### **Curriculum for B. Sc Biotechnology**

For the Candidates admitted in 2022-2023 onwards Under Autonomous, CBCS & OBE pattern



### **DEPARTMENT OF BIOTECHNOLOGY**



### VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN [AUTONOMOUS]

An ISO 9001:2015 Certified Institution | Affiliated to Periyar University Approved by AICTE | Re-accredited with "A" Grade by NAAC| Recognized Under 2(f) and 12 (b) of UGC Act, 1956. Elayampalayam, Tiruchengode-637 205, Namakkal Dt., Tamil Nadu, India

#### **B.Sc BIOTECHNOLOGY**

#### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

<b>DEO.</b> 1	Biotechnology graduate students shall attain professional/industrial expertise by
PEO: 1	developingcompetent, creative and ever ready personanty to accept recent, innovative
	and challenging roles in Industry and Academic and Research sectors
	Students shall inculcate in the development of entrepreneurial traits in order to cuddle
PFO· 2	innovative opportunities by adapting emerging biotechnological concepts in terms
1 EO. 2	of techniques with subsequent development of leadership in the course of start-up
	of small-medium scale biotech based industry
DEO. 3	Students shall progressively adapt, follow and learn the concepts of
1 EO. 3	biotechnologycontinuously by aiding modern teaching tools
<b>PEO: 4</b>	Imparting the basic and outstanding knowledge in all terms of biotechnology
DE(), 5	Students shall acquire the concepts to disseminate the advanced biotechnological aspects
160:5	andits cutting edge developments in specific and developing area in the field of
	Biotechnology

#### PROGRAMME OUTCOMES (POs)

GRADE	OUTCOME
PO: 1	To train and develop students with the much needed biotechnological education, so that they develop added competitive skill metrics (CSM) for industrial employment higher education
	and employment upon graduation
PO: 2	To comprehend the assorted knowledge of biotechnical concepts domains and their applicability in the development of value added products for the welfare of the society
PO: 3	To develop a broad range of biotechnological skills and knowledge, development of general and specific competences to meet-out current expectations and requirements of medical, pharmaceutical, bio-molecular and agricultural sectors
PO: 4	To understand and merge the knowledge and concepts of biochemical, biophysical and bio statistical domains
PO: 5	To clarify various challenges in health care by integrating different biological domains including clinical, immunological, pharmaceutical and cancer genomics

#### PROGRAMME SPECIFIC OUTCOMES (PSOs)

GRADE	SPECIFIC OUTCOME
PSO: 1	To provide solutions for the challenges faced by pharmaceutical and molecular diagnostic Sectors
<b>PSO: 2</b>	To provide technical products with high frequency of reproducibility to the society
PSO: 3	To gain vertical mobility in career that will make students more competent to face national/international qualifying exams with practical knowledge acquaintance and in modern biotechnology field
PSO: 4	To solve complex problems in the field of Biotechnology with an understanding of social, ethical, legal and cultural aspects of the society
PSO: 5	To understand the over-all theme/concepts of each specialization in biotechnology and analyzing the frequency of its applicability in industry, research and for the goodness of Society

#### VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

#### Elayampalayam - 637 205, Tiruchengode, Tamilnadu

#### **DEPARTMENT OF BIOTECHNOLOGY**

#### B.Sc., Biotechnology Curriculum (Autonomous, CBCS & OBE pattern)

#### SCHEME OF EXAMINATION

(For the Candidates admitted during the academic year 2022-2023 onwards)

Course Code	Title of the Course	Credite	Hours		Maxim	5	
Course Coue	The of the Course Creat		Theor	Practica	Internal	External	Total
	Semeste	r - I					
Language I Cou	rses (Any one course)						
21U1LT01	Tamil I						
21U1LM01	Malayalam I	3	6		25	75	100
21U1LH01	Hindi I	5	0	-	23	15	100
21U1LF01	French I						
Language II Cou	irse						
21U1CE01	Communicative English	3	6	-	25	75	100
21U1LSPE01	Professional English			-	25	75	100
Core Courses							
22U1BTC01	Cell Biology	4	4	-	25	75	100
22U1BTC02	Basics in Lab Safety	2	2	-	25	75	100
22U1BTCP01	Lab in Cell Biology	3	-	3	40	60	100
Allied Courses			•	•			
22U1BCA01	Biochemistry I	4	4	-	25	75	100
22U1BCAP01	Lab in Biochemistry I	3	-	3	40	60	100
Mandatory cour	se (Value Education)						
17U1VE01	Yoga	2	2	-	25	75	100
Total		24	24	6	255	645	900
	Semester	· – II					
Language I Cou	rses (Anv one course)						
21U2LT02	Tamil II						
21U2LM02	Malavalam II						100
21U2LH02	Hindi II	- 3	6	-	25	75	100
21U2LF02	French II						
Language II Cou	ırse						
21U2CE02	Communicative English	3	6	-	25	75	100
21U2LSPE02	Professional English			-	25	75	100
Core Courses	6						
22U2BTC03	Basic calculations in Biology	4	4	-	25	75	100
22U2BTC04	Genetics	2	3	-	25	75	100
22U2BTCP02	Lab in basic biology calculations	3	-	2	40	60	100
Allied Courses		_			-		
22U2MBA02	Microbiology	4	4	-	25	75	100
22U2MBAP02	Lab in Microbiology	3	-	3	40	60	100
Mandatory cour	se (Value Education)			_	_		
22U2BTVE01	Environmental Sciences	2	2	-	25	75	100
Research Activit	V	<u>I</u>	I	I	-		<u> </u>
22U2BTPR01	Micro Project 3	_	-	-	40	60	100
Total	1 5	24	25	5	295	705	1000

#### DEPARTMENT OF BIOTECHNOLOGY B.Sc., Biotechnology Curriculum (Autonomous, CBCS & OBE pattern) SCHEME OF EXAMINATION

#### (For the Candidates admitted during the academic year 2022-2023 onwards)

(For the Canadates damined during the academic year 2022-2023 onwards)								
Longuago I Co		1 – 111						
Language I Co	Tomil III							
21U3L103	Malayalam III 3							
21U3LW03				-	25	75	100	
21U3LH05								
2103LF01	French III							
Language II C	ourse	2			0.5	75	100	
21U2CE02	Communicative English	3	6	-	25	/5	100	
Core Courses			4	1	1.05		100	
22U3BTC05	Molecular Biology	4	4	-	25	/5	100	
22U3BTCP03	Lab in Molecular Biology	3	-	3	40	60	100	
Allied Courses			T	1	1	1	[	
18U1BCA03	Plant Science	4	4	-	25	75	100	
18U1BCAP03	Lab in Plant Science	3	-	3	40	60	100	
Skill based Ele	ctive course (SBEC) -I			1				
22U3BTS01	Forensic Sciences & Technology	2	2	_	25	75	100	
22U3BTS02	Food Biotechnology	2	2		25	15	100	
Non-Major Ele	ective Course (NMEC) - I							
22U3BTN01	Biosafety, Bioethics & IPR	cs & IPR		_	25	75	100	
22U3BTN02	Bioinformatics	2	2	-	23	15	100	
Total		24	24	6	230	570	800	
	Semester - IV							
Language I Co	uncos (Any one counce)							
Language I Co	urses (Any one course)				_			
21U4LT04	Tamil IV							
21U4LT04 21U4LM04	Tamil IV Malayalam IV	3	6		25	75	100	
21U4LT04 21U4LM04 21U4LH04	Tamil IV Malayalam IV Hindi IV	3	6	-	25	75	100	
21U4LT04 21U4LM04 21U4LH04 21U4LF04	Tamil IV Malayalam IV Hindi IV French IV	3	6	-	25	75	100	
21U4LT04 21U4LM04 21U4LH04 21U4LF04 Language II C	Tamil IV       Malayalam IV       Hindi IV       French IV	3	6	-	25	75	100	
21U4LT04 21U4LM04 21U4LH04 21U4LF04 Language II C 21U2CE02	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English	3	6	-	25	75	100	
21U4LT04         21U4LM04         21U4LH04         21U4LF04         Language II C         21U2CE02         Core Courses	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English	3	6	-	25	75 75	100 100	
21U4LT04         21U4LM04         21U4LH04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering	3	6 6 4	-	25 25 25	75 75 75	100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering	3 3 4 4	6 6 4 -	- - - 3	25 25 25 25 25	75 75 75 75	100 100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering	3 3 4 4	6 6 4 -	- - - 3	25 25 25 25 25	75 75 75 75	100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LF04         Language II C         2112CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses         22U4ZOA02	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology	3 3 4 4 3	6 6 4 - 3	- - 3	25 25 25 25 25 25	75 75 75 75 75	100 100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses         22U4ZOA02         22U4ZOAP02	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology	3 3 4 4 3 3	6 6 4 - 3 -	- - 3 - 3	25 25 25 25 25 25 40	75 75 75 75 75 60	100 100 100 100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses         22U4ZOA02         Skill based Ele	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II	3 3 4 4 3 3 3	6 6 4 - 3 -	- - 3 - 3	25 25 25 25 25 25 40	75 75 75 75 75 60	100 100 100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses         22U4ZOA02         22U4ZOA02         Skill based Ele         22U4BTS03	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         Ctive course (SBEC) -III         Poultry science	3 3 3 4 4 4 3 3 3	6 6 4 - 3 -	- - 3 - 3	25 25 25 25 25 25 40	75 75 75 75 60	100 100 100 100 100	
21U4LT04         21U4LT04         21U4LM04         21U4LF04         21U4LF04         Language II C         21U2CE02         Core Courses         22U4BTC06         22U4BTCP04         Allied Courses         22U4ZOA02         22U4ZOA02         Skill based Ele         22U4BTS03         22U4BTS04	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II         Poultry science         Marine Biotechnology	3 3 4 4 4 3 3 3 	6 6 4 - 3 - 2	- - 3 - 3	25 25 25 25 25 25 40 25	75 75 75 75 60 75	100 100 100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LF04         2114LF04         Language II C         21102CE02         Core Courses         2204BTC06         2204BTCP04         Allied Courses         2204ZOA02         2204ZOA02         Skill based Ele         2204BTS03         2204BTS04	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II         Poultry science         Marine Biotechnology         ective Course (NMEC) - II	3 3 4 4 4 3 3 3 - 2	6 6 4 - 3 - 2	- - 3 - 3 -	25 25 25 25 25 25 40 25	75 75 75 75 60 75	100 100 100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LH04         2114LF04         Language II C         21102CE02         Core Courses         2204BTC06         2204BTCP04         Allied Courses         2204ZOA02         2204ZOA02         Skill based Ele         2204BTS03         2204BTS04         Non-Major Ele         2004BTN03	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II         Poultry science         Marine Biotechnology         ective Course (NMEC) - II         Concepts of Biotechnology	3 3 4 4 4 3 3 	6 6 4 - 3 - 2	- - 3 - 3	25 25 25 25 25 40 25	75 75 75 75 60 75	100 100 100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LF04         2114LF04         Language II C         2112CE02         Core Courses         22U4BTC06         22U4BTC06         22U4BTC04         Allied Courses         22U4ZOA02         22U4ZOA02         Skill based Ele         22U4BTS03         22U4BTS04         Non-Major Ele         20U4BTN03         20U4BTN04	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II         Poultry science         Marine Biotechnology         ective Course (NMEC) - II         Concepts of Biotechnology         Biotechnology for Society		6 6 4 - 3 - 2 2	- - 3 - 3 -	25 25 25 25 25 25 25 25 25 25	75 75 75 75 60 75 75	100 100 100 100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LH04         2114LF04         Language II C         21102CE02         Core Courses         2204BTC06         2204BTCP04         Allied Courses         2204ZOA02         2204ZOA02         Skill based Ele         2204BTS03         2204BTS04         Non-Major Ele         2004BTN03         2004BTN04         Research Activ	Tamil IV         Malayalam IV         Hindi IV         French IV         ourse         Communicative English         Genetic Engineering         Lab in Genetic Engineering         Developmental Biology         Lab in Developmental Biology         ctive course (SBEC) -II         Poultry science         Marine Biotechnology         ective Course (NMEC) - II         Concepts of Biotechnology         Biotechnology for Society		6 6 4 - 3 - 2 2	- - - 3 - -	25 25 25 25 25 40 25 25 25	75 75 75 75 60 75 75	100 100 100 100 100 100 100	
2114LT04         2114LT04         2114LM04         2114LH04         2114LF04         Language II C         21102CE02         Core Courses         2204BTC06         2204BTCP04         Allied Courses         2204ZOA02         2204ZOA02         Skill based Ele         2204BTS03         2204BTS04         Non-Major Ele         2004BTN03         2004BTN04         Research Activ         2204BTPR02	Tamil IVMalayalam IVHindi IVFrench IVourseCommunicative EnglishGenetic EngineeringLab in Genetic EngineeringDevelopmental BiologyLab in Developmental Biologyctive course (SBEC) -IIPoultry scienceMarine Biotechnologyective Course (NMEC) - IIConcepts of BiotechnologyBiotechnology for Society/ityMini Project4		6       4       -       3       -       2       2       -	- - 3 - 3 - -	25 25 25 25 25 40 25 25 25 25 40	75 75 75 75 60 75 75 60	100 100 100 100 100 100 100 100	

#### DEPARTMENT OF BIOTECHNOLOGY B.Sc., Biotechnology Curriculum (Autonomous, CBCS & OBE pattern) SCHEME OF EXAMINATION

(For the Candidates admitted during the academic year 2022-2023 onwards)

	Semester	- V					
Core Courses							
22U5BTC07	Immunology	4	5	-	25	75	100
22U5BTC08	Biostatistics 4 5				25	75	100
22U5BTC09	Medical Lab Technology	4	5	-	25	75	100
Practical		•		•			
22U4BTCP05	Lab in Immunology & Medical lab tech	3	-	6	40	60	100
22U4BTCP06	Lab in Biostatistics	2	-	3	40	60	100
Elective - I							
20U5BTE01	Pharmaceutical Biotechnology	3	3		25	75	100
20U5BTE02	Tissue Engineering	5	5	-	23	15	100
Skill based Elec	tive course (SBEC) -III						
20U5BTS05	Bioinformatics	2	2		25	75	100
20U5BTS06	Cancer Biology	2	2	-	23	15	100
Mandatory Co	irse						
19U5BTEX01	Internship	-	1	-	40	60	100
Total	1	22	21	9	245	555	800
	Semester -	VI					
Core Courses							
22U5BTC010	Bioprocess technology	4	5	-	25	75	100
22U5BTC011	Plant and Animal Biotechnology	4	5	-	25	75	100
Practical		•		•			
22U4BTCP07	Lab in Bioprocess technology	3	-	5	40	60	100
22U4BTCP08	Lab in Plant and Animal biotechnology	3	-	5	40	60	100
Elective- II		•	•		•		
20U6BTE03	Genomics and Proteomics	3	3		25	75	100
20U6BTE04	Biophysics and Bioinstrumentation	5	5	-	23	15	100
Skill based Elec	tive course (SBEC) -III	•	•		•		
20U6BTS07	Nano Biotechnology	2	2		25	75	100
20U6BTS08	Environmental Biotechnology		2	-	23	15	100
Research Activi	ity						
22U6BTPR03	Major Project	3	-	5	40	60	100
Extension Activ	ity						
22U6BTEX01	Extension activity	-	-	-	40	60	100
		22	15	15	260	540	800
		140	132	48	1540	3660	5200

Course Code	Course Code 22U1BTC01 Hours/		Ν	Marks					
Credits	edits 4 CORE – I weak								
Total Hours	75 CELL BIOLOGY T P I		Int	Ext					
Max. Mark	100		4	-	25	75			
Course Objectiv	ves:								
The main objectives of this course are:									
1. Students v	vill understand th	ne structures and purposes of basic component	nts of	proka	ryotic	and			
eukaryot	ic cells, especial	ly macromolecules, membranes and organel	les.	-					
2. Students v	2. Students will understand how these cellular components are used to generate and utilize energy								
in cells.									
3. Students v	vill understand th	ne cellular components, Structural features, C	Organe	elles a	nd the	cellular			
mechani	sms and mitotic	cell division.							
Course outcome	es								
On the successfu	ul completion of	the course, student will be able to:							
CO1 Design	n the model of a	cell.			K1				
CO2 Differ	entiate the struct	ure of prokaryotic and eukaryotic cell.			K2	)			
CO3 Explai	in the organization	on of cytoskeleton, morphology and its aberr	ations		K3	}			
CO4 Comp	are and contrast	the events of Membrane trafficking, cellular	organ	elles.	K4	ŀ			
CO5 Explai	in the microscop	e and cell fractionation.			K5	&K6			
K1 - Ren	nember; K2 - Un	derstand; K3 - Apply; K4 - Analyze; K5 - Ev	valuat	e; K6	- Crea	ite			
INIT I FUNDAMENTALS OF CELL STRUCTURE 13 Hrs									
UNIT I FU	J <b>NDAMENTAI</b>	LS OF CELL STRUCTURE				13 Hrs			
UNIT IFUDiscovery of cell	JNDAMENTAI Ils; Basic proper	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H	Prokar	yotic	and E	13 Hrs Lukaryotic			
UNIT IFUDiscovery of cells. Cell division	J <b>NDAMENTAI</b> lls; Basic proper on: Cell cycle; m	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H itosis; meiosis, binary fission.	Prokar	yotic	and E	13 Hrs Lukaryotic			
UNIT IFUDiscovery of cells. Cell divisionUNIT IICH	J <b>NDAMENTAI</b> Ils; Basic proper on: Cell cycle; m ELLULAR ME	LS OF CELL STRUCTURE rties of cells; Different classes of cells – F itosis; meiosis, binary fission. MBRANES AND MATRICES	Prokar	yotic	and E	13 Hrs         Cukaryotic         13 Hrs			
UNIT IFUDiscovery of cellcells. Cell divisionUNIT IICHCell membrane-(Robertson)San	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – I itosis; meiosis, binary fission. <b>MBRANES AND MATRICES</b> osition, Structure, functions and transportation and Dayson model): Eluid Mosiac model (Se	Prokar ion (U	yotic	and E	13 Hrs       Sukaryotic       13 Hrs       13 Hrs       ine model			
UNIT IFUDiscovery of cellcells. Cell divisionUNIT IICHCell membrane-(Robertson), SamUNIT IICH	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli VTOSKELETO	LS OF CELL STRUCTURE rties of cells; Different classes of cells – H itosis; meiosis, binary fission. MBRANES AND MATRICES osition, Structure, functions and transportation and Dayson model); Fluid Mosiac model (Sa N STRUCTURE AND FUNCTION	Prokar ion (U anger l	yotic Init m Nicols	and E embra	13 Hrs       Jukaryotic       13 Hrs       ine model       14 Hrs			
UNIT IFUDiscovery of cellcells. Cell divisionUNIT IICHCell membrauer(Robertson), SamUNIT IIICHMicrotubulesCH	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli YTOSKELETO	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H itosis; meiosis, binary fission. <b>MBRANES AND MATRICES</b> osition, Structure, functions and transportation and Dayson model); Fluid Mosiac model (Sa <b>N – STRUCTURE AND FUNCTION</b> and intermediate filaments: Microfilame	Prokar ion (U anger 1	yotic Init m Nicols	and E embra son).	13 Hrs         Sukaryotic         13 Hrs         une model         14 Hrs         myosin:			
UNIT IFUDiscovery of cellcells. Cell dividUNIT IICHCell membrane(Robertson), SanUNIT IIICHMicrotubules- Ccytoskeleton: Jun	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli XTOSKELETO Cilia, flagella a potions- Gan Jun	LS OF CELL STRUCTURE rties of cells; Different classes of cells – H itosis; meiosis, binary fission. MBRANES AND MATRICES osition, Structure, functions and transportate and Dayson model); Fluid Mosiac model (Sa N – STRUCTURE AND FUNCTION and intermediate filaments; Microfilame ction and Tight Junction Desmosomes	Prokar ion (U anger I ents-	yotic Init m Nicols actin	and E embra son).	13 Hrs         Jukaryotic         13 Hrs         ine model         14 Hrs         myosin;			
UNIT IFUDiscovery of cellcellcells. Cell divisionCHUNIT IICHCell membrauerCH(Robertson), SanCHUNIT IIICHMicrotubulesCHcytoskeleton; JunCHUNIT IVST	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli VTOSKELETO Cilia, flagella actions- Gap Jun	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H itosis; meiosis, binary fission. <b>MBRANES AND MATRICES</b> osition, Structure, functions and transportation and Dayson model); Fluid Mosiac model (Sa <b>N – STRUCTURE AND FUNCTION</b> and intermediate filaments; Microfilame ction and Tight Junction Desmosomes. <b>ID FUNCTION OF CELLULAR ORGAN</b>	Prokar ion (U anger 1 ents-	yotic Init m Nicols actin	and E embra son). and	13 Hrs         Jukaryotic         13 Hrs         Ine model         14 Hrs         myosin;         15 Hrs			
UNIT IFUDiscovery of cellcells. Cell dividUNIT IICHCell membra(Robertson), SanUNIT IIICHOunit IIICHUNIT IIICHUNIT IIICHUNIT IIICHUNIT IIICHUNIT IIICHUNIT IVSTNucleusNucleus	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli XTOSKELETO Cilia, flagella a inctions- Gap Jun 'RUCTURE AN lus Ribosomes	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H itosis; meiosis, binary fission. <b>MBRANES AND MATRICES</b> osition, Structure, functions and transportate and Dayson model); Fluid Mosiac model (Sa <b>N – STRUCTURE AND FUNCTION</b> and intermediate filaments; Microfilame ction and Tight Junction Desmosomes. <b>ND FUNCTION OF CELLULAR ORGAN</b> Endoplasmic reticulum-(RER and SER). Ge	Prokar ion (U anger 1 ents-	yotic Init m Nicols actin ES	and E embra son). and	13 Hrs         cukaryotic         13 Hrs         ine model         14 Hrs         myosin;         15 Hrs         ochondria			
UNIT IFUDiscovery of cellcells. Cell divisionUNIT IICHCell membrauer(Robertson), SameUNIT IIICHMicrotubulesCHcytoskeleton; JuniUNIT IVSTNucleus, Nucleonand Chloronlasti	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli VTOSKELETO Cilia, flagella actions- Gap Jun TRUCTURE AN lus, Ribosomes, perovisomes an	LS OF CELL STRUCTURE rties of cells; Different classes of cells – H itosis; meiosis, binary fission. MBRANES AND MATRICES osition, Structure, functions and transportate and Dayson model); Fluid Mosiac model (Sa N – STRUCTURE AND FUNCTION and intermediate filaments; Microfilame ction and Tight Junction Desmosomes. ND FUNCTION OF CELLULAR ORGAN Endoplasmic reticulum-(RER and SER), Go d Glyoxisomes, vacuoles; Membrane traffich	Prokar ion (U anger 1 ents- NELL olgi co	yotic Init m Nicols actin ES	and E embra son). and x, Mite	13 HrsJakaryotic13 HrsJakaryotic13 HrsJakaryotic14 Hrsmyosin;15 Hrsochondria			
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UNIT IFUDiscovery of cellcells. Cell divisioncells. Cell membraneCICell membraneCI(Robertson), SamCIUNIT IICYMicrotubulesCIcytoskeleton; JurCYUNIT IVSTNucleus, NucleusSTMicroscopy: TypTHMicroscopy: TypVIIT VUNIT VTHMicroscopy: TypVIIIUNIT VIVISEFERENCES1.1.Paul, edition2.Lodis3.Alber4.Watso5.Gener6.Georg Edition7.R.C. I8.Pragy	JNDAMENTAI Ils; Basic proper on: Cell cycle; m ELLULAR ME Chemical comp dwich (Danielli TOSKELETO Cilia, flagella a netions- Gap Jun TRUCTURE AN lus, Ribosomes, Peroxisomes and ECHNIQUES IN pes of Microscop DEO LECTUR A. 2007. Text n, Kolkata 700 ( h et al Molecular ts et al Molecular bis and Genomes big and	<b>LS OF CELL STRUCTURE</b> rties of cells; Different classes of cells – H itosis; meiosis, binary fission. <b>MBRANES AND MATRICES</b> osition, Structure, functions and transportation and Dayson model); Fluid Mosiac model (Sac <b>N – STRUCTURE AND FUNCTION</b> and intermediate filaments; Microfilaments ction and Tight Junction Desmosomes. <b>N FUNCTION OF CELLULAR ORGAN</b> Endoplasmic reticulum-(RER and SER), Good d Glyoxisomes, vacuoles; Membrane trafficter <b>N CELL BIOLOGY</b> es, Principles of light and compound micross <b>ES, SEMINARS AND WEBINARS</b> book of cell and molecular biology, Book 009, pp-1310. r Cell biology 8th ed. Freeman, 2016. ar biology of the cell. 6th ed. Garland Sci. 20 tology of the Gene. 7th ed. Pearson Edu, 201 by M Singer, and P Berg, Blackwell Scientifi i& David Freifelder. 1998. Essentials of Mor rtcett Publishers 6 ell and Molecular Biology. New Age Interna Cell and Molecular Biology. IK International	Prokar ion (U anger I ents- <b>VELL</b> ) olgi co king. cope; cope; cope; cope; diss and 14. 3. ic Pub olecula ationa Publis	yotic Init m Nicols actin ES Cell f Cell f Allie Allie ar Bic l Publ shing	and E embra son). and x, Mite raction ded (P) ology, lishers House	13 Hrs         Jakaryotic         13 Hrs         ine model         14 Hrs         myosin;         15 Hrs         ochondria         15 Hrs         ation         5 Hrs         Ltd. 2nd         3rd			

Course Code		22U1BTC02		Hours/weak					
Credits Total Hours Max. Mark		2	COREPAPER-II		TotalHours				
		45	BASICS IN LAB SAFETY	Т	Р	Int	Ext		
		100		2	-	25	75		
Cours	e Objectives	:							
The n	nain objective	s of this course ar	re:						
1	. Students v	vill comprehend th	he appropriate lab clothing and regulations.						
2. Students will be knowledge able with laboratory emergencies, chemical risks, electrical									
	hazards, waste management and laboratory accident response.								
Sec. Co	5. Upon succ	essful completion	n of the course, students should have a clear u	unders	standin	g			
ANAHORA	of laborate	bry safety precaut	ions, emergency first aid, and response.						
Cours	e outcomes								
On th	e successful o	completion of the	e course, student will be able to:						
CO1	Respond to	o laboratory emer	gency procedures of laboratory incidents or a	accide	ents.	K1			
CO2	Know the	laboratory safety	signs.			K2			
CO3	Differentia	ate the various bio	blogical safety levels.			K3			
CO4	Adopt for	PPE usage and pr	rotective measures.			K4			
CO5	Understan	d the disposal of a	experimental wastes and spill clean-up.			K5&	zK6		
K1 - F	Remember; K	2 - Understand; K	3 - Apply; K4 - Analyze; K5 - Evaluate; K6	- Crea	nte				
Unit:1	GENE	CRAL LAB SAF	FETY	7	7 hour	s			
Lab ru	les and safety	v signs, Personal p	protective equipment, protecting clothing, has	nd pro	otection	ns, foot	t		
protec	tion, hearing	protection, respira	atory protection, Eye and face Protection.						
Unit:2	2 GLAS	S WARE SAFE	ГҮ		7hou	°S			
Inspec	ting glasswar	e before use, safe	handling and storage, vacuum and pressure of	operat	ions, c	leanin	g and		
drying	, disposal and	l spill clean-up.							
Unit:3	B CHEN	AICAL AND EL	LECTRICAL SAFETY		8hou	rs			
Safety	Datasheet, st	orage guidelines,	chemical spills, chemical exposure monitorin	ng; El	ectrici	ty gene	eral		
specif	ications, elect	rical system usage	e guide lines, preventing electrical Hazards.						
Unit:	BIOL	OGICAL SAFE			8hour	S 1			
Biolog	gical safety le	vels, safety data s	heets for infectious substances, decontaminat	tion, t	ranspo	rt and			
smpm		cal materials, eme	ergencies, exposures and spins, biological wa		sposar	•			
Unit:		GENCY PROC	EDURES AND RESPONSE TO ACCIDE	NIS Eine	IUN	ours			
Emerg	stations. Emo	res- Spill, First a	a and Emergency kits, protective procedures	, rite	exting vplosi	uisner	s, eye		
porsor	stations, Enter	contaminations	cesponses-chemical spins, gas leakages, me	ande	xpiosi	ons,			
persor	iai ilijui y aliu	contaminations.							
I Init•	6 CON	TEMPORARY	CLASSES		5hour	'S			
Video	s one emerge	ncv procedure, res	sponse to incidents, biological and chemical	waste	dispos	als.			
					F				
Refer	ence Books	C / TT 11 1							
1.	Laboratory S	arety Handbook,	1st Edition, Sabanc University (2016).						
2.	Kaj Monan Jo	DSNI(Ed.). 2006. E	biosarety and Bioethics. Isna Books, Delhi.						
3. 4	BIOethics &	BIOSAITEY By Sate	vesn IVIK (2008), IK Publishers.						
4. 5	https://www.	ccri.edu/safety/lat	<u>D_salety_for_students.ntml</u> .						
э. с	https:// <u>www</u> .	esarety.com/cours	ses/spiil-response-awareness/.	fatr-					
о.	. https://ehs.ucsc.edu/programs/research-safety/video-resources.html#fire-safety.								

Paper	aper Code 22U1BTCP01 Hours/we					rs/weal	K		
Credi	lits 3 CORE PRACTICALS-I TotalHours			ours:45					
Total Hours		60	LAB IN CELL BIOLOGY	Т	P	Int	Ext		
Max.	Mark	100		-	3	40	60		
Course Objectives:									
The main objectives of this course are to:									
1. To introduce fundamentals of cell biology techniques.									
2. To teach students the basic techniques and instrument principles in biotechnology									
3.	To giv	ve hands on cell bi	ology experiments						
Cours	e Outco	omes:							
On the	e succes	sful completion o	f the course, student will be able to:						
CO1	Be awa	are of the laborato	ry preparation of solutions.			K	.1		
CO2	Unders	stand the importan	ce, preparation of buffers.			K	.2		
CO3	Learns	to visualize the co	ells by employing different types of microscope	3		K	.3		
CO4	Bring i	in the basic techni	ques of cell biology			K	[4		
CO5	Analys	sis of characterizat	ion of known and unknown microbes and cells.			K	5&K6		
<b>K1</b> - R	Rememb	er; <b>K2</b> - Unde	erstand; K3 - Apply; K4 Analyze K5 -	Evalua	te; K	6 - Crea	te		
			Cell Biology			H	lours		
1. Prep	paration	of stock and work	ing solution: Percent solution, normal solution,	molar s	olutic	on. 3			
2. Mic	rometer	•				3			
<b>3</b> . Blo	od smea	r- differential stain	ing.			3			
<b>4</b> . Mic	roscopy	and usage of Poir	iter and Camera Lucida.			3			
5. Der	nonstrat	ion of various stag	es of mitosis using onion root tip.			3			
6. Den	nonstrat	ion of various stag	es of meiosis using grasshopper testis squash.			3			
7. Prep	paration	of Buccal Smear	squash.			3			
8. Cell	l countin	ig and viability.				3			
9. Prep	paration	of Microscope sli	de [DicotLeafSection].			3			
10. Pe	rmanent	slide preparation.				3			
Refer	ence Bo	OK(S)							
David	A. I not	npson. 2011. Cell	and Molecular Biology Lab. Manual.		T-11 D	· . 1			
DUH	lall, S E	Hawkins. 1974. L	aboratory Manual of Cell Biology. British Socie	sty for C	Lell B	1010gy,			
Mory	I I odby	attor 1003 Coll P	iology: Laboratory Manual Edition: 2 Publishe	d by D	onIon	Dublich	ina		
Incorp	L. LCUD(	alter: 1995. Cell B	iology. Laboratory Manual. Edition: 2. Publishe	u uy K(	JUJOII	r uutisti	ung.		
Relate	d Online	Contents MOO	SWAYAM NPTEL Websites etc.						
https://		zolifesciences con	yarticle/What-is-a-pH-Meter-and-How-Does-it.	Work	asny				
<u>mps./</u>	, <u>, ,, ,, ,, ,, ,, ,,</u>	2011050101005.0011	a article, what is a pri meter-and-riow-DOCS-it		мэрл				
Text l	300K								
Ruban	. P. Bas	ic Biotechniques.	1st Edition. Notion press. 2020						

Cours	se Code 22U1BCA01 Hours/		urs/ Mar		arks		
Credi	ts	4 ALLIED COURSE – I weak					
Total	Hours	75	BIOCHEMISTRY	Т	Р	Int	Ext
Max.	Mark	100		4	-	25	75
Cours	se Objectiv	ves:					
The m	ain objecti	ves of this cours	e are:				
1. To :	make the st	udents understar	nd the basics biological molecules existing t	he livi	ng cel	11.	
2. Stu	dents also	acquire knowled	ge on their biological functions and their in	iportai	nce in	n of	
molec	ules in cell	and its growth.		•			
Cours	se outcome	es s					
On th	e successfi	ul completion of	the course, student will be able to:				
C01	Acquiri	ng knowledge on	carbohydrate and its types in biology.			K1	
CO2	Underst	anding the basic	concepts on proteins and amino acids and the	neir		K2	
	properti	es					
CO3	Under t	he role of biologi	ical catalysts (Enzymes) and lipids, their rol	ein		K3	
	basic bi	ochemical reaction	ons				
CO4	To gain	over all information	tion on vitamins, their physiological functio	ns and		K4	
	deficien	cy symptoms and	d consequent diseases				
CO5	Acquiri	ng knowledge on	carbohydrate and its types in biologicalsyst	ems.		K5&	K6
		<u> </u>		-	** <		
	K1 - Reme	mber; K2 - Unde	erstand; K3 - Apply; K4 - Analyze; K5 - Eva	aluate;	K6 -	Create	
						- I	
UNIT	<b>TI</b> CA	ARBOHYDRAT	TES			13	3 Hrs
Carbo	hydrate –	classification, m	onosaccharide's (glucose, fructose, galacto	se &	xylos	e)- phy	/sical
and ch	nemical pro	perties, disaccha	arides (sucrose, lactose), polysaccharides (g	glycog	en, st	arch, p	ectin,
keratıı	n sulphate	& chondroitin su	lphate).				
UNIT		MINO ACIDS A	AND PROTEINS			13	8 Hrs
Classi	fication, St	tructure, Essenti	al and Non- essential amino acids. Defi	nition,	, Cla	ssificat	ion,
Functi	ions and P	ropertiesof protei	in. Proteins-primary, secondary, tertiary and	l quate	rnary	structu	ires.
UNIT		NZYMES		<b>T</b> 1		14	Hrs
Defini	ition, holo	enzyme, apo enz	yme, active site, Enzyme units classification	n, Loci	c and	Key m	odel
and In	duced fit h	ypothesis. Enzyr	ne kinetics (MM & LB plot), factors affecti	ng enz	yme a	activity	'. • • • •
UNIT		PIDS		1.5		15	Hrs
Classi	fication, st	ructure, function	and properties of simple, Compound, Derive	ed, Ess	sentia	l fatty a	acids
and N	on-essentia	I fatty acids,chol	lesterol.				
UNIT		TAMINS			<u> </u>	15	5 Hrs
	fication, o	ccurrence, defici	ency symptoms and biochemical functions	of vita	amins	(Fat	
SOLUDI						_	TT
UNII	VI VI	DEOLECIUR	ES, SEMINARS AND WEBINARS			5	Hrs
Defer							
		(S)	on DA Movies DW Dodwall (2006) Ham				
1.	K.K. Mu	iatry twonty fifth	edition Brantico Hall Now Jarson	ber s			
n	D Veet	and G Mast (20)	(Controll, Fichalter Hall, New Jelsey.	w.V.	<b>.</b> 1,-		
2. 2	D. voet,	and G. voet $(200)$	Joj, Biochennistry, John Wiley and Sons, Ne	W IOI	К.		
⊿	G.L ZUD	ay (1999) Bloche	Ellistry, 411 Ed, WUB, MCGraw-Hill, New	I OFK.	ام ور	-	
4. 5.	U. Satya	narayana., (2006	b) A textbook of Bi hemistry, Books & All	ied, K	olkata	lS. l.	
6.	J.L Jain.,	, (2005). Fundam	nentals of Biochemistry. S.Chand Publishing	g, New	Delh	i.	
7.D	D.L.Nelson	and M.M. Cox	(2008) Lehninger Principles of Biochemis	stry, 5	thEd,		
V	V.H.Freem	an and Company	r, New York.				

Course	Course Code 22U1BCAP01			Ho	urs/	Ma	rks				
Credits	;	3	ALLIED COURSE PRACTICAL – I BIOCHEMISTRY		ΥK						
Total H	lours	60			Р	Int	Ext				
Max. N	Iark	100		-	3	40	60				
Course	Course Objectives:										
The ma	The main objectives of this course are:										
1. To	1. To make students on understanding and identification of simple and polysaccharides, and to										
ma	ke them	in understanding	the knowledge on qualitative identificatio	n of a	mino	acids.					
2. Th	e Student	s also gain hands	on skills on basic separation of biomolecul	ar by	simple	e					
chi	omatogra	aphic techniques.									
Course	outcome	es									
On suc	cessful co	ompletion of the	course, students will be able to:								
CO1	O1 Acquiring knowledge on preparation of solutions. K1						K1				
CO2	2 Acquiring knowledge on qualitative analysis of carbohydrates. K2						K2				
CO3	Acquiri	ng knowledge on	qualitative analysis of amino acids.				K3				
CO4	Underst	tand the separation	n of amino acids by thin layer chromatograp	ohy.			K4				
CO5	Underst	tand the separation	n of lipids role by thin layer chromatograph	ıy.			K5				
K	K1 - Reme	ember; K2 - Unde	rstand; K3 - Apply; K4 - Analyze; K5 - Ev	aluate	; K6 -	Create					
1	PREPA	RATION OF SO	LUTION				3				
	Normal,	Molar, Percentage	e solution and calculation				5				
2	Analysis	of sugars a) Mor	nosaccharides - Glucose, Fructose.				3				
3	Analysis	of sugars a) Mor	nosaccharides - Galactose, Pentose.				3				
4	Analysis	of sugars b) Disa	accharides - Sucrose, Maltose and Lactose.				3				
5	Analysis	of sugars c) Poly	ysaccharide – Starch				3				
6	Analysis	of amino acids a	a) Histidine b) Tyrosine				3				
7	Analysis	of amino acids of	c) Tryptophan d) Methionine				3				
8	Analysis	of amino acids e	e) Cysteine f) Arginine				3				
9	Separatio	on of amino acids	by paper chromatography				3				
10	Separatio	on of lipids by thin	n layer chromatography				3				

#### **REFERENCES:**

1. An Introduction to Practical Biochemistry by Rodney Boyer (2003). Pearson Education.

2. Laboratory Manual of Biochemistry by J.Jayaraman (1988) Wiley Eastern

3. Practical Biochemsitry by Wilson and Walker (1994). Cambridge University Press

4. Handbook of Laboratory culture media, Reagents, Stains and Buffers by N. Kannan (2003), Panima Publishers, New Delhi

5. Calculations in Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory by (Frank H. S tephenson) (2003) ACADEMIC PRESS An Imprint of Elsevier

## **SEMESTER II**

Course Code	22U2BTC03
Credits	4
<b>Total Hours</b>	75
Max. Mark	100

#### CORE-III BASIC CALCULATIONS IN BIOLOGY

Ho	urs/	Marks			
W	ΥK				
Т	Р	Int	Ext		

#### **Course Objectives:**

The main objectives of this course are:

- 1. Students will comprehend the appropriate rounding off Significant.
- 2. Students will be knowledge able in laboratory conversions.
- 3. Upon successful completion of the course, students should have a clear understanding
- of calculations, rule for calculations.

Course o	utcomes					
On the su	ccessful completion of the course, student will be able to:					
CO1	Acquiring knowledge on round off of numbers.	K1				
CO2	Understanding the basic concepts of calculations in preparation of solutions	K2				
CO3	To understand the rule of logarithms.	K3				
CO4	To gain over all information to calculate with time. K4					
CO5	Acquiring knowledge on calculating expected genotype.	K5&K6				
K1	- Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cr	eate				
UNIT I	SCIENTIFIC NOTATION	13 Hrs				
Scientific	Notation and Metric Prefixes-Rounding Off Significant Digits in Calculations-C	onverting				
Numbers	from Scientific Notation to Decimal Notation. Conversion Factors and Canceling	Terms.				
UNIT II	SOLUTIONS MIXTURES	13 Hrs				
Solutions	Mixtures and Media-solution Concentrations by a Factor of X -Preparing Percent					
Solutions	Diluting Percent Solutions-Moles and Molecular Weight: Definitions- and C	onverting				
Molarity	o Percent-Converting Percent to Molarity- defitions of Ph.					
UNIT III RULE FOR LOGARITHMS 14 Hrs						
PCR-The	Polymerase Chain Reaction-PCR Efficiency- Definition of Product Rule for Lo	garithms-				
Power Ru	le for Logarithms-Calculating the T m of the Target Sequence-dNTPs-Quantitativ	e PCR.				
UNIT IV	CALCULATING WITH TIMES	15 Hrs				
Centrifug	ation-Relative Centrifugal Force (g Force) and Calculating Sedimentation	Times-				
Convertir	g g Force to Revolutions per Minute-Definition Forensic Science-Alleles and Ger	iotypes.				
UNIT V	CALCULATING EXPECTED GENOTYPE	15 Hrs				
Calculation	ng Genotype Frequencies-Calculating Allele Frequencies-The Hardy-Weinberg	Equation				
and Calcu	lating Expected Genotype Frequencies-Sample Variance and Sample Standard I	Deviation-				
The Mult	plication Rule.					
UNIT VI	VIDEO LECTURES, SEMINARS AND WEBINARS	5 Hrs				
REFERE	INCES:					
1. C	1. Calculations in Molecular Biology and Biotechnology. A Guide to Mathematics in the					
L	aboratory by (Frank H. S tephenson) (2003) ACADEMIC PRESS An Imprint of H	Elsevier				
2. Handbook of Laboratory culture media, Reagents, Stains and Buffers by N. Kannan (2003).						

- Panima Publishers, New Delhi
- 3. Laboratory Manual of Biochemistry by J.Jayaraman (1988) Wiley Eastern

Course C Credits	Code	<b>22U2BTC04</b>	CORE IV	Hours/ WK		Ma	Marks	
Total Ho	urs	45	GENETICS	Т	P	Int	Ext	
Max. Ma	nrk	100	021121100	-	-	25	75	
1010200 1010		100		1		20	75	
Course (	Objective	s:						
The main	objective	es of this course are	e:					
1.	Students	will be knowledge	able chromosome alterations.					
2.	Upon suc	ccessful completion	n of the course, students should have a cl	ear un	dersta	anding		
	of mend	elian genetics						
Course o	outcomes							
On the s	uccessful	completion of the	course, student will be able to:					
CO1	Acquir	ring knowledge on	mendelian principles.			K1	-	
CO2	O2 Understanding the basic concepts of extensions of mendelian principles.						2	
CO3	To understand the ploidy.				K3	}		
CO4	To gai	n over all informat	ion about population genetics.			<b>K</b> 4	ŀ	
CO5	Acquiring knowledge on DNA transfer mechanism.				K5	K5&K6		
K1	- Remem	ber; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Eva	ıluate;	K6 -	Create	;	
UNIT I	ME	NDELIAN PRIN	CIPLES			1.	3 Hrs	
Dominati	on, segre	gation, independer	nt assortment, deviation from Mendelia	n inhe	ritanc	e. Ger	otype	
& phenot	ype.							
UNIT II	EXT	<b>TENSIONS OF M</b>	IENDELIAN PRINCIPLES			1	5 Hrs	
Codomin	ance, inc	complete dominance	ce, gene interactions, pleiotropy, penet	rance	and e	express	sivity,	
Linkage,	sex linka	ge, sex limited and	sex influenced characters.					
UNIT II	I PLO	DIDY				1.	3 Hrs	
Structura	l and nu	merical alterations	s in chromosome – Euploidy – Ane	uploid	ły –	Deleti	on –	
Duplicati	on – inse	rtion – Translocatio	on.					
UNIT IV	7 POI	PULATION GEN	ETICS			14	4 Hrs	
Pedigree	analysis,	Mendalian traits a	nd sex - linked traits in human - popul	ation g	geneti	cs – H	ardy -	
Weinberg	g genetic	equilibrium.						
UNIT V	DNA	A TRANSFER M	ECHANISM			1:	5 Hrs	
In Prokar	yotes –	Transformation,	Transduction (Generalized and specia	lized)	& C	Conjuga	ation.	
Transpos	ons (Bact	eria, Human). Dav	vis U Tube experiments.					
UNIT VI	I VID	DEO LECTURES,	SEMINARS AND WEBINARS			5	Hrs	
REFERI	ENCES:							
1. 1	Molecular	r Genetics of Bacte	eria (2013) Larry Snyder, Joseph E. Pe	ers, T	ina M	. Henl	cin.	
1	ASM Pres	ss publication.	the second setting and the second			~ -		
2.	<u>Behaviora</u>	al Genetics - public	ished $2012 - 12^{\text{m}}$ editions by Robert Planck	<u>omin</u> ,	<u>John</u>	<u>C.</u> De	<u>Fries</u> ,	
(	Gerald E.	McClearn						

<u>Human Biology - Genetics</u> - published 2013 - 2<sup>nd</sup> editionsbyCK-12 Foundation

Course	Code	22U2BTCP02		Ho	Hours/		Hours/ Mark		arks
Credits		3	CORE IV	W	ΥK				
Total H	ours	24	LAB IN BASIC BIOLOGY	Т	Р	Int	Ext		
Max. M	lark	100	CALCULATIONS	-	3	40	60		
		•							
Course	Objectives	5:							
The mai	The main objectives of this course are:								
1. To m	ake the stud	lents understand th	he basics biological calculations.						
2. Stude	ents also ac	quire knowledge o	on their biological calculations. and the	ir imp	ortanc	e labo	oratory.		
Course	outcomes								
On suce	cessful com	pletion of the cou	rse, students will be able to:						
CO1	Toundersta	ndandimplementt	heprinciplesofasepticpracticesinLaborat	ory		K1			
CO2	D2 To gain knowledge on the media preparation and culturing the microorganism K								
CO3	CO3 To identify the caliberation in lab instruments.					K3	K3		
CO4	CO4 To check the estimations of biomolecules like proteins.						Ļ		
CO5 To understand and quantition of nucleic acids.					K5	&K6			
K	1 - Rememł	per; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Eva	aluate;	K6 -	Create	;		
1	Basic calc	culations in Bioche	emistry - Normality, Molarity, Molality	percer	ıt		3		
	solutions	(v/v, w/v).					5		
2	Calibratic	on of pH meter					3		
3	Preparatio	on of biological bu	Iffer - phosphate buffer				3		
4	Extraction	n of Proteins from	biological materials				3		
5	Preparing	percent solutions	and Diluting percent solutions				3		
6	. SDS PA	GE – Group Expe	riment				3		
7	Estimatio	n of Proteins by L	owry's method				3		
8	Estimati	on of Proteins by	Biuret method				3		
9	Quantita	tion of Nucleic Ad	cids by Ultraviolet Spectroscopy				3		
10	Calculatin	ng the Amount of I	Fragment Ends				3		

#### **REFERENCES:**

1. An Introduction to Practical Biochemistry by Rodney Boyer (2003). Pearson Education.

2. Laboratory Manual of Biochemistry by J.Jayaraman (1988) Wiley Eastern

3. Practical Biochemsitry by Wilson and Walker (1994). Cambridge University Press

4. Handbook of Laboratory culture media, Reagents, Stains and Buffers by N. Kannan (2003), Panima Publishers, New Delhi

5. Calculations in Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory by (Frank H. S tephenson) (2003) ACADEMIC PRESS An Imprint of Elsevier.

Course Code	22U2MBA02		Hou	rs/	Ma	arks	
Credits	4	ALLIED II	WI	K			
Total Hours	75	MICROBIOLOGY	Т	P	Int	Ext	
Max. Mark	100		4	-	25	75	
	1						
Course Objectives	s:						
The main objective	es of this course an	re:					
1. To make student	ts understanding a	nd identification of basic microbiolog	у.				
2. The students abo	out various metho	ds of sterilization and also about antim	nicrobial	chemo	otherap	oy.	
Course outcomes							
On the successful	completion of the	e course, student will be able to:					
CO1 To under	stand historical pr	ospective on the evolution of microbio	ology.		K1		
CO2 To acquir	re knowledge on t	he basic concepts on prokaryotic cellu	lar struc	ture.	K2		
CO3 To acqua	intance of basic n	utritional requirements of microorgan	ism.		K3		
CO4 To know	about the anti-mi	crobial therapy and their mode of action	on.		K4		
CO5 To under	stand historical pr	ospective on the evolution of microbio	ology.		K5	&K6	
K1 - Remem	ber; K2 - Underst	and; K3 - Apply; K4 - Analyze; K5 -	Evaluate	; K6 -	Create		
UNIT I DF	FINITION AND	SCOPE OF MICROBIOLOGY			13	3 Hrs	
History and recent	Developments Co	ntributionsofLeevenhoek LouisPasteu	r Robert	Koch	Elie		
Metchnikoff .Edwa	ard Jenner. Alexar	ider Fleming. Spontaneous generation	Biogen	lesis of			
Microbiology .Not	bel prize winners	in the field of Medicine.	, 8				
UNIT II MI	CROSCOPY				13	3 Hrs	
Simple and Comp	ounds microcop	es. Dark field contrast, Fluorescene	ce micro	oscope	s. Ele	ectron	
microscopes (TEM	A &SEM).Stain a	and staining techniques-Simple, differ	ential ar	nd spe	cial st	aining	
(Endospore and Ca	apsular).			-		-	
UNIT III CE	CLLULAR STRU	<b>ICTURES OF PROKARYOTES</b>			14	4 Hrs	
Ultra structure and	d functions of ba	cterial cell wall, Plasma membrane,	Flagella	, Pili a	and ca	psule.	
Ultra structure of f	ungi, Viruses and	cyanobacteria.	-			-	
UNIT IV ST	ERILIZATION	AND CULTURE TECHNIQUES			15	5 Hrs	
Physical and chem	ical methods. Gro	wth of bacteria – multiplication nutrit	ional req	uireme	ents. F	actors	
affecting growth. C	Growth curve, Det	ermination of growth. Media and its t	ypes, Cu	lture te	chniq	ues	
(pureculture, anaer	obic culture). Cul	tivation of anaerobes, Chemoautotrop	hs, chem	oheter	otroph	s and	
photosynthetic mic	crobes. Culture co	llection, preservation, lyophilization ar	nd freeze	drying	g.		
UNIT V AN	TIMICROBIAL	L CHEMOTHERAPY			15	5 Hrs	
Definition and type	es of antibiotics .N	Mode of action of broad and narrow sp	pectrum	antibic	tics. A	nti-	
microbial resistanc	e. Mechanisms of	f resistance. Test for evaluating anti-m	icrobial	effect.	Micro	obial	
metabolism- Micro	obial metabolism.	Photosynthesis in microbes. Role of c	chloroph	ylls, ca	rotenc	oids	
and phycobilins.					-		
UNIT VI VID	EO LECTURES	, SEMINARS AND WEBINARS			5	Hrs	
REFERENCES:							
1.	Microbiology–con Publications2010.	ncepts and application by PaulA. Ketc	hum, Wi	iley			
2.	Fundaments of M	icrobiology-Frobisher, Sauders & Top	panpubli	cations	s1975.		
3.	Microbiology-Ro	nald M. Atlas 1983.					
4.	Introductory Bioto	echnology –R. B.Si ngh C.B.D. India(19	990)				
5.	Industrial Microb	iology–Casida,E. Wiley EasternLtd19	62.				
6.	Industrial Microbi	iology–Casida,E. Wiley EasternLtd19	62.				

Course Code	22U2MBAP02
Credits	4
<b>Total Hours</b>	49
Max. Mark	100

#### CORE PRACTICAL - II LAB IN MICROBIOLOGY

Hours/ WK		Marks			
Т	Р	Int	Ext		
4	-	25	75		

#### **Course Objectives:**

The main objectives of this course are:

- 1. To make students understand on microbiological techniques, aseptic practices in laboratory.
- 2. The candidate also shall know how to maintain and culture the microorganisms. In laboratory and their biochemical identification mechanisms

Course	outcomes		
On succ	essful completion of the course, students will be able to:		
CO1	To understand and implement the principles of aseptic practices in Laboratory.	K1	
CO2	To gain knowledge on the media preparation and culturing the Microorganism.	K2	
CO3	To identify the microorganisms by staining techniques and biochemical tests.	K3	
CO4	To check the growth pattern of microorganisms towards various classes of antibiotics.	K4	
CO5	To understand and implement the principles of aseptic practices in Laboratory.	K5&K6	
K1	- Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cr	reate	
1	General Laboratory rules to be followed in microbiological Laboratory.	3	
2	Sterilization techniques (Dry heat, Moist heat, Filtration-membrane And HEPA filters).		
3	Preparation of nutrient media (Solid, semi-solid and liquid).		
4	Isolation.of.pure.culture(Streaking methods-simple, continuous, quadrant and T"streaking)	3	
5	General Laboratory rules to be followed in microbiological Laboratory	3	
6	Simple and negative staining	3	
7	Differential staining(Gram's staining, Capsule staining, Spore	2	
8	Fungal staining(LCB)		
9	Determination of bacterial motility(Hanging drop method)	2	
10	Antibiotic sensitivity test(Kirby-Bauer method)	3	
		<u>I</u>	
REFER	<b>ENCES:</b> 1. Fundaments of Microbiology-Frobisher, Sauders &Toppan publications	1975.	

2. Microbiology-Ronald M. Atlas1993.

- 3. Introductory Biotechnology –R.B.Singh C.B.D.India(1990)
- 4. Industrial Microbiology–Casida, E.Wiley EasternLtd1962.

Course (	Code	22U2VE02		Hours/ Mar		arks	
Credits		2	MANDATORY COURSE-II	W	ΥK		
Total Ho	ours	24	ENVIRONMENTAL SCIENCES	Т	Р	Int	Ext
Max. Ma	ırk	100		2	-	25	75
							L
Course (	Objectiv	ves:					
The mair	objecti	ves of this course	are:				
1. T	o impart	appropriate infor	mation and adequate knowledge about env	ironm	ental i	mpact	t
as	sessmer	nt and environmen	tal acts; to acquaint students in the area of	disast	ers ma	nagen	nent.
2. T	o unders	stand the energy s	ources, environmental pollution and remed	liatior	n using	5	
bi	otechno	logy and its contro	bl				
Course o	outcome	s					
On the s	uccessfi	ıl completion of t	he course, student will be able to:				
CO1	Acqui	re a complete kno	wledge about bio-fuel and bio-energy and i	ts nee	ds	K1	
CO2	Under	Inderstand dangerous effects of environmental pollution and its methods of				K2	r
	contro	l and management	t which make them to create more remedia	tion .			
CO3	Famili	arize the different	methods of environmental pollution using			K3	
	biotec	echnological approaches					
CO4	Obtair	a comprehensive knowledge about global environmental problem. K			K4		
CO5	This c	This course is important to handle the environmental hazards.			K5	&K6	
K1	- Reme	mber; K2 - Under	stand; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 - 0	Create	;
UNIT I	EN	VIRONMENT				5	Hrs
– Defini	tion – S	Scope – Structure	And Function Of Ecosystems- Food C	'hain,	Food	Webs	And
Ecologic	al Pyran	nids.					
UNIT II	NA	ATURAL RESOU	JRCES			5	Hrs
Renewab	le - Air	, Water, Soil, Lan	d And Wildlife Resources- Non – Renewa	ble –	Miner	al Coa	al ,Oil
And Gas							
UNIT II	I EN	IVIRONMENTA	AL PROBLEMS			3	Hrs
Environn	nental P	roblems Related T	To The Extraction And Use Of Natural Reso	ources			
UNIT IV	<b>BI</b>	ODIVERSITY					
Definitio	n – Val	ues – Consumptio	on Use, Productive Social, Ethical, Aesthe	etic A	nd Op	tion V	alues
Threats 7	o Bio D	oiversity.					
UNIT V	PC	DLLUTIONS				6	bhrs
Definitio	n – Ca	uses, Effects And	l Mitigation Measure S – Air Pollution,	Wate	r Poll	ution,	Soil
Pollution	Noise F	Pollution, Thermal	Pollution – Nuclear Hazards – Solid Wast	tes Ac	id Rai	n - Cl	imate
Change A	And Glo	bal Warming.					
UNIT V		<b>DEO LECTURE</b>	S, SEMINARS AND WEBINARS			5	Hrs
REFERA	ANCE :			1.0			•
1. E	Bridge, J	. &Demicco, R. 2	2008. Earth Surface Processes, Landforms	and S	edime	ent dep	posits.
	Lamoria	ge University Pres	68. (Edg.) 1002 Holmos' Dringinlag of Dhy	siaal (		•• To•	100 0-
2. I	Jull, P.	M. D. and Dull, L	D. (Eds.). 1995. Holmes Principles of Phys	sical C	reolog	y. Tay	
3 (	Supta 4	K Anderson	D M & Over neck I T 2003 Abrun	t char	nges i	n the	Asian
J. C	outhwe	st monsoon during	the Holocene and their links to the North	Δtlar	tic O	rean N	Vature
4	21: 354	-357.	, are more the and then mikes to the North	1 Mai		Jun. 1	acuic
4 (	Gupta 4	A. K., Anderson	D. M., Pandey, D., N., & Singh VI A K	. 200	6. Ad:	ptatio	n and
h	uman n	nigration, and evic	lence of agriculture coincident with change	es in t	he Ind	ian su	mmer
r	nonsoor	during the Holoc	ene. Current Science 90: 1082-1090.				

## **SEMESTER III**

Course Cod	e 22U3BTC05		Hours/		Ma	arks	
Credits	4	CORE V	W	K			
<b>Total Hours</b>	75	MOLECULAR BIOLOGY	Т	Р	Int	Ext	
Max. Mark	100		4	-	25	75	
Course Obj	ectives:						
The main ob	jectives of this course a	re:					
1. To far	niliarize the student in	various aspects of cell and molecular b	iology s	tream	ns incl	uding	
cellula	r organization and their	r interactions in central dogma of life.					
2. To dev	velop comprehensive un	nderstanding on the complete cellular an	id molec	ular	function	ons of	
cell or	ganelles in terms of cel	l to cell interaction, gene regulation, cell	ular sign	naling			
Course outc	omes						
On the succ	essful completion of th	e course, student will be able to:					
CO1 Te	o understand the basic c	concepts of DNA/RNA structure as gener	tic mater	rial.	K1		
CO2 To	o under the mechanisms	s of replication of DNA and it regulation			K2	( /	
CO3To know about the transcription and translation into proteins.						i	
CO4 To acquire the concepts of gene regulation and know about the transposition.				K4			
CO5 To know the function of Gene regulation and function				K5	&K6		
K1 - R	emember; K2 - Underst	tand; K3 - Apply; K4 - Analyze; K5 - Ev	aluate;	K6 - (	Create	;	
UNIT I	GENETIC MATER	IAL			8	Hrs	
Evidences sh	nowing DNA and RNA	as genetic material; DNA- Chemical con	mpositio	on & r	nolecu	ılar	
structure, W	atson and Crick's mode	el-its biological significance; Forms of D	NA (A,	В, С,	, D&Z	.) <b>.</b>	
Central dogn	na of molecular biology	/.					
UNIT II	DNA REPLICATIO	ON			12	2 Hrs	
Origin & Mo	odels of - Meselson and	d Stahl"s experiment - types of replicati	on - Me	chani	sm of	DNA	
replication in	n prokaryotes and euka	ryotes - Enzymology of replication. DN	A repair	- cau	ses of	DNA	
damage & bi	ochemical mechanism	of DNA repair. Homologous recombination	tion- Ho	lliday	/ mode	el.	
UNIT III	TRANSCRIPTION				1	2Hrs	
RNA types	and functions; RNA	A polymerase; Transcription in proka	aryotes	and	eukar	yotes;	
Posttranscrip	otional modification -	Transcription and processing of RN	A in p	rokar	yotes;	Post	
transcription	al modifications, splic	ing, spliceosomes. Editing, Nuclear ex	port of	mRN	A		
I ranscription	n and processing of RN	A in prokaryotes.			1		
	TRANSLATION &	PROTEIN SYNTHESIS	XX7 111	1		3Hrs	
Genetic cod	e: Properties of geneti	ic code; codon- anticodon interaction-	WODDIG	e nyp	otnesi	s and	
modification	of protoing & molecule	station in prokaryoles and eukaryoles;	Post tr	ansia	tional		
		CENE EXPRESSION			1/	. II	
UNIT V	<b>REGULATION OF</b>	GENE EXPRESSION			1:	5 Hrs	
Gene expres	sion. In transcriptional	fever (lac and trp operon); gene expression	ion in de			es.	
and Non-hor	nologous recombination	n Mologular techniques: DNA finger n	mation-		lologo	us	
and Non-nonhologous recombination. Morecular techniques; DNA linger printing, DNA							
INIT VI		S SEMINARS AND WERINARS			5	Hre	
		, SEMMANS AND WEDWARS			5	1113	
REFEDEN	~FS•						
	David Freifelder	19 1990 Molecular Biology 2 <sup>nd</sup> Edition M	arosa Di	ıhlich	ing he	NISA	
2	GeorgeM Malacir	ski 2008 Essentials of Molecular Biolog	$\Delta^{th} \mathbf{F}$	lition			
2	Veer Rala Rastor	i 2010 Fundamentals of Molecular Biolog	$, j, \tau$ LC	e Ro	oke In	dia	
5		1. 2010. Fundamentais of Wolcoular Dio	.ogy. All		042 110	ula	

4.	JamesD. Watson, Tania A.Baker, StephenP. Bell, Alexander Gann,
	Michael Levine and Richard Losile. 2008. Molecular Biology of
	the gene, 5 <sup>th</sup> Edition. Pearson Education.
5.	Lodhish, Berk, Matsundairg, Kaiser, Krieger, Scott, Zipursky and
	Darnell. 2004. Molecular Cell Biology, 5th Edition.W. H. Freeman and
	Company
6.	RobertF.Weaver.1999.MolecularBiology.WCBMcGrawHill
7.	E. D. P. De Robertis& E. M. F De Robertis, Jr. 2001. Cell and
	Molecular Biology, 8 <sup>th</sup> Edition.Lipincott William and Wilkins
8.	Lehninger.2005.PrinciplesofBiochemistry.NelsonCox,CBSPublishers
9.	Alexander Mc Lenna, Andy Bates, Puil Turner & Mike White. 2015.
	Molecular Biology, 4 <sup>th</sup> Edition.GS Garlan Sciences, Taylorand Francis
	Group
10.	George M. Malacinski & David Freifelder. 1998. Essentials of
	Molecular Biology, 3 <sup>rd</sup> Edition.Jones and Bartcett Publishers.

Course	Code	22U3BTCP03		Hours/ Mar		arks		
Credits		3	CORE PRACTICAL -III	W	ΥK			
Total H	ours	45	LAB IN MOLECULAR	Т	P	Int	Ext	
Max. M	lark	100	BIOLOGY	-	3	40	60	
Course	Objectives	5:						
The mai	n objective	es of this course ar	e:					
1.	1. To make students on understanding basic procedure in isolation separating purifying							
	proteins.							
2.	2. The students gain knowledge in DNA quantification and gene transfer methods							
Course	outcomes							
On succ	essful com	pletion of the cou	rse, students will be able to:					
CO1	To know	v about the isolation	on, purification and quantification ofpro	otein		K1		
CO2	To know	v about the separat	ion and quantification of DNA			K2		
CO3	To know about the various types of gene transfer techniques					K3	)	
CO4	To ident	ify and isolate the	mutated bacterial by special technique	8		K4	ł	
CO5	To know about the replica plating.				K5	&K6		
K	l - Rememb	ber; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Ev	valuate;	K6 -	Create	;	
1	Isolation	n of protein					3	
2	Estimation of protein by Lowry's method						3	
3	Purification of protein by dialysis						3	
4	Separation of proteins by native – PAGE						3	
5	Separation of DNA by agarose gel electrophoresis						3	
6	Quantifi	cation of DNA by	UV-visible spectrophotometer				3	
7	Inductio	n of mutation in b	acterial cells UV light				3	
8	Bacteria	I DNA transforma	tion by CaCl method				3	
9	Bacteria	I conjugation					3	
10	Isolation	n of auxotrophic m	utants by replica plating technique				3	
DEFER								
KEFER	$\frac{1}{1}$	D'shandD C's day	1004 DNA Streetens on 1 for sting As	. 1				
	1. 1 2 n	Richardk.Sinden	.1994.DNA Structure and function .Ac		press	D 11	1	
	2. K	K.C.Rastog1.2010.	Cill and Molecular Biology. New Age	Interna		Publis	ners.	
	5. Pi	ragya Knana.2008	Leina S. Calana and Deed L. Cana	ational	Publis	sning i	House	
	4. W	Illiam D. Stanfiel	d, Jaine S. Colome and Raul J. Cano. 2	008.				
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	0. G	.P.Jeyantni. 2009.	MolecularBiology. MJP Publishers	. 11/				
	7. N. Vidhyarasthi & D. M. Chelan. 2007. Molecular Biology. IK							
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	0. Pi	In Turner, Alexan	2 <sup>rd</sup> Edition Diog Instant Notes	me. 2	001.			
		D Kuma 2000	, 5 Edition. Diologra 2 <sup>nd</sup> Edition X <sup>ii</sup>					
	9. H	.D.Kumar.2000. N	2008 Molecular Piology, 2 <sup>th</sup> Edition. Vikas F	ublishi	ng Ho	use		
	10. A	vəsəanıbanlufiliy	21	migri	Juse			

Course C	Code	19U3BOA01	ALLIED III	Hours/ M		Ma	arks			
Credits		4	PLANT SCIENCE	WK						
Total Ho	urs	75		Т	Р	Int	Ext			
Max. Ma	ırk	100		4	-	25	75			
				•						
Course (	Objectives	3:								
The main	objective	s of this course ar	e:							
1. T	'o familiar	rize the student in	various aspects of plants.							
2. T	o develop	comprehensive u	nderstanding on the complete classifica	tions of	f plan	ts.				
Course o	utcomes									
On the su	uccessful	completion of the	e course, student will be able to:							
CO1	To gain 1	knowledge on bas	ics of fungi and algae			K1				
CO2	To gain	knowledge on bas	ics of bryophytes			K2	r			
CO3	To gain 1	knowledge on bas	ics of lichens			K3				
CO4	To gain 1	knowledge on bas	ic concepts of plant physiology			K4				
CO5	To the ed	conomically impo	rtance of algae and fungi			K5	&K6			
K1	- Rememb	per; K2 - Understa	and; K3 - Apply; K4 - Analyze; K5 - Ev	aluate;	K6 -	Create	,			
	T									
UNIT I	ALG	FAE				12	2Hrs			
Generalc	haracterist	ticsofalgae.Studyo	onthallusstructure, reproduction and life of	cycle of	f <i>Gell</i>	idium,				
Gracillar	<i>ia</i> and Pol	<i>lysiphonia</i> .Econo	mic importance of algaein industries							
UNIT II	FUN	GI				12	2Hrs			
Generalc	haracterist	ticsoffungi.Studyc	onthallusstructure, reproduction and lifecy	cleofA	garici	ıs,Pen	icilliu			
mandSac	charomyco	escerevisieae.Eco	nomicimportanceoffungi			1/	11			
		HEINS	where on the line structure many dusting	f f	-1:		2Hrs			
General C	and Squa	sucs of lungi. Si	lichens	n of f	onose	, Crus	stose,			
		OPHVTES PTE	PIDOPHVTESANDCVMNOSPEPA	15		11	)Hrs			
General	characte	ristics Study on	the structure reproduction and life	e cvcl	e of	bryon	hvtes			
(Marcha	<i>intia</i> ). Pte	ridophytes(Lycop	odium).Gymnosperms(Cycus)and their	econon	ic im	portan	ce.			
UNIT V	PLA	NT PHYSIOLO	GY GY			12	2Hrs			
Absorpt	ion of wat	ter (Activeandpass	sive). Photosynthesis (Light and	d D	ark	react	tions).			
Cyclic a	nd no	n-cyclic photopho	sphorylation.Transpirationanditstypes (	Stomat	altran	spiratio	on).			
UNIT VI	<b>VID</b>	EO LECTURES,	SEMINARS AND WEBINARS			5	Hrs			
REFERI	ENCES:									
	1. Va	shishta BR, AK. S	Sinha. (2010). Botany for Degree studen	lt —						
	Fu	ngi. S. Chand & C	co.New Delhi.							
	2. Par	ndey SN, MishraS	P and Trivedi PS.(2009). Atextbook of							
	3. Bo	tany, VolII, Vikas	Publishing House Pvt. Ltd., Delhi.							
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	6. Ad	vancesinMycolog	y.(2012).SohanSharma,randomPublicati	onsP						
	ubl	ishersandDistribu	tors,New Delhi.							
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	An	atomy, Embryolog	gy and Economic Botany, S. Chand Lim	ited.						
	8. BP	8. BP Pandey.(1986). Text Book of Botany ,VolI & II Chand. S &Co. NewDelhi.								

Course Code		19U3BOAP01		Hours/		Ma	arks		
Credits		3	ALLIED PRACTICAL-III	WK					
Total H	lours	45	LAB IN PLANT SCIENCE	Т	Р	Int	Ext		
Max. M	lark	100		-	3	40	60		
Course	Objectives	5:							
The ma	in objective	es of this course are	2:						
1.	To make st	udents on understa	anding basic concepts of fungi algae an	d bryoj	phytes	•			
2.	The studen	nts also know abou	it the lichenology and basic plant physi	ology.					
Course	outcomes								
On suce	cessful com	pletion of the cou	rse, students will be able to:						
CO1	To gain	knowledge on the	identification of fungi and algae			K1			
CO2	To gain knowledge on the identification basics of bryophytes					K2	,		
CO3	To gain knowledge on the economic importance of major plantKingdoms.								
CO4	To gain experimental knowledge on plant physiology								
CO5	To gain knowledge on the identification of fungi and algae								
K	K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cre								
1	Sectioning of given specimens Algae (or) Fungi, Bryophyte (or) Pteridophyte,								
	Gymnosp	erms.							
2	Identifica Pteridoph	tion of spotters (Pe	ermanent slides) Algae (or) Fungi, Bryo s (or) Lichens	ophyte	(or)		3		
3	Identifica	tion of spotters (M	orphology) Algae (or) Fungi Bryophy	te			3		
4	Identifica	tion of the given se	etun (Physiology) Ganong''s nhotomet	$\frac{1}{er(0r)}$			0		
	Wilmutt"	bubbl.	cup (Frightionogy) surroug s protoniet				3		
	Identifica	tion of spotter (Ec	onomic importance) Gellidium (or) Per	nicilliur	n (or)		•		
5	Yeast						3		
						·			
REFEF	RENCES:								
	1.	1. Text Book of	Algae. (2018). KS. Bilgrami and LC S	aha, 1 <sup>st</sup>	editio	on, CB	S		
	2	Publishers.		•					
	2.	Algae. (2011). (	JP. Sharma, Tata Mc Graw Hill Educat	10n.					
	3.	Advances in My	cology. (2012). Sohan Sharma, randon	n					
	4	Publications Pul	blishers and Distributors, New Delhi.						
	4.	BP. Pandey. (20	11). A Textbook of Botany: Anglosper	ms					
		– Taxonomy, Al	natomy, Embryology and Economic						
		Botany, S. Char	a Limitea.						

Course Code	22U3BTS01		Hours/		Marks					
Credits	Credits 2 SBEC – I		WK							
Total Hours	45	FORENSIC SCIENCE AND	Т	T P I		Ext				
Max. Mark	100	TECHNOLOGY	2	-	25	75				
						•				
Course Objectives:										
The main objectives of this course are:										
1. To 1	familiarize the stud	lent in various aspects of cell and mol	ecular	biolo	ogy st	reams				
inclu	iding cellular organ	nization and their interactions in DNA	replica	ation,	and p	rotein				
bios	ynthesis and translat	ional regulation								
2. To	develop compreher	isive understanding on the complete c	ellula	r and	. mol	ecular				
signaling										
3 To impart the molecular biology knowledge in applications of various human health care										
S. 101	3. To impart the molecular biology knowledge in applications of various numan health care									
On the success	sful completion of t	he course, student will be able to:								
CO1 Cain knowledge on forensic science laboratories across India										
CO2 Aca	uires knowledge on	fingerprint identification system			K2					
CO3 Kno	w whereabouts on the	he FAI and the concepts of fatality Forensi	cs		K3					
CO4 Und	erstand the concepts	of DNA finger printing technology			K4					
CO5 Fina	CO5 Finally analyzing and resulting the finger printing techniques					&K6				
K1 - Ren	K1 - Remember: K2 - Understand: K3 - Apply: K4 - Analyze: K5 - Evaluate: K6 - Create									
The remember, it chartenand, its happy, it's himily 20, its Dividuale, its cleane										
UNIT I I	NTRODUCTION				6	Hrs				
Definition, Sco	pe and branches of	forensic science. Central F.S.L. and State I	F.S.L.I	Biolog	ical					
Evidence: Nature, collection, identification, evaluation of hair and fibres.										
	DEFINITION AND	O CLASSIFICATION OF FINGERPRIN	VTS		7	Hrs				
	HENRY SYSTEM	():			,	1115				
Taking finger	prints from livin	g and dead persons. Automatic finge	er pri	int id	entific	ation				
system(AFIS).										
	FORENSICART II		1 .		5	Hrs				
Introduction, I	finding and identif	rying human face image. Postmortem	drawi	ing, r	nethoc	IS OF				
	II. FATALITVEODE	NSICS			5	Una				
Introduction of	FAIALIII FURE	haracteristics of death Road traffic fatal	ity (P'	TF) in	vection	ation				
General classif	ication of RTFs	maracteristics of death, Road traffic fatal	ity (K	11) III	vestig	ation.				
UNIT V	DNA FINGERPRI	NTING (DFP) TECHNOLOGY			7	Hrs				
An overview.	Applications of DF	P in forensic investigations, paternity disp	utes. [	DNA						
Profiling prac	tice in India with ret	ference to criminal cases.								
UNIT VI	VIDEO LECTURE	S, SEMINARS AND WEBINARS			5	Hrs				
I										
REFERENCE	ES									
1.	Richard Saferstei	n, 2001, Criminalistic: An Introduction to	Foren	sic						
	Science. 7 <sup>th</sup> edition	on Prentice-Hall,New Jersey.								
2.	Chowdhri,S. ,For	rensic Biology B.P.R.& D,Govt.of India.								
3.	Cammins,H.and	MiddleC.,1961.Fingerprints PalmsandSole	s.Dov	erPub	licatio	ns.				
4.	Furley, M.A. and I	Hamington, J.J.Fo2r4ensic DNA Technology	•							
5.	Kirby,DNA Fing	erprinting Technology.								
6.	Epplen,J.T. and E	Eabjulm,T.,1999.DNAProfilingandDNA								
	Fingerprinting Bu	ukhaagar Verlag, Switzerland.								

Course Cod	e 22U3B7	rs02		Hours/		Ma	ırks	
Credits	2		SBEC – I	W	/K		1	
Total Hours	45		FOOD BIOTECHNOLOGY	Т	P	Int	Ext	
Max. Mark	100			2	-	25	75	
Course Obj	ectives:							
The main ob	jectives of this c	ourse a	ire:					
l. Tod	evelop compreh	ensive	understanding on food biotechnology.					
2. To i	mpart the techno	ologica	l knowledge in applications food.					
Course outc	omes							
On the succ	essful completio	on of th	ne course, student will be able to:					
CO1 To	o understand the	concep	ots of basic food preservation methods			K1		
CO2 To	o understand the	role of	water in food spoilage and preservation			K2		
CO3 To	o explore the phy	sical f	actors involving in food processing			K3		
CO4 To	CO4 To make familiar with food sanitation and its importance				K4			
CO5 To prevent food wastage and protect the food materials						K5	&K6	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create								
UNIT I FOOD PRESERVATION BY APPLICATION OF HEAT								
Principles of	of Heat Transfer,	Blanc	hing, Pasteurization, Heat Sterilization.					
UNIT II	FOODPRESE	ERVAT	<b>FIONTHROUGHWATERREMOVAL</b>			8	Hrs	
Forms of W	ater in Foods,	Sorpti	on of Water in Foods, Water Activity	y, Dry	ing T	'echno	logy,	
Evaporation	Technology.							
UNIT III	FOOD PRES	SERV	ATION THROUGH PHYSICAL AND	CHEN	MICA	L 8	Hrs	
	METHODS							
Chilling, Fre	ezing, Radiatior	, Ioniz	ing, Microwave, Salt, Smoke, Sugar, Oth	er Che	mical	Additi	ves.	
UNIT IV	SENSORYE	VALU	ATION OFFOOD QUALITY			8	Hrs	
Quality facto	ors for consumer	safety	. FSSAI, HACCP, FDA. Food Packaging	g, Food	l Plan	t Sanit	ation,	
Environment	al Aspects of Fo	od Pro	cessing.					
	GENETICAL		ODIFIED FOOD	(01	1	8	Hrs	
Bovine som	atotropin, alpha	lact alt	bumin & lactoferrin in milk, Edible vacci	ne (Ch	olera	vaccin	e –	
potatoes &	Hepatitis B vaco	ne -m	aize)					
UNITVI	VIDEO LEC	TURES	S, SEMINARS AND WEBINARS			5	Hrs	
DEFEDEN	TE.							
	<b>-ES:</b> :objel Enzyme T	achnol	ogy in Food Applications (Food Biology	Sories	)" by ]	Damas	h C	
I. Mici	and Cristina M	Rosell	ogy in rood Applications (rood biology	Series	) Uy 1	Xames	пс	
2 Ency	clopedia of Bio	techno	logy in Agriculture and Food" by Dennis	R Held	Iman	and D	allas	
G H	over		is a second contract and i obde by Dellins	1 1101			11110	
3. Fermentation Processes Engineering in the Food Industry (Contemporary Food								
Engi	neering)" by Ca	rlos Ri	cardo Soccol and Ashok Pandev					

Advances in Food Biotechnology" by Ravishankar Rai V

Course Code	22U3BTN01	NMEC – I	Ho	urs/	Ma	arks			
Credits	2	BIOSAFETY, BIOETHICS & IPR	W	ΥK					
Total Hours	45		Т	Р	Int	Ext			
Max. Mark	100		2	-	25	75			
		1			L				
Course Objective	es:								
The main objective	ves of this course an	·e:							
1. To make	students on unders	standing basic principles of Biosafety gu	iidelin	es an	d to				
understar	d concepts of inte	ellectual property right and its types.	_		_				
2. The stude	ent also gains add ting/marketing.bio	led knowledge on ethical, legal and socia	l cons	iderat	ions oi	1			
Course outcome									
On the successfu	, I completion of th	e course student will be able to							
CO1 Under	stand the concepts	of basic Biosafety and Biosafety levels			K1				
CO2 Under	stand Biosafety gu	idelines and role genetically modified			K2				
Organ	isms.	identies and fole genetically mounted			112				
CO3 Under	stand the basic prin	nciples of IPR, its types and patentingPro	cedure	es.	K3				
CO4 Under	stand the concepts	of ethical, legal considerations on the			K4				
releas	e of genetically mo	odified organisms.							
CO5 Understand the concepts of bioethics					K5	&K6			
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create									
UNIT I					8	Hrs			
Bio safety: Intro	duction – bio safety	y issues in biotechnology - historicalback	groun	d.					
Biosafety Levels	- Levels of Specif	ic Microorganisms,							
Infectious Agents	and Infected Anim	nals.							
UNIT II									
Biosafety	Guidelines: Guide	lines and regulations (Cartagena Protocol	l). CGM	GEA	NC				
	103 & LW03. Rok	es of institutional biosarcty committee,		, 01/	<u>.</u>	Hrs			
Intellectual Dron	orty Dightar Introd	uction to IDD. Tupos of ID. Detents							
Trademarks Co	wright & Related l	Rights Importance of IPR – patentablean	d non	naten	table				
UNIT IV		rights, importance of it is patchaoican	u non	puten	8	Hrs			
Patents and Pate	nt Laws: Objecti	ves of the patent system - Basic r	rincin	les a	nd ge	neral			
requirements of p	atent law. Patentab	le subjects and protection inBiotechnolog	gy.	105 u	na ge	norur			
UNIT V			•		8	Hrs			
Bioethics: Introd	luction to ethics and	d bioethics, framework for ethical							
Decision making.	Ethical, legal and s	socioeconomic aspects of gene therapy. E	thical	impli	cations	s of			
GM crops, biopira	acy and biowarfare								
UNIT VI VI	DEO LECTURES	, SEMINARS AND WEBINARS			5	Hrs			
REFERENCES									
1. Beie	er F.K, Crespi R.S a	and Straus T. Biotechnology and Patent							
protection, Oxford and IBHPublishing Co. New Delhi.									
2. Jeffrey M. Gimble, Academia to Biotechnology, Elsevier Academic Press.									
3. Rajn	3. Rajmohan Joshi (Ed.). 2006. Biosafety <sup>2</sup> a <sup>o</sup> nd Bioethics. Isha Books, Delhi.								
4. Sass	on A, Biotechnolog	gies and Development, UNESCO Publica	tions.						
5. Sent	hil Kumar Sadasiva	am and Mohammed Jaabir M. S. (2008).	IPR, E	Biosaf	ety and	1			
Biotech	nology Manageme	ent, Jasen Publications, India.							

Course Code	22U3BTN02	NMEC – I	Hours/ Ma		arks					
Credits	2	BIOINFORMATICS	W	K						
Total Hours	45		Т	Р	Int	Ext				
Max. Mark	100		2	-	25	75				
<b>Course Object</b>	ives:									
The main objec	tives of this course ar	e:								
1. To fami	iarize the student in	various aspects of cell and molecular b	oiology	strea	ams in	cluding				
cellular org	ganization and their	interactions in DNA replication, and	protein	n bio	synthe	sis and				
translationa	l regulation.	-	•		•					
2. To devel	op comprehensive ur	nderstanding on the complete cellular an	nd mole	ecula	r funct	tions of				
cell organe	les in terms of cell to	cell interaction, gene regulation, cellular	r signal	ling.						
3. To impa	art the molecular biolo	ogy knowledge in applications of various	humai	n hea	lth car	e.				
Course outcon	nes									
On the success	ful completion of the	course, student will be able to:								
CO1 To u	nderstand basic know	ledge of nucleic acid sequence databases	5.			K1				
CO2 To u	nderstand the concept	s of specialized databases.				K2				
CO3 To u	nderstand the basic co	procepts of sequence analysis and sequence	e Alig	nmen	t.	K3				
CO4 To u	nderstand the concept	s of gene prediction method s through In	silico a	appro	aches	K4				
CO5 Final	ly calculation and res	ult the finger printing methods.		TT		K5				
K1 - Rer	nember: K2 - Underst	and: K3 - Apply: K4 - Analyze: K5 - Ev	aluate:	K6 -	Create	2				
						-				
UNIT I B	IOINFORMATICS	AND BIOLOGICAL DATABASES			8	BHrs				
Nucleic acid se	quence databases– G	en Bank/NCBL EMBL, and DDBL Prot	tein sec	menc	e data	bases –				
Uniprot KB and	PIR. Structure datab	ases – PDB. CATH and SCOP.		1	• • • • • • •					
	EOUENCEANALY	SIS				BHrs				
BLOCKS, PR	INTS and Pfam. Micr	oarrays- Microarray data analysis. Prote	omic da	ata A	nalvsis	3.				
	<b>IULTIPLESEOUEN</b>	NCEALIGNMENT				BHrs				
Sequence alig	nment, Dotplot, pairw	rise Sequence Alignment-Local alignmer	nt and C	Globa	l align	ments-				
Dynamic prog	ramming algorithm fo	or sequence alignment, Scoring matrices,	gap pe	enalti	es.					
UNIT IV 1	<b>RANSLATION &amp; F</b>	PROTEIN SYNTHESIS	011			BHrs				
Scoring method	ls-clustal W -Phyloge	netic Analysis-tree construction methods	s-Maxin	mum	likelih	lood				
and maximum	arsimony-distanceme	ethods-Databasesimilaritysearch-BasicLo	ocalAli	gnme	entsear	ch tool				
(BLAST).	,			0						
UNIT V F	<b>EGULATIONOF G</b>	ENE EXPRESSION				BHrs				
Gene expression	on in transcriptional	level (lac and trp operon): gene expre	ession	in ba	acterio	phages.				
Transposons –	- types and mech	nanism of transposition.Gene silenc	ing.	Reco	mbina	tion –				
Homologous a	nd Non – homologo	us recombination. Molecular technique	s; DN	A fir	nger p	rinting,				
DNA Microarra	Homologous and Non – homologous recombination. Molecular techniques; DNA finger printing,									
	iy, Gene Mapping, Pr					Ung				
UNIT VI V	y, Gene Mapping, Pr IDEO LECTURES.	SEMINARS AND WEBINARS			5	<b>л</b> тъ				
UNIT VI V	ny, Gene Mapping, Pr TIDEO LECTURES,	SEMINARS AND WEBINARS			5	о <b>п</b> т <u>з</u>				
UNIT VI V REFERENCE	ny, Gene Mapping, Pr TIDEO LECTURES, S	SEMINARS AND WEBINARS			5	, ms				
UNIT VI V REFERENCE 1.	y, Gene Mapping, Pr TIDEO LECTURES, S Bioinformatics:	Sequence, Structure and Databanks:	A	Pract	ical	<u>, 115</u>				
UNIT VI V REFERENCE 1.	TDEO LECTURES, Bioinformatics: S Approach (The P.	SEMINARS AND WEBINARS Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi	A	Pract (Edit	ical or),	<u>, 115</u>				
UNIT VI V REFERENCE 1.	y, Gene Mapping, Pr TIDEO LECTURES, S Bioinformatics: S Approach (The P Willie Taylor. 1	SEMINARS AND WEBINARS Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un	A iggins	Pract (Edit y Pr	ical or), ess.					
UNIT VI V REFERENCE 1.	<ul> <li>S</li> <li>Bioinformatics: S</li> <li>Approach (The P</li> <li>Willie Taylor. 1</li> <li>ISBN:978-019963</li> </ul>	Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un 7904.	A iggins iversit	Pract (Edit y Pr	ical or), ess.					
UNIT VI V REFERENCE 1. 2.	TDEO LECTURES, TDEO LECTURES, Bioinformatics: S Approach (The P Willie Taylor. 1 ISBN:978-019963 Bioinformatics: So	Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un 7904. equence and G <b>on</b> ome Analysis. David V	A iggins iversit	Pract (Edit y Pr	ical or), ess. 2nd					
UNIT VI V REFERENCE 1. 2.	<ul> <li>S</li> <li>Bioinformatics: S</li> <li>Approach (The P)</li> <li>Willie Taylor. 1</li> <li>ISBN:978-019963</li> <li>Bioinformatics: Se</li> <li>edition, June2004</li> </ul>	Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un 7904. equence and G <b>gŋ</b> ome Analysis, David V ,Cold spring harbor laboratorypress.ISE	A iggins iiversit W. Mo 3N:978	Pract (Edit y Pr ount.	ical or), ess. 2nd					
UNIT VI V REFERENCE 1. 2.	y, Gene Mapping, Pr TDEO LECTURES, Bioinformatics: S Approach (The P Willie Taylor. 1 ISBN:978-019963 Bioinformatics: So edition, June2004 0879697129	Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un 7904. equence and G <b>gn</b> ome Analysis, David V ,Cold spring harbor laboratorypress.ISE	A iggins iversit W. Mo 3N:978	Pract (Edit y Pr ount.	ical or), ess. 2nd					
UNIT VI V REFERENCE 1. 2. 3.	Ny, Gene Mapping, Pr TDEO LECTURES, Bioinformatics: S Approach (The P. Willie Taylor. 1 ISBN:978-019963 Bioinformatics: So edition, June2004 0879697129 David. H.M.2005	SEMINARS AND WEBINARS Sequence, Structure and Databanks: ractical Approach Series, 236), Des Hi st edition, October 2000,Oxford Un 7904. equence and G <b>27</b> ,ome Analysis, David V ,Cold spring harbor laboratorypress.ISE Bioinformatics. Secondedn .CBS Publis	A iggins iversit W. Mo 3N:978 hers, N	Pract (Edit y Pr ount. -	ical or), ess. 2nd Delhi					

4.	David, R., Westhead, J., Howard, P. and Richard, M. and Twyman Instant
	Notes- Bioinformatics Viva Books Private Limted, Chennai.
5.	Gribskov, M., Devereux, J. 1989. Sequence analysis primer. Stockton Press.
6.	Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 1st
	edition, May2001, Pearson Education. ISBN:978-8178085074
7.	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins,
	Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. 3nd
	edition, October 2004, A John Wiley & Sons, Inc., Publication. ISBN:
	978-0471478782.
8.	Seizberg, S. L., Searls, D. B. and Kasif, S. 1998. Computational methods
	in Molecular biology now comprehensive Biochemistry. Elsevier.

# Semester - IV

Course Code	22U4BTC06		Ho	urs/	Μ	arks			
Credits	4	CORE COURSE-V	W	ΥK					
Total Hours	75	GENETIC ENGINEERING	Т	Р	Int	Ext			
Max. Mark	100		4	-	25	75			
	I		.1	1	1				
Course Objective	s:								
The main objective	es of this course an	re:							
1. To make s	tudents on underst	tanding basic principles of gene manipul	ation a	and its	s appli	cation			
in the deve	elopment of novel	pharmaceutical and drug products							
2. To illustra	te creative use of a	modern tools and techniques for manipul	ation	and ar	nalysis	of			
genomic sequences.									
3. 3. To expose students to application of recombinant DNA technology in biotechnological									
research.									
Course outcomes									
On the successful	completion of the	e course, student will be able to:							
CO1 To kno	w about DNA ma	nipulating enzymes and its role in rDNA	Tech	nolog	у	K1			
CO2 To gain	n knowledge on di	fferent types plasmid vectors and their U	Jsage.			K2			
CO3 To acq	uire knowledge or	n basic gene cloning strategies.				K3			
CO4 To eva	luate the usage an	d applications of gene cloning for the dev	velopr	nent		K4			
value a	dded products.								
CO5 To kno	ow-how on versati	le techniques in recombinant DNA techn	ology.			K5			
K1 - Remem	ber; K2 - Understa	and; K3 - Apply; K4 - Analyze; K5 - Eva	ıluate;	K6 -	Create	2			
UNIT I SCO	OPE AND MILE	STONES OF GENETIC ENGINEER	ING		1	5 Hrs			
Bimolecular tools	and their applicati	ons in genetic engineering: Restriction e	ndonu	clease	es and	its			
types, DNA polyr	nerases, DNA Lig	gase, Methylase, Taq polymerase, Reve	erse tr	anscri	ptase.	DNA			
modifying enzyme	s (Alkalinephosph	natase, Polynucleotide kinase, Ter	minal		deox	у			
nucleotidyl transfe	rase). S1nuclease,	, RNAse H and DNAse I. Ligation(cohe	sive &	z blun	t end				
ligation) – linkers	& adaptor.								
UNIT II GEN	NE CLONING V	ECTORS			1	5 Hrs			
Plasmids (PBR322	2, PUC and BAC	), Lambda vectors, Phagemids, Cosmid	s, M1	3 vec	tors, S	Shuttle			
vectors and artifi	cial chromosome	es (YAC and BAC). DNA sequencin	g (M	axam-	Gilbe	rt and			
Dideoxy) methods	. DNA amplifica	tion: PCR (Principles & types - RT PC	CR, Re	eal tin	ne PC	R and			
Nested PCR). cDN	A synthesis and c	loning:mRNA enrichment, reverse transo	riptio	n.					
UNIT III CLO	DNING STRATE	CGIES			1	5 Hrs			
Cloning of interact	cting genes - Yea	ast two hybrid systems Nucleic acid	micr	o arra	ays an	d Site			
directed mutagene	sis. Methods to s	tudy gene regulation: DNA transfection	ı, Prir	ner ex	ctensio	on, S1			
mapping, RNase p	rotection assay.								
UNIT IV INT	<b>RODUCTION T</b>	O CLONING			1	5 Hrs			
Detection & Scree	ning of clones. E	xpression strategies for heterologous get	nes. V	ector	engin	eering			
and codon optimiz	ation. In-vitro trar	scription, expression of cloned genes in							
prokaryotes (bacteria - Glucose promoter) and eukaryotes (Yeast - Alcohol promoter).									
UNIT V APP	PLICATIONS O	OF rDNA TECHNOLOGY			1	5 Hrs			
Transgenic plants	with reference to	virus and pest resistances, herbicide tole	erance	and s	tress				
tolerance (cold, heat	tolerance (cold, heat and salt); cytoplasmic male stergity; delay of fruit ripening.								
Transgenic animals – Pharmaceutical products - insulin. Farm animal production. Recombinant									
DNA Technology	in the production	of vaccine. T-DNA tagging and transpo	son tag	gging,	, Tran	sgenic			
and gene knock ou	t technologies.								

#### UNIT VI VIDEO LECTURES, SEMINARS AND WEBINARS

#### **REFERENCES:**

- **1.** Molecular cloning: a laboratory manual. J. Sambrook, EF. Frisch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York.2000.
- 2. DNA cloning: a practical approach, DM. Glover and BD Hames, IRL Press, Oxford, 1995.
- **3.** Molecular and Cellular Methods in Biology and Medicine, PB. Kaufman, W.Wu. D, Kim and L.J Cseke, CRC Press, Florida, 1995.
- **4.** Methods of Enzymology vol. 152, Guide to molecular cloning techniques, SL. Berger and AR. Kimmel Academic Press, Inc. An Diego, 1998.
- 5. Methods in Enzymology. Vol 185, gene expression technology, DV. Goeddel Academic Press, inc. San Deigo, 1990.
- **6.** DNA science. A first Course in Recombinant Technology. DA. Mickloss and GA. Freyer; CokJ Spring Harbor Laboratory Press, New York, 1990.
- 7. Molecular Biotechnology. SB. Primrose, Blackwell Scientific Publishers, Oxford, 1994.
- **8.** Milestones in Biotechnology. Classic papers on genetic Engineering. JA. Davis and WS. Reznikoff, Butterworth-Heinemann, Boston, 1992.
- **9.** Route maps in Gene technology, MR. Walker and R. Rapley, BlackwelScience Ltd., Oxford, 1997.
- **10.** Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes, SM. Kingsman and AJ. Kingsman, Blackwell Scientific Publications, Oxford, 1998.
- 11. Molecular Biotechnology Glick and Pasternak.
- 12. Principles of gene manipulations Old & Primrose.

Cou	rse Co	ode	22U4BTCP04		Но	urs/	Ma	ırks		
Cred	lits		4	CORE PRACTICAL -IV	W	/ <b>K</b>				
Tota	l Hou	rs	75	LAB IN GENETIC	Т	Р	Int	Ext		
Max	. Mar	k	100	ENGINEERING	4	-	40	60		
Cou	rse Ol	bjectiv	/es:							
The 1	main o	objecti	ves of this course ar	e:						
1.	To n	nake s	tudents on understar	nding basic principles on the usage of ge	enomi	c and	plasmic	I DNA		
	in th	e deve	lopment of microbia	al recombinant clones						
2.	To L	earnir	ng tools and techniqu	ies in rDNA technology						
3.	То а	acquire	e skills on techniqu	es of construction of recombinant DN	IA - (	Clonin	g vecto	rs and		
	isolation of gene of interest.									
4.	4. To Learning techniques for production of pharmaceuticals, growth hormones, vaccines, gene									
	therapy in expression system.									
Cou	rse ou	tcome	28							
<b>On</b> t	he su	ccessfi	ul completion of the	e course, student will be able to:						
CO1		To is	olate genomic and p	lasmid DNA, and to digest them restrict	ion Er	izyme	K	1		
CO2		Shall	acquire practical kn	owledge on vector handling and target	DNA		K	2		
CO3		Shall	know about the amp	plification strategies of cloned vector			K	3		
CO4		To de	emonstrate the select	tion of recombinant clones by using sele	ctable	mark	ers K	4		
CO5		To co	nduct gene amplifica	tion experiments by PCR analysis.			K	5&K6		
	K1	- Rem	ember; K2 - Underst	and; K3 - Apply; K4 - Analyze; K5 - Ev	valuate	e; K6 ·	- Create			
1	Isola	ation o	f Genomic DNA fro	om <i>E.coli</i> .			1	0		
2	Isola	ation o	f Plasmid DNA from	n E.coli			1	0		
3	Con	structi	on of restriction map	o of a plasmid by Hind III and Bam HI			1	0		
4	Liga	tion of	f DNA and plasmid	byT4 DNA ligase.			5	,		
5	Puri	ficatio	n of DNA fragments	s from gel by electro-elution.			5			
6	Amp	olificat	tion of ligated plasm	id by PCR.			1	0		
7	Trar	sform	ation of recombinan	t DNA in Host E.coli by CaCl method.			1	0		
8	Sele	ction of	of recombinant clone	es by (IPTG-X-gal: Blue white selection)	).		1	5		
							I			
REF	ERE	NCES	:							

1. Laboratory Manual for Genetic Engineering Paperback – 1 January 2009 by Vennison, S John.

2. BIO2450L Genetics Laboratory Manual Christopher Blair CUNY New York City College of Technology

Course Code	22U4ZOA02		Ho	urs/	Ma	arks				
Credits	4	ALLIED COURSE-IV	W	ΥK						
<b>Total Hours</b>	75	DEVELOPMENTAL BIOLOGY	Т	Р	Int	Ext				
Max. Mark	100		4	-	25	75				
			•							
Course Object	tives:									
The main object	ctives of this course	are:								
1. To provi	de a comprehensive	understanding of the concepts of early ani	mal de	evelop	ment					
2. To devel	op a critical apprec	iation of methodologies specifically used	to stu	dy the	e proce	ess of				
embryon	ic development in a	nimals.								
3. To gener	ates cellular diversit	y and order within each generation.								
Course outcomes										
On the successful completion of the course, student will be able to:										
CO1 To a	ble to list the types of	of characteristics that make an organism id	eal for	the	K1					
Stud	y of developmental	biology.								
CO2 To f	familiar with the eve	ents that lead up to and comprise the proces	ss of		K2					
Ferti	ilization.									
CO3 To u	nderstand the differ	ence between Blastulation and gastrulation	l.		K3					
CO4 To a	ble to describe orga	nogenesis.			K4					
CO5 To k	Knowledge of Artific	cial Reproductive Technology			K5	&K6				
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create										
UNIT I	GAMETOGENESI	S			12	2 Hrs				
Introduction to Developmental Biology, Spermatogenesis and structure of spermatozoa, Oogenesis,										
Structure and ty	ypes of ovum.									
UNIT II I	FERTILIZATION				12	2 Hrs				
Fertilization an	d its types, Process	of fertilization in invertebrates and vertebr	ates, 1	Parthe	nogen	esis –				
Mechanism and	d its types.									
UNIT III I	BLASTULATION	AND GASTRULATION			12	2 Hrs				
Planes and path	terns of cleavage, B	lastulation and Morula. Morphogenetic m	novem	ents, (	Gastru	lation				
in Mammals.										
UNIT IV (	DRGANOGENESI	<b>S</b>			12	2 Hrs				
Origin and dev	elopment of organs,	Development of eye, heart and brain.								
UNIT V A	ARTIFICIAL REP	RODUCTIVE TECHNOLOGY			12	2 Hrs				
Induced ovulat	ion, Artificial Insem	ination, IVF, Embryo transfer, ICSI, Birth	contr	ol.						
UNIT VI	VIDEO LECTURE	S, SEMINARS AND WEBINARS			5	Hrs				
DEFEDENCE	10									
	<b>S:</b> := Del Deservelle / D	Annalan mantal Dialagra Saatt E. Cilhart 20	06							
1. Biolog	la Del Desarrollo/ L	evelopmental Biology Scott F. Gilbert 20	00							
2. Develo	prinental Biology /I	cott E. Gilbert 2013								
J. Develo	pmental Biology J	eonaid Roosevelt								
5 Develo	pmental Riology M	lary S Tyler								
6 Develo	6 Developmental Biology Michael If Scott E Cibert									
7 Develo	7 Developmental Biology Subramanian M A									
8. Develo	8 Developmental Biology David I Caroll									
9. Humar	embryonic stem ce	lls in Development Ali H. Brivanlou								
9. Human embryonic stem cells in Development Ali H. Brivanlou										
9. Human embryonic stem cells in Development Ali H. Brivanlou										

Coi	irse Code	22U4ZOAP02		Hours/		Marks	
Cre	edits	3	ALLIED PRACTICAL COURSE-IV	W	/ <b>K</b>		
Tot	al Hours	60	LAB IN DEVELOPMENTAL	Т	Р	Int	Ext
Ma	x. Mark	100	BIOLOGY	-	3	40	60
Cou	irse Objec	tives:					
The	main obje	ctives of this cours	se are:				
]	I. To em	phasize the fundai	nentals of biology and build upon those fund	lament	tals.		
4	2. To all	ow students to ga	an appreciation of development and w	hat ca	n be g	gained	trom
_	studyn	ng various vertebr	ates.	1	. 11		
1	3. To allo	ow students to und	erstand key concepts and techniques in deve	lopme	ntal b	lology	•
2	I. To pro	ovide students with	the opportunity to work together in a collar	orativ	e effoi	rt.	
:	b. To stre	engthen the ability	of students to think critically.				
Cou	irse outco	mes					
On	the succes	sful completion o	f the course, student will be able to:				
CO		able to list the type	s of characteristics that make an organism in	leal to	r the	KI	L
	Stuc	dy of development	al biology.				
CO	2 To Fort	tamiliar with the e	events that lead up to and comprise the proce	ss of		<b>K</b> 2	2
CO	3 To 1	inderstand the diff	Perence between Blastulation and gastrulation	<u> </u>		K	3
CO4	4 To a	able to describe or	ganogenesis.	1.		K4	, 
CO	5 To l	Knowledge of Art	ficial Reproductive Technology			K5	5&K6
	K1 - Rer	nember; K2 - Und	erstand; K3 - Apply; K4 - Analyze; K5 - Ev	aluate:	K6 -	Create	
1	To study	y the developing G	ametes (Testis and Ovary)				6
2	To stud	y the development	al stages of chick embryos (24hours, 48 hou	rs, 72	hours		6
	and 96 h	nours)					
3	To stud	y the development	al stages of Egg, Blastula and Gastrula				6
4	To stud	y the frog metamor	rphosis				3
5	To study	y the different type	es of placenta				6
6	To obse	rve the the structu	re of Sperm and Egg.				3
	•						
RE	FERENCI	ES:					
	1. Lat	poratory manual, I	BIOLOGY Developmental Biology Laborate	ory BI	OL-A	309	
	Μ	cGraw-Hill Publis	hers				

Course C	Code	22U4BTS03		Hours/		Marks				
Credits		2	SBEC – II	WK						
Total Ho	ours	45	POULTRY SCIENCE	Т	T P		Ext			
Max. Ma	ark	100		2	-	25	75			
Course (	Objectives	5:								
The main objectives of this course are:										
1. To	o impart k	nowledge on dif	ferent systems of breeding of poultry.							
2. To gain knowledge about selection methods of poultry										
3. To	o design	and implementa	tion of breeding programmer in develop	ing eg	gg-typ	be and	meat			
ty	pe.									
Course o	outcomes									
On the st	uccessful	completion of t	he course, student will be able to:							
COI To impart knowledge about care and management of breeders, hatchery operation, health management.					K1					
CO2	To study	the nutrition in	Poultry Science			K2				
CO3	To gain	knowledge busin	ness skills needed in poultry production.			K3				
	6	6	r J I			_				
CO4	To deve	lope basic scienc	ces and mathematics about Poultry Science			K4				
CO5	To unde	rstanding of the	Poultry Farming and production of eggs, r	neat,		K5	&K6			
K1	- Remem	ber; K2 - Unders	stand; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 -	Create				
UNIT I	GEN	NERAL INTRO	DUCTION OF POULTRY			8	Hrs			
Introduct	ion to po	ultry keeping,	poultry industry in India, Poultry breeds	and c	classe	s of fo	owls ,			
Poultry h	ousing , g	eneral principles	s of building poultry house.							
UNIT II	POU	JLTRY MANA	GEMENT			8	Hrs			
Rearing	of fowls -	– growers. Lay	ers and broilers – growth management	– sun	nmer	and w	vinter			
managem	nent.	Η ΤΈΝΧ ΝΗΓΤΕΙ	TION			0	IIma			
	I POU	Composition of	f noultry food nutriant requirements f	For for	wla	ð	Hrs			
deficienc	v sympton	-Composition o	r pounty reed – nutrient requirements r	01 10	w15 —	nuun	.1011a1			
	7 <b>PRF</b>	CAUTION OF	POULTRY			8	Hrs			
Poultry d	iseases: R	anikhet disease.	New castle disease. Fowl pox. Birds flu.	Jaccin	ation	schedu	iles			
UNIT V	ECC	DNOMICS Of	POULTRY			8	Hrs			
Poultry e	egg produ	ction – compos	sition and nutritive value of egg - use	of fea	thers	and p	oultry			
manure. I	Economic	s of poultry. Fiel	ld visit.				•			
UNIT VI	I VID	EO LECTURE	S, SEMINARS AND WEBINARS			5	Hrs			
REFERI	ENCES:									
1. F	Prakash M	alhotra (2008) E	Conomic Zoology, Adhyayna Publishers &	z Disti	ributo	rs, Nev	N			
Γ	Delhi.									
2. 0	Gnanaman	iA.R.Modern as	pects of commercial Poultry keeping. Giri	Public	cation	, Madu	ırai.			
3. E	Banerjee C	B.C. A text book	of Animal Husbandry –Oxford & IBH pu	olishir	ng Co	Pvt. L	td.,			
	New Delhi			1	a	1.0				
4.	⊐ _ Jawaid	A. and Sinha, S	8. P. (2008) A Handbook of Economic Zoo	ology.	S. Ch	and &				
	ompany,	New Delhi.	35 Romia Zaology, Dastasi Dahlisetiana M	T	dia					
	5. Upadhya, V.B. (2006) Economic Zoology. Rastogi Publications, Meerut, India.									
	Dublishing	Co NewDelbi	, L.II. (1907) Diseases of Poulity, 3th Edi	UXIC	лuan	u IDП				
Г	aonsining									

Course (	Code	22U4BTS04	Hour SBEC – U WK		Hours/ Ma		
Total Ho	lirs	<u> </u>	SBEC - II MARINE RIOTECHNOLOGV		D	Int	Fvt
Mox Me	vui s ark	45	MARINE DIOTECHNOLOGI	2	1	25	<b>EX</b> 75
	μĸ	100		2	-	23	15
Course (	Obiectives	:					
The main	objective	s of this course	are:				
1. To	understan	ding the signific	ance and importance of marine micro bio	ota.			
2. To	rational a	pplicability in th	e development of industrially important p	oroduct	s.		
3. To	gain knov	vledge on the en	vironmentally hazardous management ma	arine ec	cosyst	em.	
4. To	understan	ding the marine	pharmacology.				
Course o	outcomes						
On the s	uccessful	completion of t	he course, student will be able to:				
CO1	To und	erstand basics of	marine ecosystem and its pollution issue	×s.		K1	
CO2	Tounde	erstandbasicbiod	egradationandbioremediationmarineecos	yst		K2	2
	empollu	utants					
CO3	To und	erstand the princ	iples of biofouling.			K3	5
CO4	To acqu	uire knowledge	of waste water treatment in marine ecosys	stem.		K4	-
CO5	To acqui	re knowledge of	marine toxins.			K5	&K6
K	1 - Remen	nber; K2 - Unde	rstand; K3 - Apply; K4 - Analyze; K5 - E	lvaluate	e; K6	- Crea	te
UNIT I	MAI	RINE ORGAN	SMS AND ENVIRONMENT INTERA	CTIO	N		8 Hrs
Types of	marine en	vironment - Phy	rsical, Chemical and Biological aspects an	nd their	1	、 、	
interactio	n with ma	rine life; Air $-S$	Sea interaction; Green - house gases (CO2	and M	lethan	e)	0.11
UNIT II			/1 . 1	• ,•	1		8 Hrs
Marine p	ollution-m	ajor pollutants	(heavy metal, pesticide, oil, thermal, rad	10activ	e, pla	stics, I	itter and
Applicati	on of Prot	ical mulcators	Biosensors and bioching	is) and	accu	mutat	DIS:
		MATERIAL					8 Hrs
F	Biodegrada	ation and Bi	oremediation: Biodegradation of natu	ral an	d sv	nthetic	waste
materials	: Bioreme	diation: Separat	on, purification and bio removal of pollut	tants.	u sy		, waste
UNIT IV	<b>FOU</b>	LING AND CO	DRROSION				8 Hrs
Biofoulir	ıg; Biofiln	n formation; Ma	urine fouling and boring organisms - the	eir biol	ogy, a	idapta	tion;
Factors in	nfluencing	the settlement	of macro foulers; Antifouling and Anti be	oring tr	eatme	ents; C	orrosion
Process a	nd control	l of marine struc	tures.				
UNIT V	INT	<b>RODUCTION</b>	TO MARINE PHARMACOLOGY				8 Hrs
Terms an	d definitio	ons; Medicinal c	ompounds from marine flora and fauna -	marine	toxin	s, anti	viral and
antimicro	bial agent	s.					
UNIT V	I VID	EO LECTURE	S, SEMINARS AND WEBINARS				5 Hrs
	1. I	Recent Advance	sin MarineBiotechnologyVolume3-Milte	on fing	ermar	et al.,	1999.
	2. 0	Cynobacterial ar	d Algal Metabolisms and Environment				
	]	Biotechnology –	TasneemFatma, 1999.				
	3. I	Environmental E	iotechnology and cleaner Bioprocess-Ol	guni, E	LJ. eta	1., 200	)0.
	4. I	Environmental E	Biotechnology Theory and applications–E	vanseta	al., 20	00.	
	5. I	Environmental B	otechnology -G3a6rethM.Evamsetal.,2003	3			
	6. I	Biotechnology, l	Recombinant DNA Technology, Environi	mental	Biote	chnole	ogy –
	2	S.Maheshet al., 2	2003.				

Course Code	20U4BTN03		Ho	urs/	Ma	arks
Credits	2	NMEC - II	W	ΥK		
Total Hours	45	CONCEPTS OF BIOTECHNOLOGY	Т	Р	Int	Ext
Max. Mark	100		2	-	25	75
Course Objectiv	ves:					
The main object	ives of this course	e are:				
1. To make	non major life s	cience students in understanding basic an	d app	lied pi	rincipl	les of
biotechnol	ogy					
2. To unders	tand technical	approach in society in generating value	e add	ed, re	liable	and
reproducit	ole products.					
Course outcom	es					
On the successf	ul completion of	the course, student will be able to:				
CO1 To understand the scope and application of biotechnology						
CO2 Use	of enzymes inger	nerating basic recombinant DNA concepts.			K2	
CO3 Use	of plasmid vector	rs in experimenting and designing cloning St	trategi	es	K3	
CO4 Use	molecular te	echniques of the identification of	pos	itive	K4	
recombinant clones.						
CO5To gain knowledge about technologies in biotechnology.K5&K6						&K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create						
UNIT I SCOPE OF BIOTECHNOLOGY					8	Hrs
History of Biote	chnology; Conve	ntional and modern Biotechnology –	В	lotech	indus	tries.
Biotechi	hology tree. Strat	regies for gene cloning.				
	JOLS USED IN	GENE CLONING	11	1	8	Hrs
Restriction endo	nucleases – Type	es – Features. Ligases – linkers, adaptors an	a nom	lopoly	mer ta	ulling.
	ECTOPS				0	Una
Properties of go	od vector Const	ructed plasmids pBR 322 Cosmid vectors	Anin	<u>aal va</u>	otors	1115 SV40
Plant vectors – T	i derivatives	ructed plasmids-pBK 522. Cosmid vectors,			1015-	<b>3 v</b> <del>4</del> 0.
UNIT IV IN	TRODUCTION	NOF GENES			8	Hrs
Vector mode –	transformation a	nd transfection Vector less mode – Biol	istics	Flect	ropor	ation
Microiniection	unification a		151105,	Lieet	opon	
UNIT V SI	ELECTION OF	RECOMBINANTS			8	Hrs
Markers – PCR,	RFLP, RAPD an	d blotting techniques				
UNIT VI V	<b>DEO LECTUR</b>	ES, SEMINARS AND WEBINARS			5	Hrs
		,				
REFERENCES	:					
1. Princi	ples of gene man	ipulations. Old and Primrose (1989), 3rd edi	tion.			
2. Biotec	hnology, Sathya	narayana U (2008), Books and Allied (p) ltd				
3. Biotec	hnology and gen	omics, Gupta PK (2004). Rastogi publicatio	ns.			
4. Gene	cloning and DN	A analysis. Brown TA. (1996). Blackwell	scien	ce, Os	sney I	Mead,
Oxfor	d.					
5. A text	book of Biotechi	nology, Dubey RC (2007). S.Chand& Comp	any L	td, Ne	w Del	hi.
6. Biotec	hnology, Singh H	BD (2004). Kalyanig Publications. New Delhi	•			

Course (	Code	20U4BTN04		Hours/ Mark				
Credits		2	NMEC – II	WK				
Total Ho	ours	45	BIOTECHNOLOGY FOR T P		Р	Int	Ext	
Max. Ma	<b>Iax. Mark</b> 100 <b>SOCIETY</b> 2		-	25	75			
		1					<u>.                                    </u>	
Course (	Course Objectives:							
The main objectives of this course are:								
1. To	1. To make students on understanding the applied part of biotechnology to non-major and non-							
life	life science back ground students							
2. To	2. To understand technical approach in society in generating value added, reliable and							
reproducible products.								
Course o	Course outcomes							
On the s	uccessful	completion of the	e course, student will be able to:					
CO1	To und	erstand basic kno	wledge of silkworm, earthworm cultivation	on and	l its	K1		
	applica	tions						
CO2	To und	erstand the conce	pts of biofertilizers, bioplastics and Biow	eapon	s .	K2	r	
CO3	Tounde	erstandthebasicco	nceptsofbiodegradationofxenobioticCom	pound	S	K3		
CO4		understand th	e concepts of generating g	genetic	ally	K4	•	
COF	Tounda	ed transgenic orga	inisiis			V.5	P-VC	
CO5	10 unde Romami	erstand the c	oncepts of Transgenic animals	luotor	V6	- KJ Trooto	ano	
	- Kemenn	ber, K2 - Understa	and, K5 - Apply, K4 - Analyze, K5 - Eva	luale,	K0 - V		2	
LINIT I	TPF	NDS IN FCON	MIC BIOTECHNOLOCY			8	Hrs	
Seri cultu		ulture Aniculture	• Vermi culture and Mushroom Technolo	σν		0	1115	
	REG	LILATIONS IN	<b>BIOTECHNOLOGY</b>	·6J·		8	Hrs	
Biofertili	zers. Bior	pesticides. Bio	repellents. Pest control and managem	nent.	Bioma	uss (S	SCP).	
Bioplasti	cs, Biowea	apons.		,		() ()	- //	
UNIT II	I BIO	FUELS				8	Hrs	
Bio dyes	, Bio fuel	ls – Biodiesel &	Biogas, Bio indicators, Biodegradation	1 - Ro	ole of	genet	ically	
modifies	organisms	5.				-		
UNIT IV	rDN.	A TECHNOLO	GY			8	Hrs	
Productio	on of per	nicillin, Recombi	nant Vaccines (HBV), Recombinant	Insul	in, Pl	antibo	odies,	
Vaccines	in animal	cells, Gene thera	py.					
UNIT V	APP	LICATION OF	BIOTECHNOLOGY			8	Hrs	
Transgen	ic animals	s and their appli	cations. Mice, Sheep and Fish. Transg	genic	plants	and	their	
applicatio	ons – BT c	cotton, Flavr-Savr	tomato and golden rice.					
UNIT VI	<b>VID</b>	EO LECTURES	, SEMINARS AND WEBINARS			5	Hrs	
DEFE								
REFERI	ENCES:							
	Animal E	biotechnology, Ra	aliga IVIIVI (2000). Agrodios	Ovfa	rd or	1 1011	ŕ	
۷.	nublicati		technology. Chawla (2005).211d edition.	OXIO	ru and			
3	Biotechn	ology Sathyanar	avana $II(2008)$ Books and Allied (p) ltd					
3. 4	Industria	1 Microhiology P	atel AH (2005). Mac Millan Publishers					
5.	A text bo	ok of Biotechnol	ogy, Dubey RC (2007). S.Chand& Com	anv I.	td. Ne	w De	lhi.	
6.E	Invironme	ntal Biotechnolog	y, Chatterji AK, 3rd edition. PHI Learnin	ng Pvt	Ltd. N	Vewde	elhi.	

# Semester - V

Course Code	22U5BTC07		Ho	urs/	Ma	arks		
Credits	4	CORE COURSES-VII	W	ΥK				
<b>Total Hours</b>	75	IMMUNOLOGY	Т	Р	Int	Ext		
Max. Mark	100		5	-	25	75		
Course Objective	G.							

Course Objectives:

The main objectives of this course are:

- 1. To make students on exposing themselves to know in underlying concepts of biology of the immune system and how immunity being developed in human beings.
- 2. In addition the students also know where about on the mechanisms on the host pathogen interaction, principle defense mechanisms against infectious diseases and basic immune diagnostic techniques.

Course of	itcomes					
On the su	ccessful completion of the course, student will be able to:					
CO1	Acquire knowledge on history on immunology development, and cells and	K1				
	their role in developing overall host immune system.					
CO2	Knowing about the functions and properties of immunoglobulinand its	K2				
	expression in genetic level.					
CO3	Acquire knowledge on antigen recognition and its processing principles	K3				
	by host immune system.					
CO4	Acquire basic concepts of immune regulatory molecules andtheir role in	K4				
	defense and concepts of autoimmunity.					
CO5	Evaluate the defense mechanism against any pathogens.	K5&K6				
K1 ·	Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cr	eate				
UNIT I	HISTORY AND SCOPE OF IMMUNOLOGY	13 Hrs				
Types of	Immunity. Cells of Immune system. Organs of Immune response and their	functions.				
Haematop	oiesis. Antigen- properties, classes, epitopes, haptens and adjuvants. Factors in	ofluencing				
antigenici	y.					
UNIT II	IMMUNOGLOBULINS AND ITS EXPRESSION	13 Hrs				
Immunog	obulin- Structure, types, properties and functions. Immunoglobulin gene re-arra	ngements.				
Generatio	n antibody diversity. Somatic hyper mutation. Ig gene expression and its regulation	m.				
UNIT III	ANTIGEN PROCESSING AND PRESENTATION	14 Hrs				
MHC – ty	pes and importance- distribution and function. Antigen processing and presenta	tion to T-				
lymphocy	tes. Major classes of MHC genes and its regulation. Antigen - Antibody reaction	ns –				
Agglutina	tion, precipitation, RIA, ELISA, FACS and Immuno panning. Hybridoma Techno	logy.				
UNIT IV	CYTOKINES, IMMUNE CELL ACTIVATION AND ALLERGIC	15 Hrs				
	REACTIONS	15 1115				
Definitio	n of cytokines, classification and types of cytokine, Biological functions of c	ytokines.				
Cytokine	e receptors. T-cell and B-cell activation and differentiation. Hypersensitivity r	eactions				
and its	ypes. Plasma cells and memory cells.					
UNIT V	AUTOIMMUNITY	15 Hrs				
Definition	, types of autoimmune disorders. Mechanism of autoimmunity. Immunod	leficiency				
disorder.	Vaccines and its types. Immune response to bacterial, protozoan & parasitic	diseases.				
Immuno o	leficiency diseases (HIV). Transplantation jmmunology – types of grafts. Mech	hanism of				
graft rejec	tion Immunosuppressive therapy.					
UNIT VI	VIDEO LECTURES, SEMINARS AND WEBINARS	5 Hrs				

#### **REFERENCES:**

- 1. Ivan Riot Blackwell, 1988. Essentials of Immunology (6th Edition): Scientific Publications, Oxford,
- 2. Paul W.E (Eds) Ravan prss 1988. Fundamentals of Immunology:, New York,
- 3. Harlow and David Lane, 1988. Antibodies A laboratory Manual: cold spring harbor laboratory.
- 4. Janis Kuby Immunology, 1997. WH Freeman & Company, New York.
- 5. Tizard, 1995. Immunology IV Ed Saunders college publishers, New York.
- 6. Robert M.Coleman., 1992. Fundamental Immunology. 2 nd edition. Wim. C.Brown Publishers.
- 7. Eli Benjamini et al., 1991. Immunology A short course Wiley Publishers, NY.

Course Code	22U5BTC08		Hours	/ 1	<b>/</b> larks	
Credits	4	CORE COURSES-VIII	WK			
<b>Total Hours</b>	75	BIOSTATISTICS	ΤI	P Int	Ext	
Max. Mark	100		5 -	· 25	75	
Course Object	ives:					
The main object	tives of this course a	re:				
1. Enhanc	e students' skill tow	vards use of statistics and its application	of biosta	tistics i	n	
biotech	nological Research.					
2. In addit	tion the students a	lso know about the mechanisms enzy	mes and	basic	enzyme	
techniq	ues					
Course outcom	les					
On the success	ful completion of th	e course, student will be able to:				
CO1 To m	ake understand the s	tudents in math and statistics.		K	1	
CO2 Know	ving about the Mean	, Median, Mode		K	2	
CO3 Acqu	ire knowledge on M	ean Deviation and Standard Deviation.		K	3	
CO4 Acqu	ire basic concepts of	f Correlation, Regression.		K	4	
CO5 Evalu	CO5 Evaluate the test of significance. K5&K6					
K1 - Ren	nember; K2 - Unders	stand; K3 - Apply; K4 - Analyze; K5 - Ev	aluate; K	6 - Crea	te	
UNIT I S	TATISTICS				13 Hrs	
Definitions – Li	mitation and uses of	Statistics – Sources of data in Life Science	ces – Col	lection	lata —	
Primary & Secon	ndary data – Method	s of collection of data – Classification, Ta	abulation	& asser	tation.	
Initial y descendency data       Notifieds of concertion of data       Classification, Fabrication & assertation.         UNIT II       MEASURES OF CENTRAL TENDENCY       13 Hrs						
UNIT II M	IEASURES OF CE					
UNIT IINMean, Median,	Mode – Merits and I	Demerits.				
UNIT IIMMean, Median,UNIT IIIM	Mode – Merits and I IEASURES OF DIS	Demerits. SPERSION			14 Hrs	
UNIT IIMMean, Mediar,UNIT IIIRange, Quartile	Mode – Merits and I IEASURES OF DIS Deviation, Mean	Demerits. SPERSION Deviation and Standard Deviation –	Merits a	nd Der	<b>14 Hrs</b> nerits –	
UNIT IIMMean, Median,UNIT IIINRange, QuartileCoefficient of V	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean 'ariation.	Demerits. SPERSION Deviation and Standard Deviation –	Merits a	nd Der	<b>14 Hrs</b> nerits –	
UNIT IIMMean, Median,UNIT IIIMange, QuartileCoefficient of VUNIT IVR	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean <sup>7</sup> ariation. <b>EGRESSION &amp; C</b>	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION	Merits a	nd Der	14 Hrs nerits – 15 Hrs	
UNIT IIMMean, Mediar,UNIT IIINRange, QuartieCoefficient of VUNIT IVINIT IVRTypes of Correct	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean <sup>7</sup> ariation. <b>EGRESSION &amp; C</b> lation, Rank Corre	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION Elation, Regression equations – Fitting	Merits a	nd Der	14 Hrs nerits – 15 Hrs (Simple	
UNIT IIMMean, Mediar,UNIT IIIRange, QuartieCoefficient of VUNIT IVRTypes of Correstproblems).	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean <sup>7</sup> ariation. <b>EGRESSION &amp; C</b> slation, Rank Corre	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION Hation, Regression equations – Fitting	Merits a and red	nd Der	14 Hrs nerits – 15 Hrs (Simple	
UNIT IINMean, Median,UNIT IIINRange, QuartileCoefficient of VUNIT IVRTypes of Corresproblems).UNIT VT	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean Variation. <b>EGRESSION &amp; C</b> Addition, Rank Corre <b>EST OF SIGNIFIC</b>	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION elation, Regression equations – Fitting CANCE	Merits a and red	nd Der	14 Hrs nerits – 15 Hrs (Simple 15 Hrs	
UNIT IIMMean, Median,UNIT IIIRange, QuartileCoefficient of VUNIT IVRTypes of Corresproblems).UNIT VINIL and Altern	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean Variation. <b>EGRESSION &amp; Corre</b> Attion, Rank Corre <b>EST OF SIGNIFIC</b> ative hypothesis – La	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION Idation, Regression equations – Fitting CANCE arge sample tests based on mean, differen	Merits a and red	nd Der	14 Hrs nerits – 15 Hrs (Simple 15 Hrs Il	
UNIT IINMean, Median, Median, Median, MedianNUNIT IIINRange, QuarrierCoefficient of VUNIT IVRTypes of Corresproblems).TUNIT VTNull and Alternsample test – str	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean <sup>7</sup> ariation. <b>EGRESSION &amp; C</b> ation, Rank Corre <b>EST OF SIGNIFIC</b> ative hypothesis – La Jdent t-test, chi-squa	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION elation, Regression equations – Fitting CANCE arge sample tests based on mean, different are test.	Merits a and red ce of mea	nd Der ictions	14 Hrs nerits – 15 Hrs (Simple 15 Hrs II	
UNIT IINMean, Median,UNIT IIINRange, QuartileCoefficient ofUNIT IVTypes of Correspondents).UNIT VUNIT VInd Alternsample test – strUNIT VIV	Mode – Merits and I <b>IEASURES OF DI</b> Deviation, Mean Variation. <b>EGRESSION &amp; Collection</b> Analysis – La Analysis – La An	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION Idation, Regression equations – Fitting CANCE arge sample tests based on mean, different are test. S, SEMINARS AND WEBINARS	Merits a and red ce of mea	nd Der	14 Hrs         nerits         15 Hrs         (Simple         15 Hrs         11         5 Hrs	
UNIT IINMean, Median,UNIT IIINRange, QuartileCoefficient of VUNIT IVTypes of Corresproblems).UNIT VUNIT VNull and Alternsample test – strUNIT VIV	Mode – Merits and I Mode – Merits and I MEASURES OF DI: Deviation, Mean Variation. EGRESSION & Corresidation, Rank Corres	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION elation, Regression equations – Fitting CANCE arge sample tests based on mean, differen are test. S, SEMINARS AND WEBINARS	Merits a and red	nd Der	14 Hrsnerits15 Hrs(Simple15 Hrs115 Hrs	
UNIT II     N       Mean, Median,     N       UNIT III     N       Range, Quartile     Coefficient of V       UNIT IV     R       Types of Corresproblems).     T       UNIT V     T       Null and Altern sample test – str     V       UNIT VI     V       REFERENCE	Mode – Merits and I Mode – Merits and I MEASURES OF DIS Deviation, Mean Variation. EGRESSION & Corresidation, Rank Corres	Demerits. SPERSION Deviation and Standard Deviation – ORRELATION elation, Regression equations – Fitting CANCE arge sample tests based on mean, different are test. S, SEMINARS AND WEBINARS	Merits a and red ce of mea	nd Der	14 Hrs         nerits         15 Hrs         (Simple         15 Hrs         11         5 Hrs	

2. Mahajan, B.K. (1997). Methods in Biostatistics. 6 th edition, Jaypee BrothersMedical Publishers (P) Ltd.

Course Code	22U5BTC09		Hoi	urs/	Ma	arks		
Credits	4	CORE COURSES-IX	WK					
Total Hours	75	ENZYMOLOGY AND ENZYME	Т	Р	Int	Ext		
Max. Mark	100	TECHNOLOGY	5	-	25	75		
Course Objectives	Course Objectives:							
The main objective	es of this course a	re:						
1. To make	e students on expe	osing themselves to know in underlying	concep	ots of	enzyn	ne and		
enzyme	technology.							
2. In addit	2. In addition the students also know where about the mechanisms enzymes and basic							
enzyme	techniques.							
Course outcomes	Course outcomes							
On the successful	completion of th	e course, student will be able to:						
CO1 Acquire	knowledge in the	subject enzymes and enzyme technology	/		K1			
CO2 Knowin	g about the functi	ons and properties of enzymes.			K2	,		
CO3 To unde	rstand their funct	ional attributes.			K3	1		
CO4 Acquire enzymes	basic concepts E	nhance knowledge on industrial application	on of		K4			
CO5 Evaluate	e Legal issues rela	ated to enzyme based industries.			K5	&K6		
K1 - Remem	ber; K2 - Underst	and; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 -	Create	;		
UNIT IINTRODUCTION TO ENZYMES13 Hrs								
Enzyme nomencla	ature, enzyme con	mmission numbers, and classification of	enzyn	nes. Is	solatio	on and		
purification of enz	ymes, preparation	of purification chart, Enzyme activity, S	pecific	e activ	vity an	d turn		
over number, Marl	ker enzymes.							
UNIT II ENZ	YME KINETIC	CS:			13	3 Hrs		
Steady state, pre-s	teady state, equi	librium kinetics, Michaelis and Menten	Equat	ion ai	nd its			
derivation, Differe	nt methods to cale	culate the Km and Vmax and their signifi	cance.	Facto	or affe	cting		
Enzyme activity an	nd catalysis: pH,	substrate and enzyme concentration, tem	peratu	re, co	enzym	e and		
cofactors, Mechan	ism of action of	enzymes involving two/more substrates	. Role	of m	netal ic	ons in		
enzyme catalysis.	Enzyme inhibition	n, different types of inhibitors and activate	ors.					
UNIT III STR	UCTURE AND	FUNCTION OF ENZYMES			14	4 Hrs		
Lysozyme, chymot	trypsin, DNA pol	ymerase, RNase, proteases. Enzyme regu	lation	and $c$	ontrol	of		
their activity. Intro	duction to alloste	eric enzymes and isozymes. Bioinformati	cs ana	lysis	of stru	ctural		
and functional prop	perties of enzyme	S.			1			
UNIT IV ENZ	LYME TECHNO			•		) Hrs		
Immobilization of	enzymes, whole of	cell immobilization and their application,	comm	hercia	l produ	JCtion		
of enzymes, RNA-	catalysis, Catalyti	c antibodies -abzymes, Protein and Enzy	me en	gineei	ing: L	)esign		
	novel enzymes t	Ising Instico methods.			1			
UNIT V ENZ	LYMES IN INDU					${1}$ Hrs		
Paper making, Me	at processing, Br	ead making, Detergent preparation, End	tment	s, reg	ulation	is and		
guidennes in Enz	yme maustries,	IPR in enzyme technology (Stone was	n, B10	piasti	cs, co	rn to		
plastic)								
	EULECIUKES	, SEIMINAKS AND WEBINAKS			5	Hrs		
		AIN			5			
REFERENCES:								
1. Trevor, P. 2004	4. Enzymes: Biod	chemistry, Biotechnology, Clinical chem	istry -	-East	West	Press		

Edition, New Delhi.

- 2. Satyanarayana, U. and Chakrapani, U. 2008. Biochemistry, Books and Allied (P) Ltd, Kolkata. Nicholas, C. and Price Lewis Stevens, 1998. Fundamentals of Enzymology, 2 nd edition, Oxford University Press, New York.
- 3. David L. Nelson and Michael M. Cox, 2007. Lehninger Principles of Biochemistry, W.H Freeman and Company, New York.
- 4. Lubert, S. Jeremy M. Berg and John L. Tymoczko, 2001. Biochemistry, V edition, W.H.Freeman & amp; Company, Newyork.
- 5. Ashok Pandey, Colin Webb, Calos Ricardo Soccl and Christian Larroche, 2005.
- 6. Enzyme Technology, Asiatech publishers Inc, New Delhi.

Cou	rse Code	22U4BTCP05		Но	urs/	Ma	arks
Cred	lits	3	CORE IV	W	/ <b>K</b>		
Tota	l Hours	75	LAB IN IMMUNOLOGY &	Т	Р	Int	Ext
Max	. Mark	100	ENZYME TECHNOLOGY	-	6	40	60
Cou	rse Objectives	s:					
The 1	main objective	es of this course ar	e:				
1. To	make student	ts on practical expe	osure towards immunological technique	es in-te	erms o	f hand	ling
of lal	boratory anima	als, qualitative and	quantitative estimation of antigen - an	tibody	specif	ïcity.	
Cou	rse outcomes						
On s	uccessful con	pletion of the cou	rse, students will be able to:				
CO1	Gaining k	knowledge on hand	lling of laboratory animals.			I	K1
CO2	Knowing	about the methods	s of immunization of bleeding andsepar	ation		I	K2
	serum and	d plasma from bloo	od.				
CO3	CO3 Analysis of qualitative & quantitative estimation of antigen -antibody interaction. K3						K3
CO4 To know about the basic principles of blotting techniques in practical approach. K4						K4	
CO5 Evaluate and create laboratory test analysis kit .						K5	
	K1 - Remem	ber; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Ev	aluate	K6 -	Create	,
1	Preparation	of Serum and plass	na.				3
2	ABO Blood	grouping (Rh typin	ng) (Agglutination).				3
3	WIDAL test	, ASO test , Pregna	ancy test (Agglutination),				3
4	Radial immu	ine diffusion test, l	Rocket Immuno electrophoresis test				3
5	Ouchterlony	double immune di	ffusion technique (ODD), (Precipitatio	n test).			3
6	Counter curr	rent immune electr	ophoresis (CIE) and DOT ELISA.				3
7	Isolation and	l screening of indu	strially important enzymes (amylase) fr	rom mi	crobe.		3
8	Enzyme proc	duction and assay	(amylase).				3
9	Optimization	n of pH and temper	cature for enzyme production (amylase)	•			3
10	Immobilizat	ion of enzymes.					3
REF	<b>ERENCES:</b>						
1	. Janis Kuby	y Immunology, 199	97. WH Freeman & Company, New Yo	rk.			
2	2. Tizard, 19	95. Immunology Γ	V Ed Saunders college publishers, New	York.			

- 3. Robert M.Coleman., 1992. Fundamental Immunology. 2 nd edition. Wim. C.Brown Publishers.
- 4. Eli Benjamini et al., 1991. Immunology A short course Wiley Publishers, NY.

Course	Code	22U4BTCP06		Ho	urs/	Ma	arks	
Credits	1	2	CORE IV	W	ΊK			
Total H	lours	30	LAB IN BIOSTATISTICS	Т	Р	Int	Ext	
Max. N	lark	100		-	3	40	60	
Course	Objectives	5:						
The ma	in objective	s of this course ar	e:					
1. Т	o learn bas	ic methods of des	criptive and inferential statistics and appl	ly ther	n to re	eal		
	scenarios.							
2. 7	The knowled	lge and the correc	t use of the statistical methods will allow	stude	nts to	deal v	vith	
	data variati	ion, to organize ar	nd summarizes information, to make infe	rence	and			
	communica	ate meaningful exp	perimental results.					
Course	outcomes							
On suc	cessful com	pletion of the cou	irse, students will be able to:					
CO1	CO1 TounderstandandimplementtheprinciplesofasepticpracticesinLaboratory					K1		
CO2	CO2 To gain knowledge on the media preparation and culturing the microorganism					K2	) •	
CO3 To identify the caliberation in lab instruments.						K3	)	
CO4 To check the estimations of biomolecules like proteins.					K4	+		
CO5 To understand and quantition of nucleic acids.						K5	&K6	
K	1 - Rememb	per; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 -	Create	;	
1	Data inpu	t and error handlin	ng.				3	
2	Measure a	and central tenden	cy:- mean, median, mode.					
3	Measure a	and variability: Ra	nge: minimum and maximum:Interquart	ile rar	ige			
	and standa	ard deviation.						
4	Data man	ipulation: Select,	filter, mutate, summarise, group by,arran	ge and	l join.			
5	Graph: Ba	ar plot, scatterplot	and box plot.				3	
6	Correlatio	on and Regression					3	
7	Comparin	g mean: one samp	ble:1] T-test(parametric),2] Wilcoxon tes	t(non			3	
0	parametri	c)						
8	Comparin	ig the mean and pa	aired sample:1]1-test,2]] Wilcoxon test				3	
9	Comparin	ig the mean of two	o independent groups: 1]T-test,2]] Wilco	xon te	st		3	
10	Comparin	g the mean of mo	re than two groups:				3	
	I ANOV	A: one way and tw	vo way(parametric).					
	2]Kruskal	l-Wallis (non para	metric) alternative to one way anova.					

#### **REFERENCES:**

1. An Introduction to Practical Biochemistry by Rodney Boyer (2003). Pearson Education.

2. Laboratory Manual of Biochemistry by J.Jayaraman (1988) Wiley Eastern

3. Practical Biochemsitry by Wilson and Walker (1994). Cambridge University Press

4. Handbook of Laboratory culture media, Reagents, Stains and Buffers by N. Kannan (2003), Panima Publishers, New Delhi

5. Calculations in Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory by (Frank H. Stephenson) (2003) ACADEMIC PRESS An Imprint of Elsevier.

Course Co	de	20U5BTE01		Hours/ Marl			Marks
Credits		3	ELECTIVE COURSES-I		/ <b>K</b>		
Total Hou	rs	45	PHARMACEUTICAL	Т	Р	Int	Ext
Max. Marl	K	100	BIOTECHNOLOGY	3	-	25	75
Course Ob	jectives	5:					
The main o	bjective	es of this course are	2:				
1. Thi	is paper	encodes information	on on pharmacology, drug designing, so	urces	and a	pplicat	ions of
dru	g discov	very.					
2. Stu	dents al	lso understand the	basic and applications of pharmacology	and so	ources	of dru	ig and
ena	ble ther	n to understand the	e concepts of rDNA technology in drug	design	ning.		
Course out		completion of the	course student will be able to.				
CO1 To	underst	and the principles of	course, student will be able to:				<b>V</b> 1
$\frac{CO1}{CO2}$ To	underst	and the principles of a	of pharmacology and its development.	towar	de die	20.6.06	
$\frac{CO2}{CO3} = \frac{10}{To}$	underst	and principles of a	f developing therapeutic agents through	iowal		eases	K2 K3
eno	ineering	and the concepts of	developing incrapeutie agents through	seneti	0		K5
CO4 To	explore	the applications of	pharmaceutical chemistry				K4
CO5 Eva	luate the	e drugs and medici	ne that the student comes across.				K5
K1 - Remember: K2 - Understand: K3 - Apply: K4 - Analyze: K5 - Evaluate: K6 - Create					ate		
		,			,		
UNIT I	INT	<b>RODUCTION TO</b>	) PHARMACOLOGY				13 Hrs
History &	develop	oment in pharmac	ology. Principles of pharmacology	Phar	macol	ogy ir	the 20th
century – D	Drugs – S	Sources, dosage for	rms and routes of administration.				
UNIT II	DRU	JG NAMES & CL	ASSIFICATION SYSTEMS				13 Hrs
General Pri	inciples	of Drug action. Pl	harmacokinetics, Pharmaco dynamics, 1	measu	remen	nt of d	rug action.
Antibacteri	al, antif	ungal, anti protozo	al, antiviral, anti helmithic, anticancer, a	anti-in	flamn	natory	drugs.
UNIT III	DIA	GNOSIS AND CH	HEMOTHERAPY				14 Hrs
Prenatal dia	ignosis:	Amniocentesis, Fe	etoscopy, Non Invasive Techniques – U	ltra S	onogr	aphy.L	Diagnosis
using protei	in & enz	zymes markers, Dr	NA/RNA based diagnostics.				15 11
UNIT IV		HCH CDE Emut	bropointing IEN THE Interlauking	Clotti	ng foo	tor V	15 Hrs
Synthetic	isuiii, thoropy	• Synthetic DNA t	heropoletins, IFN, INF, Interleukins, V		ig lac	tor v	
UNIT V		DUCTION AND	APPLICATIONS				15 HRS
Probiotics	anticano	cer and anti- inflam	matory agents Biochins hiofilms and h	niosur	factar	its Tis	
Engineering	g. Recoi	mbinant vaccines a	and Cell adhesion based therapy.	5105 <b>u</b> 1	Iuctui		sue
UNIT VI	VID	EO LECTURES,	SEMINARS AND WEBINARS				5 Hrs
		,					
REFEREN	ICES:						
1.A T	ext Boo	k of Biotechnology	y. R.C. Dubey. S.Chand& Co Ltd, New	Delhi			
2.Pha	rmacolo	gy – H.P. Rang, M	.M. Pale, J.M. Moore, and Churchill Liv	vingst	on.		
3.Basi	ic Pharn	nacology – Foxter	Cox. Butterworth"s 1980.				
4.Pha	rmacolo	gy and Pharmacoth	nerapeutics - R.S.Satoskar, S.D. Bhand	hakan	n and		
S.S.	Alinap	ue.					
5. Phar	maceuti	cal Biotechnology	– S.S. Purohit4, 7Kaknani, Saleja.				
6. Phai	rmacolo	gy – Mary J. Myuk	, Richard A.Hoarey, Pamala Lippinwitt	, Will	iams l	Editior	1.
7. Integ	grated p	harmacology – Pag	ge, Curtis, Sulter, Walker, Halfman. Mos	sby Pı	ıblish	ing Co	

Course Code	20U5BTE02
Credits	3
<b>Total Hours</b>	45
Max. Mark	100

#### ELECTIVE COURSES-I TISSUE ENGINEERING

Ho W	urs/ K	Ma	arks		
Т	Р	Int Ex			
3	-	25	75		

#### **Course Objectives:**

The main objectives of this course are:

- 1. This paper deals with the use of combination of cells, engineering and materials methods, and suitable biochemical and physicochemical factors to improve or replace biological tissues.
- 2. Tissue engineering involves the use of tissue scaffold for the formation of new viable tissue for a medical purpose.

Course o	utc	omes						
On the s	ucce	essful completion of the course, student will be able to:						
CO1	To	o understand the key topics in tissue engineering.	K1					
CO2	To	o understand the stem cells and animal cells, processes, and strategies to	K2					
	re	generate or repair damaged tissues.						
CO3	To	b develop students ability to identify, formulate and adapt engineering	K3					
	so	lutions to unmet biological needs						
CO4	To	p give students a knowledge of how the biomedical industry is regulated	K4					
	an	d the route to market of for tissue engineered products						
CO5	To	o make the students evaluate and create new ideas in tissue engineering.	K5					
K1	- R	emember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Ci	reate					
UNIT I		INTRODUCTION TO TISSUE ENGINEERING	13 Hrs					
Basic de	finit	tion; current scope of development; use in therapeutics, cells as therapeut	ic agents.					
Measurer	nen	t of tissue characteristics and physical properties	-					
UNIT II		TISSUE TYPES AND TISSUE COMPONENTS	13 Hrs					
Tissue re	pair	, Engineering wound healing and sequence of events. Basic wound healing Ap	plications					
of growth	1 fac	ctors.	•					
UNIT III BIOMATERIALS								
Propertie	s of	biomaterials, Surface, bulk, mechanical and biological properties. Scaffolds	s & tissue					
engineeri	ng,	Types of biomaterials, biological and synthetic materials. Applications of biom	naterials.					
UNIT IV	7	STEM CELLS	15 Hrs					
Introduct	ion,	hematopoietic differentiation pathway Potency and plasticity of stem cells	, sources,					
embryoni	ic st	em cells, hematopoietic and mesenchymal stem cells, Stem Cell markers.						
UNIT V		STEM CELLS AND GENE THERAPY	15 Hrs					
Physiolog	gica	l models, tissue engineered therapies, product characterization. Preservation of	stem					
cells: free	zin	g and drying.						
UNIT VI	[	VIDEO LECTURES, SEMINARS AND WEBINARS	5 Hrs					
REFERI	ENC	CES:						
1. Bernhard O.Palsson, Sangeeta N.Bhatia, "Tissue Engineering", Pearson Publishers 2009.								
2. Raphael Gorodetsky, Richard Schäfer. "Stem cell based tissue repair", Cambridge: RSC								
Publishing, c 2011.								
3. John P. Fischer, Antonios G. Mikos, Joseph D. Br408nzino. "Tissue Engineering", CRC Press, 2012.								
4. Larry L. Hench, Julian R. Jones. "Biomaterials, Artificial Organs and Tissue Engineering", CRC								
Press, 20	Press, 2005.							

5. C. S. Potten, "Stem Cells", Academic Press, 1997.

Course (	Code	20U5BTS05		Ho	urs/	Marks	
Credits		2	SBEC-III	W	ΥK		
Total Ho	ours	30	BIOINFORMATICS	Т	Р	Int	Ext
Max. Ma	ırk	100		2	-	25	75
Course (	Objectives	:					
The main	objective	s of this course are	:				
1.To mak	te students	s on understanding	the basic concepts biological soft ware	es and	their a	applica	ability
in enhanc	ing the ne	ed based quality of	f living systems				
Course o	outcomes						
On the s	uccessful	completion of the	course, student will be able to:				
CO1	To und	erstand basic know	ledge of nucleic acid sequence database	es.		K1	
CO2	To und	erstand the concept	ts of specialized databases.			K2	
CO3	To und	erstand the basic co	oncepts of sequence analysis and sequen	nce		K3	
	Alignm	ient.					
CO4	To und	erstand the concept	ts of gene prediction methods through			K4	
	insilico	approaches.					
CO5	Evaluate	and create program	ns in bioinformatics.			K5	&K6
K1	- Rememb	per; K2 - Understar	nd; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 - 0	Create	
			** *				
UNIT I	BIO	INFORMATICS				13	3 Hrs
Biologica	al Databas	es- Nucleic acid	sequence databases – GenBank/NCB	I, EM	IBL, a	and D	DBJ.
Protein se	equence da	atabases – Uniprotl	KB and PIR, Structure databases – PDE	, CA1	TH and	I SCO	P.
UNIT II	SPE	CIALIZED DATA	ABASES			13	B Hrs
BLOCKS	5. PRINTS	and Pfam. Microa	rrays-Microarray data analysis. Proteor	nic da	ta Ana	lvsis.	
UNIT II	I SEO	UENCE ANALYS	SIS			14	Hrs
sequence	alignmen	t. Dot plot, pair wi	se Sequence Alignment- Local alignme	nt and	Glob	al	
alignmen	ts- Dvnan	nic programming al	gorithm for sequence alignment. Scori	ng mat	rices.	gap	
Penalties		F88	······································	-8	,	8F	
UNIT IV	/ MUI	LTIPLE SEOUEN	ICE ALIGNMENT			15	5 Hrs
Scoring r	nethods-cl	lustal W- Phylogen	etic Analysis- tree construction method	ls- Ma	ximur	n likel	ihood
and max	imum par	simony- distance	methods- Database similarity search-	Basic	Local	Aligr	nment
search to	ol (BLAS	Г).	5			0	
UNIT V	GEN	<b>E PREDICTION</b>	METHODS			15	5 Hrs
ORF find	ler, Restrie	ction site analysis.	Protein secondary structure prediction -	-Com	oarativ	e Moo	leling
-Drug De	signing	Molecular Docking	g.	·			Ð
UNIT V		EO LECTURES.	- SEMINARS AND WEBINARS			5	Hrs
		,					
REFERI	ENCES:						
1. E	Bioinforma	atics: Sequence. St	ructure and Databanks: A Practical A	pproa	ch (Tł	ne	
F	Practical A	approach Series, 23	36), Des Higgins (Editor), Willie Taylo	r. 1st	editio	n.	
	October 20	00. Oxford Univer	rsity Press. ISBN: 978-0199637904.			,	
2. E	Bioinforma	atics: Sequence an	d Genome Analysis, David W. Mount	. 2nd	editio	n.	
J	June 2004. Cold spring harbor laboratory press ISBN: 978-0879697129						
3. г	3. David, H. M. 2005, Bioinformatics, Second edn. CBS Publishers, New Delhi						
<u> </u>	A David R Westhead I Howard P and Richhoard M and Tuzzman Instant Notes						
г, L	Bioinform	natics Viva Books	Private Limted. Chennai.	-1150011		~	
5 0	Fribskov 1	M Devereux I 10	989 Sequence analysis primer Stocktor	1 Press	2		
6 1	ntroductio	n to Bioinformatic	rs Teresa Attwood David Parry-Smith	1 1 1 0 3 3 h 1 et	 editio	n	
0, 1				., 131	Junio	,	

May 2001, Pearson Education. ISBN: 978-8178085074

- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. 3nd edition, October 2004, A John Wiley & Sons, Inc., Publication. ISBN: 978-0471478782.
- 8. Seizberg, S. L., Searls, D. B. and Kasif, S. 1998. Computational methods in Molecular biology now comprehensive Biochemistry. Elsevier.

Course C	Code	20U5BTS06		Hours/ WK		Marks		
Credits		2	SBEC-III					
Total Ho	ours	30	<b>CANCER BIOLOGY</b>	Т	Р	Int	Ext	
Max. Ma	ırk	100		2	-	25	75	
Course C	Objectives	5:						
The main	objective	s of this course	are:					
1. T	o make st	udents on under	standing basic principles of Biosafety gui	deline	s and t	to		
u	nderstand	concepts of inte	ellectual property right and its types.					
2. 1	the studen	nts also gain ad	ided knowledge on ethical, legal and so	ocial c	onside	eration	is on	
		ing/marketing b	lotechnological products.					
Course o	utcomes	completion of t	he course student will be able to					
CO1	LIn	derstand the basi	ic concepts of cancer biology and types of	tumor		K1		
COI	UII		a concepts of cancer biology and types of	tumoi	•	KI		
CO2	Unders	tand the mechan	isms of cancer development and chemical	[		K2		
	involve	ed in carcinogen	esis.					
CO3	Unders	derstand molecular mechanisms and genetic principles of				K3		
	oncoge	acogene expression.						
CO4	Acquiring the knowledge on developing drug discovery approach in the K4							
	management and detection of cancer.							
CO5	CO5 Evaluate the symptoms of cancer for people around them in early stage. K5&K6							
K1	- Rememl	ber; K2 - Unders	stand; K3 - Apply; K4 - Analyze; K5 - Eva	aluate;	K6 -	Create	;	
UNIT I	FUN	DAMENTALS	OF CANCER BIOLOGY			13	3 Hrs	
Regulatio	on of Cell	l cycle, Mutatio	ns that cause changes in signal molecul	les, ef	fects	on rec	eptor,	
signal sw	vitches, tu	imor suppressor	r genes. Development and causes of ca	ncer,	Types	of ca	ancer,	
Benign ar	nd malign	ant tumor.						
UNIT II	PRI	NCIPLES OF O	CARCINOGENESIS	~ .		13	3 Hrs	
Chemical	Carcinog	genesis, Metabol	ism of Carcinogenesis, Natural History of	Carci	nogen	esis.		
UNIT III		NCIPLES OF N	MOLECULAR BIOLOGY OF CANCE	R		14	Hrs	
Oncogene	esis: Onco	ogenesis, identif	ication of Oncogenes, Retroviruses and (	Oncog	enes,	detecti	ion of	
Uncogene	es, Growt	h factors related	to transformations.			14		
		NCIPLES OF C	ANCER METASTASIS		41		) Hrs	
invesion	Drotoinos	es of invasion, i	linuagion	ee step	theor	y or		
Invasion,	Proteinas	v MOLECIILE	IS EOD CANCED THEDADY			14	L Ung	
Different	forms of	thorapy Chamor	therapy Padiation Therapy Detection of	Concor	Dro	diction	$\frac{1}{2}$	
Aggressi	veness of	Cancer Advance	es in Cancer detection	Cancer	5, 110	ulction	101	
LINIT VI		FOI FCTURE	S SEMINARS AND WEBINARS			5	Hrs	
		EOLECIURE	5, SEIMINANS AND WEDINANS			5	1115	
REFERE	INCES							
	1. Ki	ing R I B Canc	er Biology Addision Wesley Longmann I	td U	K 19	996		
	2 M	alv B W I Virc	logy a practical approach IRL press Oxf	Ford $1^\circ$	987			
3. Dunmock, N, J and Primrose S.B. Introduction to modern Virology.								
	Blackwell ScientificPublications							
		uddon R W Car	cer Biology Oxford University Press Ox	ford 1	995			
	1. 10		$\sum \sum $	, 1	,,,,,,			

# **Semester - VI**

Course Cod	e	22U6BTCO10		Hours/ M		Ma	Marks	
Credits		4	CORE – X	W	ΥK			
<b>Total Hours</b>	5	75	BIOPROCESSTECHNOLOGY	Т	Р	Int	Ext	
Max. Mark		100		4	-	25	75	
Course Obje	ectives	:						
The main ob	jective	s of this course ar	2:					
1. To	o make	e students on un	derstanding basic principles of ferme	entatio	n tech	inique	s and	
ap	plying	them in the prod	duction value added products such as	antibio	otic, v	itamin	is and	
org	ganic a	cids.			_			
2. Th	ne stud	ents also gain ad	ded knowledge on the production of a	igro b	ased p	roduc	ts for	
hu	man w	elfare.						
Course outc	omes							
On the succe	essful (	completion of the	course, student will be able to:	•		17.1		
	Unders	tand the concepts	of fermentation principles and its scope	1 <b>n</b>		KI		
	IOWNSU	team processing	of designing formantar both in Jahanstor			K)		
	vilot so	ale and its mode of	f operation	y and		K2		
$\Gamma$	Joining	and its mode of	n on the production of value added prod	lucts f	rom	K3		
	nicroo	roanisms	in on the production of value added proc	iucis I.	lom	K5		
CO4 F	Propage	ate mass production	on of agriculturally important value adde	d Proc	lucts	K4		
CO5 Evaluate and create agriculture product productions				K5&K6				
K1 - R	ememt	per; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Eva	aluate:	K6 - (	Create		
UNIT I	BAS	ICS OF BIOPRO	CESS TECHNOLOGY			13	B Hrs	
Introduction,	, Defir	ition, Scope and	applications of Bioprocess. Introducti	on to	ferme	ntatio	n and	
downstream	proces	sing technology. I	solation and screening of industrially in	iportai	nt mici	roorga	nism.	
Strain improv	vemen	t, preservation of	microorganisms.					
UNIT II	DES	IGN OF FERME	INTOR			13	Hrs	
Fermentation	n types	. Design of ferme	entor - parts and its functions. Types	of Bic	reacto	rs (Ai	r lift,	
cyclone, colu	umn, p	acked tower) Mix	ed bioreactor systems.					
Monitoring a	and cor	trolling Bioreacto	ors (pH, temperature and dissolved oxyg	en), Ir	istrum	entatio	on for	
process contr	rol - H	eat and mass tran	sfer, oxygen transfer mechanism. Princi	ples of	f upstr	eam		
processing –	Media	preparation, Inoc	ula development and sterilization.					
UNIT III	DOV	VN STREAM PR	OCESSING			14	Hrs	
Basic princip	ples of	Down- stream p	rocessing – microbial cell disruption n	nethod	ls (Cei	ntrifug	ation,	
filtration feri	mentati	ion broths). Cell s	eparation techniques (Ultra filtration, L	iquid-		extra	Ction)	
Chromatogra	apmic a	echniques: (Colu	min & Ion exchange), Physical meth	ious (1 m with		ation,	Fluid	
to computer	aided r	process control	process measurement and control system	II WIU	speer		lence	
		USTRIAL RIOT	FCHNOLOGY			15	Hrs	
Microbial sv	nthesis	and applications	- organic acids (Citric acid & acetic aci	d) En	zvmes	(Amy	vlase)	
Antibiotics (	Penicil	lin & Streptomyc	in). Vitamins (ascorbic acid & B12) an	amino	o acids	(Lvsi	ine &	
Aspartic acid).								
UNIT V	PRO	DUCTION OF A	GRICULTURAL PRODUCTS			15	Hrs	
Importance of	of mic	cro algae and it	s cultivation (Spirullina& Chlorella).	Mas	s pro	ductio	n of	
Biofertilizer	(Rhizo	bium & Azolla).	Mushroom cultivation (Milk and button	mushr	room).	Produ	iction	
and applicati	53 and applications of Biopesticide (Bacillus thuringiensis).							
UNIT VI	VID	EO LECTURES,	SEMINARS AND WEBINARS			5	Hrs	
						_		

#### REFERENCES

1. Peppler H.J. and Perlman D. 2006. Microbial Technology: Microbial Processes, 2nd Edition, Vol

I, Academic Press

2. Stanbury F, Whittaker A and Hall J.S. 1997. Principles of Fermentation Technology, Adithya Books, New Delhi.

3. Jogdand S.N. 2000. Medical Biotechnology, Himalayan Publishing House.

4. Jayanto A. 2006. Fermentation Biotechnology, Dominant Publishers and Distributors, New Delhi.

5. Cassida J.R. 2005. Industrial Biotechnology, New Age International (P) Ltd, New Delhi.

6. Juan A and Senjo A. 2007. Separation Process Biotechnology, Taylor & Francis group.

7. Patel A.H. 1997. Industrial Microbiology, Macmillan India limited.

8. Glazer A.N. and Nikaido, H. 2007. Microbial Biotechnology: Fundamentals of Applied

Microbiology, 2nd Edition, Cambridge University Press.

9. Prescott C and Dunn G. 2006. Industrial Microbiology, Agrobios (India).

10. Purohit S.S. Saluja A.K. and Kakrani H.N. 2004. Pharmaceutical Biotechnology. 1st Edition, Agrobios (India).

Course Coo	de	22U6BTC011		Hours/ N		Ma	Marks			
Credits		4	CORE – XI	WK						
<b>Total Hour</b>	rs -	75	PLANT AND ANIMAL	Т	P	Int	Ext			
Max. Mark	Σ.	100	BIOTECHNOLOGY	5	-	25	75			
Course Obj	jectives	:								
The main of	ojectives	s of this course are	e:							
1. To :	1. To make students on exposing plants technically, so as manipulate them for the production									
of d	lisease f	ree, nutritive elite	plant varieties. In addition candidates	are exp	posed (	to the	use of			
vect	tor base	d engineering of	plant genome for the generation of gen	netical	ly moo	lified	plants			
and food products.										
2. To ma	2. To make students on understanding the concepts of biotechnological approaches in animals so									
as to p	produce	therapeutically pr	roducts from ammai systems							
Course out	comes	a man lation of the	accurace student will be able to							
CO1	Vnow o	bout bosis scentia	course, student will be able to:	10 ou16		V1				
COI	NIIOW a	bout basic aseptic	conditions to be followed in plant tisst	ie cuiti	Ire	NI NI				
CO2	Underst	bry and preparing	a angingering techniques in plants and s	bout		K)	1			
02	natural	gene transfer met	bods	iooui		K2	, ,			
CO3	Underst	anding the develo	nous.	and h	asic	K3				
005	concept	s of cell lines	prinent of annual cen culture teeninque.	s and U	asic	KJ				
CO4	Maninu	lating animal cel	1 for genetic improvement by modern	recom	hinant	K4				
	technia	ues.	for generic improvement by modern	recom	omani	111				
CO5 Knowing about the principles of ethical legal and public issues on using K5&K6										
g	enetical	ly animals in proc	lucing value added products.							
K1 - F	Rememb	er: K2 - Understa	nd: K3 - Apply: K4 - Analyze: K5 - Ev	aluate:	K6 - (	Create				
		,		,						
UNIT I	PLA	NT TISSUE CUI	LTURE TECHNIQUES			13	3 Hrs			
History, Lab	boratory	v organization ster	ilization methods, types of media, med	lia prep	paratio	n, and	l plant			
growth regu	lators .	Micro propagatio	n, Callus induction. Cell culture techr	iques,	Protop	olast c	ulture			
and fusion.	Organo	genesis and some	atic embryogenesis. Haploid production	n of pl	ants					
(embryo cu	ltures).									
	GEN	ETIC ENGINE	ERING IN PLANTS			13	8 Hrs			
Selectable n	narkers,	Reporter genes a	ind promoters used in plant vectors Gen	netic ei	nginee	ring &	z crop			
1mprovemen	nt, herb	icide resistance,	insect resistance, virus resistance, pla	ints as	biorea	actors.				
Agrobacteri		nated gene transfe	r (11 plasmid and Ri plasmids) method	s in pia	ints.	1	4 77			
	BAS			•	0.0	14	Hrs			
Types of ce	Il cultur	e methods (Prima	ry & secondary). Animal Cell lines (Pr	imary	& Con	tinuou	is cell			
lines). Susp	ension	free media Dela	culture Different types of animal ce		ire me	aia, g	rowth			
Coll growth	s serum	Motobolism and	lactimation of call number	III Cui	ture ce		ISIOII,			
	CEN	S, MELADONSIN AND	AFTHODS AND ANIMAL PROPAC		N	14	Hrc			
Microiniecti	ion En	bryonic stem cel	ll gene transfer Betroviral gene trans	for T	rangga	nic at	nimale			
(Production	of trans	agenic Mice Cow	and Sheen) Animal viral vectors $(SV)$	10 viru	ansge	etro y	virus)			
Baculo virue	s expres	sion system Artit	ficial insemination Embryo transfer te	chnique	s and I	ductio	n and			
developmen	t of ani	mal vaccines for F	FMD. BTD. Rabies and anthrax	Innque		auctit	iii uiiu			
UNIT V	<b>PUB</b>	LIC ASPECTS (	DF ANIMAL BIOTECHNOLOGY			15	5 Hrs			
Ethical issue	es in A	Animal Biotechno	ology, Management aspects of Bioto	echnolo	ogy ai	nd Ge	enetic			
Engineering	g. Manip	oulation of animal	growth using hormones and probiotics	s. Man	ipulati	ng lac	tation			
and wool gr	owth in	sheep and Rabbit	·S.							
UNIT VI	VID	EO LECTURES,	SEMINARS AND WEBINARS			5	Hrs			

#### REFERENCES

- 1. Plant cell culture, A practical approach, 2nd Edition, Edited by R.A. Dixon and R.A. Gonzales.
- 2. Plant Biotechnology: An introduction to genetic engineering by Adrian Slater, Nigel W.Scott, Mark R. Fowler. Oxford University, Press,2008.
- 3. Biochemistry and Molecular Biology of Plants Bod Buchananm Wilhelm Gruissem, Russell Jones. John Wiley & Sons,2002.
- 4. Molecular Biotechnology by Glick, B.R.andJ.J.Pasternak. Scond Edition, ASMpress, Washington, 1998.
- 5. Portne R.Animal Cell Biotechnology: Methods and Protocols, Second Edition, Humana Press, 2007.
- 6. BabinkL.A. and PhilipsJ.P .Animal Biotechnology, Comprehensive Biotehenology First Supplement, Pregamon press, Oxford, 1989.
- RossantJ .and Pederson R.A.ExperimentalapproachestoMammalianEmbryonicDevelopment,Cambdrige University Press, Cambridge,1996.
- 8. IanGordon. Reproductive Technologies in farm animals, first edition, CABIInter., 2004.
- 9. LewisR.Human Genetics: Concept and applications. McGraw HillCompany, 2003.
- 10. Freshney R.L.Culture of animal cells: Amanual of basic technique and specialized applications.6<sup>th</sup>Edition,Wiley and Blackwell publications,2010.

Course	Code	22U4BTCP07		Hours/		Marks			
Credits		4	CORE PRACTICALS- VII	W	ΥK	K			
Total H	ours	75	LAB IN BIOPROCESS	Т	Р	Int	Ext		
Max. M	lark	100	TECHNOLOGY	-	5	40	60		
Course	Objective	s:							
The mai	n objective	es of this course are	:						
	1. To ma	ake students expo	sing to practical principles of ferme	entatio	n tecl	hnique	es and		
	applyi	ng them in the pr	oduction value added products such	antibio	otic, v	ritamir	ns and		
	organi	c acids. The stude	ents also gain added knowledge on the	he pro	oducti	on of	agro		
	based	products for huma	an welfare.						
	2. To m	ake students on	exposing to practical principles of	tissu	ie cu	lture	media		
	prepar	ation, cell viability,	sub culturing and viability assay techni	ques [	The ca	indida	te also		
	shall l	know how to main	ntain and culture the microorganisms	in lat	orator	ry and	l their		
	biochemical identification mechanisms.								
Course	outcomes								
On succ	essful con	pletion of the cou	rse, students will be able to:						
CO1	Underst	and the basic conce	pts on the production of alcohol, organi	icacid	and	K1			
	SCP pro	oduction. Prepare a	nimal cell media and its sterilization tec	hniqu	es.				
CO2	Underst	and in determining	the microbial growth. To filter sterilized	he		K2			
	sensitive	e media ingredients	edia ingredients and filtration technique.						
CO3	Estimati	ing the production of	of single cell protein by biochemical me	biochemical method.					
	Prepare	suspension culture	are and cultivating viruses in Embryonated egg.						
CO4	Analyzi	ng milk qualitativel	y and separating aflatoxin fungal specie	es by		K4			
	chromat	ographic method.	Observation of different types of animal	cell li	nes.				
CO5	To unde	rstand and impleme	ent the principles of aseptic practices in	Labora	atory	K58	kK6		
K	l - Remem	ber; K2 - Understa	nd; K3 - Apply; K4 - Analyze; K5 - Eva	ıluate;	K6 -	Create	•		
						1			
1	Enumer	ation of microorgan	hisms from bread			5			
2	Product	ion of alcohol from	grapes			5			
3	Product	ion and estimation	of citric acid from Aspergillus species			10			
4	Estimati	ion of alcohol from	grapes.			10			
5	Product	ion single cell prote	in from Azolla and Spirullina.			5			
6	Immohi	lization of amylago	by antranmant mathed			10			
0	Determi	nation of bacterial	growth by growth curve method			10			
7	Determi	nation of Thermal	Death point (TDP) of the bacterial same			10			
8	Determ		Death point (TDF) of the bacterial samp	ic.		10			
9	Quality	analysis of milk							
		a. MBRT test	and			10			
		b. Rezasurin	test						
10	Analysi	s of fungal aflatoxi	n by TLC			5			
REFER	ENCES					•			
1.	Juan A a	nd Senjo A. 2007.	Separation Process Biotechnology, Tay	lor &	Franci	s grou	ıp.		
	Patel A.H	. 1997. Industrial N	ficrobiology, Macmillan India limited.						
2.	Glazer A	A.N. and Nikaido,	H. 2007. Microbial Biotechnology: Fu	ındam	entals	of Aj	pplied		
	Microbi	ology, 2nd Edition,	Cambridge U5n7iversity Press.						
3.	.Prescott	C and Dunn G. 20	06. Industrial Microbiology, Agrobios (	(India)		-			
4.	Purohit	S.S. Saluja A.K. ar	nd Kakrani H.N. 2004. Pharmaceutical	Biotec	hnolo	gy. 1s	t		
	Edition,	Agrobios (India).							

Course	Code	22U4BTCP08	_	Hours/ Mar			arks	
Credits		4	CORE PRACTICALS-VIII	WK				
Total H	lours	75	LAB IN PLANT AND ANIMAL	Т	Р	Int	Ext	
Max. M	lark	100	BIOTECHNOLOGY	-	5	40	60	
Course	Objectives	s:						
The mar	in objective	es of this course are	2:					
	1. To fai	miliarize the stude	ent in various aspects of cell and mo	lecular	biol	ogy st	reams	
	includ	ing cellular organi	ization and their interactions in DNA	replica	tion,	and p	rotein	
	biosyn	thesis and translati	ional regulation		-			
	2. To dev	velop comprehens	ive understanding on the complete of	cellular	r and	mole	cular	
	signali	ons of cell organel ing.	les in terms of cell to cell interaction,	gene re	egulat	10n, co	ellular	
Course	outcomes	6						
On suce	cessful con	upletion of the cou	rse, students will be able to:					
CO1	Acquire a	complete knowled	dge about molecular marker-aided breed	ling an	d	K1		
001	apply that	y that for effective crop improvement.						
CO2	Obtain a	comprehensive kno	owledge about the concepts of plant tiss	ue cult	ure	K2	2	
	and its ap	plications.	•	<u> </u>				
C03	Gain fundamental knowledge instem cell biology and tissue engineering.						) 	
04	stem cells	s for tissue engineer	ring.	of usin	ig	174	•	
CO5	Explain significance, current status and future potential of tissue engineering.							
K	1 - Remem	ber: K2 - Understa	nd: K3 - Apply: K4 - Analyze: K5 - Eva	aluate:	K6 -	Create	;	
1	Isolation	of genomic DNA f	rom Plant.			5		
2	Preparation	on of stock solution	ns for MS medium			5		
3	MS medi	um preparation				10		
4	Inoculat	tion of explant-shoo	ot tip, meristem tip			10		
5	Inoculatio	on of explants-emb	ryo.			5		
6	Packing a	and sterilization of	glass and plastic wares for cell culture.			10		
7	Preparati	on of reagents and	media for cell culture			10	1	
8	Primer cu	ilture technique chi	cken embryo fibroblast.			10		
9	Secondar	y culture of chicker	n embryo fibroblast.			10	1	
10	Cultivatio	on of continuous ce	ell lines. vi. Quantification of cells by try	ypan bl	ue	5		
	exclusion	n dye				Ũ		
Referen	ice:							
1.	Audric, G.	and Ciel, D. 2010.	Bioengineering: Principles, Methodolo	gies an	nd Ap	plicati	ons	
	(Biotechno	ology in Agricultur	e, Industry and Medicine), Nova Science	e Pub	Inc.			
2.	Becker JM	l, Coldwell GA & 2	Zachgo EA. 2007. Biotechnology – A L	aborate	ory C	ourse.		
2	Academic.	2006 Care Clark	and Angles's 5th Ed Distance	- 11 D1	1. 1	_		
3.	Brown I A	. 2006. Gene Cloni	ing and DNA Analysis. 5th Ed. Blackwe	ell Pub	lishin	g.		
4. <i>ב</i>	Samorook	J, FILSCH I & Man $(2005)$ C $-14$	raus 1. 2001. Molecular Cloning – a La		19 IVI8 541- T	mual.2	2 Ea.	
5.	Iohn Wile	$x_1$ . (2005). Culture	or annual cens: A manual of basic tech	inques,	SUL	cattion	ι,	
6	John R W	y anu sons. Masters (2000) A	nimal cell culture 3rd Edition Oxford	Univer	sity P	ress		
	Eloronaa D	D (2006) A minute	RiotochnologroDominant Dublishers	d Diate	ony r	1035. ma		
/. 8	Sandy Prir	n. (2000). Ammal nrose. RichardTwy	vman and Bob Old (2001) Principles of	ia Disti of Gene	Man	ns. inulati	on	
0.	6th Editior	n, Blackwell Science	ce Ltd. p: 174-319.	- 00110		Pulut	<b>,</b>	
Course	Code	20U6BTE03	•	Hou	rs/	Ma	rks	

Credits		3	ELECTIVE –II	W	ΥK			
Total Ho	ours	60	GENOMICS AND PROTEOMICS	Т	Р	Int	Ext	
Max. Ma	ark	100		3	-	25	75	
Course (	Objectives	5:						
The main	n objective	es of this course ar	e:					
-	l. To mal	ke students on ur	nderstanding basic principles of genome	e and	its m	anipul	ating	
	strateg	ies endup with the	e development of novel candidate gene.					
Course of	outcomes							
On the s	uccessful	completion of the	e course, student will be able to:					
CO1	Understa	and the basic struc	ture of genome map in prokaryotic andeu	ıkaryo	otic	K1		
	organisn	ns.						
CO2	To under	rstand the mappin	g of different regions of DNA and itsamp	olificat	tion	K2		
	protocol	s.						
CO3	To acqui	ire knowledge on	different tools used in the fields ofProteo	mics.		K3		
CO4	To explo	ore with the difference	ent application of proteomics in terms of	proteir	1	K4		
005	mapping	5. 				175	0 V/	
C05	Evaluate Damanul	e and create applic	ations in proteomics.	1	VC	K5 Create	&K0	
	- Remem	ber; K2 - Understa	and; K5 - Apply; K4 - Analyze; K5 - Eva	iuate;	K0 -	Create		
TINIT T	CEN	IOMICS				10	) IIma	
Overview	Overview of Conome enotomics Prekervetia Conome Organization: operand Eukervetia							
Genome	Nuclear	Genomes and ge	ne families Organelle genomes: origin	Repe	JIIS. titive		I youe	
contents.	Tandem r	epeats. Transpose	ons and transposable elements.	Repe		DIVI		
UNIT II	DNA		METHODS			12	Hrs	
Shot gur	sequenci	ing – Contig asse	embly. Techniques for gene location: C	DRF f	inding	s. No	rthern	
Hybridiz	ation, RT	- PCR, RACE, S	S1 nuclease mapping, exon trapping. 7	Fransc	ripton	ne ana	lysis:	
SAGE an	nd Microar	rray technology.						
UNIT II	I GEN	NOME MAPPIN	J			10	Hrs	
Genetic	Mapping:	RFLP, SSLP, S	NP-Physical. Mapping, Restriction site	Мар	ping:	FISH,	STS	
mapping	. Human g	genome organizati	on. Gene therapy for inherited disorders	and in	nfectio	ous dis	seases	
and ethic	s.							
UNIT IV	ΤΟΟ	OLS OF PROTE	OMICS			10	) Hrs	
The prot	eome – th	e life cycle of pr	otein-analytical techniques. Protein sepa	iration	: 1D	PAGE	, 2D-	
PAGE, F	RPHPLC,	Protein digestion	techniques: peptide analysis- MALDI-T	OF-E	SI, Ta	Indem	Mass	
analyzers	s, Peptide	Mass finger printi	ng.					
UNIT V	APP	LICATIONS OF	PROTEOMICS			10	Hrs	
Protein r	nining, SA	ALSA algorithm	for mining specific features. Protein	expr	essior	n prof	ılıng.	
Identifyi	ng protein-	- protein interactio	ons. Mapping of protein modifications.					
UNITV	I VID	EO LECTURES	, SEMINAKS AND WEBINAKS			0	Hrs	
DEEDD								
1 Toron	ENCES	m (2002) Conomo	a and Edition Pion Scientific Dublishers	,				
1. Terence A Brown. (2002) Genomes, 2nd Edition, Bios Scientific Publishers.								
2.10m3 Publisher		u Andrew I Keau	(1999) Human Wolecular Genetics, 2nd	cunto	, DI	JS SCIC	mme	
3.Daniel	C. Liehle	r (2002) Introduc	tion to Proteomics tools for the New h	violog	v- H11	mana	press	
Totowa	NJ.	(2002) Introduc		10106.	, 110		r	
4.Pennin	4.Pennington, S. M. Dunn (2001) Proteomics: From Protein Sequence to Function 1 edition Bios							
Scientific	Publisher	rs.	···· 1··· ··· ·· · · · · · · · · · · ·					
1								

Course (	Code	20U6BTE04		Ho	urs/	Ma	Marks		
Credits		3	ELECTIVE –II	W	/K				
Total Ho	ours	60	<b>BIOPHYSICS AND</b>	Т	Р	Int	Ext		
Max. Ma	ırk	100	BIOINSTRUMENTATION	3	-	25	75		
Course (	Objective	s:							
The main	objective	es of this course a	re:						
	1. To m	hake students to d	eals with the basic instrumental principle	es leac	ling to	o biolo	gical		
~	research outputs. It also describes the biophysical concepts of different biomolecular.								
Course outcomes									
On the s	uccessful	completion of th	e course, student will be able to:						
COI	Explor Protein	es student toward	s the biophysical properties of nucleic act	ds		KI			
CO2	Acquir Techni	ing knowledge w ques	ith the basic concepts of chromatographic	;		K2			
CO3	Acquir Techni	ing knowledge w	ith the basic concepts of spectroscopic			K3			
CO4	O4 Exploring towards the use of radiation principles in the field of biomedical K4								
CO5	Science	e and magging and	lice stive source and			V5	P.V.C		
K1	Pememi	ber: K2 Underst	and: K3 Apply: K4 Applyze: K5 Eyz	Justa	K6	Create	ακο		
	- Kenlein	ber, K2 - Underst	and, KS - Apply, K4 - Analyze, K5 - Eva	iluate,	K0 - (	create			
UNIT I	BIO	PHYSICS OF N	UCLEIC ACIDS			12	2 Hrs		
Transitio	nal angles	s and their range	s. The pseudo-rotation cycle, syn – anti	orien	tation	of gly	cosvl		
bond. Ge	ometries (	of Watson- Crick	and Hoogsteen base pairs.	onen	uuion	01 81	cosji		
UNIT II	BIO	PHYSICS OF P	ROTEINS			12	2 Hrs		
Amino a	cids – Co	nformations. Phi	and Psi angles. Ramachandran plot. Pept	tide bo	ond iso	omeris	ation.		
Disulphic	le bonds,	electrostatic force	es, van der waals interaction and hydrogen	n bond	ls.				
UNIT II	I ANA	ALYTICAL TEO	CHNIQUES			10	) Hrs		
Principle	s and app	olications of Chr	omatography (Paper, thin-layer, colum	n, GC	C-MS,	GLC	, Ion		
exchange	chromate	ography, HPLC).	Principles and applications of spectros	copy.	(UV-	Vis, 1	NMR,		
Raman sj	pectroscop	by, AAS and X-ra	ay crystallography).						
UNIT IV	SEP	ARATION TEC	HNIQUES			10	) Hrs		
Introduct	ion to ele	ctrophoresis. Star	ch-gel, polyacrylamide gel (native and S	DS-PA	AGE),	agaro	se-gel		
electroph	oresis, pu	ilse field gel elec	trophoresis, immuno- electrophoresis, is	soelect	ric fo	cusing	.9		
Western	blotting		IWGLOG			10	) TT		
	KAI	DIATION BIOP	HISICS			11	) Hrs		
basic col	on counto	radiography. M	disadvantage of radio active compounds	ner, i	lquia	and	sona		
		FOIFCTURES	SEMINARS AND WERINARS			6	Hrc		
			, SEMINARS AND WEDINARS			U	1115		
REFERI	INCE								
1 Narava	anan $P(2)$	000) Essentials of	f Biophysics New Age Int Pub New De	lhi					
2. Roy R	.N. (1999)	) A Text Book of	Biophysics New Central Book Agency.	Bioph	vscial	chemi	strv –		
principles and Techniques- Unadhyay Unadhyay Nath 1997									
3. Biophy	3. Biophysical chemistry – Cantor and Schinmel. 2002								
4.Biophy	sical chen	nistry – principles	and Technique <sub>80</sub> Upadhyay, Upadhyay M	Nath.1	997				
5.Biophy	sics – Arc	ora, First edition,	Himalaya Publications, New Delhi						
6. Palani	velu, P (20	001). Analytical I	Biochemistry, and separation techniques,	Tulsi	Book	Centre			
Madurai.									

Course C	Code	20U6BTS07		Hours/ WK		Marks		
Credits		2	SBEC –III					
Total Ho	urs	45	NANO BIOTECHNOLOGY	Т	Р	Int	Ext	
Max. Ma	rk	100		2	-	25	75	
-								
Course C	bjectives	S:						
The main	objective	es of this course	are:					
3. To 1	nake stud	lents in understa	unding the basic concepts of developing na	notec	hnolog	gy, so	as to	
pro	duce biolo	ogically generat	ed value added products for the developme	nt of l	numar	welfa	are.	
Course o	utcomes							
On the su	iccessful	completion of t	he course, student will be able to:					
CO1	Know b	basic concepts o	f nanotechnology and nano materials			K1		
CO2	Know t	the concepts of f	Cabrication of bio molecular structures			K2		
CO3	Develo	p miniaturized r	nano elements			K3		
CO4	Unders	tand various and	plications of nanotechnology in the field			K4		
001	medici	ne health care a	nd drug discovery					
CO5	Evaluate	about the appli	cation of nano biotechnolpgy			K5	&K6	
K1	- Rememb	ber K2 - Under	stand: K3 - Apply: K4 - Applyze: K5 - Eva	luate	K6 - (	Create		
			stand, KS - Apply, K+ - Analyze, KS - Lva	iuate,	<b>K</b> 0 - (	create		
UNIT I	NAN	JORIOTECHN				8	Hrs	
Overview of Genome anatomies Prokaryotic Genome Organization: operons F						Fuka	rvotic	
Genomes	Nuclear	Genomes and	gene families Organelle genomes: origin	Rene	nis.		li youc	
contents	, Tucicai Tandem r	epeats Transpo	sons and transposable elements	Кере		DIA		
			S AND ITS PROPERTIES.			6	Urc	
Corbon n	natuhag	ond manageda	SAND ITSTROTERTIES.	(Inon	orido	0	1115	
Cal Doll Ila	allocubes a	and nanorous, C	r based nonestructures (dendrimers). Cold		truotu	roc		
(nanoroda	nanocao	owires, poryliter	nanocomposites	nanos	uctu	105		
		$\mathbf{MOLECULAP}$	NANOSTUDICTUDES STUDY			0	Una	
			Change Broke Electron Microscopy and I	ithog	rophy	Non		
detection	Labona	Chin Fabricati	on of bionanochin & microarray technolog	unog v	rapity.		oscale	
			NEWLOES IN NANOPIOTE CHNOLOG	y. V		0	Una	
	IVIIIN	iang: Nana biog	DEVICES IN NANOBIOTECHNOLOG	tion o	lomon			
transduci	application	te applications	of MPE in papeognesing of different analytic		lemen		ΧĽ),	
		TICATIONS (	NANOPLOTECHNOLOCY	cs		0	IIma	
UNIT V Nonomod	APP	LICATIONS (	mont of infactious discasses, concer research	hand	thoror	o Ny tion		
manomeu	ng and rad	ignosis and treat	Ment of infectious diseases, cancel researce	n anu	uleraj	by, uss	sue	
		EQ LECTUDE	SEMINADS AND WEDINADS	ig den	very.	5	IIma	
UNITVI	VID.	EULECIURE	5, SEMINARS AND WEBINARS			3	Hrs	
DEEDI								
<b>KEFEKE</b>			l'actions and a second time. Chairt a GMA	T.	1	. 1		
	NV:1	gy: concepts, ap	phications and perspectives. Christ of M. N	nema	/er, cr	lad		
A. MIITKII	i, whey v	CH publishers	2004. • Netrone Descid S. Casadahalla II. In sussiliari	000				
2. Bionno	2. Bionnotechnology: Lessons from Nature, David. S. Goodshell, Jhonwiley 2006.							
5. Duddy	, D.K. All	iall, S.A. Freder	ick, J.S. and Jack, E.L. DIOMAterials Scien	ices: A	<b>MI III(</b> ]	oduct	1011 10	
	Materials in Medicine. 2nd edition.							
4. David,	4. David, L.N. and Michael, M.C. (2006). Lehninger <sup>ss</sup> principles of Biochemistry. 4th edition.							
5. David,	S. and Go	bousnell, J. (200	of Diamatorials (2005) Di 1 i 15	ire.			MTT	
0. Moleci	ular Desig	gn and Synthesis	s от втотаterials <sub>6·1</sub> (2005). Втогодісаl Eng	gineeri	ng Di	vision	, MIT	
Open Cot	irse ware							

Course C	ode	20U6BTS08		Hours/ WK T P In		Ma	arks	
Credits		2	SBEC –III					
Total Ho	urs	45	ENVIRONMENTAL			Int	Ext	
Max. Ma	rk	100	BIOTECHNOLOGY	2	-	25	75	
Course O	bjectives	:						
The main	objective	s of this course a	are:					
3. Th	is paper p	provides insight	into environmental issues, relevant biotec	hnolo	gical o	concep	ots for	
fa	icing envi	ronmental issue	s, available biotechnological applications	in envi	ironm	ental i	ssues,	
re	elevant po	olicies. The cou	urse also tries to impart knowledge and	skill	in en	vironn	nental	
bi	iotechnolo	ogy for sustainal	ble development.					
Course of	utcomes							
On the su	iccessful (	completion of tl	he course, student will be able to:					
CO1	To prov	vide knowledge	in environmental impacts in biotechnology	1		K1		
CO2	To unde	erstand the conc	epts in various bioremediation techniques	related	l	K2		
	environ	mental aspects						
CO3	To imp	art new thoughts	about biotechnological applications on			K3		
	environ	mental issues						
CO4	To crea	te awareness reg	garding the environmental policies for their	mprov	ement	K4		
	of envir	ronmental safety	7					
CO5Evaluate environmental significant.K5&K6								
K1 ·	- Rememt	per; K2 - Unders	stand; K3 - Apply; K4 - Analyze; K5 - Eva	luate;	K6 - (	Create		
UNIT I	BAS	IC CONCEPT	OF ENVIRONMENT			8	Hrs	
Environm	ent - basi	ic concepts and	issues, global environmental problems - o	ozone	deplet	tion, U	JV-B,	
greenhous	se effect a	ind acid rain due	to anthropogenic activities, their impact a	ind bic	otechn	ologic	al	
approache		lagement.					<b>TT</b>	
	MES	UARMENIS	OF POLLUTION			8	Hrs	
An overvi	lew of all	lution type	of pollution sources of pollution me	nviron	menta	u prot	biens.	
methods	of measur	rement of pollu	of pollution, sources of pollution, mea	surem		n pon antrati	on	
hiogeoma	onificatio	n	ation, rate of pollutants in the environme	m, Dr		cintiati	011,	
	WAS	TE WATER T	RFATMENT			8	Hrs	
Microbiol	ogy of w	aste water treatn	pent aerobic process - activated sludge or	vidatic	n non	ds tri	ckling	
filter toy	vers rota	ating discs rot	ating drums oxidation ditch Anaerobi	c proc	ress -	ana	erobic	
digestion	anaerobi	c filters up- flox	w anaerobic sludge blanket reactors Treat	ment s	chem	es for	waste	
waters of	dairy, dist	tillerv. tannerv.	sugar and antibiotic industries		enenn	00 101	W db te	
UNIT IV	XEN	<b>OBIOTIC CO</b>	MPOUNDS			8	Hrs	
Xenobioti	c compou	inds - organic (c	hlorinated hydrocarbons, substituted simp	le aroi	matic	compo	ounds.	
polyarom	atic hyd	rocarbons, pes	ticides, surfactants) and inorganic (	metals	, ra	dionu	clides,	
phosphate	es, nitrates	s). Bioremediation	on of xenobiotics in environment - ecolo	gical (	consid	leratio	n,	
decay beh	avior and	degradative pla	smids, molecular techniques in bioremedia	ation				
UNIT V	ENV	IRONMENTA	L SIGNIFICANCE			8	Hrs	
Role of i	mmobiliz	ed cells/enzyme	es in treatment of toxic compounds. Bio	pestic	ides,	biorea	ctors,	
bioleachir	ng, biomin	ning, biosensors	, biotechniques for air pollution abatement	nt and	odoui	•		
control.Er	nvironmen	ntal significance	of genetically medified microbes, plants a	and an	imals.			
UNIT VI	VID	EO LECTURE	S, SEMINARS AND WEBINARS			5	Hrs	
REFERE	NCE.							

1. Wase water engineering - treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi.

- 2. Environmental Chemistry, AK. De, Wiley Eastern Ltd, New Delhi.
- 3. Introduction to Biodeterioration, D.Allsopp and K.J. Seal, ELBS / Edward Arnold.
- 4. Bioremidation, Baaker, KH and Herson D.S., 1994. Mc.GrawHill Inc, NewYork.

5. Industrial and Environmental Biotechnology - Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y.

Khan, 2006. Horizon Press.

6. Environmental Molecular Biology, Paul. A, Rochelle, 2001. Horizon Press