO	3 (	0 4	CO 5	CO 6			
Sessional Examination		×	×	×		×					
Quiz											
Assignment/Presentat	ion		×	×		×					
End Semester Examina	tion										
Laboratory examinatio	n	×	×	×		×	×	×			
Feedback Process	•	End-Semest	er Feedback								
Reference Material	<ul> <li>Tietz Textbook of Clinical Chemistry and Molecular Diagnostics :CA Burtis and DE Bruns, 6th Edition, Saunders Elsevier, 2008</li> <li>Laboratory Experiments in Biochemistry: LJ Daniel, Academic Press</li> </ul>										

Name o	of the Pi	rogram	:		B.Sc. Biotechnology (Honours)											
Course	Title:				Enviro	nment	al Scier	nce (Pr	actical)							
Course	Code: B	BT 116			Course	e Instru	ctor: C	ourse l	n-charg	ge						
Academ	nic Year	: 2023	Onwar	ds	Semester: I Year, II Semester											
No of C	redits:	2			Prereq	luisites	: Quali	fied I se	emeste	r as pe	r unive	ersity g	uidelir	ies		
Synopsi	s:	This p	ractica	cours	urse helps to understand the fundamental knowledge and tools and practical											
		applic	ations	of Envi	ronmer	ntal Scie	ences.									
Course	Outcon	nes (CO	s):	Ons	success	ful com	pletior	n of this	s course	e, stud	ents wi	ll be ab	le to			
CO 1:				Esti	mation	of pign	nent co	ntents	using s	pectro	photor	neter (l	P1, P2,	P4, P6)		
CO 2:				Sam	npling o	ling of different soil and analysis of pH (P2, P5, P7, P8)										
CO 3:				Coll	Collection of soils and determination of water holding capacity (P2, P4, P5)										5)	
CO 4:				Esti	Estimation of toxicity of plant extracts and industrial water using se									g seed		
				gerr	germination test (P2, P3, P4, P7, P8)											
CO 5:				Ana	Analysis of fungi/bacteria from soil, water and air samples (P5, P6, P2, P7)										)	
CO 6:				Lear	rning	the ex	tractio	n met	thod a	and a	nalysis	of p	igmen	ts by	paper	
				chro	omatog	raphy (	P4, P5,	P6, P7	') and [	Demon	strate	the abi	lity to	analyze	water	
				sam	ples fo	r colifo	rm bac	teria (P	4, P5, P	6, P7)						
Mappin	g of CO	s to PO	s		-											
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO	
										10	11	12	13	14	15	
CO 1	×	х		Х		х		х				х	х			
CO 2	×	х			х		х	х						х		
CO 3	×	х		х	х			х		х		х			х	
CO 4	×	x	Х	х			x	×					х			
CO 5	×	х		х	х			×	х					х		
CO 6	×			х	×	х	х	×			х		х			
Course	conten	t and o	utcome	s:												
Content					Com	petenci	es							No of F	lours	
Unit 1:																





					to be University under Section	,	
To determine chlorophyll content		mation of	•	gment	contents	using	8
of the given plant material	spe	ctrophotomet	er (P1,	PZ, P4, P6	)		
Unit 2:					· · · · · · ·		4
Quantitative analysis of soil pH	<ul> <li>San</li> <li>P8)</li> </ul>	npling of differ	ent soil	and analy	sis of pH (F	P2, P5, P7,	4
Unit 3:							
To determine water holding capacity of soil		lection of soils acity (P2, P4, I		eterminat	ion of wate	er holding	8
Unit 4:	<u> </u>	,,,,,,	,				
Bioassay of toxic compounds by	• Esti	mation of tox	cicity of	<sup>c</sup> plant ext	tracts and	industrial	8
seed germination test		er using seed	•	•			
Unit 5:	<u> </u>	0	0		(	, , ,	
Isolation of bacteria/ fungi from	• Ana	lysis of fung	i/bacte	ria from	soil. wate	r and air	8
environmental samples		nples (P5, P6, P					-
Unit 6:			, ,				
Qualitative analysis of plant	• Lea	rning the ex	tractio	n metho	d and ar	alvsis of	8
pigments by paper chromatography		ments by pape				•	
Unit 7:	<u> </u>				<u>, (; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;</u>	- / /	
Determination of coliform count in	• Der	nonstrate the	ability	to analyz	e water sa	mples for	8
different water samples		form bacteria					•
Unit 8:			().0	,, ,			
Study on biodiversity in different	• Lea	rning and und	erstand	ling of hio	diversity in	different	8
ecosystems		systems, i.e. la		-			C
Learning strategies, contact hours a		-			). 0). 0)		
Learning strategy		ontact hours			Studen	t learning ti	me (Hrs)
Lecture					orducin	t rearring th	
Seminar							
Small Group Discussion (SGD)							
Self-directed learning (SDL)							
Problem Based Learning (PBL)							
Case Based Learning (CBL)							
Clinic							
Practical	6	0			180		
Revision		0			100		
Assessment	0	7			-		
TOTAL	6				180		
TOTAL	0	/			100		
Assessment Methods:							
Formative:				Summat	ive:		
Class tests					l examinati	ion	
Assignments/presentations					ester exam		
Quiz				LING SEIT			
Mapping of assessment with COs				1			
Nature of assessment	CO 1	CO 2	CC	03	CO 4	CO 5	CO 6
Sessional Examination	X	x	X			-	
Quiz	X	x	X		X	x	x
Assignment/Presentation	Х		x				x





End Semester Examinatio	n						
Laboratory examination		Х	х	х	x	х	х
Feedback Process •	End	l-Semester F	eedback				
•	biomemb Berndt-M Soil Biolo Springer- Bioassay Fawole M Spectrum Boyer R Biochem Wohlsen from wat 350-356. Ministry and Actic Govt.	oranes. Meth Aichael W. 20 ogy, Volume Verlag Berlin experiment, A.O. and Oso n Books. F. 1990. Is ical Educatio et al. 2006. et al. 2006. of Environmon Plan, India of	hods of Enzy 005. Detern e 5, Manual n Heidelber , Catalog no b B.A. 2001. solation an on 18(4), 202 . Evaluation using precise nent and For a: Final Tech India	rmology, 14 hination of ( for Soil Ai g. . FBI1881, 2 Laboratory I d characte L-204. of the met e reference rests & Kalp . Report of t & Ka	8, 350-382. Chemical and nalysis, R. Ma 007, Flinn Scie Manual of Mic erization of hods for enu standards. Le avriksh. 2004	Physical Soi argesin, F. S entific Inc. crobiology. F photosynth merating co tters in Micr . Nat. Biodiv F Sponsored New	photosynthetic I Properties. In: Schinner (Eds.). Rev. ed. Ibadan: etic pigments. oliform bacteria obiology 40(4), versity Strategy I Project. MoEF, Delhi/Pune

Name	of the l	Prograi	m:			B.Sc. Bi	otechn	ology (	Honou	rs)					
Course	Title:					Physics	(Pract	ical)							
Course	Code:	BBT 11	18			Course	Instruc	tor: Co	urse In	-charg	е				
Acader	mic Yea	nr: 202	3 onwa	ards		Semest	er: I Ye	ear, II Se	emeste	r					
No of C	Credits	: 1				Prerequ	uisites:	Qualif	ied I se	emeste	r as pe	r unive	rsity gı	uideline	es
Synops	sis:	The	objecti	ve of t	of this course is to acquaint the students with basic physics experi-								perime	nts- to	
		prov	ide fur	ndamer	ntal kn	owledg	e and	applica	tions of	of ser	nicond	uctors	in Zen	er dioc	le and
		trans	sistors,	to pro	ovide k	basic un	dersta	nding o	of elec	tricity	and ma	agnetis	m, to	provide	e basic
		knov	vledge	and ap	applications of optics through Newton's rings and Air wedge experiments								ts		
Course	Outco	mes (C	COs):	Or	On successful completion of this course, students will be able to										
CO 1:				De	Demonstrate and determine the surface tension of water by capillary r								ry rise		
				me	ethod (	(P1, P4)									
CO 2:				De	monst	rate the	e effect	s of for	ward a	nd rev	erse bia	as in Ze	ner dio	des (P1	L, P4)
CO 3:				De	monst	rate and	d expla	in elect	tricity a	nd ma	gnetisn	n throu	gh RC t	ime co	nstant
				an	d Hall	effect e	xperim	ents (P	4)						
CO 4:				De	monst	rate an	d expla	ain thin	film in	terfere	ence us	sing Ne	wton's	rings a	nd Air
				we	edge ex	kperime	nts (P1	. <i>,</i> P4)							
CO 5:				De	monst	rate and	d expla	in trans	sistor c	haracte	eristics	of a giv	ven trar	nsistor	(P4)
CO 6:				De	mosns	strate a	nd find	d the r	ipple f	actors	of a h	nalf wa	ve and	l a full	wave
				re	ctifiers	(P1, P4	)								
Mappi	ng of C	Os to P	Os									-			
COs	PO	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×							×							
CO 2	×				×			×							
CO 3	×							×							
CO 4	×				×			×							
CO 5					х										





CO 6 X		х										
Course content and outco	mes:											
Content	Сотре	etencie.	s								No of	Hours
Unit 1:												
Transistor characteristics	NPN	l transi	stor in	commo	n emit	ter cor	aracteri nfigurati rrent ga	on and	d deter	-	4	
Unit 2:												
Charging and discharging of a capacitor – RC time constant	cap	acitors	and RC		onstan	•	citance es using				4	
Unit 3:Zenerdiodecharacteristics	diod	Demonstrate and draw the V-I characteristic curve of a zener 4 diode and determine breakdown voltage, forward knee voltage and zener resistance (P1, P4)										
Unit 4:												
Newton's rings-'R' of a lens							dius of rings ex				4	
Unit 5: Surface tension by							<b>6</b> +		. f		4	
Surface tension by capillary rise method				nod (P1		he sur	face ter	ision (	of wate	er by	4	
Unit 6:												
LCR – circuit, Series and Parallel resonance	reso	onance	circuit	s and d	leterm	ine the	se of se e induct e circuit	ance o	of the g		4	
Unit 7:	1			•	,			<b>、</b> ,	,			
Rectifier filter circuit			ate and fiers (P		e ripple	e facto	rs of a h	alf wa	ve and	a full	2	
Unit 8:			•								<b>I</b>	
Air wedge – diameter of a thin wire				deterr nethod			neter of	a give	en thin	wire	2	
Unit 9:		0	U								<b>I</b>	
Hall effect				detern ice (P1:		e dens	ity and	veloci	ty of cł	narge	2	
Learning strategies, contac	ct hours	and st			-							
Learning strategy			C	òntact	hours			Stud	dent le	arning	time (I	Hrs)
Lecture												
Seminar												
Small Group Discussion (SC	-											
Self-directed learning (SDL)												
Problem Based Learning (P	BL)											
Case Based Learning (CBL)												
Clinic												
Practical			3	0				90				
Revision												
Assessment TOTAL				7				- 90				





Assessment Methods	:									
Formative:					Summ	ative:				
Class tests					Sessional examination					
Assignments/presenta	ations				End se	emester ex	amination			
Quiz										
Mapping of assessme	nt with COs									
Nature of assessment		CO 1	CO 2	CO	3	CO 4	CO 5	CO 6		
Sessional Examination		×	×	×						
Quiz		NA	NA	NA		NA	NA	NA		
Assignment/Presentat	ion	×	NA	×		NA	×	NA		
End Semester Examina	ation									
Laboratory examination	on	×	×	×		×	×	×		
Feedback Process	• Enc	l-Semeste	r Feedback							
Reference Material	<ul> <li>P K, Jeetl Experime Lab Expe</li> <li>Melissine Academi</li> <li>Mandal, 2017.</li> <li>Prakash,</li> </ul>	hendra Ku ents, Vol-1 riments, 2 os, Drian., c Press, 20 Soumitra	mar., Sharm : Electricity :018. Napolitano, 003. Kumar., Bas shna Ram., J	ia, Prabl Magnet Jim. Ex ic Electr	hakar. F tism and perimer ronics, N	undamen d Propertionts in Moo lew Delhi,	lern Physics,	ab , Bangalore, Cambridge, Il Education,		

Name of the Pr	ogram:		B.Sc. Biotechnology (Honours)							
Course Title:			Advanced Chemistry (Practical)							
Course Code: B	BT 120		Course Instructor: Course In-charge							
Academic Year	: 2023 Onw	vards	Semester: I Year, II Semester							
No of Credits:	1		Prerequisites: Qualified I semester as per university guidelines							
Synopsis:	This pract	ical course i	ntroduces and provides knowledge and technical skills in chemistry.							
Course Outcom	nes (COs):	On succes	sful completion of this course, students will be able to							
CO 1: Demonstrate the determination of density and viscosity of given liquid us										
		Ostwald	viscometer (P1, P2) Find the composition of binary mixture using							
		refractive	index measurements(P1, P2)							
CO 2:		Determine	e the strength of individual acid and acid mixture by the conductometric							
		titration (	P1, P2)							
CO 3:		Find the d	lissociation constant of weak acid by conductivity measurement and pH							
		meter (P1	, P2)							
CO 4:		Find the	strength of $Li_2SO_4$ by the precipitation titration using conductivity							
		measuren	nents(P1, P2) Find the strength of given ferrous ammonium sulphate							
		solution u	sing redox titration (P1, P2)							
CO 5:		To estima	te the concentration of copper in the unknown sample by colorimetric							
		estimation	n (P1, P2)							
CO 6:			he kinetics of saponification of ethyl acetate by the help of conductivity							
		measuren	nent(P1, P2) To determine the purity of given sample by thin layer							
		chromato	graphy(P1, P2)							
Mapping of CO	s to POs									



MANIPAL (A constituent unit of MAHE, Manipal)



Cas	DO	<b>D</b> O	00				0					00		PO	
Cos	РО 1	РО 2	PO 3	РО 4	РО 5	РО 6	PO 7	РО 8	РО 9	РО 10	PO 11	РО 12	PO 13	РО 14	РО 15
CO 1		Z X	5	4	5	0	/	0	9	10	11	12	15	14	15
CO 1 CO 2	×														
CO 2	×	×													
	×														<u> </u>
CO 4	×	×													<u> </u>
CO 5	×	×													
CO 6	×	×													<u> </u>
Course Content		t and c	outcom		etencie	25								No c Hou	-
Unit 1:															•
Determi coefficie				• De	termin	ation o	f densi	ty of th	id visco e given f viscos	liquid	(P1, P2	• •	ty. (P1)	6	
			lar		.I. •						1				
<ul> <li>Weak Acid vs strong base</li> <li>Strong acid vs strong base</li> <li>Acid mixture vs strong base</li> <li>Acid mixture vs titrations</li> <li>Precipitation titrations</li> <li>Unit 3:</li> </ul>												2			
				ref	ractive	index	versus	compo	sition(P	P1, P2)					
Unit 4: Colorim analysis		metho	d of	<ul> <li>Deficiency</li> <li>Deficiency</li> </ul>	termin ncentra termin	e the a tions ( e the	absorba P1, P2)	ance of		of solu	utions	with di	P1) fferent elp of		
Unit 5:															
Determi dissocia weak ac	tion c id usir	constar		fro • To we pro • To sol	m the j descri ak aci ovides.( use a j ution c	oH titra be wha d/stror P1, P2 oH titra contain	ation cu at info ng base ) ation cu ing an	irve.(P1 rmation e (or urve to	l) n the l strong deterr base), t	nalf-eq acid/v nine th	uivalen veak b e conc	ce poi ase) ti entrati	itration nt in a itration on of a for an		
• Unit	6:			unl	known	weak a	acıd (ba	se)(P2)							





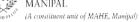
					of the UGC Act, 1956)	
		degree of diss	ociation at	different cor	ncentration	2
•	P1, P2)	ine sinti-	stant -f	alcasid (D4)		
weak acid using • Calconductivity meter	alculate the d	issociation cor	stant of we	ak acid (P1)		
• Unit 7:						
	atormina tha	strength of fe	rrous amm	onium culnha	to colution	2
-	P1, P2)	strength of le				2
• Unit 8:	1, FZ)					
	o list throo ro	asons for study	ing chomic	al kinotics (D1	1	2
		e concept of re	-	-	-	2
		the second				
		of ethyl acetat		ate constant		
measurement.	ponneation	or ethyr deetat	. (11,12)			
• Unit 9:						
	o determine t	he rate consta	nt of the re	action(P1. P2)		2
constant of a reaction				· · · · · · ·	,	
between KI and K <sub>2S2</sub> O <sub>8</sub>						
• Unit 10						
Thin Layer • E	xplain the prin	nciple and appl	ications of <sup>·</sup>	TLC (P1)		2
Chromatography • D	emonstrate t	he separation of	of compone	ents in TLC (P1	.)	
• Ic	lentify the sar	nple by compa	ring retenti	ion factor valu	ues (P2)	
Learning strategies, contact hour						
Learning strategy		Contact hours	5	Studen	t learning ti	me (Hrs)
Lecture						
Seminar						
Small Group Discussion (SGD)						
Self-directed learning (SDL)						
Problem Based Learning (PBL)						
Case Based Learning (CBL)						
Clinic						
Practical		30		90		
Revision						
Assessment		07		-		
TOTAL		37		90		
Assessment Methods:						
Formative:				native:		
Class tests				onal examinat		
Assignments/presentations			End s	emester exan	nination	
Quiz						
Mapping of assessment with COs			Γ		1	T
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination	X	x		-		
Quiz						
Assignment/Presentation	X	x	х	x	х	х
End Semester Examination						
Laboratory examination	Х	x	Х	Х	Х	Х
Feedback Process •	End-Semester	<sup>r</sup> Feedback				





Reference Material	• Yadav, JB. Advanced Practical Physical Chemistry, Goel Publishing House, 1981
	• Findlay, A. Kitchenar, JA. Practical Physical Chemistry, (6th Edition) Longmans
	Green and Co.,
	Mann, FG. Saunders BC. Practical Organic Chemistry, New York Longmann

Name	Name of the Program: Course Title:						B.Sc. Biotechnology (Honours)								
Course	Title:					Semir	nar/Jou	rnal Cl	ub						
Course	Code:	BBT 12	22			Cours	e Instru	uctor: C	Class in	-charge	9				
Acader	nic Yea	ar: 202	23 onw	ards		Semester: I Year, II Semester									
No of C	Credits	: 1				Prerequisites: Qualified I Semester as per university guidelines									ies
Synops	sis:					an allotment of an individual seminar topic related to the semester									
						e students' knowledge base and expose them to how to present									
				n clearl	•	concis	ely. Stu	Idents	will als	o lear	n how	to cor	npile t	he lite	rature
				nformat											
Course	Outco	omes (C	COs):				letion c			studen	ts will k	be able	to		
CO 1:						-	id ideas								
CO 2:							ility to								
CO 3:							and pr	esent	comple	x info	rmatior	n clear	ly and	concis	ely to
					ent grou										
CO 4:					ude on										
CO 5:							in a co								
CO 6:				Adopt	challer	nging ta	asks; stu	dents	will also	learn	how to	compil	e and i	nterpre	t data
Mappi															
COs	РО 1	PO 2									РО 15				
CO 1		×													
CO 2		×													
CO 3		×													
CO 4		×													
CO 5		×													
CO 6		×													
Course	conte	nt and	outcor	nes:											
Conten	t	Compe	etencie	s							No d	of Hour	S		
Unit 1:															
Semina	ar			vill inclu e semes						ar topi		ninute each st	-	esenta	tion
Loarnir	ng stra			t hours									uuem		
Learnir	-	-	contac	, inours	, and s		Contact	-			Stuc	lent lec	rnina t	ime (H	rs)
Lecture	-	icgy						nours			-		ii iiii y t		3/
Semina							15				45				
		Discuss	ion (SG	ח)											
Small Group Discussion (SGD) Self-directed learning (SDL)															
Problei															
Case Ba															
Clinic		Janning													
Practic	al														
Revision															
Assessi							01								
H226221	nent						11								

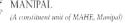




TOTAL			16		45				
Assessment Methods:									
Formative: Summative:									
Assignments/presentat	ions			-					
Mapping of assessmen									
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Examination		NA	NA	NA	NA				
Quiz		NA	NA	NA	NA	NA	NA		
Assignment/Presentati	on	х	х	х	x	х	х		
End Semester Examination	tion	NA	NA	NA	NA	NA	NA		
Laboratory examination	า	NA	NA	NA	NA	NA	NA		
Feedback Process	• End-S	Semester	Feedback						
<b>Reference Material</b>	Reference Bo	oks and J	lournals article	s related to	the seminar	topics			

Name of the P	rogram	n:		B.Sc. Biotechnology (Honours)										
Course Title:				Ger	netics ( <sup>·</sup>	Theory	)							
Course Code: E	3 <b>BT 20</b> 1	1		Cou	irse Ins	tructor	: Cours	se In-cl	narge					
Academic Year	: 2023	onwar	ds	Sen	nester:	II Year	, III Ser	nester						
No of Credits:	3			Pre	requisi	tes: Q	ualified	l previ	ous sen	nesters	s as per	<sup>.</sup> regula	tions	
Synopsis:	This o	course	introd	uces b	asic co	oncepts	in ge	netics;	chrom	osome	s, patt	erns of	f inher	itance,
	genet	ic varia	ations a	ind dis	eases.									
Course Outcon	nes (CC	Ds):	On	succes	sful co	mpletic	on of th	nis cour	se, stu	dents v	vill be a	ble to		
CO 1:				Explain Mendel's principles of segregation, and independent assortment (C1, C2, C3, C4)										nt (C1,
CO 2:				derstar	-	nd inte	rpretat	ion of l	inkage,	crossi	ng and	theorie	s. (C1,	C2, C4,
CO 3:				line aı , C2 <i>,</i> C4		ain wh	at gen	e inter	actions	and n	on-nuc	lear in	heritar	ice are
CO 4:			Exp	Explain genetic anomalies caused by changes in chromosome number and structure (C1, C2, C3, C4										
CO 5:				Outline and classify mutations and mutagens and understand genetics of cancer (C1, C2, C3, C4)										
CO 6:			-	Explain the concepts of population genetics and importance of evolution (C1, C2, C3, C5)									on (C1,	
Mapping of CC	)s to PC	Os												
COs PO 1	РО 2	PO 3	РО 4	PO 5	РО 6	PO 7	РО 8	РО 9	РО 10	РО 11	РО 12	РО 13	РО 14	РО 15
CO 1 ×	-	x	X	0		1								10
CO 2 ×		x	x	х			х							
CO 3 ×		x	X	x										
CO 4 ×		х	×		1	1			1			1	1	1
CO 5 ×		х												
CO 6 ×		х	х	х					×					
Course conten	t and o	outcom	es:										·	
Content Unit 1:		Com	petenci	es									No of H	lours







		"Sp	RED BY LIFE (Deemed to be U	niversity under Section 3 of the UGC Act, 1956)	
Principles of Heredity	<ul> <li>History of genetics law of dominance assortment, back cr C 3, C 4)</li> </ul>	e, law of segrega	ition, law	of independent	7
Unit 2:	, ,				1
Linkage & crossing over.	<ul> <li>Complete and in mechanisms, and the and three-point test</li> </ul>	heories. Frequency	of crossing		7
Unit 3:					
Non-Mendelian inheritance	<ul> <li>Gene interactions, pleiotropy, penetra cytoplasmic inherita</li> </ul>	ance and expression	vity. polyge		10
Unit 4:					
Human Chromosomes	Chromosome stru syndromes and chro	icture, types, ch omosomal theory of			8
Unit 5:					
Genes and mutations	Genetic code, DNA r	mutations and muta	agens (C1, C2	2, C3, C4)	3
Unit 6:	-				
Cancer genetics	<ul> <li>Hallmarks of cancer cancers (C1, C2, C4)</li> </ul>	-	our suppress	sors and familial	3
Unit 7:					
Population genetics:	<ul> <li>Concepts of popul frequency. Importar C5)</li> </ul>	-			3
Unit 8:	,				
Genetic counselling, testing and therapy	Genetic testing and and euphenics (C1,C)	-	therapy, eug	enics, euthenics	4
Learning strategies c	ontact hours and studer	t learning time			
Learning strategies, e	ontact nours and studer	Contact hours		Student learning	time (Hrs)
Lecture		45		135	
Seminar					
Small Group Discussio	on (SGD)				
Self-directed learning	· · ·				
Problem Based Learni					
Case Based Learning (	CBL)				
Clinic					
Practical					
Revision					
Assessment		05		-	
TOTAL		50		135	
		1		<u> </u>	
Assessment Methods					
Assessment Methods Formative:	:		Summative	e:	
	:			e: xamination	
Formative:			Sessional e		





Mapping of assessmen	t with COs			•							
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO6				
Sessional Examination		X	Х	Х	Х						
Quiz		NA	NA	NA	NA	NA	NA				
Assignment/Presentation	n	Х	Х	Х	Х	Х	Х				
End Semester Examinat	ion	Х	Х	Х	Х	Х	Х				
Laboratory examination		NA	NA	NA	NA	NA	NA				
Feedback Process	Iback Process   End-Semester Feedback										
	<ul> <li>publicati</li> <li>Human O York Inc.</li> <li>Chromos David J. A</li> <li>An intro R.C.Richa</li> <li>A Guide Scientific</li> </ul>	on. Chromoson ; 4th ed. Some abno Amor. Oxfo duction t ard Lewon to Humar c Publishin	mes by Mille ormalities an ord Universit o Genetic A tin, W.M-Gil	er, Orlando J. d Genetic cou ty Press, USA Analysis by A bert, W.H. Fr apy by Rolan	, Therman, I unselling. By ; 5 editions Anthony, J.F eeman publi d W. Herzog	Eeva. Spring R.J. McKinla . J.A. Miller cation, , Sergei Zolo	undern College er-Verlag New y Gardner and , D.T. Suzuki tukhin. World				

Name of	f the Pr	ogran	า:		B.Sc. Biotechnology (Honours)											
Course 1	Title:				Mole	ecular B	Biology	(Theor	γ)							
Course (	Code: B	BT 20	3		Cour	rse Inst	ructor:	Course	e In-cha	arge						
Academ	ic Year:	2023	Onward	ds	Sem	ester: I	l Year,	III Sem	ester							
No of Cr	edits: 3				Prerequisites: Qualified previous semesters as per regulations											
Synopsis	5:		-			this course are to acquaint the students with general Molecular biology										
		pri	nciples,	to prov	/ide fui	ndame	ntal kn	owledg	e of bi	ologica	l macro	omolec	ules, in	cluding	g DNA,	
		RN	A, and p	roteins	s, and t	o unde	rstand	the fun	ctions	of the I	nacron	nolecul	es.			
Course	Outco	mes	On suc	successful completion of the course, student will be able to												
(COs):																
CO 1:			Know t	ow the structure and function of macromolecules such as DNA, RNA and Proteins										s (C1,		
			C2).													
CO 2:			Explain	•		-	•	lication	and u	ndersta	nd the	role of	variou	s prote	ins in	
			genom	e replic	ations	(C2, C4	.)									
CO 3:			Learn v	arious	types o	of DNA	damag	es and	know a	issociat	ed DN/	A repaii	r mecha	anisms	(C2,	
			C3)													
CO 4:			Explain	the sy	nthesis	, proce	ssing a	nd func	tioning	g of RN/	As (C2,	C4)				
CO 5:			Unders	tand th	ne regu	lation o	of gene	expres	sion ar	nd justi	fy the ii	nporta	nce of	DNA bi	nding	
			protein	is (C2, C	22).											
CO 6:			Discuss	and ill	ustrate	the pr	opertie	es, type	s of ve	ctors ar	nd anal	yse the	ir appli	cations	; (C2,	
			C4). Dis	scuss ai	nd expl	ain the	variou	s genor	ne reg	ulation	activity	/ (C2, C	4).			
Mapping	g of COs	s to P	Os													
COs	PO	РО	PO	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CO 1	×			×												
CO 2	×															



(A constituent unit of MAHE, Manipal)



						r –	1	1	SPIRED BY VS	,	University under S			<u>т</u>	<b>-</b>
CO 3	×		×		×										
CO 4	×			×											
CO 5	×		×												
CO 6	×		<u> </u>	<u> </u>										1	
Course c	ontent	and o												<i>с</i>	
Content			Сотре	tencies									NO	of Hou	ırs
Unit 1:		a va al								· .					
Introduc		and			•		-					ure, an	d 3		
concepts Molecula		in Tr	tunc	tions o	IT DNA,	KNA, C	arbohy	drate,	proteil	ns and	lipias (	(1, 02)			
Unit 2:		89													
Genome	replica	tion	in th • Unde (C2) • Unde elon	e DNA erstand erstand gation a	(C2, C3 I the rc I the I and ter	) ole of v process minati	arious p	oroteir NA rej eplicati	olicatio on(C2,	ved in n inclu C4)	DNA re	variation eplicatio nitiatior	n		
Unit 3:					<u> </u>				,	,					
Recombi the Mole		at evel	hete • Unde	ribe th onstrat roduple	e proce te thre exes (C I the re	ess of h e strai 2).	iomolog nded ai	gous re nd fou	ecombi Ir strar	nation nded D	(C2, C2 NA he				
Unit 4:				•	•										
DNA dar repair	nages	and	<ul> <li>alkyl</li> <li>Explace</li> <li>C4)</li> <li>Illust</li> <li>excise</li> <li>alkyl</li> </ul>	uss abo ation a ain diffe trate ar	nd bull erent ty nd disti d nucle epair,	rious t (y addu (pes DN (nguish otide e mismat	ypes of ucts (C2 NA repa DNA re xcision	f DNA ) ir mec epair r repair,	lesion hanism nechar , SOS re	s with hisms s esponse	illustar uch as e in bac	damages tions (C2 the bas steria an nd brea	2, e d		
Unit 5:															
Structure synthesis processir function	s, ng	and NAs:	<ul> <li>term</li> <li>UInd</li> <li>Explanation</li> <li>Explanation</li> <li>Understand</li> </ul>	ain the linatior lerstand ain the adenyla erstand	basic p in pro d trans proces ation. ( l the sy	rinciple karyot cription s of mF C2) nthesis	es of tra es and e n in mit RNA pro s and pr	eukary ochon cessin ocessi	otes (C dria an g: capp ng of n	2) d chlor ing, Int on-cod	oplast ron spl	licing an	d		
Unit 6:															
Regulatio expressio	-	gene	<ul><li>Defin</li><li>Expla</li><li>Elabore</li></ul>	ain the	structu	ire of n		ome. (0	22,)		-	s (C1)	6		





	Define	DNA methy	nodification ( lation and e nethylation (C	explain t	he re	egulation of	gene		
	-	-	n by miRNAs						
Unit 7:									
Structure and study of DNA binding proteins	<ul><li>Explain</li><li>Explain</li></ul>	DNA binding the structure	ls for studying proteins and and function pressors (C2)	their inte	ractio	n with DNA (		4	
Unit 8:	D'					(62)		_	
Regulation of genome activity	<ul> <li>Illustrat compou</li> <li>Explain</li> <li>Explain loops (C)</li> </ul>	e signal tran unds (C2) signal transm the second m C2)	changes in ge ismission by iission mediat nessengers an n of genome	import o ed by cel d genom	f extr I-surfa e regu	acellular signace receptors lation by fee	(C2) dback	5	
Unit 9:		0		,	0	•	<b>、</b>		
Vectors for gene delivery	<ul> <li>Applica</li> <li>Distingu</li> <li>Explain</li> <li>Explain</li> <li>Illustrat</li> </ul>	tions of vario uish between the animal vi Ti plasmids, s	st the propert us types of ve plasmids and ruses, single s huttle vectors and functio	ctors (C3 cosmids tranded   s, yeast v	) (C4) phage: ectors	s (C2) s (C2)	flower	8	
Learning strategies,			nt learning tir	ne					
Learning strategy			Contact h			Stude	nt learn	ina tii	me (Hrs)
Lecture			45			135		5	
Seminar									
Small Group Discussi	on (SGD)								
Self-directed learning	g (SDL)								
Problem Based Learn	ing (PBL)								
Case Based Learning	(CBL)								
Clinic									
Practical									
Revision									
Assessment			05			-			
TOTAL			50			135			
Assessment Method	s:								
Formative:					Sumr	mative:			
Class tests						onal examina	ation		
Assignments/present	ations				End s	semester exa	minatio	n	
Quiz									
Manning of access	ont with co	)c							
Mapping of assessment		CO 1	CO 2	CO 3		CO 4	CO	5 1	CO 6
			002	0.0	,		0.	-	



MANIPAL (A constituent unit of MAHE, Manipal)



Quiz							
Assignment/Presenta	ition	х	Х	х	х		
End Semester Examin	nation	х	Х	х	х		
Laboratory examinati	ion	NA	NA	NA	NA	NA	NA
Feedback Process	• En	d-Semester F	eedback				
Reference Material	<ul> <li>Karp, Go (7th edi</li> <li>Krebs JB</li> <li>David F Edition,</li> <li>Verma a</li> <li>Harvey</li> </ul>	erald. Cell and tion), 2013 E, Goldstein E Clark, Nan Academic Ce and Agarwal. Lodish; Arnol	d Molecular Bi S, Kilpatrick S ette J. Pazde II, 2018 Molecular Bic d Berk; Chris	iology: Concer T. Lewin's Ger rnik, Michelle blogy, S Chand A. Kaiser; Mc	ots and Experi nes XII, Jones e R. McGehe l and compan onty Krieger; A	8th edition), 2 iments, John V & Bartlett Lea e. Molecular y, 2010 Anthony Brets ology, Macmill	Viley & Sons rning, 2018 Biology 3rd scher; Hidde

Name	of the F	Program	า:		E	3.Sc. Bio	techno	ology (H	lonours	s)						
Course	Title:				r	Microbio	ology (1	Theory)								
Course	Code:	BBT 20	5		C	Course I	urse Instructor: Course In-charge									
Acader	nic Yea	r: 2023	3 onwa	rds	S	Semeste	ester: II Year, III Semester									
No of C	Credits:	3			F	Prerequi	erequisites: Qualified previous semesters as per regulations									
Synops	sis:	This	course	provide	es knov	vledge o	on the g	general	princip	les of	microbi	ology, t	he role	e and fu	inction	
		of m	icrobes	s in eco	system	m, their importance in diseases, agriculture, fermentation technology										
		and i	n vario	us othe	r disci	plines in	cluding	g recom	ibinant	DNA t	echniq	Jes.				
Course	Course Outcomes (COs): On successful con						etion of	this co	urse, s	tudent	s will b	e able t	0			
CO 1:							-					•	•			
	microbiology and															
CO 2:						be and i				•	-	l forms	and ce	ell struc	ture of	
						es of bao		-								
CO 3:						lustrate the gene transfer mechanisms in prokaryotes (C2, C3) ne microbes based on their nutritional requirements (C2, C3, C4)										
CO 4:																
CO 5:				•		relate t					nicrobi	al popu	ulation	s and i	role of	
						lence fa										
CO 6:						the use	of micr	obes ir	ferme	ntatio	n produ	cts and	in reco	ombina	nt DNA	
				techno	logy (C	23)										
Mappi	-		1	1												
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9		PO	PO	PO	PO	PO	
										10	11	12	13	14	15	
CO 1	Х	X	Х		Х											
CO 2	Х		х												_	
CO 3	Х		Х			x		Х								
CO 4	Х		х		Х											
CO 5	Х					X										
CO 6	X	<u> </u>	X			Х		Х							<u> </u>	
	Course content and outcomes:															
Conten						Сотр	etencie	25					No of H	lours		
Unit 1:		Unit 1:														





	$^{*Gp}_{RED \ B^{*}} V^{S}$ (Deemed to be University under Section 3 of the UGC Act, 1956)	
Historical background: Major milestones and disease terminologies in microbiology; Biogenesis and Pasteur's experiments disproving spontaneous generation; Prokaryotic and Eukaryotic microbial cells - endosymbiotic theory	List the major milestones, explain and outline the spontaneous generation theory and endosymbiotic theory (C1, C2)	3
Unit 2:		
Microbiological techniques: Microscopy, principles and types of microscopy; optical, TEM and SEM; the concept of asepsis, and sterilization methods	List and explain the different microscopic techniques; explain and apply the methods of sterilisation (C1, C2, C3)	3
Unit 3:		
Morphology: Morphological forms of bacteria; cocci, bacilli, spirilla & PPLOs; bacterial cell structure, appendages, serotypes, endosporulation; general structure and properties of fungi & viruses	Define and infer the morphological forms of bacteria, and properties of fungi and viruses (C1, C2)	7
Unit 4:		_
Nutritional classification: Nutritional classification of microorganisms - Culture medias & bacterial growth curves	Compare and classify bacteria based on their nutritional requirements (C2, C3, C4)	3
Unit 5:		
Gene transfer mechanisms: Conjugation, Transduction, Transformation and Transposons in gene transfer in prokaryotes and their applications	What are the different gene transfer mechanisms in bacteria? Explain and illustrate the gene transfer mechanisms in bacteria and understand their applications (C1, C2, C3)	4
Unit 6:		
Variations in microbial population: Spontaneous and induced variation in microbial population	Define and describe the concept of spontaneous and induced variations (C1, C2)	3
Unit 7:	1	
Microbes in environment: Microbes in extreme environments - thermophiles and alkalophiles; interaction among microbial populations: Gause principle, symbiosis, antibiosis	Describe and provide examples for extremophiles and distinguish between different microbial interactions (C1, C2)	4
Unit 8:		
Microbial metabolism: Nature and diversity in microbial metabolism; Microbial virulence factors - antigenic nature, toxins <b>Unit 9:</b>	Explain the role of toxins in bacterial virulence and microbial metabolites (C2)	5
Parasitic diseases: Entamoeba histolytica; Plasmodium; Vaccines	Infer the role of microbes in diseases (C2)	4
Unit 10:	·	
Applications: Nitrogen fixing microbes in agriculture (2); microbial fermentation products and their uses	Describe and understand the role of microbes in agriculture and summarise the role of microbes in fermentation (C2, C3)	5
Unit 11:		
Genetic engineering of microorganisms: Recombinant DNA Techniques	Summarize and demonstrate the role of microbes in genetic engineering (C2, C3)	4





Learning strategies, con	ntact hours a	nd studen	t learning tir	ne							
Learning strategy			Contact ho	urs		Studer	nt learning t	ime (Hrs)			
Lecture			45			135					
Seminar											
Small Group Discussion	(SGD)										
Self-directed learning (S											
Problem Based Learning											
Case Based Learning (Cl											
Clinic											
Practical											
Revision											
Assessment	Assessment					-					
TOTAL		50			135						
Assessment Methods:											
Formative:					Summat	ive:					
Class tests					Sessional examination						
Assignments/presentat	ions				End sem	d semester examination					
Quiz											
Mapping of assessmen	t with COs	1									
Nature of assessment		CO 1	CO 2	CC	03	CO 4	CO 5	CO 6			
Sessional Examination		×	×	×		×					
Quiz											
Assignment/Presentation		×	×	×		×	×	×			
End Semester Examinat	ion	×	×	×		×	×	×			
Laboratory examination	<u>1</u>	NA	NA	NA	4	NA	NA	NA			
Feedback Process	• End	l-Semeste	r Feedback								
Reference Material	Medical I	Microbiolo	ogy – Mims C	A, Play	fair JHL, Ro	oitt IM, W	akelin D, Wi	lliams R – 1998			
	- Mosby	Publicatio	n								
	Clinical V	'irology – I	Richman DD,	Whitle	ey RJ, Hayd	len FG – 2	002 - ASM P	ress			
	• Topley &	Wilson M	icrobiology a	nd Mi	crobial Infe	ections – 2	2005 – Hodd	ler Arnold			
								A, Gorman SP,			
	-		– Wiley Black		01	- / 0	,	,,			
			crobiology - I		am JL, Ingra	aham CA -	- 1999 – S C	hand & Co.			
	ology - Willey	-	-								
			nogy - willey	J, Jall		100u D - 2					

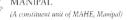
Name of the P	Program:		B.Sc. Biotechnology (Honours)							
Course Title:			Biophysics (The	eory)						
Course Code:	BBT 207		Course Instructor: Course In-charge							
Academic Yea	r: 2023 onwa	rds	Semester: II Ye	ar, III Seme	ster					
No of Credits:	3		Prerequisites:	Qualified p	revious se	mesters as p	er reg	ulations		
Synopsis:	principles/ and imagir	approaches using tools of biol	course is to eful to study biolo ogical importanc ology, biolumines	ogy- to prov e. To impar	ide basic kı t fundame	nowledge on ntal concept	instru s of op	mentations tics, lasers,		
Course Outco	mes (COs):	On successful	completion of this course, students will be able to							





CO 1:				Understand physical and chemical concepts used to solve biological problems (C2, C4)											
CO 2:				Explain	the us	efulne	ss of p	hysics a	approa	ches, s	such as	spectr	oscopy	, micro	scopy,
				spectro (C2)	metry,	nanote	echnolo	ogy and	imagir	ng tool	s to stı	ıdy biol	ogy an	d applio	cations
CO 3:				Compar	e diffe	rent ty	pes of	electro	omagn	etic ra	diation	and th	eir ap	plicatio	ns and
				effects o	on biol	ogy and	d huma	n healt	h as we	ell as di	fferent	types c	of radia	tion det	tectors
				(C3)											
CO 4:				Explain	•	• •		-							ell as
				their th											
CO 5:				Explain the working principle of Magnetic Resonance Imaging, Optical Coheren Tomography and their applications (C2, C5)											ent
<u> </u>														(	· <b>-</b>
CO 6:				Explain			•							-	-
				Time Re (SPR) ar				•	oscopy	(TRFS)	and Su	urface p	lasmo	n reson	ance
Mapping	of CO	s to PO		(SPR) ai	ա երել	ication	s (cz, c	.5)							
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×														
CO 2	×														
CO 3	×				×										
CO 4	×														
CO 5	×								×						
CO 6		х			х										
Course c	ontent	and o	utcom	es:											
Content					Com	petenci	es							No of F	lours
Unit 1:															
Introduc			•			•			rinciple	e of X-r	ay diffı	actions	and	7	
and appl						•	ons (C2	-							
spectron			olicatio	ns and						viour	of san	nples ι	using		
ultracent	trifugat	tion					•	hods (C					_		
						utline	the	princ	•	and	applic	ations	of		
							-	ion (C2		ا مر م ام			- \		
Unit 2:					● EX	piain n	iass sp	ection	euyan	u appli	cations	s (C2, C	וכ		
Introduc	tion	to p	hotod	ynamic	• •	utline	the	conce	pt of	F Dha	tomor	phogen	ocic	5	
therapy,		•		•			escence		ρι ΟΙ	FIL		PHOREI	iesis,	J	
photody									mic th	erany	and me	echanis	m of		
Viruses,						•	•	•				roteins			
photody				-	-	-	cids (C2		5 001	, יווי	, p				
biolumin		•		)				,,							
Unit 3:															
Introduc	tion	to	,	various	• Ex	plain s	pectros	scopic 1	techniq	ues in	cluding	absorp	otion	6	
spectros	сору	techr	niques	and		•	•	•			-	Raman			
applicati	ons				Dy	namic	Light S	catterir	ng (C2,	C4)					
										ormatio	on usin	g FTIR	and		
					N	VR Spe	ctrosco	opy (C5	)						
Unit 4:															







		SPIRE	D BY LIFE (Deemed to be Unit	versity under Section 3 of the UGC Act, 1956)				
Introduction to fluorescence resonance energy transfer (FRET), Time Resolved Fluorescence spectroscopy (TRFS) and Surface plasmon resonance (SPR) and applications	icence resonance ion (C2, C5) iore using Time C5) nce (SPR) and	6						
Unit 5:								
Introduction to radiation detectors and microscopy	<ul> <li>Explain (C2, C5)</li> </ul>	te radiation detectors and applications (C2) 7 the working principle of confocal microscope b) fy optical microscope and electron microscope						
Unit 6:								
Introduction to Quantum dots, optical coherent tomography (OCT), magnetic resonance imaging (MRI)	<ul> <li>Explain</li> <li>Imaging</li> </ul>	quantum dot imag the working princi g, Optical Coherent tions (C2, C5)	ple of Magn	etic Resonance	5			
Unit 7:								
Introduction to electromagnetic radiation including LASER and applications	and types o ies of tissue	gnetic radiation, f lasers (C2, C5) s and laser-tissue ical and photo	7					
Unit 8:		n (C2, C5)						
Introduction to Optical and	• Explain	the working princ	iple of optic	cal and magnetic	2			
Magnetic tweezers	-	rs and their applica		-				
Learning strategies, contact hours ar	ad student	loarning time						
Learning strategies, contact nours and Learning strategy	iu stuuent	Contact hours		Student learning	time (Hrs)			
U		45		135				
Lecture Seminar		45		155				
Small Group Discussion (SGD)								
Self-directed learning (SDL)								
Problem Based Learning (PBL)								
Case Based Learning (CBL)								
Clinic								
Practical								
Revision								
Assessment		05		-				
TOTAL		50		135				
Assessment Methods:				1				
Formative:			Summativ	<b>.</b>				
Class tests				e. examination				
Assignments/presentations				ter examination				
Quiz								





Mapping of assessment	with COs									
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6			
Sessional Examination		×	×	×						
Quiz		NA	NA	NA	NA	NA	NA			
Assignment/Presentatio	×		×		×					
End Semester Examinati	on	×	×	×	×	×	×			
Laboratory examination		NA	NA	NA	NA	NA	NA			
Feedback Process	back Process    End-Semester Feedback									
	<ul> <li>CRC Press, 20</li> <li>Daune Michel Press, 1999.</li> <li>Van Holde KE, 2005.</li> <li>Banwell CN, India Tata-Mc</li> <li>Lakowicz JR. I Academic/ Ple</li> <li>Nadeau JL. Int Scientists, Flo</li> </ul>	l. Molecula , Jonson W McCash El Graw-Hill Principles o enum Publ croduction	/C. Principle M. Fundan Publishing of Fluoresc ishers, 199 to Experim	es of Biophy nentals of I Company Li cence Spect 9. nental Bioph	vsical Chem Molecular S td. 2017. roscopy (2n	istry, U.S.A. Spectroscop Id Ed.), Nev	, Prentice Hall, y, New Delhi,			

Name of the Program:	B.Sc. Biotechnology (Honours)											
Course Title:	Geneti	Genetics (Practical)										
Course Code: BBT 209	Course	Course Instructor: Course In-charge										
Academic Year: 2023 onwards	Semest	er: II Yea	ar, III Se	emeste	r							
No of Credits: 2	Prereq	Prerequisites: Qualified previous semesters as per regulations										
Synopsis: This practical course	introduce	ntroduces and provides knowledge and practical skills in genetic analysis										
Course Outcomes (COs): On succ	essful com	ssful completion of this course, students will be able to										
CO 1: Explain	and analy	se how t	he tra	nsmissio	on of g	genes o	occur w	ithin tl	ne fam	ily and		
distingu	ish betwe	en transr	nission	of dom	inant a	and rec	essive j	ohenot	ypes, (l	P1, P2)		
	anding the											
P3)	-	-	-					-				
CO 3: Demon	stration a	nd inter	oretatio	on of i	nherita	ince of	f blood	group	o and	of sex		
	nation (P1											
CO 4: Explain	lymphocy	te cultur	e, meta	aphase	prepa	ration a	and ide	entify a	bnorm	alities.		
Calculat	ion of chro	omosome	e lengtl	h. (P1, F	2, P3)							
CO 5: Examin	ation of mi	totic stag	ges and	l polyte	ne chr	omosor	nes (P1	., P2, P	3)			
CO 6: Knowle	dge of moi	phology	of fruit	: fly (P1,	, P2)							
Mapping of COs to POs												
COs PO PO PO3 PO4	PO5 PO	6 PO 7	PO	PO 9	РО	PO	PO	РО	PO	PO		
1 2			8		10	11	12	13	14	15		
CO1 × X X												
CO 2 × .												
CO 3 × X	х											
CO 4 ×	х											
CO 5 ×												
CO 6 ×												
Course content and outcomes:												





Content	Competencies				No of Hours			
Unit 1:								
Pedigree analysis	Demonstration of Peo	digrees and probler	ns (P1, P2)		4			
Unit 2:								
Mendel experiments	Demonstration of do	minant and reces	sive phenot	ypes and their	4			
	transmission in mono-	-/ di-/ tri- hybrids (I	P1, P2, P3)					
Unit 3:								
Genetic problems	Demonstration of link	age of genes on a c	hromosome	and cross-overs	4			
	(P1, P2, P3)							
Unit 4:								
Blood typing	Experiment on blood	group and demon	stration of b	oiochemical and	4			
	genetic background (P	P1, P2, P3)						
Unit 5:								
Barr body	Experiment, demonst	ration, and interpre	etation of sea	k determination	4			
	with buccal mucosa ce	ells. (P1, P2, P3)						
Unit 6:	1							
Metaphase preparation	Lymphocyte culture, r	metaphase prepara	ition, and sc	reening (P1, P2,	16			
and Karyotyping	P3)							
Unit 7:								
Micrometry	Experiment and dem	omosomes and	4					
	calculation (P1, P2, P3	calculation (P1, P2, P3)						
Unit 8:								
Mitosis	Squash preparation of	f mitotic stages witl	n onion root	tips (P1, P2, P3)	8			
Unit 9:								
Polytene Chromosomes	Preparation and demo	onstration of polyte	ne chromoso	ome (P1, P2, P3)	4			
Unit 10:								
Spotters (Drosophila	Demonstration of var	rious phenotypes o	of Drosophil	a melanogaster	8			
Phenotypes)	(P1, P2)							
Learning strategies, conta	act hours and student le	earning time						
Learning strategy		Contact hours		Student learnin	g time (Hrs)			
Lecture								
Seminar								
Small Group Discussion (S	GD)							
Self-directed learning (SD	•							
Problem Based Learning (	•							
Case Based Learning (CBL								
Clinic								
Practical		60		180				
Revision								
Assessment		07		-				
	TOTAL 67 180							
Assessment Methods:		1		l				
Formative:			Summativ	e:				
			Sessional e	Sessional examination End semester examination				
Class tests Assignments/presentation	nc							





Mapping of assessment	with COs								
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Examination		Х	Х	Х					
Quiz		NA	NA	NA	NA	NA	NA		
Assignment/Presentatio	n	Х	Х	Х	Х	Х	Х		
End Semester Examinati	on								
Laboratory examination		Х	Х	Х	Х	Х	Х		
Feedback Process	• Enc	l-Semester	Feedback						
Reference Material	<ul> <li>Theory and problems of genetics, 4th edition by Elrod S.L. and Stansfield W.D. (Schaum's outlines) (2002), Tata McGraw-Hill, New Delhi.</li> <li>Genetics – Classical to modern, 1st Edition. P.K. Gupta. 2013.</li> <li>Chromosomal Aberrations: Basic and Applied aspects by Obe.G. and A.T. Natarajan (1990) Springer Verlag, Berlin.</li> </ul>								

Name of the Program:					B.Sc.	Biotec	nnology	y (Hond	(Honours)							
Course T	tle:				Mole	cular B	iology	Practio	cal)							
Course C	ode: Bl	BT 211			Cours	e Instr	uctor: (	Course	In-cha	rge						
Academi	c Year:	2023 (	Dnwa	rds	Seme	ster: II	Year, I	II Seme	ester							
No of Cre	dits: 2				Prere	quisite	s: Qual	ified p	revious	s semes	sters as	s per re	gulatio	ons		
Synopsis	:	biolog chara	gy prin cteriz	nciples; t ation of	his course are to acquire hands-on training in fundamentals of molecular o provide fundamental knowledge on techniques involved in isolation and nucleic acids; and to understand the various methods of qualitative and s of nucleic acids derived from various biological samples.											
Course O	utcom	es (COs	): 0	n succes	sful co	mpleti	on of th	nis cour	se, stu	dents v	vill be a	able to				
CO 1:	various					l sourc	es (P1,	P2, P3,	P4)							
CO 2: Experiment and quantify DN (P3, P4, P5)							fy DNA	and R	NA usi	ng qua	litative	and q	uantita	tive m	ethods	
CO 3: Test for purity of isolated nucleic acids from various biological sources (P4, P5)																
CO 4: Demonstrate the process of bacterial transformation (P2, P3, P4)																
CO 5:				kplain th	e meth	od for	isolatic	on and	purifica	ation of	mitoc	hondria	a (P2, P	3).		
Mapping																
COs	PO	PO	PO	PO 4	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	1	2	3		5	6	7	8	9	10	11	12	13	14	15	
CO 1	×		×		×	×		×								
CO 2	×			×	×			×								
CO 3 CO 4	×		×	×				×								
CO 4 CO 5	×			×		×		×								
CO S		and ou	tcom			~		^								
Content	Jiiteiit		teoni	Compe	toncio	-								No of	Hours	
Unit 1:				compe	iencies	,								100	110013	
Isolation Escherich chromoso	Isolation and purification of Escherichia coli chromosomal DNA • Ex qu • Te					alian the process of isolation and purification of Escherichia coli nomic DNA (P1, P2, P3, P4) periment and quantify Escherichia coli genomic DNA using alitative and quantitative methods (P3, P4, P5) t for purity of Escherichia coli genomic DNA (P4, P5)										
Unit 2:																





		"SPIRED BY			
Isolation of plasmid DNA	Illustrate the meth			-	8
	Apply methodolog	y for isolation of pl	asmid DNA (F	73)	
Unit 3:				(	
Agarose Gel	• Explain the proces	0 0	•		8
Electrophoresis of plasmid	Analyse the outcor	me of agarose gel e	lectrophores	is (P4)	
DNA					
Unit 4:			(22)		0
Preparation of competent	Demonstrate comp			(52)	8
cells and bacterial transformation	Make use of comp			mation (P3)	
	Test for successful	bacterial transform	nation (P4)		
Unit 5:					
Restriction digestion of		-	estion of pla	smid DNA and	8
plasmid DNA	perform the exper				
	Analyse the outcor	me of restriction dia	gestion of pla	smid DNA (P4)	
Unit 6:	<u> </u>			/ <b>\</b>	
Isolation of genomic DNA	Illustrate the meth	-			8
from cell line	Apply methodolog	y for isolation of ge	enomic DNA (	P3)	
Unit 7:	<u> </u>				
Determination of the	• Show the process of		• •		8
concentration and purity of	<ul> <li>Apply and analyse</li> </ul>	e the outcome of c	oncentration	and purity of	
DNA by ultraviolet	DNA (P3, P4)				
absorption spectroscopy					
Unit 8:	<u> </u>				I
Isolation of total RNA and	Demonstrate and	plan the process of	isolation of F	RNA and purity	8
assessment of purity and	analysis (P2, P3)				
integrity	Analyse and deter		e of isolatio	n of RNA and	
	purity of RNA (P4,	-			
Learning strategies, contact	hours and student lea	rning time		I	
Learning strategy		Contact hours		Student learni	ng time (Hrs)
Lecture					
Seminar					
Small Group Discussion (SGD	)				
Self-directed learning (SDL)					
Problem Based Learning (PBI	L)				
Case Based Learning (CBL)					
Clinic					
Practical		60		180	
Revision					
Assessment		07		-	
TOTAL		67		180	
Assessment Methods:					
Formative:			Summative		
Class tests			Sessional e	examination	
Assignments/presentations			End semes	ter examinatior	
Quiz					
Mapping of assessment with	1 COs				





Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5				
Sessional Examination	х	x	x						
Quiz									
Assignment/Presentation	NA	NA	NA	NA	NA				
End Semester Examination									
Laboratory examination	х	x	x	х	х				
Feedback Process	End-Semester Feedback								
Reference Material	<ul> <li>Sue Carson Heather Miller Melissa Srougi D. Scott Witherow. Molecular Biology Techniques: A Classroom Laboratory Manual, 4th Edition, Academic Press, 2019</li> <li>Chaitanya K.V. Cell and Molecular Biology: A Lab Manual, PHI learning, 2013</li> <li>Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 2010</li> <li>Joseph Sambrook and Michael R. Green. Molecular Cloning: A Laboratory Manual 4th Edition, Cold Spring Harbor Laboratory Press, 2014.</li> </ul>								

Name of the Program:			B.Sc. Biotechnology (Honours)												
Course Title:			Microbiology (Practical)												
Course Code: BBT 213			Course Instructor: Course In-charge												
Academic Year: 2023 onwards			Semester: II Year, III Semester												
No of Credits: 2				Prerequisites: Qualified previous semesters as per regulations											
					se introduces and provides knowledge and technical skills in handling microbes										
		and ur	nderst	and thei											
				cessful completion of this course, students will be able to											
CO 1: List and i				illustrate the basic methods in microbiology (C1, P2)											
CO 2: Obtain p				pure cultures of microorganisms from mixed cultures (P2)											
CO 3: Identify P4)				fy bacteria based on their Gram staining and other staining characteristics (P2,											
CO 4:						lain and classify different bacteria based on biochemical tests (P2, P3, P4)									
					strate the ability to analyse and classify bacteria based on susceptibility to tics (P2, P4)										
Mapping	of CO	s to PC	)s												
COs P	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	РО 12	РО 13	РО 14	РО 15
CO 1	х						х			-					
CO 2	х				х		х								
CO 3	х		Х		х			х							
CO 4	х		Х		Х			х							
CO 5	х		Х		х			Х							
Course co	ontent	t and o	utcom	es:											
Content Com					npetend	cies								No of	Hours
Unit 1:															
Basic	me	thods		in • List and explain the basic methods in microbiology (C1, P2) 8								8			
Microbiology: media															
preparatio			lizatio	-											
smear preparation and simple															
staining															
Unit 2:															





Gram staining	• Identi (P2, P	•	based on the	eir Gram stain	ing characteristics	8
Unit 3:						
plate, pour plate technic	iques, (P2) treak-	n pure cult	tures of micro	oorganisms fro	m mixed cultures	8
Unit 4:						
Antimicrobial suscept test			e ability to an to antibiotics	•	ify bacteria based	8
Unit 5:						
Metabolic characterizati		•	nd character iles (C1, P2, P3		based on their	12
Unit 6:						
Bacterial motility	Perfor	rm and disp	play the bacter	ial motility test	t (P2)	8
Unit 7:						
Determination of bac numbers				bacterial num idity (P2, P3, P4	bers and measure 1)	8
Learning strategies, con	tact hours and s	tudent lear	rning time			
Learning strategy		Contac	t hours		Student learning tir	ne (Hrs)
Lecture						
Seminar						
Small Group Discussion	(SGD)					
Self-directed learning (S	DL)					
Problem Based Learning	; (PBL)					
Case Based Learning (CB	5L)					
Clinic						
Practical		60			180	
Revision						
Assessment		07			-	
TOTAL		67			180	
Assessment Methods:						
Formative:				Summative		
Class tests				Sessional ex	amination	
Assignments/presentation	ons			End semeste	er examination	
Quiz						
Mapping of assessment	with COs		T			
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5
Sessional Examination		×	×	×	×	
Quiz						
Assignment/Presentatio						
End Semester Examinati						
Laboratory examination		×	×	×	×	×
Feedback Process		nester Feed				
Reference Material	• Harley JP, Pre	scott LM, L	aboratory Exe	rcises in Micro	biology, McGraw Hil	l, 2002.





• Mukesh Kumar, Practical Manual for Undergraduates Microbiology, Jain Brothers India,
2010.

Name of t	he Pr	ogram:			В	Sc. Bio	otechn	ology (	Honou	ırs)						
Course Tit	:le:				B	Biophysics (Practical)										
Course Co	de: B	BT 215			C	Course Instructor: Course In-charge										
Academic	Year:	2023	onwa	ards		Semester: II Year, III Semester										
No of Cre	dits:	1			P	Prerequisites Qualified previous semesters as per regulations										
Synopsis:		The ob	jectiv	es of thi	s cours	urse are to acquaint the students with basic biophysics experiments -										
		to prov	vide	hands oi	n traini	aining of various optical spectroscopy techniques, to provide basic										
		knowle	edge	on radia	tion ar	nd the	ir dete	ections,	to pr	ovide	basic ii	nforma	tion o	n diffei	rential	
		scanniı	ng ca	lorimetr	y, diffr	iffraction grating and their applications, to provide information on										
				y and ap	•											
Course Ou	utcom	es (CO	s):			ul completion of this course, students will be able to										
CO 1:				Determ		•	fic rota	ition of	sucros	se solu	tion us	ing a h	alf sha	de		
				polarim												
CO 2:				Explain												
CO 3:				Explain		-	-	as well	as abso	orptior	ı (V-vis	), fluor	escenc	e and F	Raman	
				spectro		<u> </u>										
CO 4:				Explain												
CO 5:				Determ			-	of the	e lines	in the	mercu	iry spe	ctrum	by min	imum	
						ethod (P1,P4) he forbidden energy gap of a semiconductor (P1, P4)										
CO 6:				Determ	ine the	e torbic	den e	nergy g	gap of a	a semio	conduc	tor (P1	<i>,</i> P4)			
Mapping																
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
CO 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CO 1 CO 2	×			×	×			×								
CO 2 CO 3	×			~	×	×		×								
CO 3					^	^	×	×								
CO 4	X			x			^	^								
CO 6	X			×												
Course co		and ou	itcon													
Content				npetenci	ος								N	o of Ho	urs	
Unit 1:			0011	iperenen										5 05 110	015	
Fluoresce	nce		• T	o demo	nstrate	the fl	uores	cence s	spectra	of bi	omoleo	ules a	nd 2			
spectrosco				issignme					•							
Unit 2:	. ,			- 00	· - 7			<u>, -</u> /-	,				1			
Raman sp	ectros	сору		o demor ssignme				•		tone a	nd eth	ianol a	nd 2			
Unit 3:								(, -), -	• /							
UV-vis spe	ectros	vqoo	• T	o demoi	nstrate	and v	erifv B	eer La	mbert'	s law i	ising n	otassiu	ım 4			
,							•									
permanganate solution and to find concentrat solution using the calibration curve (P1, P4)																
Unit 4:					0				. ,	,			I			





Polarimeter	• To detern		•				-	4
	polarimet sucrose so			nd the	e unkn	own concent	ration of	
Unit 5:								
Numerical aperture of an optical fiber	Determina	ation of I	numerical a	pertu	re of an	optical fiber	(P1, P4)	4
Unit 6:								
Energy gap of a	To determ	vina tha	forbiddon	norm	ann of	acomicond	uctor (D1	4
semiconductor	P4)	inte the		energy	gap O	a semiconu		4
Unit 7:	1 7							
Diffraction grating	• To deterr	nine th		oth o	f tha l	ines in the	mercury	4
Dimutetion grating			num deviat				mercury	•
Unit 8:								
GM counter		culate (	a) Thresho	ld vo	ltage (	tics of a GM b) Plateau r GM tube (P1	egion (c)	4
Unit 9:				-				
Differential scanning	• To demo	nstrate	the therm	al pro	operties	of a sam	ole using	2
calorimetry	differentia	al scanni	ng calorime	etry (P	1, P2)			
Learning strategies, co	ntact hours a	nd stude	ent learning	time				
Learning strategy		(	Contact hou	ırs		Studer	nt learning t	ime (Hrs)
Lecture								
Seminar								
Small Group Discussion	(SGD)							
Self-directed learning (S	SDL)							
Problem Based Learnin	g (PBL)							
Case Based Learning (C	BL)							
Clinic								
Practical		3	30			90		
Revision								
Assessment			)7			-		
TOTAL		3	37			90		
Assessment Methods:					-			
Formative:						native:		
Class tests	•					onal examina		
Assignments/presentat	ions				End se	emester exar	nination	
Quiz								
Mapping of assessmen	t with COs							
Nature of assessment		01	CO 2	C	03	CO 4	CO 5	CO 6
Sessional Examination	×		×	×	-			
Quiz	NA	4	NA	N	۹	NA	NA	NA
Assignment/Presentation			NA	×		NA	×	NA
End Semester Examinat								
Laboratory examination	ı ×		×	×		×	×	×
Feedback Process •	I	mester F	eedback			•		





Reference	• Lakowicz JR. Principles of Fluorescence Spectroscopy (2nd Ed.), New York, Kluwer
Material	Academic/ Plenum Publishers, 1999.
	<ul> <li>Dennis H. Goldstein. Polarized Light, USA, CRC Press, 2011.</li> </ul>
	Ferraro John. Introductory Raman Spectroscopy, USA, Academic Press, 2002
	• Jay L. Nadeau. Introduction to Experimental Biophysics: Biological Methods for Physical Scientists (Foundations of Biochemistry and Biophysics), Florida, USA, CRC Press; 1 Edition, 2011.
	• Van Holde KE, Jonson WC. Principles of Biophysical Chemistry, U.S.A., Prentice Hall, 2005.
	• Seeger Karlheinz. Semiconductor Physics: An Introduction, USA, Sprnger, 2004.

Name	of the	Progra	am:			B.Sc. B	iotechr	nology (	Honou	rs)					
Course	e Title					Seminar/Journal Club									
Course	e Code	e: BBT 2	217			Course Instructor: Course In-charge									
Acade	mic Ye	ear: 20	)23 onv	vards		Semest	ter: II Y	ear, III :	Semest	ter					
No of	Credit	s: 1				Prereq	uisites:	Qualifi	ied pre	viou	s semest	ers as	ber reg	ulation	S
Synop	sis:	This	course	e will i	nclude	an allot	tment o	of an in	dividua	al sei	minar to	pic rela	ted to	the se	mester
		cour	rses. Th	nis wil	l enhar	nce stud	lents' l	knowled	dge ba	se ar	nd expos	e then	n to ho	w to p	resent
		info	rmatior	n clea	rly and	l concis	ely. Stı	udents	will al	so le	arn how	to co	mpile	the lite	erature
		data	ibase ir	nforma	ation.										
Course	e Outc	omes	(COs):	0	n succe	essful co	mpleti	on of th	nis cour	se, s	tudents v	will be	able to		
CO 1:				E	xpress	thought	s and io	deas eff	ectivel	У					
CO 2:	CO 2: Demonstrate the ability to listen carefully and react														
CO 3:								presen	t comp	olex i	nformati	ion cle	arly and	d conci	sely to
different groups															
CO 4: Conclude on information															
CO 5:	D5: Define the problem in a concise manner														
CO 6:				A	dopt cł	nallengiı	ng tasks	s, and le	earn ho	w to	compile	and in	terpret	data.	
Mappi	ing of	COs to	POs		-									-	
COs	РО	РО	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
	1	2								10	11	12	13	14	15
CO 1		×													
CO 2		×													
CO 3		×													
CO 4		×													
CO 5		×													
CO 6		×													
Course	e cont	ent an	d outco	mes:											
Conter	nt	Сотр	etencie	'S							No of H	ours			
Unit 1	:														
Semina	ar					otment		ndividu	al semi	nar	30 minu		al prese	entatior	n for
topic related to the semester cou											each stu	udent			
Learning strategies, contact hours and student learning time															
Learni	ng stro	ategy				(	Contact	t hours			Stu	dent le	arning	time (H	lrs)
Lectur						-					-				
Seminar 15 45															
Small Group Discussion (SGD)       Self-directed learning (SDL)															





Problem Based Learnin	ng (PBL)								
Case Based Learning (	CBL)								
Clinic									
Practical									
Revision									
Assessment			01			-			
TOTAL			16			45			
Assessment Methods:									
Formative:	Formative: Summative:								
Assignments/presenta	itions								
Mapping of assessme	nt with COs								
Nature of assessment		CO	1	CO 2	CO 3	CO 4	CO 5	CO 6	
Sessional Examination		NA	4	NA	NA	NA			
Quiz		NA	4	NA	NA	NA	NA	NA	
Assignment/Presentat	ion	Х		х	х	х	х	х	
End Semester Examina	ation	NA	4	NA	NA	NA	NA	NA	
Laboratory examination	on	NA	4	NA	NA	NA	NA	NA	
Feedback Process         •         End-Semester Feedback									
<b>Reference Material</b>	Reference Bool	ks and	Journ	als articles r	elated to th	ne seminar to	opics		

Name of the Program:						B.Sc.	B.Sc. Biotechnology (Honours)									
Course	Title:					Biost	Biostatistics (Theory)									
Course Code: BBT 202							Course Instructor: Course In-charge									
Academic Year: 2023 Onwards							ster: I	l Year,	IV Sen	nester						
No of Credits: 3							Prerequisites: Qualified previous semesters as per regulations									
Synopsi	s:		To prov	vide ne	cessar	y found	lation i	n prob	ability	and pr	obabili	ty dist	ributio	ns so a	s to apply	
			it to mo	odel an	d anal	yse bio	logical	pheno	menor							
Course	Outcor	nes (O	COs):	On su	uccessf	ul com	pletion	of this	s cours	e, stud	ents w	ill be a	ble to			
CO 1:				DESC	RIBE d	ifferen	t appro	aches	to proł	bability	r. (C6)					
CO 2:				SUM	MARIZ	E elem	entary	theore	ms of <sub>l</sub>	orobab	oility. (O	25)				
CO 3:				DISTI	NGUIS	H betw	veen di	screte	and co	ontinuc	ous ran	dom v	ariable	es, and	IDENTIFY	
				when	and h	ow to i	use the	ir corr	espond	ling dis	tributi	ons. (C	4, C4)			
CO 4:				RELA	TE mar	ginal, o	conditio	onal ar	id joint	distrik	oution	functio	ns. (Cé	5)		
CO 5:				EVAL	UATE e	expecta	tions c	of linea	r comb	inatio	n of rai	ndom v	variable	es. (C6)		
CO 6:				APPL	Y hypo	thesis	testing	(C3)								
Mappin	g of CO	Ds to I	POs													
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 15	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
CO 1	×															
CO 2	×															
CO 3	×															
CO 4	×															
CO 5	x															
CO 6				×												
Course	conten	t and	outcon	nes:												
Content	-	Со	mpeten	cies										No of	Hours	







Unit 1:		
Introduction	• EXPLAIN how probability and probability distributions are applied to	2
and basic	model and analyse biological phenomenon. (C6)	
concepts	• DISTINGUISH between all four levels of measurements (C4)	
	• EXPLAIN different types of variables (C6)	
Unit 2:		
Sampling	DEFINE population, sample (C1)	5
1 0	• STATE the advantages and disadvantages between sample studies and	
	census. (C1)	
	• EXPLAIN different types of samples (C2)	
	<ul> <li>DESCRIBE probability sampling and non-probability sampling (C1)</li> </ul>	
	• EXPLAIN simple random sampling, stratified random sampling, systematic	
	sampling, cluster sampling, multistage sampling, multiphase sampling	
	(C2)	
	<ul> <li>WRITE merits and demerits of different types of method of sampling (C3)</li> </ul>	
	<ul> <li>EXPLAIN sampling error (C2)</li> </ul>	
Unit 3:		
Descriptive	DISTINGUISH between all four levels of measurements (C4)	6
statistics		0
Statistics	EXPLAIN different types of variables (C6)     DIFFERENTIATE between frequency tabulations and frequency survey	
	• DIFFERENTIATE between frequency tabulations and frequency curves	
	EXPLAIN different measures of central tendency (C2)	
	COMPUTE different measures of central tendency (C3)	
	• WRITE demerits and merits of Arithmetic mean, Geometric mean,	
	Harmonic mean, Median and Mode (C3)	
	EXPLAIN different measures of dispersion (C2)	
	<ul> <li>COMPUTE different measures of dispersion (C3)</li> </ul>	
	WRITE merits and demerits of Range, Mean deviation, Variance, Standard	
	deviation, Coefficient of variation, Quartile deviation and inter quartile	
	range (C3)	
	<ul><li>range (C3)</li><li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li></ul>	
Unit 4:		
<b>Unit 4:</b> Probability		8
Probability and	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> </ul>	8
Probability and	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> <li>Illustrate the difference between probability computation for discrete &amp;</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> <li>Illustrate the difference between probability computation for discrete &amp; continuous random variables (C4)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> <li>Illustrate the difference between probability computation for discrete &amp; continuous random variables (C4)</li> <li>Describe random variables (C1)</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> <li>Illustrate the difference between probability computation for discrete &amp; continuous random variables (C4)</li> <li>Describe random variables (C1)</li> <li>List properties of probability functions (C2)</li> <li>Recall the definitions of marginal probabilities, conditional probabilities</li> </ul>	8
Probability and probability	<ul> <li>CREATE presentation of data as tabular, graphs and diagrams (C5)</li> <li>State basic theorems &amp; properties of probability (C1)</li> <li>Solve problems that involve the application of basic theorems and properties of probability (C6)</li> <li>Define and illustrate conditional probability (C4)</li> <li>Illustrate total probability rule &amp; Bayes' rule (C4)</li> <li>Apply the definition of conditional independence to determine whether two events are conditionally independent (C4)</li> <li>Illustrate the difference between probability computation for discrete &amp; continuous random variables (C4)</li> <li>Describe random variables (C1)</li> <li>List properties of probability functions (C2)</li> </ul>	8





r	${}^{*Gp}_{RED} \cong {}^{*V}$ (Deemed to be University under Section 3 of the UGC Act, 19.	
	<ul> <li>Recall the definitions of a Bernoulli trial, Binomial experiment and properties of a Poisson process (C1)</li> <li>Recognize cases where the following distributions could be an applied model: Bernoulli, Binomial and Poisson (C2)</li> <li>Identify parameters of: Bernoulli, Binomial and Poisson (C2)</li> <li>Calculate probabilities, the mean and variance of the following random variables: Bernoulli, Binomial and Poisson (C4)</li> <li>Approximate Binomial probabilities using a Poisson distribution where appropriate (C6)</li> <li>Demonstrate an understanding of the basic concepts of continuous random variables of common continuous distributions (C3)</li> <li>Identify the parameters, calculate probabilities, mean and variance of: Bernoulli, Binomial, Poisson and Normal (C4)</li> <li>Recall the properties of a Normal distribution, and those of the standard Normal distribution (C1)</li> <li>Obtain probabilities related to Normal random variables using the standard Normal table (C4)</li> </ul>	
	<ul> <li>Approximate Binomial probabilities using a Normal distribution wherever</li> </ul>	
	appropriate (C5)	
Unit 5:		
Sampling distribution and confidence intervals	<ul> <li>SUMMARIZE the Central Limit Theorem (C2)</li> <li>DISTINGUISH between a parameter and a statistic (C2)</li> <li>DEFINE sampling distribution (C1)</li> <li>DISTINGUISH between population distribution and sampling distribution (C2)</li> <li>DESCRIBE the relationship between sample size and the variability of an estimator (C1)</li> <li>DESCRIBE the distribution of the sample mean (C1)</li> <li>DESCRIBE the distribution of the difference between two sample means (C1)</li> <li>DESCRIBE the distribution of the sample proportion (C1)</li> <li>DESCRIBE the distribution of the difference between two sample means (C1)</li> <li>DESCRIBE the distribution of the difference between two sample proportions (C1)</li> <li>ESTIMATE unknown population parameter using a point estimator for the parameter (C2)</li> <li>CONSTRUCT and INTERPRET a confidence interval for a population proportion, mean, difference between two sample proportions, difference between two sample means (C5, C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C2)</li> <li>DETERMINE sample statistics from a confidence interval (C2)</li> </ul>	8
Unit 6:		
Tests of significance	<ul> <li>STATE correct hypotheses for significance test about a population proportion, mean, difference between two sample proportions, difference between two sample means (C1)</li> <li>INTERPRET P-values in context. (C3)</li> <li>INTERPRET a Type I error and a Type II error in context, and give the consequences of each. (C3)</li> </ul>	8





PDESCRIBE the relationship between the significance level of a test, P(Type II error), and power, (C2)     DISTINGUISH between a parametric and nonparametric tests of significance (C2)     PDESCRIBE the characteristics of the sampling distribution of sample proportion, mean, difference between two sample proportions, difference between two sample means (C2)     CALCULATE probabilities using the sampling distribution of the sample proportion, mean, difference between two sample proportions, difference between two sample means (C3)     ILLUSTRATE whether the conditions for performing inference are met (C3)     USE t statistic for one sample mean or proportion when population standard deviation is known (C3)     USE t statistic for one sample mean or proportion when population standard deviation is known (C3)     USE t statistic for compare two means or two proportion when population standard deviation is known (C3)     USE t statistic to compare two means or two proportion when population standard deviation is known (C3)     USE t statistic to compare two means or two proportion when population standard deviation is known (C3)     USE t statistic to compare two means or two proportion when population standard deviation is known (C3)     USE t statistic to compare two means or two proportion (C3)     USE t statistic (C2)     USE of Analysis of Variance (ANOVA) (C3)     COMPUTE a significance test to compare two means or two proportion (C3)     USE that is the orrelation between two variables (C4, EXPLAIN F-test (C2)     USE of Analysis of Variance (ANOVA) (C3)     COMPUTE statistical test for one-swap ANOVA (C3)     ULSTRATE whether the correlation between two variables (C4, C3)     ILLUSTRATE whether the correlation between two variables (C4, C3)     ILLUSTRATE whether the correlation is significant. (C3) CALCULATE and INTERPRET the correlation for a set of data (C4) STATE basic assumptions behind regression analysis (C1) ILLUSTRATE whether the correlation is apelfied margin of er			$\gamma_{SP} \eta_{RED} \simeq \gamma_{V} \gamma_{V}^{Se}$ (Deemed to be	University under Section 3 of the UGC Act, 1956)					
• USE of Analysis of Variance (ANOVA) (C3)       • COMPUTE statistical test for one-way ANOVA (C3)         Unit 7:       • CALCULATE and INTERPRET the correlation between two variables (C4, C3)       4         and regression       • CALCULATE whether the correlation is significant. (C3)       4         • ILLUSTRATE whether the simple linear regression equation for a set of data (C4)       5         • STATE basic assumptions behind regression analysis (C1)       1         • ILLUSTRATE whether a regression model is significant (C3)       7         • RECOGNIZE regression analysis applications for purposes of description and prediction (C2)       8         Unit 8:       • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error (C3)       4         • DESCRIBE how the margin of error of a confidence interval changes with the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)       6         • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)       6         • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)       6         • Learning strategies, contact hours and student learning time       1         Learning strategy       Contact hours       Student learning time (Hrs)		<ul> <li>II error), and power. (C2)</li> <li>DISTINGUISH between significance (C2)</li> <li>DESCRIBE the character proportion, mean, dif difference between two</li> <li>CALCULATE probabilities proportion, mean, dif difference between two</li> <li>ILLUSTRATE whether the (C3)</li> <li>USE z statistic for one standard deviation is known of the standard deviation is unle COMPUTE a significance</li> <li>USE t statistic to compare standard deviation is known of the standard deviation is known of the standard deviation is unle COMPUTE a significance</li> <li>USE t statistic to compare standard deviation is unle COMPUTE a significance (C3)</li> <li>ANALYZE paired data by produce a single sample</li> </ul>	p between the significance level a parametric and nonparametrics of the sampling distribut ference between two samples ample means (C2) a using the sampling distribution ference between two samples ample means (C3) e conditions for performing infor- sample mean or proportion we own (C3) sample mean or proportion we known (C3) test for one sample mean or pro- two means or two proportion we own (C3) test to compare two means or a first taking the difference with	of a test, P(Type netric tests of tion of sample e proportions, n of the sample e proportions, erence are met hen population hen population portion (C3) when population two proportion hin each pair to					
<ul> <li>COMPUTE statistical test for one-way ANOVA (C3)</li> <li>Unit 7:</li> <li>Correlation and regression</li> <li>CALCULATE and INTERPRET the correlation between two variables (C4, C3)</li> <li>ILLUSTRATE whether the correlation is significant. (C3)</li> <li>CALCULATE the simple linear regression equation for a set of data (C4)</li> <li>STATE basic assumptions behind regression analysis (C1)</li> <li>ILLUSTRATE whether a regression model is significant (C3)</li> <li>RECOGNIZE regression analysis applications for purposes of description and prediction (C2)</li> <li>Unit 8:</li> <li>Sample size determination</li> <li>ILLUSTRATE the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error (C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)</li> <li>ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)</li> <li>ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)</li> <li>Learning strategies, contact hours and student learning time</li> <li>Learning strategies, contact hours and student learning time (Hrs)</li> </ul>			ce (ANOVA) (C3)						
Correlation and regression• CALCULATE and INTERPRET the correlation between two variables (C4, C3)4• ILLUSTRATE whether the correlation is significant. (C3) • CALCULATE the simple linear regression equation for a set of data (C4) • STATE basic assumptions behind regression analysis (C1) • ILLUSTRATE whether a regression model is significant (C3) • RECOGNIZE regression analysis applications for purposes of description and prediction (C2)4Unit 8:• ILLUSTRATE the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error (C3) • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3) • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3) • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence (C3)4Learning strategies, contact hours and student learning time Learning strategyContact hoursStudent learning time (Hrs)		-							
and regressionC3• ILLUSTRATE whether the correlation is significant. (C3)• CALCULATE the simple linear regression equation for a set of data (C4)• STATE basic assumptions behind regression analysis (C1)• ILLUSTRATE whether a regression model is significant (C3)• RECOGNIZE regression analysis applications for purposes of description and prediction (C2)Unit 8:Sample size• ILLUSTRATE the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence interval changes with the sample size and the level of confidence c (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DES									
Unit 8:         Sample size determination       • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population proportion with a specified margin of error (C3)       • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)       • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)       • ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)       • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)         • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)       • DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)         • DESCRIBE how the margin of error of a confidence C (C3)       • DESCRIBE how the margin of error of a confidence C (C3)         • DESCRIBE how the margin of error of a confidence C (C3)       • DESCRIBE how the margin of error of a confidence C (C3)         • DESCRIBE how the interval confidence C (C3)       • DESCRIBE how the margin of error of a confidence C (C3)         • DESCRIBE how the interval confidence C (C3)       • DESCRIBE how the interval for a population mean with a specified margin of error (C3)         • DESCRIBE how the margin of error of a confidence C (C3)       • DESCRIBE how the interval for a population mean with a specified margin of error (C3)         • DESCRIBE h		<ul> <li>C3)</li> <li>ILLUSTRATE whether the</li> <li>CALCULATE the simple line</li> <li>STATE basic assumptions</li> <li>ILLUSTRATE whether a resonance</li> <li>RECOGNIZE regression as</li> </ul>	correlation is significant. (C3) near regression equation for a se behind regression analysis (C1) egression model is significant (C3	et of data (C4)					
determinationinterval for a population proportion with a specified margin of error (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)• Learning strategies, contact hours and student learning time Learning strategyContact hoursStudent learning time (Hrs)	Unit 8:	,							
Learning strategy         Contact hours         Student learning time (Hrs)	Sample size determination	<ul> <li>determination interval for a population proportion with a specified margin of error (C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence C (C3)</li> <li>ILLUSTRATE the sample size required to obtain a level C confidence interval for a population mean with a specified margin of error (C3)</li> <li>DESCRIBE how the margin of error of a confidence interval changes with the sample size and the level of confidence c (C3)</li> </ul>							
Lecture 45 135		,		· · ·					
	Lecture	45	)	135					





Seminar									
Small Group Discussion (SG	GD)								
Self-directed learning (SDL)	)								
Problem Based Learning (P	BL)								
Case Based Learning (CBL)									
Clinic									
Practical									
Revision									
Assessment		05				-			
TOTAL		50				135			
Assessment Methods:									
Formative:					Sumr	mative:			
Class tests					Sessi	onal exa	mination		
Assignments/presentations	s	End semester examination						ion	
Quiz									
Mapping of assessment w	ith COs								
Nature of assessment		CO 1	CO 2	CO 3	(	CO 4	CO 5	CO 6	
Sessional Examination		х	х	х	>	ĸ			
Quiz		NA	NA	NA	1	NA	NA	NA	
Assignment/Presentation		NA	NA	NA	1	NA	NA	NA	
End Semester Examination		х	х	х	>	ĸ	х	x	
Laboratory examination	-	NA	NA	NA	1	NA	NA	NA	
Feedback Process	• End	-Semester	Feedback						
Reference Material	<ul> <li>Ross SM. Introduction to probability models. Academic press; 2014.</li> <li>Johnson NL, Kemp AW, Kotz S. Univariate discrete distributions. John Wiley &amp; Sons; 2005.</li> <li>Johnson NL, Kotz S, Balakrishnan N. Continuous univariate distributions. John Wiley &amp; Sons; 1991.</li> <li>Rosner B. Fundamentals of biostatistics. Duxbury Thomson Learning; 2000.</li> <li>Bhat BR. Modern probability theory. New Age International; 2007.</li> <li>Daniel WW. Biostatistics: a foundation for analysis in the health sciences. John Wiley &amp; Sons; 2008.</li> </ul>								

Name of the	Program:		B.Sc. Biotechnology (Honours)				
Course Title:			Pharmacology and Pharmacogenomics (Theory)				
Course Code:	BBT 204		Course Instructor: Course In-charge				
Academic Ye	ar: 2023 Onw	/ards	Semester: II Year, IV Semester				
No of Credits	: 3	Prerequisites: Qualified previous semesters as per regulations					
Synopsis:	pharmacolo mechanisms the drug de	gy and phas, actions, a evelopment	s course are to acquaint the students with the general, Principles of armacogenomics. To provide fundamental knowledge of the drug, their and side effects, to understand the role of regulatory bodies in controlling t. To understand how the molecular biology techniques, help in the rugs and personalization of it.				
Course Outco	omes (COs):	On successful completion of the course, students will be able to					
CO 1:	CO 1: Learn the important discoveries and know about the scientist in the field of pharmacology (C1)						





CO 2:				Understand the what happens to drug in the body when the drug is taken and what											
				body does to drug and how various parameters affect the influence (C2, C3)											
				•		-			•			the hyp		-	-
					and Alzheimer's disease and understand their application in drug discovery (C2,										
				C3)											
CO 3:				•	plain the mode of actions of various classes of chemotherapy drugs, types of										
					ncer chemotherapies, and antidotes used for heavy metal poisoning (C2, C3) plain the role of biotechnology in the development of pharma filed										
CO 4:				•						•		•			
						us tech	niques	used	to in p	harma	cology	studies	and it	ts appl	ication
				(C1, C2											
CO 5:						-	-			-		cology			
CO 6:						•		-		•		now th	-		•
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				psychia		disorde			aise	ases,	Pulmo	onary	diseas	ses, o	Cancer
Mappin	a of CO	s to Pr		pnarm	acogen	omics (	(12, 13)								
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CO 5	×														
CO 6	×		×		×										
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Unit 1:															
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Unit 2:															
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and						-	•					sforma			
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Unit 3:			Cybe	ment		Jigan		103 (CZ	, coj.						
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poisonin						ugs use							,		
Unit 4:	5				0	01 1.54		,		0	,,,,	,	1		
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pharma			-		-							drugs			
•			C3)					,	•			Ũ			
sciences															
sciences															
	ory issu	es	Desc	ribe th	ne dru	gs and	Cosm	etics A	Act, CD	SCO g	uidelir	ies, US	FDA	4	





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	utilizing anin (C2, C3)	nals an	d human s	ubject	ts for th	ne drug disco	overy process	
Unit 6:								
Pharmacogenetics	Understand	the hist	ory and ea	rly evi	dence a	nd examples.	Describe the	4
and	concept of	pers	onalized	medio	ine. F	Pre- and p	post-genomic	
pharmacogenomics	pharmacoge	netics, o	current stat	tus (C2	2, C3)			
Unit 7:								
Categories of	Explain the	drug	metabolize	er, dru	ıg targ	et and drug	transporter	6
pharmacogenomic	encoding ger	nes shov	wing variati	ion aff	ecting	lrug response	. Cellular and	
knowledge	functional as	says (C	2, C3)					
Unit 8:								
Pharmacogenomics	Describe th	e phar	macogeno	mics	of ma	jor disease	like Neuro-	5
of major classes of							iseases, and	
diseases						-	ajor diseases.	
		•	•	-			ic association	
	studies (C2, 0							
Unit 9:								
Tools and	Explain the	tools.	and techn	iques.	and t	he diagnosti	c testing for	5
techniques in	•					•	microarrays,	
pharmacogenomics				•			nologies and	
phannacogenennes		-	-		•	-	e association	
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	Pharmacoge	-	-		.5 m a		y und thuis.	
Learning strategies, c					e			
Learning strategy			ict hours		-	Student	learning time	(Hrs)
Lecture		45				135		(
Seminar								
Small Group Discussio	n (SGD)							
Self-directed learning								
Problem Based Learni								
Case Based Learning (	<u> </u>							
	CBL)							
Clinic								
Practical								
Revision								
Assessment		05				-		
TOTAL		50				135		
Assessment Methods	:							
Formative:					Summ			
Class tests						nal examinati		
Assignments/presenta	ations				End se	mester exam	ination	
Quiz								
Manning of accord	nt with COc							
Mapping of assessme Nature of assessment		1	<u> </u>		0.2	CO 4		CO 6
		L	CO 2		03	CO 4	CO 5	CO 6
Sessional Examination			X	X	^			
					NA	NA		
Assignment/Presentat			X	X		X	x	X
End Semester Examin	ation x		Х	х		х	х	Х





Laboratory examina	ation	NA	NA	NA	NA	NA	NA
Feedback Process	• Er	nd-Semester F	eedback		•	•	
Reference	• Essentia	als of Medica	l Pharmacolo	gy (7th Ed.)	– Tripathi KD	, Jaypee Brot	thers Medical
Material	Publish	ers (P) Ltd, 20	)13				
	• Basic a	nd Clinical Pl	harmacology	(11th Ed), K	atzung B.G. e	et al., Tata N	AcGraw - Hill
	Educati	on, 2009.					
	-	-	evaluation: p	oharmacologi	cal assays. V	ogel, Hans G	Gerhard (Ed.).
		er, 2008.					
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		ss B. Altman,	David Flockh	art, David B.	Goldstein. Ca	ambridge Un	iversity Press,
	2012.						
		gulatory Affai					
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		ment of India	•		-		
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	-	s. Yui-Wing Fr					
	• The pha	armacological	basis of ther	apeutics. (11	th Ed), Goodı	man Gilman,	A., Rall, T.W.,
	Nies, A.	I.S. and Taylo	r, P. McGraw	Hill, Pergamo	on Press, 200	6.	
	• T E Klei	n, R B Altman	(2004) Pharn	nGKB: the ph	armacogenet	ics and	
	pharma	acogenomics l	knowledge ba	se. Pharmaco	ogenomics J.4	(1):1	

Name of	the Pr	ogram	:			B.Sc.	Biotec	hnolog	y (Hon	ours)					
Course Ti	itle:					Plant	t Biote	chnolog	gy (The	ory)					
Course Co	ode: B	BT 206	;			Cour	Course Instructor: Course In-charge								
Academi	c Year	: 2023	Onwa	ards		Seme	Semester: II Year, IV Semester								
No of Cre	edits:	3			Prerequisites: Qualified previous semesters as per regulations									ons	
Synopsis		This n	nodule	e helps	to u	ndersta	nd th	e knov	wledge	obtai	ned in	basic	cours	es of	plant
		biotec	hnolo	gy, to pr	ovide f	fundam	ental k	nowle	dge of	plant c	ell, tiss	ue and	organ	culture	e & its
		transla	tional	applica	ations,	and to	under	stand	the fu	ndame	ntal of	tools a	and te	chnolo	gy for
		produc	ct scal	e-up & d	crop im	prover	nent.								
Course O	utcom	nes (CO	)s):	On succ	cessful	comple	etion of	this co	ourse, s	tudent	s will b	e able t	to		
CO 1:				Learnin	g the h	nistory	and air	n and t	target,	Plant o	ell, tiss	sue and	d orgar	n cultur	e and
				their im	portar	nce in c	rop imp	provem	ient an	d susta	inabilit	y (C1, 0	C2)		
CO 2:				Explain	the me	ethods	ds for culture, protoplast fusion and cell hybridisation (C2, C4)								
CO 3:				Learnin	g meth	ods to	ods to develop disease free plants (C2, C4)								
CO 4:				Explain	xplain the fundamentals of somaclonal and gametoclonal variations and their									their	
				impact	on trai	trait improvement of plants (C2, C5) and Discuss and illustrate the plan								plant	
				metabo	lite an	d prodı	uct scal	e up st	rategie	s (C2, C	C4, C6)				
CO 5:				Knowle	dge on	gene	transfe	r techi	niques	and de	evelopr	ment o	f trans	genic p	olants,
				availab	le trans	sgenic o	rops ir	India a	and wo	rd, ger	ie cloni	ing, RFL	P, tran	sposor	is and
				insertio	nal mu	itagene	sis (C1	, C2) ai	nd Und	erstan	ding of	nitroge	en fixat	ion, fea	atures
				of <i>nif</i> ge	enes, g	ene tra	nsfer fo	or herb	icide a	nd stre	ss tolei	rance (0	C2, C3)		
CO 6:				Learnin	g differ	ent typ	es of b	ioinsec	ticides	and bio	ofertiliz	ers and	d Know	ledge c	n RET
				species	, germp	mplasm collection, preparation and conservation									
Mapping	of CO	s to PC	)s												
COs	PO	РО	PO	PO	PO	PO	РО	РО	РО	PO	РО	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×	×													



(A constituent unit of MAHE, Manipal)



		1		1	r		1	1	Spired BY LIS	(Lieemea to be	Conversity under	Section 3 of the UG	C AG, 1936/	-	
CO 2	×	×													
CO 3	×	×													
CO 4	×	×		×											
CO 5	×	×													
CO 6	×	×								×					
Course o	ontent	t and o	utcome	es:											
Content			Com	petenc	ies								No	of Hou	rs
Unit 1:													•		
Historica	al overv	view of	• De	efine a	and ex	plain p	blant t	issue	culture	conce	ept, in	nportan	t 4		
the gen	esis of	f Plant			es (C1,						•				
Biotechr	nology		• Ui	ndersta	anding	the typ	es of pl	lant tis	sue cult	ture an	d its in	npact o	n		
			ag	gro-eco	nomic	produc	tivity (	C2, C4)							
Unit 2:				- 		-							•		
Tissue	culture	e and	• De	efine th	ne fund	ament	als of c	lonal v	ariatior	ns (C1,	C2, C5	)	4		
genetic	Variab	ility in										tions i	n		
Plant Sto	ocks			-	2, C5, (										
				-			ntial ap	oplicati	ons of I	Plant b	reedin	g (C2).			
						•		•				etoclona	al		
			va	riation	s (C2)						0				
Unit 3:															
Producti	on of c	lisease	• Le	arn th	e suita	ble me	ethods	to cul	ture di	fferent	: expla	ants and	d 4		
free plar	nts: Sho	oot –							1, C2, C		•				
tip – cult	tures, s	hoot –						•							
tip – gra	fting, v	iricidal													
compou	nds.														
Unit 4:															
Protopla	ist is	olation	• Pr	ovide e	effectiv	e meth	nods fo	r proto	plast fr	om pla	int tiss	ues (C2	) 4		
and cult	ure		• Ex	plain	cell h	ybridiz	ation	techni	ques	and t	heir (	effectiv	е		
			pr	otocol	s (C2, 0	C5)									
			•	ustrate	screer	ning me	ethods	for hyb	oridized	l cells (	C2)				
			• Ex	plain t	he met	hods fo	or cultu	ure, ma	intena	nce and	d rege	neratio	n		
			of	cybric	ds fron	n plant	cells (C	C2, C5)							
			• Id	entifica	ation o	f eite cl	ones fr	om hy	vbrids a	nd cyb	rids ((	C2, C5)			
Unit 5:															
Plant ce			• Lis	st the b	oasic se	t up fo	r initial	ising p	ant cel	l cultur	es (C	1)	8		
Industria	al scale	up	• Di	scuss t	the role	e of pla	ant gro	wth re	gulato	rs ( boʻ	th nat	ural an	d		
				nthetio											
				•						mpoun	ds fro	m plan	t		
							eactors		-						
						-	guish (	conver	tional	and	moder	n plan	t		
				-	; tools (										
				-			-	-	ansfer i	-	ts (C6)				
					-			-	genous	and	end	ogenou	S		
			in	fluence	ers of p	lant ce	ll cultu	res (Cé	5)						
Unit 6:															
Genetic	Engine	ering:			-	-	ansfer	metho	ds – Ti	plasmi	id and	suitabl	e 8		
				-	C1, C2)										
			• Pr	oducti	on of ti	ransger	nic plan	its							





	1		$(R_{ED} \otimes V)^{*}$ (Deemed to be Un	iversity under Section 3 of the UGC Act,	2530/
	Currently available		nd word (C2	, C4)	
	<ul> <li>Characterization of</li> <li>Understanding RFL</li> </ul>	-	lincortional	mutaganasis	
	(C1, C2)	P, transposons and		mutagenesis	
Unit 7:					
Biology of Nitrogen Fixation in Plants	<ul> <li>Understanding the and Global Scenario</li> </ul>		Illy modified	Crops -India	5
	Define Nitrogen cyc		rogen fixatio	n (C1,C2)	
	Illustrate the mecl		-		
	crops (C2)			-	
	Demonstrate the m	ethods for Nif gene	, herbicide re	esistance and	
	stress tolerant gene	es in plants (C2)			
Unit 8:	-				
Advances in	• Define insecticides	and fertilizers (C1)			4
bioinsecticides and	• Explain the toxic e	ffects of synthetic	pesticides a	nd fertilizers	
biofertilizers	(C2,C5)				
	Illustrate the mech	nanism iof bioferti	lizers and bi	oinsecticides	
	(C2)				
	• Explain the poter		of bioinsec	ticides - an	
	ecological perspect				
	Discuss the advanta	-			
	for combating pests	s and pathogens of	plants (C1, C	2, C5)	
Unit 9:					-
Preservation of rare	Illustrate the metho				4
plant species,	Explain the method		rbarium prep	arations and	
germplasm collection	in vivo and in vitro				
and conservation	• Explain the strategi		N and Botani	cal Survey of	
	India for conservati				
	• Explain the guidel		BSI for pre	servation of	
	indigenous RET spe				
	entact hours and studen			Ctudovat lo aver	ing times (11mg)
Learning strategy		Contact hours			ning time (Hrs)
Lecture Seminar		45		135	
Seminar Small Group Discussion					
Self-directed learning (					
Problem Based Learning	· · ·				
Case Based Learning (C					
Clinic	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
Practical					
Revision					
Assessment		05		-	
TOTAL		50		135	
Assessment Methods:		I			
Formative:			Summative	2:	
Class tests			-	xamination	
Assignments/presenta	tions			ter examinatio	'n
	-				





Quiz							
Mapping of assessment	with COs						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination		х	х	Х	Х		
Quiz		х	х	Х	х	х	х
Assignment/Presentatio	n	х	х	Х	Х	х	х
End Semester Examinati	on	х	х	Х	Х	х	х
Laboratory examination		NA	NA	NA	NA	NA	NA
Feedback Process	• Er	nd-Semeste	r Feedback				
Reference Material	Univers Plant Ce Plant Ti Plant Ti 2nd Ed. Transge Plant Ti Amster Microph Publish Plant M	ity Press ell Culture: . ssue Cultur Ssue Cultur CRC press. enic plants N ssue Cultur dam. ropogation ers, Dordre lolecular Bio	A practical a e Manual – I e – Concept /ol.1 & 2:- Ku e: Applicatic – Debergh cht. plogy - Griers	pproach - Diz indsey K – 1 s and labora ung S-D, Wu ons and limit PC, Zimmer son D, Covey	xon RA, Gonz 991- Kluwer atory exercise R – 1993 - Ae ations – Bho	zales - IRL Pro Academic Pu e – Trigiano cademic Pres jwani SS – 1 1990 - Kluw , London.	ubl, Dordrecht & Gray, 1999, ss, San Diego 990 - Elsevier, ver Academic

Name o	of the l	Program	m:		B.Sc. Biotechnology (Honours)										
Course	Title:				Bioinformatics (Theory)										
Course	Code:	BBT 20	)8		Course Instructor: Course In-charge										
Acader	nic Yea	nr: 2023	3 onwa	ards	Seme	Semester: II Year, IV Semester									
No of C	credits:	3			Prere	quisite	s: Qua	alified	previou	ıs seme	esters a	is per r	egulati	ons	
Synops	is:	This	course	will pro	ovide fu	undame	ental kr	owled	ge of va	nrious k	oioinfor	matics	tools a	nd data	abases
		from	i majo	r consor	tiums s	such as	NCBI a	and int	roduce	studer	nts to t	he com	putatio	onal me	ethods
		for s	olving	biologic	al prob	lems.									
Course	Outco	mes (C	Os):	On suc	cessful	l compl	etion c	of this c	ourse,	studen	ts will k	oe able	to		
CO 1:				List of	differe	nt type	es of da	ta four	nd at th	e NCB	, and o	ther re	source	s and e	explain
				how to	o locate	e and e	xtract	data fro	om key	bioinf	ormatio	s datal	bases a	ind res	ources
				(C1, C2	2)										
CO 2:				List the	e conce	epts and	d applio	cations	of sequ	lence s	imilarit	y searc	ching ar	nd prov	ride an
				outline	e of the	differe	ent app	roache	s to see	quence	alignm	nent (C	1, C2, C	3)	
CO 3:				Apply	the cor	ncepts o	of phylo	ogeneti	ics to in	fer phy	/logeny	from s	sequen	ces. (C2	2, C3)
CO 4:				Infer t	he diffe	erent le	vels an	d orga	nisatior	n of pro	otein st	ructure	es (C1, C	C2)	
CO 5:					•				nforma				• •		
				-		ction m	apping	, comp	utatior	al gen	e predi	ction a	nd mot	if findir	ng (C1,
				C2, C3	)										
Mappir	ng of C	Os to P	Os												
COs	PO	PO	PO									PO			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	Х														
CO 2	Х		Х			Х				Х					



(A constituent unit of MAHE, Manipal)



									NSPIRED BY	(Deemed t	o be University i	nder Section 3 of th	ve UGC Act, 19	56)		
CO 3	Х		Х			Х				Х						
CO 4	Х									Х						
CO 5	Х		Х			Х				Х						
Course	conte	nt and	outcom	es:			-	-								
Conten	t						Сотр	etencie	s					No c	of Hou	urs
Unit 1:															-	
goals classific and ex databa	and a cation tract in ses.	applicat of biol	tion o logical	f bioi databa	ases: Sco informa ases, loo cus on N	tics, cate	NC hov bio	of diffe BI, and v to loc informa , C2)	other cate an	resou d extra	rces a ict dat	and exp ta from	plain i key	11		
Unit 2:														1		
scoring similari	g mat ity sea	rices arches	(PAM	and ng pa	homol BLOSU irwise	JM),	sec pro app	the o Juence vide a proache C3)	simil an out	larity tline c	searc	ching e diffe	and erent	9		
Unit 3:																
	of trees,	tree co	onstruct	-	phylog ethods,	-		oly the er phylo						5		
Unit 4:																
proteir and te visualiz tertiary	n struct ertiary ation, y struct	ture ba struct second	isics, pi ures, j lary stri	rimary, proteir ucture	databa secono struct predict	dary ture		er the d protein				organisa	ation	10		
Unit 5:																
Compu primer predict	desi	al biolo gning,		strictio putatic	n mapp onal g	oing, gene	of cor	ntify informa primer nputati ling (C1	desig onal ge	n, rest ene pre	for t rictior	n map	pose ping,	10		
Learnir	ng strat	egies,	contact	hours	and stu	Ident	learni	ng time								
Learnir	ng strat	egy					Contac	t hours			St	udent l	earnii	ng tim	e (Hr	s)
Lecture	ē						45				13	85				
Semina	ar															
Small G				))												
Self-dir																
Proble	m Base	d Learr	ning (PB	L)												
Case Ba	ased Le	arning	(CBL)													
Clinic																
Practic	al															
Revisio	n															
	ment	-	_	-			05	-			-					
Assessi							50				13	85				
Assessi TOTAL																
		/lethod	s:													



(A constituent unit of MAHE, Manipal)



	$\sim R_{\rm ED}  {\rm set}^{\rm VV}$ (Deemed to be University under Section 3 of the UGC Act, 1956)							
Class tests				Sessional examination				
Assignments/presentat	ions			End sem	ester examinati	on		
Quiz								
Mapping of assessment	t with CO	S						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5		
Sessional Examination		Х	х	x	х			
Quiz		NA	NA	NA	NA	NA		
Assignment/Presentation	on	Х	х	x	х	x		
End Semester Examinat	ion	Х	х	x	х	х		
Laboratory examinatior	1	NA	NA	NA				
Feedback Process	• 6	End-Semeste	er Feedback					
	NationXxxxninationXxxxNANANANANA							

Name of the	Program:	B.Sc. Biotechnology (Honours)					
Course Title	:	Immunology (Theory)					
Course Code	e: BBT 210	Course Instructor: Course In-charge					
Academic Ye	ear: 2023 onward	s Semester: II Year, IV Semester					
No of Credit	s: 3	Prerequisites: Qualified previous semesters as per regulations					
Synopsis: This course provides knowledge on the basic principles of immunology, the role and function of immune cells and different types of immunity, the generation of immunity, their importance invarious conditions such as autoimmune disorders, immunodeficiency syndromes, and other diseases, various assays related to antigen-antibody reactions synthesis and in various other disciplines including production of monoclonal antibody techniques.							
Course Outo	omes (COs): Or	successful completion of this course, students will be able to					
CO 1:	Le	arn the major milestones and basic concepts in the field of immunology (C1, C2)					
CO 2:		illustrative description of immune cells and lymphoid organs of the immune stem. (C1, C2, C3)					
CO 3:	CO 3: Understanding inflammatory mediators, acute and chronic inflammation including leukocyte recruitment, and trans-endothelial migration (C1, C2, C4)						
CO 4: Compare and contrast antigens, haptens and superantigens. Understanding antigen-antibody reactions and techniques (C1, C2, C3)							





CO 5:			Understanding antibody structure, classes, functions, and c technology (C1, C2, C3, C5).										versity. Hybridom					
CO 6:					<u> </u>			icture :	and fu	oction	Antigo	n nroco	ssing a	ssing and				
000.				presenta							-	•	Song	inu				
Mapping	of COs	to PO				70000	. 8		. ejeet	0.10 (0.	_,, <							
COs	РО	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	РО 13	PO	PO			
CO 1	1 x	2 X	3 X	4         5         6         7         8         9         10         11         12         1										14	15			
CO 2	X	^	x		х													
CO 3	x		x															
CO 4	x		x															
CO 5	x		x															
CO 6	X																	
Course co	ntent	and ou	tcome	es:														
Content			Con	npetenc	ies								No	of Ho	urs			
Unit 1:				-														
Historical	storical background Milestones of immunology. General introduction to the innate and									d	2							
& Basic co	oncept	pts adaptive immune system (C1, C2)																
Unit 2:																		
Immune cells & Cells and organs of the immune system -Thymus, bone marrow																		
Lymphoid	ymphoid organs spleen, lymph node. T and B lymphocytes. Origin, activation,							١,										
			diffe	erentiat	ion, ch	aracte	ristics a	and fun	ctions	Natur	e of T a	nd B ce	II					
			surf	ace rec	eptors	(C1, C2	2, C4, C	6)										
Unit 3:																		
Inflamma	tion			te and diators, C3)						•								
Unit 4:				,														
Cytokines	&		Cyto	okines,	Proper	ties,	functio	ns and	d class	sificatio	on of	cytokin	e	4				
Complem			-	ilies. Int	-													
			Con	nplemei	nt cor	npone	nts a	nd bi	ologica	al cor	nseque	nces c	of					
			com	nplemer	nt activ	ation.												
			(C1	, C2, C4	<i>,</i> C6).													
Unit 5:																		
Immunog	lobulir	IS		icture		-			-					8				
				ogical a			•		•			0						
			-	es and		-	-			-	moral	and cel	I-					
			med	diated ir	nmune	respo	nses (C	.1, C2,	C3, C6									
Unit 6:	<b>F</b>				4 a . I				<b>C</b>			ي الم	<u></u>	-				
Antibody	Engine	ering		ridoma			•							4				
			C3)	ir applic	สมบทร.	ANUD	ouy all	reisity		355 SWI	conng	(UI, U2	<u>,</u>					
Unit 7:			[[[]]]															
Antigens,	Antigo	n-	Anti	igens,	Supe	rantige	nc	Adjuva	ints	٨٣	ntiaon-	antibod	v	4				
antibody i	-		inte Imn Agg	ractions nunodif lutinatio	s: Antik fusion on rea	oody at and actions	ffinity a Imi	and avi munoe	dity, P lectrop	recipita horesi	ation r s te		5: 25	4				
Unit 8:				tion (C2				00 -										





						Deemed to be University under Sec				
Transplantation Immunology	MHC mole restriction	cules. Co and its ro ssing and	bility Comple ongenic and ble in immun presentation	inbr e res	ed stra sponse,	ins of mice	. MHC	3		
Unit 9:										
Hypersensitivity	Mediated ( Reactions	Type I) a Immune	ctions; Gell nd Ab - meo – complex-r ypersensitivit	diateo nedia	d (Type ated (T	II) Hyperse ype III) and	nsitivity	3		
Unit 10:										
Immune Tolerance,	Immune to	erance: C	entral and pe	eriphe	eral tole	erance of T c	ells and	4		
Autoimmunity, &	B cells.	Autoimmu	unity; Defini	ition,	etiolo	gical factor	rs and			
Immunodeficiency	Autoimmur	ie disorde	ers (C1, C2, C3	s, C4)						
Unit 11:										
Immunization &	mmunization & Types of immunity – Innate and adaptive and immunization and									
vaccination	vaccines and vaccination. Immune deficiency and its associated disorders.(C1, C2, C3, C5)									
Learning strategies, cor	ntact hours a	nd studer	nt learning tir	ne						
Learning strategy	earning strategy					Studer	nt learning	time (Hrs)		
Lecture			45			135				
Seminar										
Small Group Discussion	(SGD)									
Self-directed learning (S	DL)									
Problem Based Learning	g (PBL)									
Case Based Learning (Cl	BL)									
Clinic										
Practical										
Revision										
Assessment			05			-				
TOTAL			50 1				135			
Assessment Methods:					1					
Formative:					Summ					
Class tests						nal examinat				
Assignments/presentat	ons				End se	emester exan	nination			
Quiz										
Mapping of assessment	t with COs									
Nature of assessment		CO 1	CO 2	CC	) 3	CO 4	CO 5	CO 6		
Sessional Examination	Sessional Examination x				х	х				
Quiz	х	х		х	х	x	х			
Assignment/Presentation		Х	х		х	х	x	х		
End Semester Examinat	ion	х	х		Х	х	x	х		
Laboratory examination		NA	NA		NA	NA	NA	NA		
Feedback Process	• End-S	Semester	Feedback							
Reference Material	•		Immunology, oldsby (Autho	•	homas	J. Kindt (Aut	hor), Barba	ara A. Osbor		





• Basic Immunology: Functions and Disorders of the Immune System 6th Edition by
Abul K. Abbas MBBS (Author), Andrew H. Lichtman MD PhD (Author), Shiv Pillai
MBBS PhD (Author)
• Review of Medical Microbiology and Immunology, Sixteenth Edition 16th Edition by
Warren Levinson (Author)
• Roitt's Essential Immunology (Essentials) 13th Edition by Peter J. Delves (Author),
Seamus J. Martin (Author), Dennis R. Burton (Author), Ivan M. Roitt (Author)

Name of the Program:				В	B.Sc. Biotechnology (Honours)										
Cours	e Title:				C	Cell and Tissue Engineering (Theory)									
Cours	e Code	: BBT 2	12		C	Course Instructor: Course In-charge									
Acade	emic Ye	ar: 202	3 onwa	nrds	S	Semester: II Year, IV Semester									
No of	Credits	s: 3			Prerequisites: Qualified previous semesters as per regulations										
Synop	osis:		The o	objectiv	ves of t	this course are to acquaint the students with fundamentals of cell and									
			tissu	e engir	neering, to provide fundamental knowledge of various tools and techniques										
used in cell biology and tissue engineering, and to underst								dersta	nd the c	oncep	ts of st	em cell			
biology and its applications															
Cours	Course Outcomes (COs): On suc						npletio	n of thi	s cours	e, stuc	lents w	ill be ab	le to		
CO 1:				Exp	olain va	rious t	echniq	ues in	cell bio	ology t	o a) se	eparate	cells b	) to ev	/aluate
				cel	ular fu	nctions	and c)	outline	cell im	morta	lization	technic	ques (C	C1, C2, (	23)
CO 2:				Exp	lain or	igin, fea	atures a	and app	licatior	ns of st	em cel	ls (C2, C	3)		
CO 3:				Dis	tinguisl	h the	various	types	of DI	VA da	mages	and ill	ustrate	DNA	repair
mechanisms (C2, C4)															
CO 4:					-	inciples				-					
CO 5: Explain applications of tissue engineering in the field of medicine															
(C1, C2)															
CO 6:				Illu	strate e	ethical i	ssues r	elated	to tissu	e engi	neering	g (C2)			
Марр	ing of (	COs to I	POs												
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
										10	11	12	13	14	15
CO 1	×			×											
CO 2	×			×											
CO 3	×		×		×										
CO 4	×			×											
CO 5	×		×												
CO 6	×														
Cours	e conte	ent and	outcor	nes:											
Conte				Compe	etencies	s							No o	f Hours	
Unit 1	.:														
Introd	luction,	, princip	oles	• Def	ine and	explair	n princi	ples an	d meth	odolog	gy for is	olating	5		
	ethodo			and	charac	terizing	g prima	ry (C1,	C2)						
isolation and • Explain various cell separation techniques (C2, C3)															
	cterizat			• Ider	ntify ce	llular pl	nenoty	pes usir	ng flow	cytom	etry (C	3)			
· ·	ry cells														
Unit 2													1		
		id met								•		nctions	6		
for an	imal ce	ell cultu	re			•			•	•	-	oxicity,			
				mig	ration,	adhesi	on, apo	ptosis,	cell cyc	le ana	lysis (C	2)			
Unit 3	:														





-										
Cell Immortalization		and exp alizing cells	lain differe (C1, C2)	nt techniq	ues used	for 4				
Unit 4:						1				
Stem cell biology	Define a	ind explain	general con	cepts of ster	n cell biolog	y 12				
	Define a	nd disting	uish features	of embryon	ic stem cells	and				
	adult ste	em cells (C	2 <i>,</i> C3)							
	• Evaluate	e the impo	rtance of the	erapeutic str	ategies of s	tem				
	cells and	d outline bi	ioethics of st	em cell tech	nology (C2, (	(3)				
Unit 5:										
Introduction, principles	s of 12									
and methods in tissue	nd methods in tissue cells, biomaterials and 3D printers (C2)									
engineering	engineering  • Outline the applications of tissue engineering									
	constructing models of various tissues (C2)									
Unit 6:										
Bioreactors	3									
Unit 7:										
Regulatory and ethical	Outline	regulatory	and ethical	issues in tis	sue enginee	ring 3				
ssues in tissue (C1)										
ngineering										
Learning strategies, conta	ict hours and	l student l	earning time							
Learning strategy		Со	ontact hours		Student	learning tin	ne (Hrs)			
Lecture		45	5		135					
Seminar										
Small Group Discussion (S	GD)									
Self-directed learning (SDL	_)									
Problem Based Learning (I	PBL)									
Case Based Learning (CBL)	1									
Clinic										
Practical										
Revision										
Assessment		05	5		-					
TOTAL		50	)		135					
Assessment Methods:										
Formative:				Summa						
Class tests				Sessiona	al examination	on				
Assignments/presentation	15			End sem	nester exami	nation				
Quiz										
Mapping of assessment w	/ith COs		T	T	T	1				
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6			
Sessional Examination		Х	х		х					
Quiz	NA	NA	NA	NA	NA	NA				
Assignment/Presentation	х	х	х	х	х	х				
End Semester Examination					х	х	x			
Laboratory examination		NA	NA	NA	NA	NA	NA			
Feedback Process •	End-Se	emester Fe	edback							





Reference Material	<ul> <li>Freshney. Culture of Animal cells: a manual of basic and specialized application. 2016.</li> <li>7th edition, Willey Blackwell Publishers.</li> </ul>
	<ul> <li>Shay Fisher. Cellular and tissue engineering: concepts and application. 2016. World Scientific Publishers.</li> </ul>
	• Ulrich Meyer, Thomas Meyer, Jorg Handschel, Hans Peter Wiesmann. Fundamentals of Tissue Engineering and Regenerative Medicine. 2013. Springer Publishers.
	• David Warburton. Stem Cells, tissue engineering and regenerative medicine. 2015. World Scientific Publishers

Name	of the	Progra	im:		B.Sc	. Biote	chnolo	gy (Hor	nours)						
Cours	e Title:				Pha	rmacol	ogy an	d Pharr	nacoge	enomic	s (Prac	tical)			
Cours	e Code	: BBT 2	14		Cou	rse Ins	tructor	: Cours	e In-ch	arge					
Acade	emic Ye	ar: 202	23 onw	ards	Sen	nester:	ll Year,	IV Sen	nester						
No of	Credits	: 1			Prerequisites: Qualified previous semesters as per regulations										
Synop	Synopsis:       The objectives of administration; to drug induced cell demonstrations; to DNA sequencing pharmacogenomic         Course Outcomes (COs):       At t					e skills cy; to e skills advanc tanding	to dem underst to use ed hig g.	onstrat and th PCR ba gh thr	te the ne pha sed tec oughpu	various rmaco chnique ut mo	s proce logical es to de lecular	ss of p princip etect ge	harmad bles us enetic v	cokineti ing cor variation	ics and mputer ns; and
Cours	e Outco	omes (	COs):	At	the enc	l of the	course	studer	it shall	be abl	e to:				
ad					now about lab animals and to understand different mode of drug Iministrations (P1, P2)										
CO 2: Lea					irn and ., P2)	demon	strate	the skil	to test	t the d	rug con	centra	tion in l	oiologic	al fluid
CO 3: Der					pemonstrate the skills in performing in vitro pharmacokinetics studies related to toxicity, drug release (P1, P2, P3)										
CO 4: Unc					Understanding and performing skills and knowledge about the use of PCR based methods in pharmacogenomics (P1, P2, P3)										
CO 5:						nding a g in pha	•		-			dge ab	out the	e use c	of DNA
CO6				for	Understand usage of different high throughput technologies (NGS, Microarray) for personalised medicine and to broadly understand analysis and interpretation of outcomes (P1, P2, P3)										
Марр	ing of (	COs to	POs												
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	PO 12	PO 13	РО 14	РО 15
CO 1	×														
CO 2	×														
CO 3	×														
CO 4	×			Х				х							
CO 5	×			×				×				1			
CO 6	х			х				х							
Cours	e conte	ent and	outcor	nes:								•			
Conte Unit 1					Сотре	tencies							No o	f Hours	;
Anima	Animal maintenance, handling and routes of administration				mair	unders ntenanc es of ac	ce, han	dling, a	nimal c	are an	d study	/ of the			





Unit 2:								
<i>in vitro</i> toxicity		emonstrate in nan cell line m	4					
Unit 3:	451161			,,				
Pharmacokinetic	Demonst	rate the drug r	elease in vitr	o (P1. P2. P3)	2			
measurements of drugs				- ( ) / - /				
Unit 4:					•			
Detection of drug	• Skills t	o demonstra	ate detecti	ion of drug	4			
concentration in biological	concentr	ation in biologi	cal sample (P	P1, P2, P3)				
sample		_						
Unit 5:								
Polymerase Chain Reaction	• Using the	e polymerase	Chain Reacti	ion (PCR) based	6			
(PCR) techniques	techniqu	es like PCR-	RFLP for id	lentifying SNPs				
	ıg (P1, P2, P3)							
Unit 6:								
DNA sequence analysis to	Understa	nd how Sang	er sequencin	ng is performed	6			
identify pharmacogenomic	and a bro	oad understand	ling of workfl	ow and how the				
variations.								
Unit 7:								
Microarrays and testing	Understa	nd how the	microarray o	can be used in	4			
genome wide association of	pharmac	ogenetic (P1, P	2, P3)					
SNPs								
Learning strategies, contact ho	urs and stude							
Learning strategy		Contact hours		Student lear	rning time	e (Hrs)		
Lecture								
Seminar								
Small Group Discussion (SGD)								
Self-directed learning (SDL)								
Problem Based Learning (PBL)								
Case Based Learning (CBL)								
Clinic								
Practical		30		90				
Revision								
Assessment		07						
TOTAL		37	90					
Assessment Methods:				-				
Formative:			Summa					
Class tests				al examination				
Assignments/presentations			End sen	nester examinati	on			
Quiz								
Mapping of assessment with C	Ds							
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Examination	X	Х	Х	X				
Quiz	NA	NA	NA	NA	NA	NA		
Assignment/Presentation	NA	x	NA	x	NA	NA		
End Semester Examination			+	+ +				





Laboratory examinati	on	Х	х	х	х	х	х			
Feedback Process	• End	-Semester Fe	eedback		•					
Reference Material	<ul> <li>Badyal D. Medical F</li> <li>Medhi B. Jaypee B</li> <li>Sambroo Cold Sprii</li> </ul>	., Practical M Publishers 20 and Prakash rothers Medi k J and Russ ng Harbor La	lanual of Pha 18 A, Practical N cal Publisher el DW. Mole boratory Pre	Aanual of Exp s, 2017 ecular Clonin ss, Cold Sprir	or Medical St perimental ar g: A laborato ng Harbor, Ne ular Biology	nd Clinical Pha pry manual ( ew York, 200	armacology, 3rd Edition) 1.			
	<ul> <li>Walker, John M. (Series Ed.) Methods in Molecular Biology, Springer Nature 20</li> <li>Head S.R., Ordoukhanian P., Salomon D.R. (Eds.) Next Generation Seque Methods and Protocols. Springer Nature 2018.</li> </ul>									

Name of the Program:					B.Sc.	B.Sc. Biotechnology (Honours)											
Course							-	gy (Pra									
Course	Code:	BBT 21	L6			Course Instructor: Course In-charge											
Acade	mic Yea	r: 202	3 On	wards	Sem	Semester: II Year, IV Semester											
No of	Credits:	1			Prer	Prerequisites: Qualified previous semesters as per regulations											
Synop	sis:	This	modu	ule helps	to understand the practical applications of Plant Biotechnology, to provide												
		fund	amer	ntal knov	wledge on concepts of plant tissue culture, influence of types of nutrient												
		med	ia an	d growth	n regulators, and to understand the fundamental tools and technology for												
		plan	t, cell	, tissue a	nd orga	d organ culture and promote large-scale propagation of disease free plants.											
Course	Outco	On succ	cessful	essful completion of this course, students will be able to													
CO 1:	Outline	the m	ethods	for pre	paratio	n of op	otimal r	nedia f	or exclu	usive pl	ant spe	ecies					
CO 2:				Demon	stratio	n of va	rious r	nethod	s to pr	ocess a	and pe	rform t	he exp	erimer	it with		
				various	explar	its and	learnin	g meth	ods to	develo	p disea	se free	plants.				
CO 3:				Explain	the fu	undame	entals (	of som	aclonal	and g	ameto	clonal	variatic	ons and	d their		
				impact	on tr	ait imp	provem	ent of	plant	s and	discus	s and	illustra	te the	plant		
				metabo	olite ide	entificat	ion an	d produ	uct scal	e up st	rategie	s					
CO 4:				Discuss	s the nature of explants and the proliferation capacities for different plant												
				species	es, and comparative analysis of organogenetic and somatic embryogenic												
				potenti	als												
CO 5:				Conclue	de and	combin	e the r	ole of e	each ex	perime	nts in r	elation	with pl	ant bre	eding,		
				biotech	nology	and ag	ricultu	re									
CO 6:				Creatin	g soma	itic hyb	rids an	d cybrid	ds with	protop	last iso	lation a	and fusi	ion			
Mappi	ng of C	Os to P	Os														
COs	PO	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
CO 1	×	х															
CO 2	×	х		х				х					х	х			
CO 3	×	х			Х										х		
CO 4	×	х		×		х						х					
CO 5	×	х															
CO 6	×	х								×			х		х		
Course	e conter	nt and	outco	omes:													
Conter	nt			Compe	tencies								N	o of Ho	ours		
Unit 1																	
Asepti	c tran	sfer	and	• Defir	ne and	explai	n plar	it tissu	e culti	ure cor	ncept,	import	ant 2				
	e steril			miles	stones	(C1, C2	)										
explan	ts a	nd I	DNA														





	$V_{2p_{TR}_{ED}} \propto V^{V}$ (Deemed to be University under Section 3 of the UGC Act, 19	
isolation from plants raised aseptically <b>Unit 2:</b>	<ul> <li>Understanding the types of plant tissue culture and its impact on agro-economic productivity (C2,C4)</li> <li>Understanding the types of chemicals and the role in DNA isolation (C2,C4)</li> <li>Defining and explaining the protocol of DNA isolation (C1, C2)</li> </ul>	
Preparation of different nutrient media (MS, White, B5 media)	<ul> <li>Provide effective methods for media preparation (C2)</li> <li>Explain media constitution (C2, C5)</li> <li>Computing the strength of salts (C2)</li> <li>Explain the methods of preparation of stock and working concentration (C2, C5)</li> <li>Identification of elite media and growth hormone combinations ideal for plants (C2, C5)</li> </ul>	2
Unit 3: Initiation of static cultures from different explants (root tip, shoot tip, leaf primordial, flowers)	<ul> <li>Classify the types of explants comparing their regeneration potential (C2)</li> <li>Estimate and compare the output of plantlets from various explants (C5, C6)</li> </ul>	4
Unit 4: Understanding the preparation of growth regulators and their combinatorial effects	<ul> <li>Define the fundamentals of stock preparations and storage (C1, C2, C5)</li> <li>Explain the preparation of natural and synthetic growth regulator impact on plants (C2, C5, C6)</li> <li>Demonstrate the potential applications of crop &amp; horticultural improvement (C2).</li> <li>Outline the mechanism of function of growth regulators (C2)</li> <li>Analyse the proliferative properties of growth regulator combinations(C4)</li> </ul>	2
Unit 5: Establishment of suspension cultures		4
Unit 6: Protoplast Isolations from plant tissue	<ul> <li>Knowledge on isolation of protoplasts (C1, C2)</li> <li>Viability assessments in protoplast</li> <li>examples of stains for assessing the heath of protoplasts (C2, C4)</li> </ul>	4





	1			University under Section 3 of the UGC Act, 19.					
Unit 7:	Understanding	<ul> <li>Characterization of health and yields of isolated protoplasts(C</li> <li>Understanding the heterogeneous properties and doubli time in protoplasts (C1, C2)</li> </ul>							
					6				
Protoplast fusion techniques	<ul> <li>Illustrate the me</li> <li>Demonstrate the creating and sele</li> <li>Analyze and corr</li> </ul>	<ul> <li>Define use of fusogens and the types (C1,C2)</li> <li>Illustrate the mechanism of fusion in protoplasts and types (C2)</li> <li>Demonstrate the methods for chemofusion and its role in creating and selecting hybrids, cybrids and heterokaryons (C2)</li> <li>Analyze and compare the protoplast fusion techniques and it capacity to develop trait improvement in crops (C4, C5)</li> </ul>							
Unit 8:	•								
Establishment of Hairy root cultures	<ul> <li>Explain the mornormal roots (C2</li> <li>Illustrate the confirmation via plant biotechnol</li> <li>Explain the pote and its commerce</li> <li>Discuss the transplant the transpl</li></ul>	mechanism of h molecular analysis	ces between hairy root and how it w f hairy root o C5) employed by	induction, its as exploited by culture in plants plant scientists	4				
Unit 9:									
Analysis of secondary metabolites obtained from plant tissue using Thin layer chromatography	<ul> <li>Explain the prep development of</li> <li>Explain the infor</li> <li>Explain the difference</li> </ul>	ethods of Thin layer paration of plant ext TLC plates (C2,C5) mation given by a T erences in a chrom implicity and inform	tract , loadir LC plate (C2 atography e	ng principle and 2,C5) xperiments yet	2				
Learning strategies, conta	act hours and studer	nt learning time							
Learning strategy		Contact hours		Student learnin	g time (Hrs)				
Lecture									
Seminar Small Group Discussion (S Self-directed learning (SD	L)								
Problem Based Learning (	· · · ·								
Case Based Learning (CBL	)								
Clinic									
Practical		30		90					
Revision									
Assessment		07		-					
TOTAL		37		90					
Assessment Methods:									
Formative:			Summativ	e:					
Class tests			Sessional e						
Assignments/presentation	ns		End semes	ter examination					
Quiz									



Г



Mapping of assessment	with COs						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination		Х	х	х	х		
Quiz		Х	х	х	х	x	х
Assignment/Presentatio	n	Х	х	x	x	x	х
End Semester Examinati	on						
Laboratory examination		Х	х	х	х	х	х
Feedback Process	• En	d-Semester	Feedback				
Reference Material	Universi Micropr Publishe Plant Ce Plant M Plant M Plant M Plant Ti 2nd Ed. Plant Ti Amstere	ity Press opogation ers, Dordrec ell Culture: A olecular Bic olecular Bic osue Cultur CRC press. ssue Culture ssue Culture dam.	<ul> <li>Debergh</li> <li>blogy – Gold</li> <li>blogy – Gold</li> <li>blogy - Griers</li> <li>e – Concept</li> <li>e Manual – L</li> <li>e: Application</li> </ul>	PC, Zimme pproach - Dix berg RB – 19 son D, Covey s and labora indsey K – 19 ons and limit	rman RH – kon RA, Gonz 83 - Allan R L SN - Blackie, atory exercis 991- Kluwer	1990 - Kluv ales - IRL Pre iss Inc. New London. e – Trigiano Academic Pu bjwani SS – 1	York. & Gray, 1999, bl, Dordrecht 990 - Elsevier,

Name o	f the Pi	ogram	<b>:</b>		В.	Sc. Biot	echno	logy (H	onours	5)						
Course 7	Title:				Bi	oinforn	natics (	Practic	al)							
Course (	Code: B	BT 218	3		Co	ourse In	structo	or: Cou	rse In-o	charge						
Academ	ic Year	: 2023	onw	ards	Se	emester	: II Yea	nr, IV Se	emeste	r						
No of Cr	edits: 1	L			Pr	rerequis	sites:	Qualifie	ed prev	vious se	emeste	ers as p	er regu	llations	5	
Synopsis	s:	This	prac	tical cou	rse wi	ll provid	de trair	ning in	usage	of bioir	nforma	tics too	ols and	databa	se for	
		life	sciend	e reseai	ch and	d educa	tion.									
Course (	Outcon	nes (CC	Ds):	On suce	n successful completion of this course, students will be able to											
CO 1:				Extract	tract data from specific databases using accession, gene symbols, keywords and											
				also bu	so build an advanced search query for performing the same (C1, C2, C3).											
CO 2:				Apply	pply the sequence alignment techniques to infer homology and perform											
				phyloge	hylogenetic analysis (C1, C4)											
CO 3:						a visuali:				-					logical	
					atabases using a graphical interface and also download the same (C1, C2)											
CO 4:				-	entify and apply the tools to predict the secondary structures of protein equences and 3D structure visualization (C2, C3)									rotein		
											-					
CO 5:						quence		dentific	ation o	of restr	iction	sites, v	irtual o	digestic	on and	
				designi	ng prir	mers (C2	2, C3).									
Mappin	g of CO	s to PC	Ds			_										
COs	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CO 1	Х		Х							Х						
CO 2	Х				Х	Х				Х						
CO 3	Х			Х						Х						
CO 4	Х				Х	Х				Х						





CO 5 X	Х						Х							
Course content and outcomes:														
Content	Com	petencie	s									No	of Hou	ırs
Unit 1:													,	
Exploring biological databases (Nucleotide - Genbank, Gene, Pathways - KEGG, Literature - PubMed), Drug Bank and PubChem	ge	tract da ne sym arch que	bols,	keywo	ords	and	also	build	d an	adva	anced	4		
Unit 2:	T													
Sequence alignment: Sequence alignment techniques: Pairwise (BLAST), Multiple (CLUSTAL), phylogenetics (MEGA).	-	oply the mology				-			-			4		
Unit 3:	1											<b>1</b>		
Genome Browsers: Application and functionality of UCSC genome browser.	da	ake use ta fror aphical i	n dif	ferent	bi	ologi	ical	datab	ases	usi	ng a	6		
Structural bioinformatics: Secondary structure prediction, PDB and Visualization of protein structures using DeepView,	sti	entify a ructures sualizati	of	protei			•				•	8		
Unit 5:														
Computational biology: Primer designing using Primer3 and <i>in</i> <i>silico</i> PCR, <i>In silico</i> Restriction mapping using NEBCutter	sit	ilize the es, virtu	ial dig	gestion								8		
Learning strategies, contact hours a	nd stu	dent lea	arning	g time										
Learning strategy		Conta	ct hou	ırs					Stud	ent le	earning	g tim	e (Hrs)	1
Lecture														
Seminar														
Small Group Discussion (SGD)														
Self-directed learning (SDL)														
Problem Based Learning (PBL)														
Case Based Learning (CBL)														
Clinic														
Practical		30						!	90					
Revision														
Assessment		07							-					
TOTAL		37							90					
Assessment Methods:		l												
Formative:						Su	ımma	tive:						
Class tests						Se	ssion	al exa	amin	atior	ו			
Assignments/presentations						En	nd ser	neste	er exa	amin	ation			
Quiz														
Mapping of assessment with COs														
Nature of assessment	<u> </u>	D 1		CO 2			CO 3	3		CO	4		CO 5	
			L	55 2		L		-			•	1	22.2	





Sessional Examination		Х	x	х	x	
Quiz		NA	NA	NA	NA	NA
Assignment/Presentation	n	Х	x	х	х	x
End Semester Examination	on					
Laboratory examination		Х	x	х	х	х
Feedback Process	• E	nd-Semester Fe	eedback			
Reference Material	<ul> <li>Innis, Press.</li> <li>Vincze with https:,</li> <li>Wisha &amp; Has: drug https:,</li> <li>Berma Shindy resear</li> </ul>	David H. Gelfan r, T., Posfai, J., & restriction e //doi.org/10.10 rt, D. S., Knox, C sanali, M. (2008 targets. Nucle //doi.org/10.10 n, H. M., Wes /alov, I. N., & E ch, 28(1), 235–2	de to Methods a d, John J.Sninsk Roberts, R. J. ( enzymes. Nuclei 93/nar/gkg526 C., Guo, A. C., Ch 3). DrugBank: a ic acids res 93/nar/gkm958 tbrook, J., Feng Bourne, P. E. (2 242. https://doi uses and open so	(2003). NEBcutt (2003). NEBcutt ic acids res leng, D., Shrivas knowledgebas earch, 36(Data g, Z., Gilliland, 2000). The Prot i.org/10.1093/r	/hite. Published ter: A program t search, 31(13), stava, S., Tzur, D e for drugs, dru base issue), G., Bhat, T. N. sein Data Bank.	by Academic to cleave DNA 3688–3691. D., Gautam, B., Ig actions and D901–D906. , Weissig, H.,

Name	of the	Progra	m:			B.Sc. Bio	techno	logy (H	onours	5)						
Course	e Title:					Immuno	logy (F	ractica	I)							
Course	Code:	BBT 22	20			Course I	nstruct	or: Cou	rse In-o	charge						
Acader	mic Yea	ar: 202	3 onwa	ards		Semeste	r: II Yea	ar, IV Se	emeste	r						
No of C	Credits	: 1				Prerequi	isites: (	Qualifie	ed prev	ious se	mester	rs as pe	er regul	ations		
Synops	sis:	This p	ractica	l coui	rse wi	ll help to	o undei	rstand	the bas	sic con	cepts a	and var	ious in	nmuno	logical	
		techni	ques tl	hat ir	nclude	antigen-	antibo	dy intei	raction	s, quar	ititatio	n of ar	ntigens	or ant	ibody,	
		ELISA	etc.													
Course	Outco	omes (C	Os):		On su	On successful completion of this course, students will be able to										
CO 1:						Inderstand the basic concepts and would have hands on training for various										
					immu	inologica	l techni	ques. <i>,</i> (	C1, C2,	C3, C4	)					
CO 2:						rstand h	•	•					or the	detect	ion of	
					immu	mmunoglobulin levels in the serum (C1, C2, C3, C4)										
CO 3:						knowledge in estimation of an unknown amount of antigen using										
						mmunoelectrophoresis techniques (C1, C2, C3, C4)										
CO 4:						Understand agglutination reactions to assess the presence of antibodies in a										
						men. (C2,										
CO 5:						rstanding			ng anti	gens a	nd anti	bodies	throug	gh the	assays	
						LISA (C1,										
CO 6:						ing and L		-	•	•		v cyton	netry a	nd estir	nating	
					the ir	nmune ce	ells (Imi	nunopł	nenoty	ping) (C	:1, C2)					
Mappi					_											
COs	PO	PO	PO	PO	PO	_	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CO 1	×	Х	Х	×					ļ		ļ					
CO 2	×	Х		×	x	х										
CO 3	×			×	x			х								
CO 4	×	х	Х	×		х										





CO 5	×	х	Х	×											
CO 6	×	x	X	×		x		x							
Course	conter	nt and	outco	mes:											
Conten	t			Compet	encies									No of H	ours
Unit 1:															
Blood G	Groupir	ng		Hemage	lutinat	ion ass	ay for A	BO blo	od grou	up typir	ng dete	erminat	tion	4	
				of and F	kh facto	or (P1, F	P2, P3,	P4)							
Unit 2:															
Comple	ete bloo	od cour		Determi hemato				•		and le	arn th	e basis	s of	4	
Unit 3:							(	,,.	-,						
Lympho	ocyte			Isolatior	n of lyn	nphocy	tes fro	m per	ipheral	blood	by fico	ll metl	hod	6	
Prepara	ation			and che	cking tl	he viab	ility of	isolate	ed lymp	hocyte	s (P1, F	P2, P3,	Ρ4,		
				P8)											
Unit 4:															
Immun	oprecip	oitatior		Demons							-			6	
assays				of antig								-	-		
				quantita		•				•	-	Immu	no-		
				electrop	phoresis	s of a g	iven sa	mple (I	P1, P2, I	P3, P4,	P6)				
Unit 5:				Damaana	+	<b>af b</b>							+	2	
Aggluti	nation	assays		Demons								n of la	itex	2	
Unit 6:				beads ir	mune	ci aggii	ullialic	11 8558	ys (P1, 1	rz, rs,	P4)				
Enzyme	-linko	d		Determ	ine the	concer	tration	ofant	igen hv	sandwi	ch and	Dot Fl	154	4	
Immun				method					igen by	Sanuw			.157	4	
Unit 7:	030100	111 4550	iy3	method	5 (1 ±, 1	2,13,1	<del>т</del> , т 0,	10)							
Immun	opheno	otypine	Į	Immund	pheno	tvping	of blo	od cel	ls usin	g Flow	Cvtor	netrv a	and	4	
			-	develop	•					-	•	-			
				generat	-				,			•			
Learnin	ng strat	egies,	conta	ct hours	and st	udent	learnin	g time							
Learnin	ig strat	egy				0	Contact	hours			Stuc	lent led	arning	ı time (H	Irs)
Lecture	;														
Semina	r														
Small G	iroup D	iscussi	on (SC	GD)											
Self-dir				-											
Probler				BL)											
Case Ba	ased Le	arning	(CBL)												
Clinic															
Practica						3	0				90				
Revisio															
Assessr	nent						7				-				
TOTAL						3	57				90				
Assessr	ment M	lethod	s:								1				
Format									Su	mmativ	/e:				
Class te										ssional		nation			
Assignn		oresent	tation	s						d seme			tion		
Quiz				-											





Mapping of assessmen	t with COs						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination		Х	х	х	х		
Quiz		Х	x	х	х	х	х
Assignment/Presentati	on	Х	x	x	х	х	х
End Semester Examina	tion						
Laboratory examinatio	n	Х	x	х	х	х	х
Feedback Process	• End	d-Semester F	eedback				
Reference Material	Laborate	ory manual f	or Immunolo	gy experime	nts.		
	<ul> <li>Hay FC Publishin</li> </ul>		ood OMR (2	2003) Practio	cal Immunol	ogy, 4th Ed	., Blackwell

Name of	f the Pr	ogram	n:		B.Sc. Bi	otechn	ology (	Honou	rs)						
Course 1	Title:				Cell and	d Tissue	e Engin	eering	(Pract	ical)					
Course (	Code: B	BT 222	2		Course	Instruc	tor: Co	ourse Ir	-charg	ge					
Academ	ic Year:	: 2023	onwa	ards	Semest	er: II Y	ear, IV	Semes	ter						
No of Cr	edits: 1	-			Prerequ	uisites:	Qualifi	ied pre	vious	semest	ers as	per reg	ulation	S	
Synopsis	5:		-		of this co						•				
				•	eering - to provide fundamental knowledge on techniques involved in isolation										
					tion of p	•			-						0.
					ne vario				cellula	ar funct	tions; a	ind to p	provide	fundaı	mental
				-	nstructi										
Course (	Dutcom	es (CC	Ds):		ccessful										
CO 1:				•	n the pr										erform
					nalian c			<u> </u>						-	
CO 2:				•	ment a				numbe	rs, eva	luate o	cytotox	icity ar	nd cate	egorize
					ased on										
CO 3:					nstrate										
CO 4:				Explai	n princij	oles of	fluores	scence	micros	сору (Г	P5)				
Mappin			1										_		
COs	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×		×		×	×		×							
CO 2	×			×	×			×							
CO 3	×		×	×				×							
CO 4	×					×		×							
Course o		and o	utcor	nes:											
Content					Compet	encies							N	o of Ho	ours
Unit 1:															
Introduc			ign o	f cell	<ul> <li>Expla</li> </ul>		-					e vario	ous 2		
biology	aborate	ory			instr	uments	s used t	o stud	y cells	(P1, P2	, P3)				
Unit 2:															
Animal o	ell cult	ure			• Dem	onstrat	e sub-o	culturir	ig the i	mamma	alian ce	ells (P2)	) 4		
Unit 3:				•											
Retrieva	l and o	cryopr	eserv	ation	• Outli		proces	s of ret	rieval a	and cry	oprese	rvation	of 2		
of cells					cells	(P3)									
Unit 4:															





				-46D	BY LIF (Deemed to be Unive	rsity under Section 3 of the UGC Act, 1	(65)
Cell counting us hemocytometer		opply the mocytor			cell cou	nting using	4
Unit 5:							•
Cytotoxicity assays (MTT assa	iy) • A	nalyse cy	totoxicity	using MT	Гassay (Р4)		2
Unit 6:	-			-			•
Flow cytometry- Principles an		• •	•		metry (P2)		4
concept, and (a) Cell cycle analysis (b) Immunophenotyi		valuate c ising flow	•	•	id identifica	ation of cells	
Unit 7:							
Fabrication of nano-fibro scaffold	ous • L	Inderstan	ding the p	orinciples o	of electrospi	nning (P2)	2
Unit 8:							
3D culturing using scaffolds		valaia ma	thede in	in a line of the office of the		and avaluate	6
SD culturing using scanolus	it	•				and evaluate t generation	0
Unit 9:		<u> </u>					
Fluorescence microscopy		xplain pr nicroscop	•	and appli	cations of	fluorescence	4
Learning strategies, contact l				time			
Learning strategy			Contact			Student lear	ning time (Hrs)
Lecture							<u> </u>
Seminar							
Small Group Discussion (SGD)	)						
Self-directed learning (SDL)							
Problem Based Learning (PBL	)						
Case Based Learning (CBL)	1						
Clinic							
Practical			30			90	
Revision			50			50	
Assessment			07			-	
TOTAL			37			90	
Assessment Methods:							
Formative:					Summativ	-	
Class tests						xamination	
Assignments/presentations					End semes	ter examinatio	on
Quiz							
Mapping of assessment with	COs						
Nature of assessment	-	CO	1	CO 2	2	CO 3	CO 4
Sessional Examination		X		x			
Quiz		N		NA		NA	NA
Assignment/Presentation		X		X		x	X
End Semester Examination							
Laboratory examination		Х		х		х	Х
Feedback Process •	End	-Semeste			1		
Reference Material •	Freshney	. Culture	of Animal			sic and special	ized application.





• Shay Fisher. Cellular and tissue engineering: concepts and application. 2016.
World Scientific Publishers.
• David Warburton. Stem Cells, tissue engineering and regenerative medicine.
2015. World Scientific Publishers.
• Harris, Graham and Rickwood. Cell biology protocols. 2006. Wiley & Sons., Ltd.

• Harris, Graham and Rickwood. Cell biology protocols. 2006. Wiley & Sons., Ltd.

Name of	ame of the Program: ourse Title: ourse Code: BBT 224 cademic Year: 2023 onwards					. Biote	chnolo	gy (Hor	nours)						
Course 1	Title:				Sem	inar/Jo	ournal (	Club							
Course (	Code: B	BT 224	l I		Cou	rse Inst	tructor:	Cours	e In-cha	arge					
Academ	ic Year	: 2023	onw	ards	Sem	ester:	ll Year,	IV Sem	nester						
No of Cr	edits:	1			Prer	equisit	es: Qu	alified	previo	us sem	esters	as per i	regulat	ions	
Synopsis	s:			se will ir								•			
				This will					-		•			•	
				ion clear	•	concis	sely. St	udents	will a	lso lea	rn how	to co	mpile	the lite	erature
				informa											
Course (	Outcon	nes (CC	)s):			ssful completion of this course, students will be able to noughts and ideas effectively									
CO 1:				•	V										
CO 2:				Demon											
CO 3:						e's views and present complex information clearly and concisely t									sely to
					-	groups									
CO 4:					de on information										
CO 5:						e problem in a concise manner									
CO 6:				Adopt o	challen	ging ta	sks, and	llearn	how to	compi	e and i	nterpr	et data.		
Mappin	ř –					-		-			-				
COs	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1 2 3 4				5	6	7	8	9	10	11	12	13	14	15
CO 1		×													
CO 2		×													
CO 3		×													
CO 4		×													
CO 5		×													
CO 6		×													
Course of	onten	t and o	utcor	nes:											
Content		Сотр	etenc	ries									No of H	lours	
Unit 1:															
Seminar				e will inc				n indiv	idual s	eminar			oral pr	esenta	tion
		<u> </u>		ed to the							for e	ach stu	ident		
Learning	g strate	gies, c	ontac	t hours a	and stu		-								
Learning	g strate	gy					Contac	t hours	i		Stu	dent le	arning	time (H	lrs)
Lecture							-				-				
-	Seminar						15				45				
	Small Group Discussion (SGD)														
-	Self-directed learning (SDL)														
-	Problem Based Learning (PBL)														
Case Bas	Case Based Learning (CBL)														
Clinic															
Practica	ractical														
Revision	l														





Assessment	(	01		-	-					
TOTAL		:	16		45	45				
Assessment Methods:										
Formative:			Summ	Summative:						
Assignments/presentatio	ns			-	-					
Mapping of assessment	with COs									
Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6				
Sessional Examination		NA	NA	NA	NA					
Quiz	NA	NA	NA	NA	NA	NA				
Assignment/Presentation	х	x	х	Х	х	х				
End Semester Examination N			NA	NA	NA	NA	NA			
Laboratory examination NA			NA	NA	NA	NA	NA			
Feedback Process	End-Semester Feedback									
<b>Reference Material</b> Reference Books and Journals articles related to the seminar topic					topics					

Name of the Program:			B.Sc. Biotechnology (Honours)												
Course Title: Course Code: BBT 301			Microbial Biotechnology (Theory)												
				Course Instructor: Course In-charge											
Academic Year: 2022-2023				3	Semest	ter: ۱۱۱ ۱	/ear, V	Semes	ter						
No of Cr	edits:	3			Prereq	uisites:	Quali	fied pro	evious	semest	ters as	per reg	gulation	าร	
Synopsi	s Thi	s cours	se in	troduces	and p	provide	s knov	vledge	in tw	o maj	or fiel	ds of I	biotech	nology	using
:	mic	roorga	nisms	s – food i	ood microbiology and bioprocess engineering.										
Course Outcomes (COs): On suc			On succ	successful completion of this course, students will be able to											
CO 1: Lis			List and	List and describe the sources, types, incidence and significance of microorganisms in											
				food (C	od (C1, C2)										
CO 2: Define			Define	Define and explain major characteristics of food spoilage, and apply suitable											
				preserv	eservation methods to overcome food spoilage (C1, C2, C3)										
CO 3:					etermine methods of culturing microorganisms in food (C2, C4)										
CO 4:				Describ	Describe and apply suitable quality standards for food preservation and understand										
their					their significance (C2, C3)										
CO 5: Defi				Define and describe the fermentation process through description of											
			microorganisms and their improvement, media requirements, fermenter parts and												
,				ypes, and the methods associated (C1, C2) rovide examples for fermentation processes using microorganisms (C2, C3)											
					examp	les for	fermen	itation	process	ses usi	ng micr	oorgan	isms (C	C2, C3)	
Mappin	Ē	1									-				-
COs	PO	PO 2	PO.	3 PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
	1									10	11	12	13	14	15
CO 1	×										-				
CO 2	×							×			-				-
CO 3	×		×												
CO 4	×		×	×	×										
CO 5	×														
CO 6	×									×					
Course	conten	t and o	utcor	nes:											
Content					Co	mpete	ncies							No of H	lours







Unit 1:		
Historical background, predominant	List and describe the sources, types, incidence and	5
microbes in food – bacteria and fungi,	significance of microorganisms in food (C1, C2)	
sources of microbes in food, beneficial		
uses of microbes in food		
Unit 2:		
Factors influencing microbial growth in	Define and explain major characteristics of food	5
food and food spoilage, indicators of	spoilage, and apply suitable preservation methods to	
food spoilage, foodborne diseases	overcome food spoilage (C1, C2, C3)	
Unit 3:	· · · · ·	
Methods to determine food-borne	Compare and analyse methods of culturing	4
pathogens	microorganisms in food (C2, C4)	
Unit 4:		
Methods to control microbes in food –	Outline suitable quality standards for food	4
irradiation, heat, temperature, pH,	preservation and explain their significance (C2, C3)	
water activity, preservatives		
Unit 5:		
Quality assurance in foods, HACCP	Outline suitable quality standards for food	3
principles, biosensors in food industry,	preservation and explain their significance (C2, C3)	-
GM foods		
Unit 6:		
Introduction to Fermentation	Define and explain the fermentation process through	4
	description of microorganisms and their	7
	improvement, media requirements, fermenter parts	
	and types, and the methods associated (C1, C2)	
Unit 7:	and types, and the methods associated (C1, C2)	
Production strains	Define and explain the fermentation process through	4
	description of microorganisms and their	4
	improvement, media requirements, fermenter parts	
	and types, and the methods associated (C1, C2)	
Unit 8:		
Media	Define and explain the fermentation process through	4
incula .	description of microorganisms and their	7
	improvement, media requirements, fermenter parts	
	and types, and the methods associated (C1, C2)	
Unit 9:	and types, and the methods associated (e1, e2)	
Fermenter	Define and explain the fermentation process through	3
	description of microorganisms and their	5
	improvement, media requirements, fermenter parts	
	and types, and the methods associated (C1, C2)	
Unit 10:	ן אות נארכא, אות נווב ווובנווטעא אשטטומנבע (כב, כב)	
Fermentation	Define and explain the fermentation process through	5
	description of microorganisms and their	U.
	improvement, media requirements, fermenter parts	
	and types, and the methods associated (C1, C2)	
Unit 11:	and types, and the methods associated (C1, C2)	
Products of fermentation	Evaluin and identify specific eventues for	Λ
	Explain and identify specific examples for fermentation processes using microorganisms (C2, C3)	4
Loorning strategies, contact hours and		
Learning strategies, contact hours and	student learning time	





Learning strategy			act hours		Student learning time (Hrs)					
Lecture					135					
Seminar										
Small Group Discussio	n (SGD)									
Self-directed learning	(SDL)									
Problem Based Learni	ng (PBL)									
Case Based Learning (	CBL)									
Clinic										
Practical										
Revision										
Assessment		05			-					
TOTAL		50			135					
Assessment Methods	:									
Formative:				Summative:						
Class tests				Sessional e	Sessional examination					
Assignments/presenta	ations			End semester examination						
Quiz										
Mapping of assessme	nt with COs			-						
Nature of assessment CC			CO 2	CO 3	CO 4	CO 5	CO 6			
Sessional Examination	Sessional Examination			×	×					
Quiz										
Assignment/Presentation										
End Semester Examina	End Semester Examination ×			×	×	×	×			
Laboratory examination	on	NA	NA	NA	NA	NA	NA			
Feedback Process	End-Semester Feedback									
<b>Reference Material</b>	• Adams MR, Moss MO. Food Microbiology (3rd ed.), RSC Publishing, Cambridge 2000									
	• Frazier WC, Westhoff DC. Food Microbiology (4th ed.), Tata McGraw-Hill Publications,									
	2008									
	Ray B. Fundamental Food Microbiology (3rd ed.), CRC Press, Boca Raton, 2005									
	• Stanbury PF, Whitaker A, Hall SJ. Principles of Fermentation Technology (2nd ed.),									
	Butterworth-Heinemann, 1995									
	• Shuler ML, Kargi F. Bioprocess engineering - Basic concepts, Prentice Hall, 1992									
	<ul> <li>Patel AH. Industrial Microbiology, Macmillan India Press, 2000</li> </ul>									

Name of the Program:			B.Sc. Biotechnology (Honours)					
Course Title:			Developmental Biology (Theory)					
Course Code: BBT 303			Course Instructor: Course In-charge					
Academic Year: 2023 onwards		rds	Semester: III Year, V Semester					
No of Credits: 3			Prerequisites: Qualified previous semesters as per regulations					
Synopsis:	The objectives of this course are to acquaint the students with the basics of Developmental							
	biology, I	knowledge	e of early, late, and post-embryonic development, the role of					
	parthenog	enesis, r	egeneration, and their applications, the medical implications of					
	developmental biology, and also the role of stem cells and their applications in biotechnolog							
Course Outcomes (COs): On succe			essful completion of this course, students will be able to					
CO 1: Explain			the concepts of development and the process of spermatogenesis &					
oogenesi			is, and patterns of development (C2, C5)					





				Explain the process of pre- and post-embryonic development including organ											
				systems (C2, C5)											
CO 3:				Illustrate the embryogenesis (somatic and zygotic) in plant systems (C2)											
CO 4:				Explain different types of parthenogenesis and the significance of parthenogenesis											
				in plants and animals (C2, C5)											
CO 5:				Explain the phenomena of regeneration (stem cells) and its applications (C2. C5) Discuss the medical implications of developmental biology including teratogenesis,											
CO 6:						nedical al defe	•			•			-	-	enesis,
Mappin	ĭ														
COs	РО 1	РО 2	PO 3	РО 4	РО 5	РО 6	PO 7	РО 8	РО 9	PO 10	PO 11	РО 12	РО 13	РО 14	PO 15
CO 1	×	2		-	5	0	/	0		10	11	12	15	17	15
CO 2	×														_
CO 2			v												
CO 4	×		X												
	×		x											-	
CO 5 CO 6	×		X		v									1	
	×	- tand	outcome	X	Х	1		Х	Х			1	1	I	1
		Land											No	ofllo	
Content			Compe	tencies									NO	of Hou	115
Unit 1:			11:44 - 11				<b></b>				Masha				
Basic c	•	s of	-			•		•							
develop	ment		differe	ntiatioi	n & gro	wth inc	luding r	norpho	ogeneti	c move	ements	. (C2, C	5)		
Unit 2: Early															
•	embryonic Gametogenesis (spermatogenesis and oogenesis). Fertilization include pment types of eggs and egg membranes. Oviparity, ovoviviparity an, oviviparity. Cleavage; types, planes, and patterns. The process of early embryonic development including fate maps and cell lineages presumptive organ forming areas, blastula, gastrulation, embryonic							and oos	renesis	). Fertil	ization	include	es 10		
2010100	ment		vivipari embryo presum	of egg ity. Cle onic d nptive	s and eavage; evelop organ	egg n ; types <i>,</i> ment formin	nembra planes includir g areas	nes. C , and p ng fate , blast	Dviparit atterns e map ula, ga	:y, ovc s. The p s and	ovivipar process cell	ity an, of ear lineage	,d ly s,		
-	ment		vivipari embryo	of egg ity. Cle onic d nptive	s and eavage; evelop organ	egg n ; types <i>,</i> ment formin	nembra planes includir g areas	nes. C , and p ng fate , blast	Dviparit atterns e map ula, ga	:y, ovc s. The p s and	ovivipar process cell	ity an, of ear lineage	,d ly s,		
Unit 3:			vivipari embryo presum inducti	of egg ity. Cle onic d nptive on and	s and eavage; evelop organ organi	egg n ; types, ment formin; izers (C	nembra planes includir g areas 1, C1, C	ines. C , and p ng fate , blast 2, C4,C	Dviparit Patterns e map ula, ga (5)	zy, ovc s. The g s and strulat	ovivipar process cell ion, er	ity an, of ear lineage nbryon	,d ly s, ic		
Unit 3: Late	embry	ronic	vivipari embryo presum inducti Placent	of egg ity. Cle onic d nptive on and tal type	s and eavage; evelop organ organi es, Neu	egg n ; types, ment formin; izers (C urulatio	nembra planes includir g areas 1, C1, C n inclu	ines. C , and p ng fate , blast 2, C4,C ding ne	Dviparit Patterns e map ula, ga (5)	zy, ovc s. The g s and strulat	ovivipar process cell ion, er	ity an, of ear lineage nbryon	,d ly s, ic		
Unit 3: Late develop	embry	ronic	vivipari embryo presum inducti	of egg ity. Cle onic d nptive on and tal type	s and eavage; evelop organ organi es, Neu	egg n ; types, ment formin; izers (C urulatio	nembra planes includir g areas 1, C1, C n inclu	ines. C , and p ng fate , blast 2, C4,C ding ne	Dviparit Patterns e map ula, ga (5)	zy, ovc s. The g s and strulat	ovivipar process cell ion, er	ity an, of ear lineage nbryon	,d ly s, ic		
Unit 3: Late develop Unit 4:	embry		vivipari embryo presum inducti Placent directe	of egg ity. Cle onic d nptive on and tal type d cell r	s and eavage; evelop organ organi es, Neu nigratio	egg n ; types, ment formin; izers (C urulatio on. (C1,	nembra planes includir g areas 1, C1, C n inclu C2, C4,	nes. C , and p ng fate ;, blast 2, C4,C ding ne , C5)	Dviparit atterns e map ula, ga 5) eural ci	y, ovc s. The p s and sstrulat	vivipar process cell ion, er velopm	ity an, of ear lineage nbryon nent an	,d ly s, ic nd 6		
Unit 3: Late develop	embry ment embry		vivipari embryo presum inducti Placent directe	of egg ity. Cle onic d nptive on and tal type d cell r e an o pment tus, ca	is and eavage; evelop organ organi es, Neu nigratio utline the o rdiovas	egg n ; types, ment forming izers (C urulatio on. (C1, of or of nerve scular s	nembra planes includir g areas 1, C1, C n inclue C2, C4, rganoge ous sys ystem,	nes. C , and p ng fate , blast 2, C4,C ding ne , C5) enesis. stem, 1 respira	Dviparit atterns e map ula, ga 5) eural cr Explai limb, e tory sy	rest de n and rstem, rest de	vivipar process cell ion, er velopm ce, ph gastroi	ity an, of ear lineage nbryon nent an nare th arynge	,d ly s, ic nd 6 ne 8 al		
Unit 3: Late develop Unit 4: Post	embry ment embry		vivipari embryo presum inducti Placent directe Provide develo appara	of egg ity. Cle onic d nptive on and tal type d cell r e an o pment tus, ca	is and eavage; evelop organ organi es, Neu nigratio utline the o rdiovas	egg n ; types, ment forming izers (C urulatio on. (C1, of or of nerve scular s	nembra planes includir g areas 1, C1, C n inclue C2, C4, rganoge ous sys ystem,	nes. C , and p ng fate , blast 2, C4,C ding ne , C5) enesis. stem, 1 respira	Dviparit atterns e map ula, ga 5) eural cr Explai limb, e tory sy	rest de n and rstem, rest de	vivipar process cell ion, er velopm ce, ph gastroi	ity an, of ear lineage nbryon nent an nare th arynge	,d ly s, ic nd 6 ne 8 al		
Unit 3: Late develop Unit 4: Post develop	embry ment embry		vivipari embryo presum inducti Placent directe Provide develo appara system	of egg ity. Cle onic d nptive on and tal type d cell r e an o pment tus, ca , endoo	is and eavage; evelop organ organi es, Neu nigratic poutline the o rdiovas crine sy	egg n ; types, ment formin; izers (C urulatio on. (C1, of or of nerve scular s ystem, u	nembra planes includir g areas 1, C1, C C1, C n includ C2, C4, cganoge ous sys ystem, urogeni	nes. C , and p ng fate , blast 2, C4,C ding ne , C5) enesis. stem, 1 respira tal syst	Dviparit atterns e map ula, ga 5) eural cu Explai limb, e story sy em. (C:	rest de n and 2, C4, C	vivipar process cell ion, er velopm ce, ph gastroi 5).	ity an, of ear lineage nbryon nent an nare th arynge ntestin	,d ly s, ic nd 6 ne 8 al al		
Unit 3: Late develop Unit 4: Post develop Unit 5:	embry ment embry ment	onic	vivipari embryo presum inducti Placent directe Provide develo appara system Micro- type of zygotic dorma	of egg ity. Cle onic d nptive on and tal type d cell n e an o pment tus, ca , endoo and me fovules embry ncy, ge	is and eavage; evelop organ organi es, Neu nigratic outline the o rdiovas crine sy ega-spc and er rogenes	egg n ; types, ment formin; izers (C urulatio on. (C1, of or of nerve scular s ystem, u orogene mbryos sis. See	nembra planes includir g areas 1, C1, C C1, C1, C n includ C2, C4, cganoge ous sys ystem, urogeni esis, the sesis, the carchit	anes. C , and p ng fate , blast 2, C4,C ding ne , C5) enesis. stem, l respira tal syst edevelo nd sho recture	Dviparit atterns e map ula, ga 5) eural cr Explai limb, e tory sy eem. (C: opment ot deve (develo	rest de n and steen, 2, C4, C cal patt	velopm comp cell ion, er velopm ce, ph gastroi 5). ern of e nt, son t and fu	ity an, of ear lineage nbryon nent an hare th arynge ntestin embryo natic an unction	,d ly s, ic nd 6 ne 8 al al s, 6 nd )),		
Unit 3: Late develop Unit 4: Post develop Unit 5: Plant embryog	embry ment embry ment	onic	vivipari embryo presum inducti Placent directe Provide develo appara system Micro- type of zygotic	of egg ity. Cle onic d nptive on and tal type d cell n e an o pment tus, ca , endoo and me fovules embry ncy, ge	is and eavage; evelop organ organi es, Neu nigratic outline the o rdiovas crine sy ega-spc and er rogenes	egg n ; types, ment formin; izers (C urulatio on. (C1, of or of nerve scular s ystem, u orogene mbryos sis. See	nembra planes includir g areas 1, C1, C C1, C1, C n includ C2, C4, cganoge ous sys ystem, urogeni esis, the sesis, the carchit	anes. C , and p ng fate , blast 2, C4,C ding ne , C5) enesis. stem, l respira tal syst edevelo nd sho recture	Dviparit atterns e map ula, ga 5) eural cr Explai limb, e tory sy eem. (C: opment ot deve (develo	rest de n and steen, 2, C4, C cal patt	velopm comp cell ion, er velopm ce, ph gastroi 5). ern of e nt, son t and fu	ity an, of ear lineage nbryon nent an hare th arynge ntestin embryo natic an unction	,d ly s, ic nd 6 ne 8 al al s, 6 nd )),		
Unit 3: Late develop Unit 4: Post develop Unit 5: Plant	embry ment embry ment genesis	ronic	vivipari embryo presum inducti Placent directe Provide develo appara system Micro- type of zygotic dorma	of egg ity. Cle onic d nptive on and tal type d cell r e an o pment tus, ca opment tus, ca , endoo and me ovules embry ncy, ge ,C5) eration. cells a	is and eavage; evelop organ organi es, Neu nigratic outline the o rdiovas crine sy ega-spc and er rogenes erminat ; epir Regen nd et	egg n ; types, ment formin; izers (C urulatio on. (C1, of or of nerve scular s ystem, u orogene mbryos sis. See tion, di morpho hics. N	nembra planes includir g areas 1, C1, C n includ C2, C4, rganoge ous sys ystem, urogeni esis, the sesis, the d archit ifferent osis, r i in plan Aultiple	and p and p and p and fate b blast 2, C4,C ding ne c, C5) enesis. tal syst enesis. tal syst enesis. tal syst a develo and sho ecture iation, morpha harians o ovula	Dviparit atterns e map ula, ga 5) eural ci Explai limb, e tory sy em. (C: ot deve (devel- de- al ullaxis and a ation a	rest de rest de rest de rest de rand rest de rest de r	velopm comp cell ion, er velopm comp ce, ph gastroi 5). ern of e nt, son t and fu differer comp ans. Er nbryo	ity an, of ear lineage nbryon nent an nent an nare th arynge ntestina embryo natic an unction ntiation transfe	,d ly s, ic nd 6 ne 8 al al s, 6 nd ), ), ), ry 5 ic		





Parthenogenesis	and artificial par	Parthenogenesis; Natural parthenogenesis (arhenotoky and thelytoky) 4 and artificial parthenogenesis Parthenogenic significance in plants and animals (C1, C2, C5, C6)							
Unit 8:									
Stem cells	Stem cell; poter biotechnology Ex cells. (C2, C5, C6	xplain the ty							
Unit 9:									
Medical	Teratogens, mo	orphological	defects, a	nd genetic	mechanism	s of 2			
implications	congenital malfo	rmations (C	2 <i>,</i> C4)						
Learning strategies,	contact hours and	l student lea	arning time						
Learning strategy		(	Contact hour.	s	Studen	t learning tir	ne (Hrs)		
Lecture		4	5		135				
Seminar									
Small Group Discuss	sion (SGD)								
Self-directed learnin	· · ·								
Problem Based Lear									
Case Based Learning	<u> </u>								
Clinic									
Practical									
Revision									
Assessment		C	)5		-				
TOTAL		5	0		135	135			
Assessment Method Formative: Class tests	as:			ion					
Assignments/preser	ntations			End se	mester exan	nination			
Quiz									
Mapping of assessn		1	1	T	1	1	1		
Nature of assessme		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Examination	on	Х		х	х				
Quiz									
Assignment/Present	tation	Х	х	х	х	х			
End Semester Exam	ination	Х	х	х	х	х	х		
Laboratory examina	tion	NA	NA	NA	NA	NA	NA		
Feedback Process	• End	-Semester F	eedback						
Reference Material	Publisher Plant Eml a part of Plant Tiss Amsterda Micropro Publisher Phytohor	s, Sunderlar bryogenesis Springer Scie sue Culture: am. pogation – s, Dordrech mones: A	nd, Massachu María F. Su ence+Busine Applications Debergh Po t. Window to	ntal Biology, usetts, USA. I árez and Pet ss Media, LLG and limitati C, Zimmerm Metabolisr Sikander (Ed	SBN-10: 978 er V. Bozhko C, 2008 ons – Bhojw an RH – 19 n, Signaling	0878933846 ov (Eds.), Hur ani SS – 199 90 - Kluwer ; and Biote	mana Press, 0 - Elsevier, r Academic chnologica		





<ul> <li>Plant Propagation by Tissue Culture 3rd Edition Volume 1. The Background, Edwin</li> <li>F. George, Michael A. Hall, Aberystwyth, and Geert-Jan De Klerk (Eds), Springer,</li> </ul>
The Netherlands.2008

Name of the Program:					B.Sc.	B.Sc. Biotechnology (Honours)									
Course 1	Title:				Adva	anced G	ienomi	ics (The	ory)						
Course (	Code: B	BT 305	5		Cour	se Inst	ructor:	Course	e in-cha	arge					
Academ	ic Year	: 2023	onwar	ds	Sem	Semester: III Year, V Semester									
No of Cr	edits: 3	3			Prer	Prerequisites: Qualified previous semesters as per regulations									
Synopsis	5:	The	object	ives of t	his cou	his course are to:									
		• a	cquain	t the st	tudents with fundamentals of genomics and advanced molecular biology									biology	
		te	echniqu	ues											
		• p	rovide	fundam	nental	knowle	dge of	prokar	yotic a	ind euk	aryotic	genon	nes, ep	igeneti	cs and
	functioning of g														
	applic	ations o	of tools	and te	chniqu	es usec	l in ger	iome so	cience						
Course C	essful	comple	tion of	the cou	urse, st	udents	will be	able to	C						
CO 1:						ucture	and or	ganizat	ion of	prokary	otic ar	nd euka	aryotic	genom	es and
			1	regulato	ory elei	ments	(C1, C2	)							
CO 2:						genon	ne proj	ect and	its app	olicatio	ns (C2,	C3)			
CO 3: Describ					e the	various	types	of ep	igenet	ic regu	lations	for ge	ene ex	pressic	on and
techniqu					ues to	underst	and ep	oigeneti	c proc	esses (O	C1, C2,	C3)			
CO 4:	CO 4: Describe					arious	tools a	nd met	hods u	ised for	genor	ne anal	ysis alo	ong wit	h their
				applicat											
CO 5:				Explain	the c	the concepts of pharmacogenomics and its applications, and genome									
				evolutic	on and	molecu	lar phy	logene	tics (C1	1, C2, C	3)				
Mapping	g of CO	s to PC	)s												
COs	РО	РО	PO	PO	РО	PO	РО	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1	×			×											
CO 2	×			×											
CO 3	×		×		×										
CO 4	×			×											
CO 5	×		×												
Course o	ontent	and o	utcom	es:											
Content						Сотре	tencies	;					No	of Hou	rs
Unit 1:															
Prokary	-					<ul> <li>Defi</li> </ul>	ne phy	sical st	ructur	e and o	organiz	ation o	of 5		
organiza						prok	aryotic	: genon	ne (C1,	C2)					
concept	•		-	•		-		-	-	ments	with	OPERO	N		
and thei		in func	tions o	of <i>lac</i> and	d trp	syste	em as e	example	e (C2)						
operons															
Unit 2:															
Eukaryo	-														
organiza						Ū			•		•				
features		nuclea	r and	l orgai	nelle	geno				Dutline			of		
genome	S					chro	moson	nes and	lorgan	elle gei	nomes	(C2)			
Unit 3:															





	<sup>(1)</sup> SpirRED W <sup>1</sup> <sup>(Ne)</sup> (Deemed to be University under Section 3 o	( the UGC Act, 1956)					
Human Genome Project – overview, inception and timelines, goals and objectives, strategies followed, outcomes and achievements, ELSI program, applications, human diversity Unit 4:	<ul> <li>Explain overview of human genome project and its application in the field of medicine (C2)</li> <li>Explain human genome diversity (C2)</li> <li>Evaluate importance of mapping strategies (C3)</li> </ul>						
<b>Genome functioning</b> – repeat elements in genomes, classification, function	<ul> <li>Explain repetitive DNA content of genome their classification (C2).</li> </ul>	is and 3					
Unit 5: Epigenetics - DNA methylation, histone modifications and regulatory RNAs. Imprinting, techniques used in genome analysis	<ul> <li>Explain epigenetic modifiers for regulati gene expression (C2).</li> <li>Explain genome imprinting (C2)</li> <li>Examine various techniques used epigenome analysis (C4)</li> </ul>	on of 6 for					
Unit 6:							
Genome analysis methods and tools – enzymes used in genetic engineering and their features and applications, cDNA synthesis methods, cloning methods, screening methods for DNA and cDNA libraries	<ul> <li>Outline characteristic features and function enzymes for genetic engineering (C2)</li> <li>Explain methods for cDNA synthesis cloning (C5)</li> <li>List the methods for screening cDNA genomic library (C4)</li> </ul>	and					
Unit 7:							
DNA sequencing and analysis of genome variations	<ul> <li>Outline the tools for analysing ge variations (C2)</li> <li>Explain various methods of application genome analysis (C3)</li> </ul>						
Unit 8: Pharmacogenomics – concepts, history and evolution, methods, importance and applications of personalized medicine	<ul> <li>Define concepts in pharmacogenomics (C</li> <li>Discuss history and evolution pharmacogenomics (C3)</li> <li>Evaluate importance and application personalized medicine (C5)</li> </ul>	of					
Unit 9:							
Genome evolution and comparative genomics	<ul> <li>Explain various theories for genome evo (C2)</li> <li>Explain principles, objectives and methor molecular phylogenetics (C3)</li> <li>Discuss importance of comparative gen (C2)</li> </ul>	ods of					
Learning strategies, contact hours and st	lent learning time	•					
Learning strategy		nt learning time (Hrs)					
Lecture	45 135						
Seminar Small Group Discussion (SGD) Self-directed learning (SDL) Problem Based Learning (PBL)							
Case Based Learning (CBL) Clinic							





Practical							
Revision							
Assessment		05			-		
TOTAL		50			135		
Assessment Methods:							
Formative:				Summative	2:		
Class tests				Sessional e	xamination		
Assignments/presentat	tions			End semes	ter examination		
Quiz							
Mapping of assessmer	nt with COs						
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	
Sessional Examination		×	×		×		
Quiz		×	×	×	×	×	
Assignment/Presentati	on	×	×	×	×	×	
End Semester Examina	tion	×	×	×	×	×	
Laboratory examinatio	n	NA	NA	NA	NA	NA	
Feedback Process	• End-S	emester Feedl	back				
<b>Reference Material</b>	Introduction	on to Genomics	s, by Arthur M.	Lesk; Oxford	d University Press.	,	
	Human Ge	netics and Gen	omics by Bruc	e R. Korf and	l Mira B. Irons; Wi	lley Blackwell.	
	Human Mc	lecular Geneti	cs by Tom Stra	ichan and An	drew Read; Garla	nd Science.	
	Genomics	and Personaliz	ed Medicine:	What Everyo	one Needs to Kno	w, by Michael	
	Snyder; Ox	ford University	press.			-	
	Genomes 3	, by T. A. Brow	n; Garland Sci	ence.			
	Molecular	Biology of the (	Cell 6th Edition	, by Bruce Al	berts, Alexander J	ohnson, Julian	
Lewis, David Morgan, Martin Raff, Keith Roberts and Peter Walter; Garland Science							

Name of the Pro	ogram:	B.Sc. Biotechnology (Honours)	B.Sc. Biotechnology (Honours)					
Course Title:		Nanobiotechnology (Theory)						
Course Code: BB	BT 307	Course Instructor: Course In-charge						
Academic Year:	ar: 2023 onwards Semester: III Year, V Semester							
No of Credits:	3	Prerequisites: Qualified previous semesters as per regulations						
Synopsis:	nanopart	e introduces and provides knowledge about the synthesis and characterisation eles with various methods. It provides fundamental knowledge of applications rials in the field of biotechnology.						
Course Outcome	es (COs):	On successful completion of this course, students will be able to						
CO 1:		Explain the history and basic concepts of nanoscience (C1)						
CO 2:		Study the variation in physical and chemical properties of nanoparticles with s (C1)	the variation in physical and chemical properties of nanoparticles with size					
CO 3:		Discuss the various synthesis (Lithography, Sol-Gel, Chemical reduction, Ball mill etc.,) methods used in synthesis of polymeric nanoparticles, carbon nanotub dendrimers Discuss the working principle and applications of various characterisation techniqu (AFM, SEM, TEM) used in nanotechnology. (C1, C2, C3)	bes,					
CO 4:		the use of different nanoparticles (solid lipid nanoparticles, synthetic and ymeric nanoparticles, carbon nanotubes, polymeric nanofibers) as drug s (C1, C2)						





CO 5:	CO 5: Discuss the applications of nanotechnology in various fields (Therapy, Diagnostic								ostics						
				plant biotechnology etc.,) (C2) Understand the principle and mechanism of nanotoxicity (C1, C2, C4)											
CO 6:	(			Underst	and th	e princi	ple and	mecha	anism c	of nand	otoxicit	y (C1, C	.2, C4)		
Mappin			1												
COs	РО 1	PO 2	PO	3 PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	РО 12	РО 13	РО 14	PO 15
CO 1	×														
CO 2	×														
CO 3	×														
CO 4	×		×												
CO 5	×							×							
CO 6	×												×		
Course	content	t and o	utcor	nes:											
Content			Con	npetencie	25								No	of Hou	rs
Unit 1:															
Fundam	entals	of	• 0	Dutline th	e histo	ry of na	anotech	nnology	develo	opmen	t (C1)		2		
Nanosci	ence ar	nd	• E	xplain th	e basio	conce	pts of	nano s	science	, nanc	bioscie	ence an	d		
Nanoteo	chnolog	SY .	t	echnolog	y (C1)										
			• L	ist the te	chnolo	gical ad	lvantag	es of n	anoma	terials	(C1)				
Unit 2:															
Properti	es of		• V	Vhat are	the Phy	sical p	roperti	es, Che	mical p	ropert	ies and	l Surfac	e 2		
Nanoma	terials		р	roperties	s of nar	nomate	rials (C	1)							
Unit 3:															
Synthes	is and		• [	Discuss To	p-dow	n appro	baches	of nand	oparticl	e synt	hesis (O	22)	12		
Characte	erizatio	n of	• E	xplain va	por de	posion	(chemi	cal vap	or dep	ositior	n physic	cal vapo	or		
Nanoma	terials		d	lepositior	n) Sol-g	el proc	essing	and che	emical	synthe	sis, lith	ograph	у		
			0	of nanopa	rticle s	ynthesi	s (C2)								
			• S	ynthesis	of carl	oon bas	sed nar	nomate	rials Ca	arbon	nanotu	ube Arc	h		
				lischarge,				-							
				ynthesis					•	-					
			• 0	Compare	tem, s	EM and	d Scanr	ning Pro	obe Mi	crosco	py (SP	M) AFN	1,		
			S	canning <sup>-</sup>	Funneli	ng mic	roscope	e techn	iques. (	(C1, C2	., C3)				
Unit 4:															
Nanobio	techno	ology		xplain th	e syntł	nesis ar	nd appl	ication	s of m	agneti	c nano	particle	es 12		
				C2)											
				xplain th	•			•		drug de	elivery	(C2)			
				Vhat is co		-									
<ul> <li>List the ideal properties of nanoparticles for drug delivery. (C1)</li> </ul>															
<ul> <li>Compare and contrast active and passive targeting (C4)</li> </ul>															
				xplain pl		temper	ature r	respons	sive po	lymers	used	for dru	g		
				lelivery.(0	-										
				xplain th	•••			-	•		-				
				olid lipid	-		-		-	-	c nanop	particle	s,		
			C	arbon na	notube	es, poly	meric n	anofib	ers (C2)	)					
Unit 5:			1												
Applicat				ummariz	-								6		
Nanoted	nnolog	SY	• E	xplain th	e nano	materia	als used	<u>l in the</u>	<u>rapeu</u> ti	ic appl	ication	s(C2)			





				. MED	B1 C (Deemed b	o be University under Section 3 of t	ne 000 na, 1736)	
	<ul> <li>Explain how nanoparticles are used in developing molecular devices (C2)</li> </ul>							
	• Explain the	-			s in neu	iroscience, t	issue	
			er therapy (C2)					
	• Summarize		plications of	f na	anomate	erials in p	olant	
	biotechnolo	gy (C2)						
Unit 6:			- 2 - 1 - 1 - 1 - N					
	What is Name	•		lanon	naterials	s in environi	ment 11	
safety aspects of	which cause	•		<b>.</b> .				
Nanotechnology	<ul> <li>Explain toxic</li> </ul>	0,	airborne manu	factu	red nan	omaterials in	h the	
	environmen		<b>c</b> .					
	<ul> <li>Explain the r</li> </ul>		-				2)	
	What are the		•	techr	nology?	(C1)		
Learning strategies, co	ntact hours and	d student	-					(11.)
Learning strategy			Contact hour	S			t learning tin	ne (Hrs)
Lecture			45			135		
Seminar	((()))							
Small Group Discussion	· · ·							
Self-directed learning (S								
Problem Based Learnin								
Case Based Learning (C	BL)							
Clinic								
Practical								
Revision								
Assessment			05			-		
TOTAL			50			135		
Assessment Methods:								
Formative:					Summ	ative:		
Class tests					Session	nal examinat	ion	
Assignments/presentat	ions				End se	mester exam	ination	
Quiz								
Mapping of assessmen	t with COs	[				1		
Nature of assessment		CO 1	CO 2	(	CO 3	CO 4	CO 5	CO 6
Sessional Examination		Х			Х	X		
Quiz						Х		
Assignment/Presentation		Х	x		Х	Х	х	Х
End Semester Examinat		X	x		Х	X	X	X
Laboratory examination		NA	NA		NA	NA	NA	NA
Feedback Process			r Feedback					
Reference Material	<ul><li>perspecti</li><li>deVilliers</li></ul>	ves, Wiley MM, Ara	1irkin CA. Na /-VCH, Verlag ( mwit P, Kwon on of Pharmac	GmbH GS.	l & Co. 2 Nanote	2004 chnology in	Drug Deliver	
			nodicino in Dia	onne	tics Sci	ence Publish	ers. 2012	
	<ul> <li>Rozlosnik</li> </ul>		neulcine in Dia	161103	105, 50	chec i ablisti		
			Nanotoxicolo	-				h Biologica





Name of the Program:						В.	B.Sc. Biotechnology (Honours)										
Course 1							Research Methodology (Theory)										
Course (	Code: B	BT	309				Course Instructor: Course In-charge										
Academ	ic Year	: 20	23 0	nwar	ds		Semester: III Year, V Semester										
No of Cr							Prerequisites: Qualified previous semesters as per regulations										
Synopsis	5:		This (	cours	e prov	ides kn	owledg	e and ι	underst	anding	with th	ne conc	epts of	f rese	earc	h, lite	rature
			revie	ew an	d resea	provides knowledge and understanding with the concepts of research, literature esearch design. Further to impart the facts related quality and biosafety, good											
			labor	ratory	/ pract	ices, go	ood ma	nufact	uring p	ractice	s, vario	ous reg	ulatory	/ boc	dies	and a	lso to
	understand the im						ance of	researd	ch, scie	ntific w	riting a	nd eth	ical issu	ues i	nvol	ved.	
Course Outcomes (COs): On suc						uccess	ful com	pletior	n of this	s course	e, stude	ents wil	l be ab	le to			
CO 1:					Defi	ne and	explair	n the ba	asic cor	ncept ar	nd type	s of res	earch	(C1,	C2, (	C5)	
CO 2:					Und	erstand	d the ir	nporta	nce of	literatu	ure rev	iew an	d to fo	ormu	late	a res	search
					prob	olem. U	nderst	and an	d expla	in the s	scientif	ic desig	n (C2,	C5, C	26)		
CO 3: Design									cluding				ques,	obt	aining	g data,	
	case st									pretatio		-					
						•	the dif	ferent	kinds o	f scient	ific doc	ument	s and	d pre	esenta	ations.	
(C1, C2						-											
CO 5:								•		resear			ng of I	haza	rdo	us ma	terial.
					Expl	ain the	ethics	involve	d in re	search	(C1, C2	, C5)					
Mapping	-																
COs	PO 1	PO	2 P	03	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО	PO	РО	PO		РО	PO
											10	11	12	13		14	15
CO 1	×					×	×			×							
CO 2	×			×		×	×										
CO 3	×			×	×	×	×		×								
CO 4	×	×		×		×	×		×								
CO 5	×			×		x	×							×			
Course o		: and															
Content			Corr	npete	ncies										No	of Ho	urs
Unit 1:																	
Researc	h conce	ept							-	esearch		-			5		
					•	•				such as		•	•				
										litative		•	•	al;			
			К	lesear	rch pro	cess; m	nain coi	mponei	nts of a	ny rese	earch (C	.2, C4, C	.5)				
Unit 2:	D!		6				1.1.1.	• • • • • •							2		
Literatu	re Revi	ew				•	(C2, C5	•	rtance	of revi	ew of I	researc	n repo	rts	3		
Unit 3:														,			
Designin	-			•					-	ulate h		. ,			6		
scientifie										tion o		earch	proble	m;			
research	ו						role and tests of hypothesis (C1, C6)										
							the investigation; objectives of research; experimental										
				-		meline											
	Explain the im criteria (C2, C5)						ance of	f Labor	atory r	noteboo	ok and	docun	nentati	on			
Unit 5:																	







Research	Selection of	test models	and techniqu	es (C1)		5			
Methods	<ul> <li>Discuss rese</li> </ul>								
		-	s, case study r	-					
	Process, ana								
Unit 6:		-		-					
Scientific Writing	Define scie	ntific writir	ig and expla	in different	kinds of so	cientific 10			
	documents	such as (re	esearch pape	r, review pa	iper, book r	eviews,			
		•	oject reports a	nd research	project propo	osals to			
	funding agencies) (C1, C2, C5)								
	Explain and outline the importance of oral and poster presentation o								
	research papers in conferences/symposia and effective presentation skills; Scientific editing tools (C2, C5)								
11	skills; Scient	fic editing t	001s(C2,C5)						
Unit 7:	. Evelvete eve				·1	16			
<ul> <li>Quality and Evaluate quality assessment and consciousness (C5)</li> <li>safety and Ethical Explain and justify the importance of Good laboratory practices, Good</li> </ul>									
issues	<ul> <li>Explain and justify the importance of Good laboratory practices, Good manufacturing practices, Food and Drug administration, Central drugs</li> </ul>								
135465	standard cor	il ulugs							
	Importance	•	•		eration pro	cedure:			
			usage and safe	-					
	and materia								
	Ethical Com	SC; IPR							
	and Patent								
Learning strategie	s, contact hours a		-						
Learning strategy			Contact hours			arning time (H	lrs)		
Lecture		4	45 135						
Seminar	(202)								
Small Group Discu									
Self-directed learn	. ,								
Problem Based Le Case Based Learni									
Clinic									
Practical									
Revision									
Assessment		C	15		-				
TOTAL		5	0		135				
Assessment Meth	ods:				•				
Formative:				Summati	ve:				
Class tests				Sessional	examination	1			
Assignments/pres	entations			End seme	ester examina	ation			
Quiz									
Mapping of assess									
Nature of assessm		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		
Sessional Examina	llion	Х	X	Х	Х				
Quiz	ntation		v						
Assignment/Prese End Semester Exa		x	X	X	X	X	X		
Laboratory exami	X NA	X NA	X NA	X NA	X NA				
Laboratory examin	lation	NA	INA	INA	INA	INA	INA		





Feedback Process	End-Semester Feedback
Reference Material	How to write a scientific paper. Robert A Day. IEEE
	• Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE, 2005.
	• Geoffrey R. Marczyk, David DeMatteo& David Festinger, Essentials of Research Design and Methodology, John Wiley & Sons, 2004.
	<ul> <li>John W. Creswel, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE, 2004.</li> </ul>
	• Suresh C. Sinha and Anil K. Dhiman, Research Methodology (2 Vols-Set), Vedam Books, 2006.
	• C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Publisher, 2008. (and 2015, available online)
	R. Pannershelvam, Research Methodology, Prentice Hall, India, 2006.
	<ul> <li>Manfred Max Bergman, Mixed Methods Research, SAGE Books, 2006.</li> </ul>
	• Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin, The Research Imagination, Cambridge University press, 2007.
	Cochrain & Cox, Experimental Designs, II Edn. Wiley Publishers, 2006.
	• Text Book on Intellectual Property Right, N K Acharya; 6th ed; 2012.
	• Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. J W. Creswell; 3rd ed.
	• Staff, World Health Organization (2009) Handbook: Good Laboratory Practice (GLP) (Available online).
	• P. Oliver. A student's Guide to Research Ethics. Open University Press. 2010 (Available online)

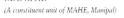
Name of th	e Prog	gram:			B.Sc.	Biotec	hnolog	gy (Hor	nours)						
Course Title	e:				Micro	bial Bi	iotechr	nology	(Pract	ical)					
Course Cod	le: BB1	r <b>3</b> 11			Cours	e Instr	uctor:	Course	e In-ch	arge					
Academic \	/ear: 2	2023 o	nward	s	Seme	ster: I	II Year	, V Sen	nester						
No of Credi	its: 1				Prere	quisite	es: Qua	alified	previo	us sen	nesters	as pei	<sup>r</sup> regula	ations	
Synopsis:		This p	ractica	l cours	se intro	oduces	and p	rovide	s know	ledge	and te	chnica	l skills	in mic	robial
		biotec	hnolog	gy.											
Course Out	come	s (COs)	:	On su	successful completion of this course, students will be able to										
CO 1:				List a	ist and illustrate the basic methods in microbial biotechnology (C1, P2)										
CO 2:					solate microorganisms from the environment and obtain pure culture and										
					dentify pathogenic microorganisms using PCR (P2, P4)										
CO 3:				Name	Name, explain and qualitatively analyse enzyme activity (P2, P3, P4)										
CO 4:				Estim	stimate biomass and analyse growth curve patterns of microbes and to										nd to
				detec	etect microbes in raw and processed food materials (P1, P2)										
CO 5:				Demo	Demonstrate the ability to qualitatively differentiate milk (P2, P4)										
CO 6:				Expla	in the J	orincip	le and	demor	nstrate	citric a	acid pr	oductio	on (P2)		
Mapping of	f COs t	o POs		-		-	-	-	-				-		
COs					PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1 2 3 4				5	6	7	8	9	10	11	12	13	14	15
CO 1															
CO 2								×							
CO 3	CO 3 ×				×			×							
CO 4	CO 4 × ×							×							





CO 5	×		×		×			×					1		
CO 6	×		~		~		×	x							
Course con	tent a	nd out	comes												
Content				1	peten	cies								No of	Hours
Unit 1:															
Basic meth	nods	in mi	crobial	• Li	st an	d exp	lain t	he ba	isic m	ethod	s in	microb	bial		2
biotechnolo						nology					5		Jiai		
Unit 2:	07					07	(- )	,							
Isolation c	of mic	crobes	from	• Ex	xplain	metho	ods to	isolat	e micr	oorgar	nisms	from t	the		4
environmer					•	ment a				-					
pure culture			0		-					(	,				
Unit 3:															
Identificatio	on of p	oathog	ens by	• A	nalyze	the p	oresen	ce of	patho	genic	micro	organis	ms		4
PCR		Ū			•	CR (P2,			•	0		U			
Unit 4:						• •									
Qualitative	assay	of enzy	ymes	• N	ame, e	explain	and ex	kamine	meth	ods to	analys	e enzy	me		4
	•	·	•			(C1, P2					,	,			
Unit 5:						<u> </u>	<u> </u>								
Biomass est	imatio	on		• Ex	xplain	metho	ds to :	study l	biomas	s and	analys	se grov	vth		2
					•	atterns					,	U			
Unit 6:															
Bacterial	grov	vth	curve	• Ex	xplain	metho	ds to :	study l	biomas	s and	analys	se grov	vth		4
analysis				С	urve pa	atterns	of mic	robes	(P2)		-	-			
Unit 7:															
Methylene	blue r	eductio	on test	• D	emons	trate	and a	analyse	e metl	nods	to qu	alitativ	ely		2
for examin	ning	presen	ice of	di	ifferen	tiate m	nilk (P2	, P4)							
microbes in	milk														
Unit 8:															
Turbidity	t	est	for	• D	emons	trate	and a	analyse	e metl	nods	to qu	alitativ	ely		2
Pasteurizati	ion			di	ifferen	tiate m	nilk (P2	<i>,</i> P4)							
Unit 9:															
Examinatio	n of	raw	and	• 0	utline	metho	ds to s	tudy n	nicrobi	al num	bers i	n raw a	and		4
processed f	ood			р	rocess	ed food	d mate	rials (P	1, P2)						
Unit 10:															
Laboratory-	scale	prod	luction	• Ex	xplain	the	princip	le an	d der	nonstr	ate c	itric a	cid		2
of citric acid	k			р	roduct	ion (P2	.)								
Learning st	rategi	es, con	tact ho	ours ar	nd stuc										
Learning str	rategy					0	Contact	t hours			St	udent l	learn	ing tim	e (Hrs)
Lecture															
Seminar															
Small Group	o Discu	ussion	(SGD)												
Self-directe	d leari	ning (S	DL)												
Problem Ba	sed Le	arning	g (PBL)												
Case Based	Learn	ing (CE	BL)												
Clinic															
Practical						3	0				90	)			
Revision															
Assessment						C	)7				-				







TOTAL		3	57			90		
Assessment Methods:								
Formative:					Summa	tive:		
Class tests					Session	al examinat	ion	
Assignments/presentatio	ns				End sen	nester exam	nination	
Quiz								
Mapping of assessment	with COs							
Nature of assessment		CO 1	CO 2	(	CO 3	CO 4	CO 5	CO 6
Sessional Examination		×	×		×	×		
Quiz								
Assignment/Presentation	ı							
End Semester Examination	on							
Laboratory examination		×	×		×	×	×	×
Feedback Process	• End	-Semester F	eedback					
Reference Material	• D.K. Mah	eshwari, Pra	ectical Microl	biolog	gy, Chan	d publishers	s, India, 2010	)
		Kumar, Pra India, 2010	actical Manu	ual f	or Unde	ergraduates	Microbiolo	gy, Jain

Name of the P	rogran	n:		B.Sc	Biotec	hnolo	gy (Hor	nours)						
Course Title:				Deve	elopme	ntal Bi	ology	(Practi	cal)					
Course Code: I	BBT 31	13		Cour	se Inst	ructor:	Cours	e In-ch	arge					
Academic Year	r: <b>202</b>	3 onwa	ards	Sem	ester: I	II Year,	, V Sen	nester						
No of Credits:	1			Prer	equisit	es: Qua	alified	previou	us sem	esters a	as per r	egulati	ions	
Synopsis:	The o	objectiv	ves of t	his cou	irse are	to acq	uaint t	he stuc	lents w	ith har	nds on t	training	g on bas	sics of
	deve	lopme	ntal bio	ology, s	structu	re and	develo	pment	of spe	erms, e	egg, em	nbryos;	histolo	ogy of
	repro	oductiv	ve orgai	ns.										
<b>Course Outcor</b>	nes (C	Os):	Or	succe	ssful co	mpleti	on of t	his cou	rse, stu	Idents	will be	able to		
CO 1:			Le	arn and	d illustr	ate an	d analy	se diff	erent t	ypes o	f eggs a	and spe	erms, fa	actors
			aff	ecting	sperm	quality	and fe	cundity	y (P2, P	3)				
CO 2:			Ur	Understand and perform about the plant embryogenesis and artificial se										seed
			ge	rminat	ion (P2	, P4)								
CO 3:			Со	mpare	the d	evelop	menta	l stage	es in E	Prosopl	nila/C.	elegan	s/Frog	s and
			Ch	icks an	d to lea	rn the	technic	ques to	study	he dev	elopme	ental st	ages (P	2, P3)
CO 4:			Le	arn to	perforr	n, ider	ntify, ex	kplain a	and An	alyse t	he hist	ologica	l chan	ges in
			ma	ammali	an repi	roducti	ve orga	ns (P2	, P3)					
Mapping of CC	)s to P	Os												
COs PO	PO	PO	PO	PO	PO	PO	РО	РО	PO	PO	PO	PO	РО	PO
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1 ×		х												
CO 2 ×		х		х			х							
CO 3 ×		×		х			×							
CO 4 ×		х		×			×							
Course conten	t and	outcon	nes:											
Content		(	Compet	encies								No	of Hou	rs
Unit 1:														





Study of tissue structure	<ul> <li>Observer reproduce</li> </ul>	e and analyse active organs (P2		tology	of mammalian	2
Unit 2:						
Study of sperms	<ul> <li>Identify (P2, P3)</li> </ul>	-	normalities i	n the ma	ammalian sperms	2
<b>Unit 3:</b> Plant embryogenesis	<ul> <li>Explain, (P2, P4)</li> </ul>		monstrate	various t	types of embryos	2
Unit 4:	(* = , * * )					
Preparation of Artificial seeds		e and perform ition and germin			of artificial seed	4
Unit 5:				-7		
Study of early	Perform	n, identify, illust	rate the dif	ferent s	stages of embryo	6
developmental stages					chamber (P2, P3)	
Unit 6:	1	· · · · ·		00		
Developmental biology	Demon	strate the rad	icle and	plumule	developmental	2
of seed embryo		s under different		-		
Unit 7:						I
Fecundity		strate and analy of various facto			city in Drosophila	2
Unit 8:						
Development of Hen's	Perform	n the window te	chnique on	Hen's e	gg to analyse the	4
Egg		oment (P2, P4)				
Unit 9:	r					
Determination of plant	• Establis	hment of suspen	sion culture	and det	ermination of cell	6
cell growth		under different of				•
Learning strategies, cont						
Learning strategy			ct hours		Student lear	ning time (Hrs)
Lecture						
Seminar						
Small Group Discussion (S	GD)					
Self-directed learning (SD						
Problem Based Learning						
Case Based Learning (CBL						
Clinic	1					
Practical		30			90	
Revision						
Assessment		07			-	
TOTAL		37			90	
Assessment Methods:		I			I	
Formative:				Summ	ative:	
Class tests					nal examination	
Assignments/presentatio	ns				mester examinatio	on
Quiz						
Mapping of assessment	with COs					
Nature of assessment		CO 1	CO	2	CO 3	CO 4
Sessional Examination		Х	x			





Quiz					
Assignment/Presentation	on				
End Semester Examinat	tion				
Laboratory examinatior	n	х	х	х	х
Feedback Process	• End	-Semester Feedba	ck		
Reference Material	<ul> <li>biology, C</li> <li>Melissa A university</li> <li>Trigunaya Genetics 93884490</li> <li>Plant Tiss Amsterda</li> <li>Plant Pro F. George The Neth</li> <li>Plant cell</li> </ul>	Continental publica and Gibbs. (2006 y press (Int. studen at M.M. (2019). A I & Developmental D7X sue Culture: Applic am. pagation by Tissue e, Michael A. Hall, erlands.2008. I culture protocols	George, P. V. (2 ations, Trivandrum ). A practical Guide at edition). ISBN: 97 Manual of Practica Biology Part 1. S ations and limitatio Culture 3rd Edition Aberystwyth, and s. Victor M. Loyol ess Inc, Totowa, Ne	e to Developmenta 780199249718. I Zoology: Biodiver cientific Publisher ons – Bhojwani SS n Volume 1. The Ba Geert-Jan De Kler a-Vargas and Feli	al Biology, Oxford rsity, Cell Biology, s, India, ISBN-10: – 1990 - Elsevier, ackground, Edwin k (Eds), Springer,

Name of the F	Program	:		B.	Sc. Bio	techno	logy (H	onours	;)							
Course Title:				A	dvance	d Geno	mics (	Practic	al)							
Course Code:	BBT 315	5		C	ourse li	nstruct	or: Cou	rse In-o	harge							
Academic Yea	r: 2023	onwar	ds	Se	emeste	r: III Y	ear, V S	Semest	er							
No of Credits:	1			Pi	rerequi	sites:	Qualifi	ed prev	vious se	emeste	rs as po	er regu	lations			
Synopsis:	The o	bjective	es of tl	nis cou	rse are	to acc	juaint t	he stu	dents v	with va	rious n	nethod	s of pra	actical		
	exper	imenta	tion in	advanc	ed gen	omics a	and out	come a	analysi	s. This i	nclude	s unde	rstandiı	ng the		
	princi	ples be	hind tł	ne map	ping o	f plasm	nids an	d acqu	iring sł	kills and	d techr	niques (	of resti	riction		
	digest	ion, co	ncepts	behind the Polymerase chain reaction, learning isolation of RNA, and nstration of advanced molecular techniques and the conceptual basis for												
	visual	ization.	Demo	nstrati	on of a	dvance	d mole	ecular t	echniq	ues an	d the c	concept	tual ba	sis for		
	RNA e	express	ion and	d geno	me-wio	le DNA	analys	sis and	their	applica	tion fo	r mole	cular g	enetic		
						NA seq	uencin	g, micr	barrays	s, and n	ext-gei	neratio	n seque	encing		
	is a highlight of the co															
					e end of the course, students shall be able to: rm and interpret Restriction digestion and mapping of plasmids. (P1, P2, P3)											
CO 1:			Perf	orm an	d interp	oret Res	striction	n digest	ion and	d mapp	ing of p	lasmid	s. (P1, F	י2 <i>,</i> P3)		
CO 2:			Perf	erform Polymerase Chain Reaction for various purposes												
CO 3:			Perf	erform and interpret results of Polymerase chain reaction (PCR) - restriction										riction		
			fragi	ment le	ngth p	olymor	phism (	PCR-RF	<sup>:</sup> LP) (P1	L, P2, P3	3)					
CO 4:			Und	erstand	l the p	rinciple	and m	ethod	for RN	A isolat	ion an	d know	the m	ethod		
			and	explain	the rea	al Time	-PCR: p	rinciple	e, appli	cations	, etc (P	1, P2, F	°3)			
CO 5:			Perf	orm a	nd ur	dersta	nd the	e cono	cept b	ehind	denat	uring	agaros	e gel		
			-	electrophoresis for RNA (P1, P2, P3)												
CO 6:						nowledge of methods to Perform and understand the concept behind DNA										
	sequenc					sis and	next ge	neratio	on sequ	iencing	(P1, P2	2 P3)				
	Vapping of COs to POs															
COs PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО	PO	РО	PO	PO	РО		
									10	11	12	13	14	15		
CO 1 X X X																





<u> </u>									SPIRED BY	(Deemea to	be University unde	section 3 of the U	GC Ad, 1956)		
CO 2	X		X			X									
CO 3	Х		Х			Х									
CO 4	Х		Х			Х									
CO 5	Х		Х			Х		X							
CO 6	Х		Х		Х	Х		Х							
Course		t and o	utcome	1											
Content				Com	petenc	ies								No of H	lours
Unit 1:			<u> </u>	T.,		<u> </u>									
Restrict		gestior	n and		-			hod fo		-	•			4	
mappin	g of pla	smias.						s and t	ne ur	ndersta	na con	cepts t	penina		
Unit 2:				тар	ping (P	1, PZ, I	-3)								
		oin r	aatian	Lind	orstone	ling th		ont of	Dalur	noraca	chain	rootio	n and	2	
Polymer	ase cr	nain re	eaction			-		ept of			chain	reactio	n and	2	
Unit 3:				KHOV	vieuge	то арр	ly the n	nethod	(Р1,	PZ, P3)					
		ain ra	action	Dorf	ormina	and	intorn	roting		lto of	Dolum	oraca	chain	4	
Polymer restricti					-			reting ment le			•			4	
polymoi		-	-	Teac	lion-re	suicu	nnagi	nentie	ngth	poryint	nhiin	і (г 1, г	2, F3)		
Unit 4:	pilisili		1 LF /												
RNA iso	ation			Knov	vladaa	ofthe	nrincin	le and r	nothe	d for B	NA isol	ation (	D1 D7	2	
NNA ISU	ation			P3)	Meuge	orthe	princip		netin		INA 1501	ation (i	-1, -2,	2	
Unit 5:				13/											
Denatur	ing ;	agarose	e gel	Und	erstand	ling of	the co	oncept	hehi	nd den	aturing	agaro	se gel	2	
electrop	-	-	-			-		and the			-	-	-	2	
Unit 6:				cico		0010 10				104 10		. ().			
	ime-PC	R: pr	inciple,	Lear	ning of	the m	nethod	and ex	plana	tion al	out w	orking	of the	4	
applicat			•		-			applica	•			-			
Unit 7:											, ,	,			
DNA sec	uencin	g and a	analysis	Knov	wledge	of con	cept ar	nd met	hod t	o Perfo	orm and	d unde	rstand	4	
		•			-		•	analysi							
Unit 8:															
Demons	tration	of	DNA	Und	erstand	ling of	the pri	inciple	behin	d metl	nod cor	ncept o	f DNA	4	
microar	ray exp	erimen	nt	micr	oarray	experii	ment w	ith an c	vervi	ew for	applica	tions (I	P1, P2,		
				P3)											
Unit 9:															
Next Ge	neratio	n sequ	encing:	Knov	wledge	of th	ne prir	nciple	behin	d, and	l meth	od of	Next	4	
overviev	v.			Gen	eration	Seque	ncing: v	with an	over	all viev	ı (P1, P	2, P3)			
Learnin	-		ontact	hours a	and stu										
Learning	g strate	gy				Cc	ontact h	nours			St	udent l	earning	ı time (H	lrs)
Lecture															
Seminar															
Small G	•			)											
Self-dire		-													
Problem				.)											
Case Ba	sed Lea	rning (	CBL)												
Clinic															
Practica						30	)				90	)			
Revisior															
Assessm	ient					07					-				





TOTAL		(1)	37			90		
Assessment Methods:								
Formative:				Su	ummative:			
Class tests				Se	essional ex	aminati	ion	
Assignments/presenta	tions			Er	nd semeste	er exam	ination	
Quiz								
Mapping of assessmer	nt with COs							
Nature of assessment		CO 1	CO 2	COS	3 C	04	CO5	CO6
Sessional Examination		Х	Х	Х		X		
Quiz								Х
Assignment/Presentati	on	Х	Х	Х		x	Х	
End Semester Examina	tion							Х
Laboratory examinatio	n	Х	Х	Х		x	Х	Х
Feedback Process	• End	-Semester F	eedback					
<b>Reference Material</b>	Sambroo	k J and Rus	sel DW. Mo	lecular (	Cloning: A	laborat	tory manua	l (3rd Edition)
	COLD SPE	RING HARBC	R LABORAT	ORY PRE	SS Cold Sp	ring Ha	rbor, New Y	′ork, 2001.
	Walker, J	ohn M. (Ser	ies Ed.) Metł	nods in I	Molecular	Biology	, Springer N	ature 2013.
	Head S.R	., Ordoukha	nian P., Saloı	mon D.R	. (Eds.) Ne	xt Gene	eration Sequ	uencing
	Methods	and Protoco	ols. Springer	Nature	2018.			

Name o	f the Pı	rogram	n:		B.Sc	. Biote	chnolog	gy (Hor	nours)						
Course <sup>-</sup>	Title:				Nan	obiote	chnolog	gy (Pra	ctical)						
Course	Code: B	BBT 317	7		Cou	rse Ins	tructor:	Cours	e In-cha	arge					
Academ	ic Year	: 2023	onwar	ds	Sem	ester:	III Year,	V Sem	nester						
No of Cr	edits:	1			Prer	equisi	tes: Qua	lified	previou	ıs seme	esters a	is per r	egulati	ons	
Synopsi	s:		practi echnolo		urse i	ntrodu	ces and	d prov	rides k	nowled	ge an	d tech	nical s	kills in	nano
Course	Outcon	nes (CC	Ds):	On s	uccess	ful cor	npletior	n of thi	s cours	e, stude	ents wi	ll be ab	le to		
CO 1:				Synt	hesize	nano	particles	s with v	various	metho	ds (P1,	P2)			
CO 2:				Expla	ain the	e princi	ple of cl	haracte	erisatio	n nano	particle	es with	various	metho	od (P2)
CO 3:							orinciple otoxicity		echani	sm of n	anotox	cicity. A	lso to le	earn m	ethods
CO 4:				Stud	y drug	releas	e kineti	cs (P1,	P2)						
Mappin	g of CO	s to PO	Os		<u>,                                     </u>										
COs	PO	РО	PO	РО	PO	PO	<i>PO</i> 7	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6		8	9	10	11	12	13	14	15
CO 1	×		×		×										
CO 2	×				×	×									
CO 3	×												×		
CO 4	×							×							
Course	content	t and o	outcome	es:											
Content				Com	petend	cies							No	of Hou	rs
Unit 1:															
Instrum	entatio	n (AFN	л, sem,	• Id	entify	the ins	strumen	ts (P2)						4	
NMR, II	R, UV	spectr	oscopy,	• De	emons	trate t	he work	ing of i	nstrum	ients us	sed in s	ynthesi	s		
Zetasize	r, Rota	ry Evap	orator,	ar	nd cha	racteri	sation o	f nano	particle	es (P2)					





		6)
Lyophiliser, Ball mill, High Pressure homogenizer, High Speed homogenizer, Scatteroscopy, Nitrogen evaporator)	• Summarise the working principle of the instruments (P2)	
Unit 2:		
Synthesis of gold nanoparticles.	<ul> <li>List the applications of gold nanoparticles in the field of biotechnology (P1)</li> <li>Make use of trisodium citrate reduction method to synthesis of gold nanoparticles (P3)</li> <li>Explain variation in the size of gold nanoparticles by varying the concentration of reducing agent. (P2)</li> <li>Demonstrate the Bottom up approach for the synthesis of nanoparticles (P2)</li> </ul>	4
Unit 3:		
Synthesis of silver nanoparticles – Sweet /Green Nanochemistry/ Microemulsion	<ul> <li>Make use of hot plate or domestic microwave oven to synthesize the silver nanoparticles (P3)</li> <li>Synthesis of silver nanoparticles by microemilsion (P2)</li> <li>Summarise the green chemistry principles and its application for silver nanoparticle synthesis (P2)</li> <li>Explain the use of spectrophotometer to calculate particle size (P2)</li> </ul>	4
Unit 4:	· · · · · · · · · · · · · · · · · · ·	
Microwave synthesis of zinc hydroxy sulphate Nano plates and zinc oxide nano rods.	<ul> <li>Show the synthesis of zinc hydroxyl sulfate nanoplates and zinc oxide nanorods (P2)</li> <li>Comparison of different morphologies (rods/plates) of nanoparticles obtained by changing the reagent concentrations and ratio. (P2)</li> </ul>	2
Unit 5:	· · · · ·	
Estimation of IC50 of nanoparticles against cell lines growing <i>in vitro</i>	<ul> <li>Understand the toxicity of nanoparticles (P2)</li> <li>List the different assays to determine the cell toxicity (P1)</li> <li>Demonstrate the MTT Assay to find the IC50 of nanoparticles (P2)</li> <li>Find and Interpret IC50 (P1, P2)</li> </ul>	2
Unit 6:		
Antimicrobial activity of nanoparticles.	<ul> <li>List the nanoparticles used in antimicrobial therapy (P1)</li> <li>Demonstrate the antimicrobial activity of nanoparticles (P2)</li> <li>Find minimum inhibitory concentration (P1)</li> </ul>	2
Unit 7:		
Nano formulation and In vitro drug release study.	<ul> <li>List the applications of in-vitro drug release study (P1)</li> <li>Construct a calibration curve for the drug release kinetics (P3)</li> <li>Find the concentration of drug in the given solution (P1)</li> </ul>	2
Unit 8:		
Synthesis of cadmium sulphide quantum dots in microemulsion.	<ul> <li>Define Quantum Dots (P1)</li> <li>Make use of microemulsion method for the synthesis of CdS quantum dots (P3)</li> </ul>	2





			<i>i</i>	I	
	•	osorption spectruneter of the partic			
Unit 9:	• Find the diam				
Synthesis of quantum dots	Make use of	agarose gel elect	ronhoresis for	the synthesis	2
using gel electrophoresis		ulphide nanopar	•	the synthesis	2
technique.		ne principle of fo		nonarticles in	
coninquei	agarose matr			noparticles in	
	-	fluorescent ban	ds under UN	/ illuminator	
		formation of na			
Unit 10:	indicating the			-/	
Synthesis of silver	• Show the svr	nthesize of a ser	ies of silver na	anonarticles of	4
nanoparticles of variable size.	varying sizes			inopur ticles of	
		e variation of	λmax with	size of the	
	nanoparticles		Villax With	5120 01 110	
	•	lours of the nand	narticles to its	size (P2)	
Unit 11:				, 5120 (1 2)	
Synthesis of nanofibers using	Demonstratio	on of the electros	sninning equin	ment (P1)	2
electrospinning		the nanofibers us			-
Learning strategies, contact h			nig ciccuospii	·····δ (1 <i>2)</i>	
Learning strategy		Contact hours		Student learn	ina time (Hrs)
Lecture					ng tine (mo)
Seminar					
Small Group Discussion (SGD)					
Self-directed learning (SDL)					
Problem Based Learning (PBL)					
Case Based Learning (CBL)					
Clinic					
Practical		30		90	
Revision					
Assessment		07		-	
TOTAL		37		90	
Assessment Methods:					
Formative:			Summativ	ve:	
Class tests			Sessional	examination	
Assignments/presentations			End seme	ster examinatior	า
Quiz					
Mapping of assessment with	COs				
Nature of assessment		CO 1	CO 2	CO 3	CO 4
Sessional Examination		х	х		
Quiz					
Assignment/Presentation		х	х	x	х
End Semester Examination					
Laboratory examination		х	х	x	x
Feedback Process	End-Semeste	r Feedback			
Reference Material • E	delstein AS, Camr	narata RC. Nanor	materials: Synt	hesis, Properties	and Applicatio
	nstitute of Physics				





Cooke, J. Hebert, D. and Kelly, JA. Sweet Nanochemistry: A Fast, Reliable
Alternative Synthesis of Yellow Colloidal Silver Nanoparticles Using Benign
Reagents, J. Chem. Educ. 2015, 92, 2, 345-349.
• Andrew J. Frank, AJ. Cathcart, N. Maly KE and Kitaev, V.
Synthesis of Silver Nanoprisms with Variable Size and Investigation of Their Optical
Properties: A First-Year Undergraduate Experiment Exploring
Plasmonic Nanoparticles, J. Chem. Educ. 2010, 87, 10, 1098-1101.

Name o	f the P	rogram	:	E	B.Sc. Bi	otechn	ology (	Honou	rs)						
Course 1	Title:			S	Semina	r/Journ	al Club	)							
Course	Code: E	3BT 319	)	0	Course	nstruc	tor: Co	urse In	-charge	3					
Academ	ic Year	r: 2023	onwa	irds S	Semest	er: III Y	ear, V S	Semest	er						
No of Cr	edits:	1		F	Prerequ	isites:	Qualifi	ied pre	vious s	eme	sters as p	oer reg	ulation	s	
Synopsi	s:	This co	ourse	will incl	nclude an allotment of an individual seminar topic related to the semester enhance students' knowledge base and expose them to how to present										
		course	s. Thi	s will ei	nhance	stude	nts' kn	owledg	ge base	e and	l expose	them	to ho	w to p	resent
				clearly a	nd con	cisely. S	Student	s will a	lso lear	n ho	w to com	pile th	e litera	ture da	tabase
		inform													
	Durse Outcomes (COs):         On successful completion of this course, students will be able to														
CO 1:															
CO 2:	Demonstrate the ability to listen carefully and react														
CO 3:	O 3: Apply one's views and present complex information clearly and concisely to														
				differe	-										
CO 4:				Conclu											
CO 5:				Define	the pro	blem i	n a con	cise ma	nner						
CO 6:				Adopt	challen	ging tas	sks, and	learn	how to	com	pile and	interpr	et data	•	
Mappin	-			_											
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	РО 12	РО 13	РО 14	РО 15
CO 1		×													
CO 2		×													
CO 3		×													
CO 4		×													
CO 5		×													
CO 6		×													
Course	conten	t and o	utcon	nes:											
Content	Сс	ompete	ncies								No of H	ours			
Unit 1:															
Seminar	Th	nis cour	rse wi	ll includ	e alloti	ment o	of an in	dividua	al semi	nar	30 minu	utes ora	al prese	ntatior	n for
	to	pic rela	ted to	the sen	nester	courses	5				each st	udent			
Learning	-		ontac	t hours a	and stu						1				
	ng strategy Contact hours Student learning time (Hrs)														
Lecture						-					-				
Seminar						15					45				
Small Gr				D)											
Self-dire			-												
Problem	n-Based	l Learni	ing (PE	BL)											
Case Bas	sed Lea	arning (	CBL)												
Clinic															





Practical										
Revision										
Assessment		0	1		-	-				
TOTAL		1	6		45					
Assessment Methods:										
Formative:				Sum	mative:					
Assignments/presentatio	ns									
Mapping of assessment	with COs									
Nature of assessment		CO 1	CO 2	CO 3	CO 4	CO 5	CO 6			
Sessional Examination		NA	NA	NA	NA					
Quiz		NA	NA	NA	NA	NA	NA			
Assignment/Presentation		х	х	х	х	х	х			
End Semester Examination	n	NA	NA	NA	NA	NA	NA			
Laboratory examination		NA	NA	NA	NA	NA	NA			
Feedback Process	• 1	End-Semeste	er Feedback							
Reference Material	e Books and	l Journals arti	cles relate	ed to the semin	ar topics					

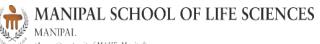
Name o	f the Pı	ogram	:		B.Sc.	Biotec	hnolog	y (Hon	ours)						
Course T	Title:				Tuto	rials/Se	eminar,	/Journa	al Club						
Course	Code: B	BT 302			Cour	se Instr	ructor:	Course	In-cha	rge					
Academ	ic Year	: 2023	onwa	ards	Seme	ester: Il	l Year,	VI Sem	lester						
No of Cr	edits:	4			Prere	equisite	es: Qua	alified p	oreviou	s sem	esters a	as per r	egulati	ons	
Synopsi	s:	This	cours	se will ind	clude a	n allotn	nent of	an indi	vidual	resear	ch topio	c. This v	vill not	only er	hance
		the	resea	rch know	nowledge base of students but also provide them exposure to how to present mation clearly and concisely. Students will also learn how to compile the										
		rese	arch	informat	tion cle	early a	nd con	cisely.	Studer	nts wil	l also	learn ł	now to	comp	ile the
		rese	arch	data.											
Course Outcomes (COs):         On successful completion of this course, students will be able to															
CO 1:															
CO 2:		Demonstrate the ability to listen carefully and react													
CO 3:				Apply or	ne's vie	ws and	presen	it comp	lex info	ormatio	on clear	ly and	concise	ly to di	fferent
				groups											
CO 4:				Conclud	e on in	format	ion								
CO 5:				Define a											
CO 6:				Adopt c	halleng	ing tas	ks, and	learn h	low to	compil	e and i	nterpre	t data.		
Mappin															_
COs	PO1	PO 2	POS	3 PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO	PO	PO	PO	PO	PO
										10	11	12	13	14	15
CO 1		×													
CO 2		×													
CO 3		×						×							
CO 4		×						×							
CO 5		×						×							
CO 6		×						×							
Course	ontent	and o	utcon	nes:											
Content	Content Competencies									۸	lo of Ho	ours			





Unit 1:	This so		ماريمام مالم	the out of		::	20			ntation for	
	research		iciude alic	otment of a	in ina	ividual	30-minutes oral presentation for each student				
Learning strategie			d student	learning time	e						
Learning strategy				Contact ho				Stude	nt learning	time (Hrs)	
Lecture				-				-			
Seminar				60				180			
Small Group Discu	Small Group Discussion (SGD)										
Self-directed learn	ning (SDL	_)									
Problem-Based Le	earning (	PBL)									
Case Based Learni											
Clinic											
Practical											
Revision											
Assessment				01				-			
TOTAL				61				180			
Assessment Meth	nods:										
Formative:						Summ	ative	:			
Assignments/pres	entatior	IS				-					
Mapping of asses		ith COs									
Nature of assessm			CO 1	CO 2	CO	3	CC	4	CO 5	CO 6	
Sessional Examina	ation		NA	NA	NA	۱	NA	١			
Quiz			NA	NA	NA	۱	NA	l l	NA	NA	
Assignment/Prese			х	х	х		х		х	х	
End Semester Exa	minatior	า	NA	NA	NA	۱	NA	۱.	NA	NA	
Laboratory examination			NA	NA	NA	۱	NA	۱.	NA	NA	
Feedback Process	;	• End	l-Semester	<sup>-</sup> Feedback							
<b>Reference Materi</b>	al	Reference I	Books and	Journals arti	cles rel	lated to	the I	researc	h topics		

Name of the Pr	ogram:		B.Sc. Biotechnology (Honours)						
Course Title:			Research Project Work						
Course Code: B	BT 399		Course Instructor: Supervisors						
Academic Year:	: 2023 Onward	S	Semester: III Year, VI Semester						
No of Credits:	16		Prerequisites: Qualified previous semesters as per regulations						
			le an allotment of individual research work for each student. This will						
			wledge base and expose them to conducting and carrying out research-						
	based tasks.	Students	will also learn how to compile and interpret results.						
Course Outcom	ies (COs):	On succe	ssful completion of this course, students will be able to						
CO 1:		Define p	roblems, formulate hypotheses, test hypotheses, analyse						
CO 2:		Explain,	problematize, synthesize, and articulate						
CO 3:		Apply an	d draw conclusions from data, establish hypotheses, and predict cause-						
		and-effe	ct relationships;						
CO 4:		Analyse	cause-and-effect relationships						
CO 5:		Define a	a problem in a concise manner						
CO 6:		Adopt cl research	hallenging tasks; students will also learn how to compile and interpret a data						





Mappin	g of CC	)s to P	Os												
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1						×									
CO 2						×									
CO 3						×									
CO 4						×		×							
CO 5						×		×							
CO 6						×		×							
Course	conten	t and c	outcom	es:		1	1					1			
Content	-		Compe	etencies	5						No of Ho	ours			
Unit 1:											<b>,</b>				
Researc	h Proie	ect	This co	ourse v	vill inc	ude al	lotmen	t of an	individ	lual	26 hours	s of lab	orator	/ traini	ng and
				ch topi							research				
Learnin	g strat	egies. c				ident le	earning	time							
Learnin	-	-					-	t hours	•		Stud	dent le	arning	time (H	lrs)
Lecture	9	- 57					-				-		<u>9</u>		
Semina	r														
Small G		iscussio	on (SGD	)											
Self-dire				/											
Problem		¥		)											
Case Ba				-/											
Clinic		in ning i													
Practica							480				144	0			
Revisior							-00					0			
Assessn							01								
TOTAL	ient						481				144	0			
TOTAL							401				144	0			
Assessn	nont M	othode	••												
Formati		ethous						Summa	tivo						
Assignm	-	rocont	ations/	Manus	rint ci	hmissi		Project	repo	rt ci	Ibmissio	n/I Iniv	orcity	Viva	Voce
Assignin	ients/p	nesent	ations	vianus	inpt st	10111331		Examina	•	11 30	101113310		reisity	viva	VULL
Mappin	g of as	sessme	nt with				I								
Nature	-					CO 1		0 2	CO	3	CO 4		CO 5		0 6
		I Examination			NA		NA	N/		NA			<b>`</b>		
Quiz		matio	NA NA					NA	N/		NA		NA		NA
	nent/Dr	econta	itation x					X	X		X		X		x
End Sen						x x		x	x		X		X		x
Laborat						NA		NA	N/		NA		NA		NA
Feedba			•		nd-Sor	nester			IN/	•	IN/A		IN/A		
recuba		terial						ack s article				∔ مام س			

Name of the Program:	B Sc. Biotechnology (Honours)
Course Title:	Laboratory Rotation





Course (	Code: E	BBT 401	L		Cours	e Inst	ructor: I	Facility	In-cha	rge						
Academ	ic Year	: 2023	onwa	rds	Seme	ster: I	V Year,	VII Sen	nester							
No of Cr	edits:	4				-	es Qual and abov	-	reviou	s sem	esters	as per	regula	ations	with a	
Synopsis	s:	This c	ourse	will incl			ory traini		igh-en	d facilit	ies and	high tl	hrough	put dat	ta. This	
		will e	nhance	e stude	nts' kn	owled	dge base	e and e	expose	them	to how	to co	nduct a	and car	ry out	
		resea	rch-bas	sed tasl	<s.< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></s.<>											
Course (	Outcon	nes (CC	Ds):	On	success	sful co	ompletio	n of th	is cour	se, stu	dents w	vill be a	able to			
CO 1:				Ana	Analyse different biological data											
CO 2:				Exp	Explain, problematize, synthesize, and articulate											
CO 3:				Арр	Apply and conclude the data											
CO 4:				Ana	nalyse cause-and-effect relationships Define the problem in a concise manner											
CO 5:																
CO 6:					-	-	ng tasks			nts will	also le	earn h	ow to	use fa	cilities,	
				con	npile ar	nd inte	erpret re	search	data							
Mappin	g of CC	s to PC	Ds	1											_	
COs	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
CO 1						×										
CO 2						×										
CO 3						×										
CO 4						×		×								
CO 5						×		×								
CO 6						×		×								
Course o	conten	t and o														
Content			Com	petenci	ies							No of	Hours			
Unit 1:			1													
Laborato	ory Rot	ation					de hand				arious			aining	per	
							high-thr		ut data	1		week				
Learning	-	-	ontact	hours,	and st			-			<u> </u>					
Learning	j strate	gy					Contact	nours			Stud	ient ied	arning t	time (H	rs)	
Lecture																
Seminar																
Small Gr	-			)												
Self-dire		Ų		1)												
Problem				L)												
Case Bas Clinic	seu Lea	n ning (	CDLJ								-					
Practica	1						120				360					
Revision							120				300					
Assessm							1									
TOTAL	ient						1 121				- 360					
IUIAL							121				300					
Assessm	nent M	ethods	•													
Formati		cinous	•						Su	mmati	ve:					
Report S		sion														
Mannin	g of as	sessme	ent wit	h COs												





Nature of assessment	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Sessional Examination	NA	NA	NA	NA		
Quiz	NA	NA	NA	NA	NA	NA
Assignment/Presentation	х	х	х	Х	х	х
End Semester Examination	NA	NA	NA	NA	NA	NA
Laboratory examination	NA	NA	NA	NA	NA	NA
Feedback Process	-Semester Fe	eedback				
<b>Reference Material</b> Reference E	Books and Jo	urnals article	s related to t	he research	topics	

Name o	f the P	rogran	n:		B. Sc.	Biotec	hnolog	gy (Hor	nours)						
Course 7	Title:				Tutor	ials/Se	minar	/Journa	al Club						
Course (	Code:	BBT 40	3		Cours	se Instr	uctor:	Course	e In-cha	arge					
Academ	ic Yea	r: 2023	3 onv	vards	Seme	ster: I	/Year,	VII Ser	nester						
No of Cr	edits:	4			Prere	quisite	s: Qu	alified	in prev	ious s	emeste	ers as p	oer reg	ulation	s with
					a CGF	PA of 7	and at	oove							
Synopsis	s Th	is cours	se wi	ll include	e an allo	tment	of an ir	ndividu	al rese	arch to	pic. Th	is will r	not only	/ enhar	nce the
:				ledge ba				•					•		
	inf	ormati	on cl	early and										rch dat	a.
Course (	Outcor	nes (CC	Ds):	On suce	cessful (	comple	tion of	<sup>f</sup> this co	ourse, s	student	s will b	oe able	to		
CO 1:				Express	though	nts and	ideas	effectiv	/ely						
CO 2:				Demon	strate t	he abil	ity to li	isten ca	arefully	and re	act				
CO 3: Apply one's views and present complex information clearly and concisely to															
				differer	nt group	os									
CO 4:				Conclue	de on ir	format	tion								
CO 5:				Define	a probl	em in a	concis	se man	ner						
CO 6:				Adopt	challen	ging ta	sks; st	udents	will a	lso leai	rn how	ı to co	mpile a	and int	erpret
				researc	h data										
Mappin	g of CO	Os to P	Os			-			_			_			
COs	PO	PO	PO	-	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1		×													
CO 2		×													
CO 3		×						×							
CO 4		×						×							
CO 5		×						×							
CO 6		×						×							
Course										_					
Content	C	ompete	encie	S						No	o of Ho	urs			
Unit 1:															
Seminar			rse w	ill includ	e allotr	nent of	an ind	ividual	resear	ch   30	)-minu	te			
		pic •	<u> </u>												
Learning	-	-	conta	ct hours	and st			-				. I		. ///	
Learning	g strate	egy				Conte	act hou	irs		5	student	iearni	ng time	e (Hrs)	
Lecture						-					00				
Seminar				<u>(</u> )		60				1	L80				
Small Gr															
Self-dire	ected le	earning	s (SDL	-)											





Problem-Based Learning	(PBL)								
Case Based Learning (CB	L)								
Clinic									
Practical									
Revision									
Assessment			01				-		
TOTAL			61				180		
Assessment Methods:									
Formative:					Summ	nativ	e:		
Assignments/presentation	ons				-				
Mapping of assessment	with CO	Ds							
Nature of assessment		CO 1	CO 2	C	03	(	0 4	CO 5	CO 6
Sessional Examination		NA	NA	N	A	١	NA		
Quiz		NA	NA	N	A	١	NA	NA	NA
Assignment/Presentatio	n	Х	х	x		×	(	х	х
End Semester Examinati	on	NA	NA	Ν	A	1	NA	NA	NA
Laboratory examination		NA	NA	Ν	A	1	A	NA	NA
Feedback Process	•	End-Sem	lester Feedb	ack					
Reference Material	Refere	nce Books	and Journal	ls articl	es relat	ed to	the rese	earch topics	

Name o	f the P	rogram	า:			B.Sc. B	iotech	nology	(Hono	ours)					
Course 7	Title:					Resear	rch Pro	ject W	ork						
Course	Code: E	BBT 40	5			Course	e Instru	ictor: S	upervi	sor					
Academ	ic Year	: 2023	8 Onwa	rds		Semes	ter: IV	Year, \	/II Sem	nester					
No of Cr	edits:	12				Prereq	uisites	: Quali	ified in	previo	ous sen	nesters	s as pe	r regul	ations
						with a	CGPA	of 7 an	d abov	/e					
Synopsis	s:	This	course	e will ir	iclude a	an allot	ment o	of indiv	vidual r	esearc	h work	for eac	ch stud	ent. Tł	nis will
			ance s			-			•						ry out
			earch-b												
Course	Outcon	nes (CC	Ds):			sful cor	npletic	on of th	is cour	se, stu	dents v	vill be a	able to		
CO 1:				Ana	lyse										
CO 2:				Exp	lain, pr	oblem	atize, s	ynthes	ize, art	iculate					
CO 3:					•					lata, es	stablish	n hypot	theses,	and p	predict
						-effect									
CO 4:				Ana	lyse ca	use-an	d-effeo	ct relati	ionship	)S					
CO 5:				Def	ine the	proble	em in a	concis	e manı	ner					
CO 6:				Add	opt cha	llengin	g tasks	, and le	earn ho	w to c	ompile	and int	terpret	data.	
Mappin	g of CC	s to P	Os						_						
COs	РО	РО	PO	РО	РО	РО	РО	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1						×									
CO 2						×									
CO 3						×									
CO 4						×		×							
CO 5						×		×							





CO 6			×		×							
Course content and outco	omes:								•			
Content	Compete	encies						No o	f Hours			
Unit 1:												
Research Project	This co	urse	will i	nclude	allotn	nent	of an	26 h	ours of	labora	tory tra	ining
	individua	al rese	arch to	pic				and I	researc	h per v	veek	
Learning strategies, conta	ict hours a	and st	udent	learnin	g time							
Learning strategy				Contac	ct hour.	s		St	udent l	earnin	g time (	(Hrs)
Practical				-				-				
Seminar												
Small Group Discussion (S	GD)											
Self-directed learning (SDI	_)											
Problem Based Learning (	PBL)											
Case Based Learning (CBL)												
Clinic												
Practical				360				10	080			
Revision												
Assessment				01				-				
TOTAL				361				10	080			
Assessment Methods:												
Formative:		Sun	nmativ	e:								
Assignments/presentation	าร	Proj	ject rej	port I su	ubmissi	ion and	l Unive	rsity Vi	iva Voce	e Exam	ination	1
Mapping of assessment w	vith COs	-										
Nature of assessment		CO	1	CO 2		CO 3	C	04	CO	5	CO 6	5
Sessional Examination		NA		NA		NA	N	IA				
Quiz		NA		NA		NA	N	IA	NA		NA	
Assignment/Presentation		х		х		х	х		х		х	
End Semester Examination	n	х		х		х	х		х		х	
Laboratory examination		NA		NA		NA	N	IA	NA		NA	
Feedback Process	NA											
Reference Material	Reference	ce Boo	ks and	Journa	ls articl	les rela	ted to	the res	earch t	opics		

Name of the Pro	ogram:		B.Sc. Biotechnology (Honours)
Course Title:			Tutorials/Seminar/Journal Club
Course Code: Bl	BT 402		Course Instructor: Course In-charge
Academic Year:	2023 onwards	5	Semester: IV Year, VIII Semester
No of Credits:	4		Prerequisites: Qualified in previous semesters as per regulations
Synopsis:	This course	will inclu	de an allotment of an individual research topic. This will not only
	enhance the	research	knowledge base of students but also provide them exposure to how
	to present r	esearch i	nformation clearly and concisely. Students will also learn how to
	compile the	research	data.
Course Outcom	es (COs):	On succ	essful completion of this course, students will be able to
CO 1:		Express	thoughts and ideas effectively
CO 2:		Demons	trate the ability to listen carefully and react





CO 3:						e's viev groups		presen	t com	olex in	formati	on clea	arly and	d conci	sely to
CO 4:						on info		on							
CO 5:				De	fine th	e probl	em in a	a conci	se mar	ner					
CO 6:				Ad	opt cha	allengir	ng tasks	; stude	ents wi	ll also l	earn ho	w to c	ompile	and int	erpret
				res	earch	data									
Mappin	g of CC	)s to PC	Os												
COs	РО 1	РО 2	PO 3	РО 4	РО 5	РО 6	РО 7	РО 8	РО 9	РО 10	PO 11	РО 12	РО 13	РО 14	РО 15
CO 1		×													
CO 2		×													
CO 3		×						×							
CO 4		×						×							
CO 5		×						×							
CO 6		×						×							
Course															
Content		Com	peten	cies							No oj	Hours			
Unit 1:		This			in alu	مام مالد		<u></u>	م : مما:	بالماريما	20.00				
Seminar		rese	arch to	opic		de allo				viduai		ach stu	oral pre dent	esentat	lon
Learning	-	-	ontact	hours	and st	udent		-							
Learning	g strate	egy					Conto	ict hou	rs		9	Student	t learni	ng time	e (Hrs)
Lecture							-					~~			
Seminar			1000	~			60				1	.80			
Small G				)											
Self-dire Problem		_		21.)											
Case Ba				,											
Clinic			CDLJ												
Practica	1														
Revisior															
Assessm							01				-				
TOTAL							61				1	80			
Assessm	nent M	ethods	:												
Formati	ve:									Summ	native:				
Assignm	ients/p	resent	ations							-					
Mappin	-			h COs		0.4	0.0	2			<u></u>		0.5		
Nature o						01	CO	2	CO 3		CO 4	C	05	CO	b
Sessiona	ai Exam	matior	1			A A	NA NA		NA NA		NA NA	•	IA	NA	
Quiz Assignm	ont/Dr	acanta	tion		X		X		x		X NA			X	
End Sen						A	NA		NA		NA		IA	NA	
Laborate						A	NA		NA		NA		IA IA	NA	
								nack							
Feedback Process         End-Semester Feedback															





Name o	f the P	rogran	n:			B.Sc.	Biotech	nology	y (Hon	ours)					
Course								oject W	-	-					
Course	Code: E	3BT 49	9					uctor:		visor					
Academ	nic Year	r: 2023	3 onwa	rds		Seme	ster: IV	/Year,	VIII Se	meste	ſ				
No of C	redits:	16				Prere	quisite	s: Qua	lified in	n previ	ous se	mester	s as pe	r regul	ations
Synopsi	s:	Thi	s cours	e will iı	nclude	an allo	tment	of indiv	vidual	researd	h wor	k for ea	ich stud	dent. T	his will
						-			•			to cor			ry out
				1								nd inte			
Course	Outcor	nes (C	Os):									s will be			
CO 1:												otheses	s, analy	ze,	
CO 2:						roblem							+		
CO 3:										lata, e	stablis	sh hypo	theses	, and p	predict
CO 4:						d-effect ause-ai				<b>n</b> c					
CO 4: CO 5:						e probl				•					
CO 5:						-					arn h	ow to co	omnile	and int	ernret
200.					earch (	•	5 10513	, stude			Jannin		Sinplie		.crprct
Mappin	g of CC	)s to P	Os												
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO 1						×									
CO 2						×									
CO 3						×									
CO 4						×		×							
CO 5						×		×							
CO 6						×		×							
Course	conten	t and o	outcom	es:											
Content			Comp	etencie	25						No of I	Hours			
Unit 1:															
Researc	h Proje	ect				lude al	lotmen	it of an	indivi			urs of la		•	ning
				rch top						1	and re	search	per we	ek	
Learnin	-		contact	hours	, and s	tudent	1					C+			(11.00)
Learning	g strate	egy					Conto	ict hou	rs		•	Student	learni	ng time	e (Hrs)
Lecture Semina	~						-					-			
Small G		scussi	on (SGE	))											
Self-dire				<i>'</i> )											
Problem				L)											
Case Ba			0.	-1											
Clinic		0	()												
Practica							480					1440			
Revisior															
Assessm							01					-			
TOTAL							481					1440			
Assessn	nent M	ethod	s:												
Formati	ve:									Summ	ative:				





Assignments/presentatio	ns/Manuscri	pt submis	sion		Dissertation su Viva Voce Exan		nd University
Mapping of assessment v	with COs						
Nature of assessment		3 CO 4	CO 5	CO 6			
Sessional Examination		NA	NA	NA	NA		
Quiz		NA	NA	NA	NA	NA	NA
Assignment/Presentation		х	х	х	х	х	х
End Semester Examination	n	х	х	х	х	х	х
Laboratory examination		NA	NA	NA	NA	NA	NA
Feedback Process	• End						
Reference Material	Reference	icles re	lated to the rese	arch topics			

MANIPAL SCHOOL OF LIFE SCIENCES MANIPAL (A constituent unit of MAHE, Manipal)



## 7. PROGAM OUTCOMES (POs) AND COURSE OUTCOMES (COs) MAPPING

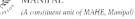
51.         Course         Course         Course         Course         1         2         4         5         6         7         8         9         10      <		<u> </u>				)S) Ar		JUKS			IES (C	<u>.Us) n</u>	VIAPP	ING																
1         Barton         Basics of Biolegy-1         3         Cot Cot Cot         Cot Cot	SI.	Course	Course Name	Credit	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO											
1         Barton         Basics of Biotechnology         3         Cot Cot Cot Cot         Cot Cot Cot         Cot Cot Cot         Cot Cot         Cot	No.	Code		s	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15											
1         Bart of the intervant of a biology-1         3         Code of Cod					CO1		CO4		CO3																					
Indertinging         Image: Column biase intermediate intermedia	1	BBT 101		3	to																									
2         881 03         Biology-II         3         00         CO         CO <thco< th=""> <thco< th="">         CO</thco<></thco<>			Biotechnology		CO4																									
No.         No. <td></td> <td></td> <td></td> <td></td> <td>CO1</td> <td></td> <td>CO1</td> <td></td> <td>CO1</td> <td></td>					CO1		CO1		CO1																					
10         10<	2	BBT 103	Biology-I	3	to		CO5		CO3																					
3         887105         Biology II         3         100         1					CO6																									
i         i					CO1	CO1		CO4						CO6																
4         8F1 107         Chemistry         3         CO1 CO CO CO CO CO CO CO CO CO CO CO CO CO	3	BBT 105	Biology II	3	to	to																								
4         BBT 107         Chemistry         3         Co. Co. Co. Co. Co. Co. Co. Co. Co. Co.						CO6																								
i         i					CO1																									
5         BRT 109         Computer Science         3         C01 CO4         C02 CO4         C02 CO3         C01 CO3         C01 CO4         C03 CO4         C	4	BBT 107	Chemistry	3				CO5																						
5         BF1 109         Computer Science         3         to to to         CO1         CO2         CO1																														
3         81.10         Science         3         Cod Cod         Cod         Cod			Computer		CO1		CO2	CO2		CO1				CO1																
6         BFT 111         Biology I         1         CO1         CO1         CO2         C	5	BBT 109		3								CO3																		
6       8F111       Biology I       1       to to to to to to       COI to to to       COI to to       COI to to       COI to to       COI to to       COI to to       COI to to       COI to to       COI to to       COI to       COI to <thcoi to       <thcoi to       <thcoi t</thcoi </thcoi </thcoi 			Science																											
interplane         interpl										CO4				CO6																
7         BBT 113         Biology II         1         CO1 COS         CO1 COS         CO3 COS	6	BBT 111	Biology I	1																										
7         861 13         800g II         1         to to to to to to to to to to to to to t																														
i.e.         i.e. </td <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>CO4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>CO6</td> <td></td> <td></td> <td></td> <td></td> <td></td>	_							CO4						CO6																
8         BBT 115         Chemistry         1         C01 co6         C01 co6         C01 co2         C01 co6         C02 co6         C02 co6         C02 co6         C03 co6         C01 co6         C03 co6         C01 co6         C03 co6         C04 co6         C04 co6<	7	BBT 113	Biology II	1																										
8       BFT 10       Chemistry       1       too       CO       COO       COO      COO       COO      COO <th< td=""><td></td><td></td><td></td><td></td><td></td><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>						CO6																								
Image: series of the series	-																													
9         BBT 117         Computer Science         1         C01 to CO4         C02 CO4         C02 CO4         C04 CO4         C04         C04         C01 to CO4         C04	8	BBT 115	Chemistry	1																										
9       BBT 11       Outputer Science       1       to CO4       CO4       CO4      CO4       CO4       CO4 <td></td>																														
9         8111         Science         1         CO4         CO4 <td></td> <td></td> <td>Computer</td> <td></td> <td></td> <td></td> <td>CO2</td> <td></td> <td></td> <td>CO4</td> <td></td> <td>CO4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>			Computer				CO2			CO4		CO4																		
10         85         10<	9	BBI 117		1				CO4	CO4																					
10       BBT 119       Seminar/Journal (lub       1       to CC6       to CC6       1       1       to CC6       1       1       1       to CC6       1       1       1       to CC6       1       1       1       to CC6       1 <td>-</td> <td></td> <td></td> <td></td> <td>C04</td> <td>601</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>C04</td> <td></td> <td></td> <td></td> <td></td> <td> </td>	-				C04	601								C04																
11         100	10	DDT 440	Seminar/Journal																											
11       BBT 102       Cell biology       3       CO1       CO2       CO2       CO3	10	RR1 113	Club	1																										
11       BBT 102       Cell biology       3       to       Co       Co<					CO1	006	602																							
i         i	11	<b>DDT 102</b>		2																										
12         BBT 104         Biochemistry         3         C01         C02         C03	11	DD1 102	Cell biology	5																										
12       BBT 104       Biochemistry       3       to       to       to       to       CO6       CO6      CO6      CO6       <						CO1		CO3																						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	12	BBT 104	Biochemistry	з																										
13       BBT 106       Environmental Science       3       C01 to COS       i       C04 to COS       i <t< td=""><td>12</td><td>001 104</td><td>biochemistry</td><td>J</td><td></td><td></td><td></td><td>000</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	12	001 104	biochemistry	J				000																						
13       BBT 100       Environmental Science       3       to COS       io						000	000	CO4																						
Science       Cos       <	13	BBT 106		3																										
14       BBT 108       Physics       3       C01 to CO6       4       4       C04 c       4       4       5       C05 cO6       5       6	10		Science	-																										
14       BBT 108       Physics       3       to       CO       C       I       I       I       CO       I <thi< th=""> <thi< th="">       I</thi<></thi<>									CO4				CO5																	
$ \frac{1}{16}  \frac{1}{10}  \frac{1}{10}$	14	<b>BBT 108</b>	Physics	3																										
15       BBT 110       Advanced Chemistry       3       C01 to C06       5       C06       C01 CO3       C03       C01       C03       C01       C03       C01       C03       C01       C03       C01       C03       C01       C03       C03       C04       C03       C03       C03       C04       C03       C04       C03       C03       C04			,																											
15       BBT 110       Advanced Chemistry       3       to CO6       io CO6       CO3       io CO6       io CO6      io CO6      io CO6			<b>A J J J</b>				CO6	CO1																						
Image: Chemistry       Cond       Con	15	BBT 110		3																										
16         BBT 112         Cell Biology         2         CO1         CO1         CO3         CO1         CO4         CO1         CO3         CO4         CO3         CO4         CO3         CO4         CO3         CO4         CO3         <			Chemistry																											
16       BBT 112       Cell Biology       2       to COG       to COG      to COG						CO1	CO3		CO4	CO1	CO	CO1		CO5	CO4															
16       BBT 112       Cell Biology       2       CO6       CO5       CO6       CO6       CO4       CO6       CO6       C <thc< th=""> <thc< th="">       C</thc<></thc<>																														
Image: second	16	BBT 112	Cell Biology	2	CO6	CO5		CO6				CO6																		
17       BBT 114       Biochemistry       2       CO1 to CO6       4       5       CO3 to CO6       CO3 to CO6       CO1 to CO6       5       5       5       5       5       5         18       BBT 116       Environmental Science       2       CO1 to CO6       CO1 to to to       CO2 to CO3       CO2 CO3       CO1 CO6       CO3 CO3       CO1 CO6       CO3 CO3       CO3 CO3       CO1 CO6       CO3 CO3       CO3 CO3       CO3 CO4       CO3       CO3 CO3       CO3 CO3       CO3 CO4       CO3       CO3 CO3       CO3 CO3       CO3 CO4       CO3 CO3       CO3 CO3       CO3 CO4       CO3 CO3       CO3 CO3       CO3 CO4       CO3 CO3       CO3 CO3       CO3 CO3       CO3 CO3       CO3 CO4       CO3 CO3       CO3 CO3       CO3 CO4       CO3 CO3<			5,																											
17       BBT 114       Biochemistry       2       to CO6       to CO6      to CO6										CO6																				
Image: Marcine state         Image: Ma					CO1					CO3		CO1																		
18         Environmental Science         2         CO1         CO1         CO4         CO1         CO2         CO1         CO2         CO1         CO3         CO3         CO3         CO4         CO3         CO3         CO4         CO3         CO3         CO4         CO4         CO3         CO3	17	BBT 114	Biochemistry	2																										
18         Environmental Science         2         to CO6         to CO5         CO3         CO3         CO4         to         CO3         CO4         to           18         BBT 116         Environmental Science         2         to CO6         to CO5         CO3         CO3         CO4         to         CO3         CO4         CO5										CO6																				
18         BI 116         Science         2         CO6         CO5         CO6         CO6         CO5         CO5					CO1	CO1	CO4					CO1	CO5	CO3	CO6				CO3											
	19	BBT 116	Environmental	2				CO3		CO6	CO4					CO3		CO5												
CO6 CO6	10	551 110	Science	2	CO6	CO5					CO6	CO6					CO5													
								CO6	CO6																					





		<b>•</b> ••	<b>.</b>									eemed to be Un						
SI.	Course Code	Course Name	Credit		PO 2	PO 3	РО 4	PO	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PO 13	PO 14	PO
No.	Code		5	<b>1</b> CO1	2	3	4	<b>5</b> CO	6	/	<b>8</b> CO1	9	10	11	12	13	14	15
				to				2			to							
				CO4				co			CO4							
19	BBT 118	Physics	1	CO4				4			004							
10								to										
								СО										
								6										
		Advanced		CO1	CO1													
20	BBT 120	Chemistry	1	to	to													
		,		CO6	CO6 CO1													
21	BBT 122	Seminar/Journal	1		to													
21	DD1 122	Club	1		CO6													
				CO1		CO1	CO1	CO2			CO2		CO6					
22	DDT 201	Constine	2	to		to	to	CO3										
22	BBT 201	Genetics	3	CO6		CO6	CO4	CO6										
							CO6											
		Molecular		CO1		CO3	CO1	CO3										
23	BBT 203	Biology	3	to		CO5	CO2											
		5.		CO6 CO1	CO1	CO1	CO4	CO1	CO3		CO3							
				to	01	to		CO1	CO5		CO5							
24	BBT 205	Microbiology	3	CO6		CO4		004	CO6		000							
						CO6												
				CO1	CO6			CO3				CO5						
25	BBT 207	Biophysics	3	to				CO6										
				CO5														
26	<b>DDT 200</b>	o		CO1		CO1	CO1	CO3	CO4									
26	BBT 209	Genetics	2	to			CO3											
				CO6 CO1		CO1	CO2	CO1	CO1		CO1							
27	BBT 211	Molecular	2	to		CO3	CO3	CO2	CO4		to							
		Biology	_	C05			CO5		CO5		CO5							
				CO1		CO3		CO2		CO1	CO3							
28	BBT 213	Microbiology	2	to		CO4		to		CO2	to							
				CO5		CO5		CO5			CO5							
20	DDT 045	<b>D</b> : 1 ·		CO1			CO2	CO1	CO3	CO4	CO1							
29	BBT 215	Biophysics	1	to CO6			CO5 CO6	CO3			to CO4							
				000	C01		000				04							
30	BBT 217	Seminar/Journal	1		to													
		Club			CO6													
				CO1			CO6											
31	BBT 202	Biostatistics	3	to														
				CO5														
22	DDT 204	Pharmacology &	2	CO1		CO2 CO3		CO6	CO4									
32	BBT 204	Pharmacogenom	3	to CO6		CO3												
<u> </u>		ics		CO1	CO1	200	CO4						CO6					
33	BBT 206	Plant	3	to	to		04						000					
55	201 200	Biotechnology	Ĵ	CO6	CO6													
				CO1		CO2			CO2				CO2					
34	BBT 208	Bioinformatics	3	to		CO3			CO3				to					
				CO5		CO5			CO5				CO5					
				CO1	CO1	CO1		CO2	CO4		CO4							
35	BBT 210	Immunology	3	to		to		CO5	CO6									
				CO6		CO5		600										
26	BBT 212	Cell & Tissue	2	CO1		CO3	CO1	CO3										
36	DD1 212	Engineering	3	to CO6		CO5	CO2 CO4											
				000			004											







SI.	Course	Course Name	Credit	РО	РО	PO	РО	РО	РО	PO	РО	РО	РО	РО	PO	PO	РО	PO
No.	Code	course Name	s	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Pharmacology &		CO1		-	CO4	-	-		CO4	-						
37	BBT 214	Pharmacogenom ics	1	to CO6			CO5 CO6				CO5 CO6							
38	BBT 216	Plant Biotechnology	1	CO1 to CO6	CO1 to CO6		CO2 CO4	CO3	CO4		CO2		CO6		CO4	CO2 CO6	CO2	CO3 CO6
39	BBT 218	Bioinformatics	1	CO1 to CO5	00	CO1	CO3	CO2 CO4 CO5	CO2 CO4				CO1 to CO5					
40	BBT 220	Immunology	1	CO1 to CO6	CO1 CO2 CO4 CO5 CO6	CO1 CO4 CO5 CO6	CO1 to CO6	CO2 CO3	CO2 CO4 CO6		CO3 CO6							
41	BBT 222	Cell & Tissue Engineering	1	CO1 to CO5		CO1 CO3	CO2 CO3 CO5	CO1 CO2	CO1 CO4 CO5		CO1 to CO5							
42	BBT 224	Seminar/Journal Club	1		CO1 to CO6													
43	BBT 301	Microbial Biotechnology	3	CO1 to CO6		CO3 CO4	CO4	CO4			CO2		CO6					
44	BBT 303	Developmental Biology	3	CO1 to CO6		CO3 CO4 CO5	CO6	CO6			CO6	CO6						
45	BBT 305	Advanced Genomics	3	CO1 to CO5		CO3 CO5	CO1 CO2 CO4	CO3										
46	BBT 307	Nanobiotechnolo gy	3	CO1 to CO6		CO4					CO5					CO6		
47	BBT 309	Research Methodology	3	CO1 to CO5	CO4	CO2 to CO5	CO3	CO1 to CO5	CO1 to CO5		CO3 CO4	CO1				CO5		
48	BBT 311	Microbial Biotechnology	1	CO1 to CO6		CO2 CO4 CO5		CO3 CO5		CO6	CO3 to CO6							
49	BBT 313	Developmental Biology	1	CO1 to CO4		CO1 to CO4		CO2 CO3 CO4			CO1 to CO4							
50	BBT 315	Advanced Genomics	1	CO1 to CO6		CO1 to CO6	CO1	CO6	CO2 to CO6		CO5 CO6							
51	BBT 317	Nanobiotechnolo gy	1	CO1 to CO4		CO1		CO1 CO2	CO2		CO4					CO3		
52	BBT 319	Seminar/Journal Club	1		CO1 to CO6													
53	BBT 302	Tutorial/Seminars /Journal Club	4		CO1 to CO6						CO3 to CO6							
54	BBT 399	Research Project/ Submission of dissertation/ Submission of manuscript	16						CO1 to CO6		CO4 to CO6							





SI.	Course	Course Name	Credit	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
No.	Code		s	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
55	BBT 401	Laboratory Rotation	4						CO1 to CO6		CO4 CO5 CO6							
56	BBT 403	Tutorials/Semina rs/Journal Club	4		CO1 to CO6						CO3 to CO6							
57	BBT 405	Research Project work progress report I submission/ Presentation	12						CO1 to CO6		CO4 CO5 CO6							
58	BBT 402	Tutorials/Semina rs/Journal Club	4		CO1 to CO6						CO3 to CO6							
59	BBT 499	Research Project work /Submission of manuscript	16						CO1 to CO6		CO4 CO5 CO6							