## Kurukshetra University, Kurukshetra

(Established by the State Legislature Act-XII of 1956) ("A<sup>++</sup>" Grade, NAAC Accredited)



## Syllabus for Post Graduate Programme M.Sc. Biochemistry

(3<sup>rd</sup> & 4<sup>th</sup> Semester)

As per NEP 2020 Curriculum and Credit Framework for Postgraduate Programme

> with CBCS-LOCF w.e.f 2025-26

DEPARTMENT OF BIOCHEMISTRY FACULTY OF LIFE SCIENCES

KURUKSHETRA UNIVERSITY, KURUKSHETRA -136119

HARYANA, INDIA

Session: 2024-25					
Part A – Introduction					
Name of	Programme	M. Sc. Biochemis	stry		
Semester		Semester- III	•		
Name of	the Course	Immunology2			
Course C	Code	M24-BCH-301			
Course 7	Гуре	CC-9			
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course I	Learning Outcomes (CLO)	CLO1: Compare a	and contrast the different typ	bes of immunity	
After con will be al	npleting this course, the learner	<ul> <li>and their correlation for effective immune response, overview of immune system (including its cells and organs). Design and model of different types of immunoglobulins and antigens.</li> <li>CLO 2: Conceptualize the molecular basis of antigen antibody interactions, immune cell interactions, recognition molecules and immunomodulatory molecules.</li> <li>CLO 3: Understand the genetic basis of diversity of immune response and also knowledge of immunization.</li> <li>CLO 4: Gain knowledge of immune response against infectious agents and tumors, adverse effects of immune response including autoimmune disorders, hypersensitivity and immunodeficiency disorders</li> </ul>			
Credits Theory Practical Total				Total	
Credits			0	1011	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Terr	n Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	tion Time	3 hours			
	Part B-	Contents of the	Course		
Instruction unit and of The comp The exam compulso Unit	ons for Paper- Setter: The example one compulsory question by taking pulsory question (Question No. 1) inter will be required to attempt 5 ry question. All questions will car	niner will set 9 qu ng course learning ) will consist of a 5 questions, selecting ry equal marks. <b>Topics</b>	estions asking two questio g outcomes (CLOs) into c t least 4 parts covering en ing one question from each	ns from each consideration. tire syllabus. n unit and the Contact Hours	
I	I       Introduction to immune system: Innate and acquired immunity, self vs non-self-discrimination, structure and functions of primary and secondary lymphoid organs.       15         Cells involved in immune responses: Phagocytic cells and their killing mechanisms; T and B lymphocytes. Nature of antigen and antibody: Antigens vs immunogen, haptens, structure and functions of immunoglobulins; isotypic, allotypic and idiotypic variations				
II       Major Histocompatibility Complex (MHC) genes and products: polymorphism of MHC genes, role of MHC antigens in immune responses, MHC antigens in transplantation.       15         Humoral and cell mediated immune responses: Kinetics of primary and secondary immune responses, complement activation and its biological consequences, antigen processing and presentation, cytokines and co-stimulatory       15				15	
III	Generation of diversity in immune antigen specific receptor, organizat	<b>ne system:</b> Clonal inter ion and expression	selection theory- concept of of immunoglobulin genes-	15	
	generation of antibody diversity, C	Organization and ex	pression of T-cell receptor		

genes- generation of T cell receptor diversity, <b>In</b> immunization.	nmuni	ization: Active & p	assive
IV <b>Tolerance vs activation of immune</b> immunosuppression, hypersensitivity (Types I, II, I <b>Immune responses in diseases:</b> Immune respon	rance, 15 viral,		
and autoimmunity.	orders		
		Total Contact	Hours 60
Suggested Evaluation	·		
Internal Assessment: 30	amination: 70		
internal Assessment. 50			
<ul> <li>Theory</li> </ul>	30	> Theory:	70
Theory     Class Participation:	<b>30</b> 5	> Theory: Written Ex	<b>70</b> amination
Theory •Class Participation: •Seminar/presentation/assignment/quiz/class test etc.:	<b>30</b> 5 10	Theory: Written Ex	<b>70</b> amination
<ul> <li>Theory</li> <li>Class Participation:</li> <li>Seminar/presentation/assignment/quiz/class test etc.:</li> <li>Mid-Term Exam:</li> </ul>	<b>30</b> 5 10 15	Theory: Written Ex	70 amination
<ul> <li>Theory</li> <li>Class Participation:</li> <li>Seminar/presentation/assignment/quiz/class test etc.:</li> <li>Mid-Term Exam:</li> <li>Part C-Learning F</li> </ul>	<b>30</b> 5 10 15 <b>Resou</b>	Theory: Written Ex rces	70 amination
Theory <ul> <li>Class Participation:</li> <li>Seminar/presentation/assignment/quiz/class test etc.:</li> <li>Mid-Term Exam:</li> </ul> Part C-Learning F Recommended Books/e-resources/LMS:	<b>30</b> 5 10 15 <b>Resou</b>	Theory: Written Ex rces	70 amination

1. Immunology, 13<sup>th</sup> ed. by Roitt et al., Mosby Publications.

2. Cellular and Molecular Immunology, 10<sup>th</sup>ed. by Abbas and Litchman, Saunders Publication.

3. Kuby Immunology, 7th ed. by R.A. Goldsby et al, W.H. Freeman & Co.

4. Immunology: an introduction, 4<sup>th</sup> Edition by Ian R Tizard, Saunders College Publishing.

Session: 2024-25					
	Part	A – Introduct	ion		
Name of Progra	amme	M. Sc. Bioche	mistry		
Semester		Semester – II	[		
Name of the C	ourse	Genetic and P	rotein Engineering		
Course Code		M24-BCH-30	2		
Course Type		CC-10			
Level of the co	urse	400-499			
Pre-requisite f	uisite for the course (if any)				
Course Learning Outcomes (CLO) CLO 1: Understand the basic of genetic enginee				engineering and	
After completin	g this course, the learner will	r will steps involved in a gene cloning experiment.			
be able to	8	CLO 2: Know	the various methods of s	gene transfer into	
be able to.		<i>E. coli</i> , yeast, plant cells and animal cells and also know			
		how to construct a genomic/cDNA library			
		CLO 3: Gair	n knowledge of reco	mbinant protein	
		production in ba	cteria and eukaryotic cel	lls.	
		CLO 4: Learn	the relationships between	een protein sequence,	
		structure and fu	unctions of proteins and	l role of site directed	
		mutagenesis in e	engineering proteins for	industrial purpose	
Credits		Theory	Practical	Total	
		4	0	4	
Teaching Hours per week		4	0	4	
Internal Assess	ment Marks	30	0	30	
End Term Exa	n Marks	70	0	70	
Max. Marks		100	0	100	
Examination T	ime	3 hours			
	Part B- C	Contents of the	e Course		
Instructions for	r Paper- Setter: The examin	er will set 9 qu	uestions asking two qu	lestions from each	
unit and one cor	npulsory question by taking co	ourse learning (	outcomes (CLOs) into	consideration. The	
examinee will 1	sholl (Question No. 1) will c	stions selection	ast 4 parts covering el	each unit and the	
compulsory que	stion All questions will carry	equal marks.	g one question from	cach unit and the	
Unit	To	pics		Contact Hours	
I Gene	<b>cloning strategies:</b> Isolation at	nd purification of	of nucleic acid and its	15	
quantif	ication and analysis: Molecular	tools and their a	applications: Restriction		
endonu	cleases; DNA modification	enzymes; Site	directed mutagenesis;		
Clonin	g vectors; Ligation of DNA	A fragments: 1	Linkers, adapters and		
homop	olymeric tailing; Construction of	of genomic libra	ry: mRNA enrichment;		
Revers	e transcription; Synthesis o	f cDNA and	library construction,		
Oligon	ucleotide synthesis, purification	n, and its appli	cation in screening of		
librarie	s, Genome editing; CRISPR-Cas	59			
II Expres	sion vectors: Choice of expre	ession system: H	Expression in bacterial.	15	
yeast, i	nsect and mammalian cells; Bac	ulovirus express	ion systems; Expression		
of hete	rologous genes; Factors affecting	g the expression	of cloned genes; Codon		
bias; V	bias; Vector engineering and codon optimization; Ti-plasmid				
Trans	genic and gene knockout te	chnologies: Tra	ansgenic methodology;		
Transg	enic animals and plants; Targ	geted gene rep	lacement; chromosome		
engine	ering	<u> </u>		15	
111 Studyi	ng gene expression and functi	on: Studying th	e transcript of a cloned	15	
gene; I	ces by deletion analysis. Identify	on a DNA mole	cule, identifying control		
of a c	loned gene by HRT & HART	Studving prot	ein-protein interactions		
(Phage	display and the veast two hybrid	systems)	Protoni interactions		
0-	(Phage display and the yeast two hybrid systems)				

<ul> <li>Production of proteins from cloned genes: Expression of foreign genes in <i>E. coli</i>, promoters general problems with the production of recom Production of recombinant protein by eukaryotic production in yeast, insect cells and mammalian c protein production from live animals and pla purification using His-tag, Importance of gene of production of recombinant pharmaceuticals.</li> <li>IV Protein engineering: Directed mutagenesis procedures: Oligonucleotide M13 DNA, Oligonucleotide-directed mutagenesis amplified Oligonucleotide-directed mutagenesis, mutagenesis with degenerate oligonucleotide insertion/deletion mutagenesis, DNA shuffling, mamino acids</li> </ul>	essio used bbina cell ells, ants). clonin de-di s wit Erro otide nutan hang	n in <i>E. coli</i> (Vectors for 1 in expression vectors, nt protein in <i>E. coli</i> ); s (Recombinant protein Pharming- recombinant Recombinant protein ng in medicine for the rected mutagenesis with h plasmid DNA, PCR- pr-prone PCR, random primers, random t proteins with unusual	15
amino acids reducing the number of free sult	-hvdr	vl residues increasing	
enzymatic activity modifying metal cofactor requi	reme	nts decreasing protease	
consitivity, modifying protoin specificity increase			
sensitivity, mounying protein specificity, merea	asing	enzyme stability and	
specificity, altering multiple properties		Total Contact Hours	60
Suggested Evaluati	on N	fethods	00
Internal Assessment: 30	-	End Term Exa	mination: 70
> Theory	30	> Theory:	70
• Class Participation:	5	Written Exa	amination
• Seminar/presentation/assignment/quiz/class test etc.:	10		
• Mid-Term Exam:	15		
Part C-Learning	Reso	ources	
Recommended Books/e-resources/LMS:			
1. Gene Cloning and DNA Analysis - An Introduction, Publishing.	8 <sup>th</sup> eo	lition, by T. A. Brown (2	2018), Blackwell
<ol> <li>Molecular Biotechnology - Principles &amp; application <u>Glick</u>, <u>Cheryl L. Patten</u> (2018), ASM Press.</li> </ol>	is of	Recombinant DNA, 4 <sup>th</sup>	ed., Bernard R.
<ol> <li>Principles of Gene Manipulation, 7<sup>th</sup> ed., <u>Sandy B. I</u> Scientific Publication.</li> </ol>	Prim	ose, <u>Richard Twyman</u> (2	2006), Blackwell
4. Analysis of Genes and Genomes, 9 <sup>th</sup> ed. (2015) by Rid	chard	J Reece, John Wilev &	Sons, Ltd.
5. Beier F.K, Crespi R.S and Straus T. Biotechnolo	gy a	nd Patent protection, C	Dxford and IBH

Session: 2024-25					
Part A – Introduction					
Name of	Programme	M. Sc. Biochemis	stry		
Semester		Semester- III			
Name of	the Course	Human Physiolo	gy		
Course (	Code	M24-BCH-303			
Course 7	Гуре	DEC-1			
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course Learning Outcomes (CLO) CLO1: To understand the functions and regulation of					
After cor	After completing this course, the learner digestive system including hormonal control.				
will be a	Il be able to: CLO 2: To understand the structure and functions of				
respiratory and excretory systems, gas exchange, acid-base					
		homeostasis and the	eir physiological significance		
		CLO 3: Learn the	function of nervous system,	role of different	
		blood cells, mechai	hism of homeostasis and phys	siology.	
CLO 4: Learn the role of different hormones in physiolog					
Cradita		Theory	Proctical	Total	
Creans			Flactical	10141	
T 1'	TT 1	4	0	4	
Teaching Hours per week 4 0			0	4	
Internal End Tor	Assessment Marks	30	0	30	
End Ter	in Exam warks	/0	0	/0	
Examina	arks ation Time	100 2 hours	0	100	
Examina	non Thie Dont P	Contonta of the			
T		- Contents of the		f	
<u>instruction</u>	ons for Paper- Setter: The example	niner will set 9 qu	uestions asking two questions asking two questions	ons from each	
compulso	ry question (Question No. 1) wi	ll consist of at les	A parts covering entire	syllabus The	
examinee	will be required to attempt 5	questions, selectin	g one question from each	unit and the	
compulso	ry question. All questions will ca	rry equal marks.			
Unit		Topics		Contact	
		_		Hours	
Ι	Gastrointestinal Physiology: S	Secretory function	ns of the alimentary	15	
	tract: General principles of alime	entary tract secreti	on; Basic mechanism		
	of stimulation of alimentary trac	t glands; Basic me	echanism of secretion		
	by glandular cells; Lubricating a	and protective pro	perties of mucus and		
	importance of mucus in gastroint	testinal tract, Com	position, function and		
	regulation of saliva, gastric, pa	ncreatic, intestinal	and bile secretions.		
	Digestion and absorption of carb	ohydrates, lipids a	nd proteins		
11	<b>Respiration</b> : Components of re-	espiratory system	and their functions;	15	
	transfer of blood gases- O <sub>2</sub> and C	CO <sub>2</sub> , Bohr effect; re	ole of chloride ions in		
	oxygen transport, effect of 2,3	-BPG on O <sub>2</sub> affi	nity of Hb, Clinical		
	importance of 2,3-BPG.				
	Acid Base Balance: Role of	blood buffers, r	espiratory and renal		
	mechanism in the maintenance of	f blood pH			
	<b>Excretory System</b> : Structure of	nephron, formatio	n of urine, tubular re-		
	absorption of glucose, water	and electrolytes	; tubular secretion,		
	regulation of water and elect	rolyte balance, r	ole of kidneys and		
	hormones in their maintenance.			17	
	General principles of nervous	system: Neuron; ty	ypes of synapses; role	15	
	of Ca <sup>+2</sup> in release of neurotran	nsmitter from pre	-synaptic membrane;		

function of receptor proteins and second	lary	mess	enger on the		
postsynaptic neuron; Characteristics	of	som	e important		
neurotransmitters (Dopamine, GABA, Gl	utan	nate,	Acetylcholine,		
Serotonin, NO). Biochemistry of muscle	cont	raction	n and Vision;		
Biochemical basis of obesity.					
Blood Cells and Blood Clotting: Blood comp	oner	nts and	their function;		
plasma proteins; blood coagulation.					
IV Hormones: Classification and mechanism	of a	action.	Physiological	15	
functions, regulation and abnormalities of g	grow	th ho	rmones, ADH,		
oxytocin, thyroid hormones, mineralocorticoid	d, gl	ucoco	ticoid, insulin,		
glucagon, parathyroid hormone, and male	and	femal	e reproductive		
hormones					
Neurochemistry of vision and hearing					
			Total Contact H	Hours 60	
Suggested Evaluation	on M	lethod	S		
Internal Assessment: 30			End Term Exa	amination: 70	
> Theory	30	$\checkmark$	Theory:	70	
Class Participation:	5		Written Ex	amination	
• Seminar/presentation/assignment/quiz/class test etc.:	10				
• Mid-Term Exam:	15				
Part C-Learning I	Reso	ources			
<b>Recommended Books/e-resources/LMS:</b>					
1. Biochemistry, 2 <sup>nd</sup> edition, Moran. Neil Patterson	Publ	ishing			
2. Fundamentals of Biochemistry, 2nd edition, D Vo	2. Fundamentals of Biochemistry, 2nd edition, D Voet & G J Voet. John-Wiley & Sons.				
4					
3. Biochemistry, 5 <sup>th</sup> edition, JM Berg, L Stryer. W H	I Fre	eeman	& Co. N York.	5	

s rincipi stry, (2003)Η

Freeman & Co. New York.
5. Textbook of Medical Physiology, 11<sup>th</sup> ed., A C Guyton & J E Hall. (2005) Elsevier.

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Session: 2025-26					
Part A – Introduction					
Name of	Programme	M. Sc. Biochemis	stry		
Semester		Semester- III			
Name of	the Course	Molecular Genet	tics		
Course (	Code	M24-BCH-304			
Course 7	Гуре	DEC-1			
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course 1	Learning Outcomes (CLO)	CLO1: Learn the	basic principles of heredit	ty, genetic	
After con	npleting this course, the learner	variation and gene	interaction and how genes in	fluence the	
will be a	hle to:	traits and contribute to biological functions			
will be a	CLO 2: Understand the types, causes and consequences o				
genetic mutations, abnormalities in chromosomes, structura					
		changes and ploidy	and their implications in hea	lth and disease	
CLO 3: Learn to understand the principles of gene linkage					
		recombination, ch	romosomal inheritance and	application of	
pedigree analysis for studying human genetic traits an				etic traits and	
hereditary diseases					
CLO 4: Learn the genetic variations within the population,			population, their		
evolution and mapping of genome to study genetic divers			enetic diversity,		
<i>a i</i>		adaptation and inhe	eritance patterns	<b>T</b> 1	
Credits		Theory	Practical	Total	
		4	0	4	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Ter	m Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	ation 11me	3 hours	Cauraa		
T d d'		Contents of the	Course	C 1	
Instructi	ons for Paper- Setter: The exam	iner will set 9 qu	estions asking two questio	ns from each	
unit and	one compulsory question by taking the second s	ng course learning	g outcomes (CLOS) into c	ting avillabus	
The over	buisory question (Question No. 1	) will collsist of a	ing one question from each	une synabus.	
compulso	ry question All questions will can	ry equal marks	ing one question nom each		
Unit		Topics		Contact	
Cint		1 opres		Hours	
Ι	Introduction to Genetics, Mendel's	laws of inheritance	e and its applications.	15	
	monohybrid and dihybrid crosses,	types of dominanc	e, test cross and back		
	cross				
	Gene interactions: Concept of gene.	, allele (multiple an	d pseudo-), incomplete		
	dominance, codominance, dup	licate genes, co	omplementary genes,		
	supplementary genes, lethal genes	, pleiotropic genes	s and multiple alleles,		
	genomic imprinting, penetrar	nce, expressivity	and phenocopy;		
	Extrachromosomal /cytoplasmic inh	eritance: Inheritanc	e of mitochondrial and		
	chloroplast genes, maternal inheritar	nce			
11	Abnormalities in genes and chron	mosomes: Mutation	is and its types, causes	15	
	and detection of gene mutation	ns, mutant types:	Lethal, conditional,		
	biochemical, loss of function, gain	ot function, germin	nal vs somatic mutants,		
	insertional mutagenesis	1 . 1 .	11. 1 1 1		
	<b>Unromosomal alterations:</b> Struct	ural: translocation,	deletion, duplication,		
	Inversion and tragile sites		···· · · · · · · · · · · · · · · · · ·		
	prumerical: Ploidy (triploidy, trise	omy and monoson	iny) and their genetic		

implications					
III Linkage and recombination					15
Human karyotype: banding patterns and nomenclature of aberrant and					
banding karyotypes					
Chromosomal theory of inheritance: Sex	de	termina	ation and se	Х	
differentiation in animals, multiple sex chromosomes, sex linkage and its					
characteristics					
Human genetics and pedigree analysis: Diso	rders	of au	itosomes (cysti	C 1	
fibrosis, galactosemia, albinism, phenylketonuria	, Hu	ntingto	n's disease and	d 1	
sickle cell disease), sex chromosomes (colour blin	aness	s, Iragi	le A-disease and	0 4	
Klinefalter syndroma)	ie, i	urner	syndrome and	u	
IV <b>Population genetics:</b> Definition and scope of por	ulati	on gen	etics gene pool	1	15
gene frequency Hardy-Weinberg-principle and its	annli	cations	erres, gene poor	·,	10
<b>Evolutionary genetics:</b> Speciation, allele and ge	enetic	variat	ions, sources o	of	
variations. Molecular clock and relationship with e	volut	ionary	biology	1	
Genome mapping: Genetic maps (linkage maps	s, cyt	ogenet	ic maps and it	S	
types with examples), Genetic markers and its ty	pes,	protein	based markers	8,	
Linkage mapping of DNA markers (AFLP and s	equer	ice tag	ged sites (STS)	),	
physical mapping of genomes					
			Total Contact	Hours	60
Suggested Evaluation	on M	ethod	<u>s</u>		
Internal Assessment: 30			End Term Ex	aminat	tion: 70
> Theory	30	$\checkmark$	Theory:	70	
• Class Participation:	5		Written Ex	kaminat	tion
• Seminar/presentation/assignment/quiz/class test etc.:	10				
• Mid-Term Exam:	15				
Part C-Learning F	Reso	urces			
<b>Recommended Books/e-resources/LMS:</b>					
1. Essential genes (2006), Benzamin Lewin, Pearson edu	icatio	on inter	national.		
2. Human Molecular Genetics (2004), 3 <sup>rd</sup> ed., Tom Strac	chan a	and An	drew P Read, G	arland S	Science.
3. Molecular Biology of Gene (2008), 6 <sup>th</sup> ed., Watson education Inc.	n, Ba	ker et	al, Levine and	Losick	, Pearson
A <b>Principles of Constitute</b> (2005) $\mathcal{S}^{\text{th}}$ ad Cardenar <i>et al.</i>	Iohn	***	NY XY 1		
	JOINT	wilev	New York.		

- Genetics: Conceptual approach (2003), Benjamin A P, W H Freeman and Company, New York.
   Principles of Genetics (2006), 4<sup>th</sup> ed., Snustad and Simmons, Wiley

Session: 2024-25					
Part A – Introduction					
Name of	Programme	M. Sc. Biochemi	stry		
Semester	r	Semester- III	Ĩ		
Name of	f the Course	Nutritional Bioc	hemistry		
Course (	Code	M24-BCH-305			
Course 7	Гуре	DEC-2			
Level of	the course	400-499			
Pre-requisite for the course (if any)					
Course	Learning Outcomes (CLO)	CLO 1: Acquire of	letailed knowledge regarding	g biological	
After con	mpleting this course, the learner	basis of nutrition an	nd how diet influences health.		
will be a	ble to:	CLO 2: Focus on	the health benefits of typic	al nutrients	
will be u		including macro an	d micro minerals and vitamin	s.	
		CLO 3: Know the l	pasic concepts of food toxicity	y and safety	
		CLO 4: Help stud	lents understand the nutritiv	ve value of	
common Indian foods and nutritional disorders.					
Credits		Theory	Practical	Total	
		4	0	4	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Ter	m Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	ation Time	3 hours			
	Part B	- Contents of the	e Course		
compulso examinee compulso Unit	will be required to attempt 5 or y question. All questions will car	ll consist of at lea questions, selectin rry equal marks. Topics	ast 4 parts covering entire g one question from each	syllabus. The unit and the	
Cint		ropics		Hours	
I       Composition of human body, Energy content of foods, respiratory quotient of food stuffs, measurement of energy expenditure (direct and indirect calorimetry), BMR: measurement and significance of BMR, factors affecting BMR, Specific dynamic action (SDA)       15         Carbohydrates: nutritional importance, sources of available carbohydrates, fibers in nutrition: beneficial effects, adverse effects and their sources, glycemic index, alternative sweetners       115         Lipids: nutritional importance, major classes of dietary lipids, properties and composition of plasma lipoproteins, essential fatty acids and their physiological functions;       115         Proteins: nutritional importance, nitrogen balance, assessment of nutritive value of proteins, concept of balanced diet.       125				15	
	In avinerals: nutritional significance, dietary sources, deficiency symptoms and toxicity symptoms of major and trace minerals.       13         Vitamins: dietary sources, physiological functions and specific deficiency diseases associated with fat and water soluble vitamins, hypervitaminosis of fat soluble vitamins       13				
III	Food toxicity and safety:	Microbial contar	nination, Environmental	15	
	III <b>Food toxicity and safety</b> : Microbial contamination, Environmental 15 contamination, Natural food toxins and Antinutrients: naturally occurring food borne toxicants, protease inhibitors, Hemagglutinin, hepatotoxins, allergens, oxalates, toxin from mushrooms, animal food stuffs and sea foods: Agricultural				

			1
residues, Intentional food additives: types of	food ad	ditives-attributes	and
related health concerns			
<b>Phytochemicals</b> : Classification and the	eir ph	sysiological effe	ects;
Nutraceuticals: different types of Dietary supple	ements a	and typical ingredi	ents
of Functional foods			
IV Nutritive value of common Indian food: cereal	ls and mi	illets, sugar and st	arch 15
foods, pulses and legumes, oil seeds and r	uts, foo	od of animal or	igin.
Nutritional disorders: Lipoproteins and cardio	ovascular	r disease: 'good'	and
'bad' cholesterol, development of cardiovascula	ar diseas	se and risk factors	s for
cardiovascular disease.			
Protein energy malnutrition: etiology, clinical	features	s, metabolic disor	ders
and management of Marasmus and Kwashion	kar dise	eases. Nutrition	and
Cancer: Associations between nutritional factor	ors and c	common cancer s	ites;
effect of different foods, beverages, physical pa	arameters	s and other additi	onal
factors on cancer.			
		Total Contact	Hours 60
		rotur contact	00
Suggested Evaluation	on Meth	nods	
Suggested Evaluation Internal Assessment: 30	on Meth	nods End Term Ex	amination: 70
Suggested Evaluation Internal Assessment: 30 > Theory	on Meth	nods End Term Ex ≻ Theory:	camination: 70
Suggested Evaluation Internal Assessment: 30 > Theory • Class Participation:	<b>30</b> 5	iods End Term Ex ➤ Theory: Written E	xamination: 70     70     xamination
Suggested Evaluation Internal Assessment: 30 > Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.:	<b>30</b> 5 10	nods End Term Ex ➤ Theory: Written E	amination: 70     70     xamination
Suggested Evaluation Internal Assessment: 30 > Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam:	<b>30</b> 5 10 15	nods End Term Ex ➤ Theory: Written E	amination: 70     70     xamination
Suggested Evaluation Internal Assessment: 30 > Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: Part C-Learning I	<b>30</b> 5 10 15 <b>Resource</b>	iods End Term Ex ➤ Theory: Written E: ces	<b>Examination: 70</b> 70         xamination
Suggested Evaluation Internal Assessment: 30 Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: Part C-Learning I Recommended Books/e-resources/LMS:	<b>30</b> 5 10 15 <b>Resource</b>	iods End Term Ex ➤ Theory: Written E Ces	amination: 70 70 xamination
Suggested Evaluation Internal Assessment: 30 Theory • Class Participation: • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: Part C-Learning I Recommended Books/e-resources/LMS: 1. Biochemistry by U. Satyanarayana (2002). Books and	30         30         5         10         15         Resource           allied (P         allied (P	nods End Term Ex ➤ Theory: Written E Ces P) Ltd.	amination: 70 70 xamination
Suggested Evaluation         Internal Assessment: 30         ➤ Theory         • Class Participation:         • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:         Part C-Learning I         Recommended Books/e-resources/LMS:         1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S.	<b>30</b> 5 10 15 <b>Resource</b> allied (P	P) Ltd. ell (2008) 3 <sup>rd</sup> ed. (	xamination: 70 70 xamination Oxford University
Suggested Evaluation         Internal Assessment: 30         ▶ Theory       • Class Participation:         • Class Participation:       • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:       Part C-Learning I         Recommended Books/e-resources/LMS:       1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S. Press Inc., New York.	<b>30</b> 5 10 15 <b>Resource</b> allied (P 5. Truswe	P) Ltd. ell (2008) 3 <sup>rd</sup> ed. (	amination: 70       70       xamination       Oxford University
Suggested Evaluation         Internal Assessment: 30         ➤ Theory       • Class Participation:         • Class Participation:       • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:       Part C-Learning I         Recommended Books/e-resources/LMS:       1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S. Press Inc., New York.       3. Contemporary Nutrition by Wardlaw Smith (1996) 6 <sup>th</sup>	an Meth           30           5           10           15           Resource           allied (P           5. Truswe           ed. Mc (0)	P) Ltd. Graw Hill Inc., New	amination: 70       70       xamination       Oxford University       w York.
Suggested Evaluation         Internal Assessment: 30         ➤ Theory         • Class Participation:         • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:         Part C-Learning I         Recommended Books/e-resources/LMS:         1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S. Press Inc., New York.         3. Contemporary Nutrition by Wardlaw Smith (1996) 6 <sup>th</sup> 4. Nutritional Biochemistry by S. Ramakrishnan and S. Young S.	an Meth         30         5         10         15         Resource         allied (P         5. Truswee         ed. Mc (Venkat R	P) Ltd. Graw Hill Inc., Nev Rao (1995) T. R. Pu	amination: 70       70       xamination       Oxford University       w York.       blications.
Suggested Evaluation         Internal Assessment: 30         ➤ Theory         • Class Participation:         • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:         Part C-Learning I         Recommended Books/e-resources/LMS:         1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S. Press Inc., New York.         3. Contemporary Nutrition by Wardlaw Smith (1996) 6th         4. Nutritional Biochemistry by S. Ramakrishnan and S. Y.         5. Food Chemistry by Owen Fennema (1996) 3rd ed. CB	allied (P         allied (P         . Truswe         ed. Mc (Venkat R         C Press.	P) Ltd. Graw Hill Inc., New Cao (1995) T. R. Pu	amination: 70       70       xamination       Oxford University       w York.       blications.
Suggested Evaluation         Internal Assessment: 30         ➤ Theory         • Class Participation:         • Seminar/presentation/assignment/quiz/class test etc.:         • Mid-Term Exam:         Part C-Learning I         Recommended Books/e-resources/LMS:         1. Biochemistry by U. Satyanarayana (2002). Books and         2. Essentials of Human Nutrition by J. Mann and A.S. Press Inc., New York.         3. Contemporary Nutrition by Wardlaw Smith (1996) 6thematical Biochemistry by S. Ramakrishnan and S. Y.         4. Nutritional Biochemistry by S. Ramakrishnan and S. Y.         5. Food Chemistry by Owen Fennema (1996) 3rd ed. CF.         6. Food Science Chemistry and Experimental Foods Texators	allied (P allied Mc C venkat R C Press. by M. S	P) Ltd. Graw Hill Inc., Nev Swaminathan (1990	amination: 70       70       xamination       Oxford University       w York.       blications.       )). The Bangalore

Session: 2024-25					
	Part A – Introduction				
Name of	Programme	M.Sc. Biocher	nistry		
Semester	•	Semester – II	[		
Name of	the Course	Developmenta	al and Cancer Biology		
Course (	Code	M24-BCH-30	6		
Course 7	Гуре	DEC-2			
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course 1	Learning Outcomes (CLO)	CLO 1: Learn	about gene expression and	its regulation at	
After con	npleting this course, the learner will	different levels.			
be able to	· · · · · · · · · · · · · · · · · · ·	CLO 2: Learr	n about jumping genes and	1 interactions of	
		molecules with	nucleic acids.		
		CLO 3: Exp	lain how molecular defec	ts can lead to	
		development of	cancer.		
		CLO 4: Kno	w about development of	Drosophila and	
		concepts of gene	omics.	-	
Credits		Theory	Practical	Total	
		4	0	4	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Ter	m Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	tion Time	3 hours			
	Part B- C	ontents of the	e Course		
Instruction unit and construction compulson examinee compulson	ons for Paper- Setter: The examination of the compulsory question by taking construction (Question No. 1) will construct will be required to attempt 5 que ry question. All questions will carry	er will set 9 qu ourse learning o onsist of at lea stions, selectin equal marks.	estions asking two questions usking two questions of the parts (CLOs) into constast 4 parts covering entire g one question from each	ons from each sideration. The syllabus. The unit and the	
Unit	,	Topics		Contact	
т				Hours	
1	Regulation of Gene Expression: expression in prokaryotes and euka expression of lac, galactose, araB regulation of ribosome synthesis, m protein interactions, different regulat basis of regulation of gene expressio nucleosomes, DNA sensitivity and h post-transcriptional level- Regulation stability, translational, post -translatio	Different lev aryotes, operon AD, trp opero otifs involved tory sequences n at transcriptio ypersensitivity, of RNA splici nal, and protein	vels of regulating gene a concept, Regulation of ons and lambda phages, in DNA-protein, protein- in eukaryotes, Molecular on level <i>i.e.</i> repression by Modification of histones; ing, RNA transport, RNA degradation level.	15	
II	Transposable genetic elements: Nor transposable genetic elements in significance of transposable elements. Interaction of nucleic acids with sm	n-replicative and bacteria, yeast, all molecules:	d replicative transposition, maize, drosophila and Reactions of nucleic acids	15	
	with non-carbon electrophiles, nitro anticancer drugs, photochemical mo ionizing radiations on nucleic acids	odifications of	nucleic acids, effects of		
III	Molecular biology of cancer: Hall	narks of cance	er: Benign and malignant	15	
	tumors, types of cancers, cancer compounds, DNA and RNA viruses,	causing agen mechanism of	tts- radiations, chemical carcinogenesis, important	-	

characteristics of cancerous cells, proto-oncoger and tumor suppressor genes, gain of function r growth factors, growth factor receptors, intracellu transcription factors, cell cycle control proteins, a proteins into oncogenes; Rb and P <sup>53</sup> as tumor expression and immortalization of cells. <b>Angiogenesis in cancer</b>	nes a nuta ular s apop sup	nd oncogenes, oncoge tions of proto-oncoger signal transducers, nuc totic proteins, DNA rep pressor genes, telomer	nes nes- lear pair rase	
IV Developmental Biology: Basic concepts and pr	incip	oles; cell fate determin	ation 15	
and differentiation; stem cells and their role in de	velo	pment and cancer		
<b>Epigenetics in development and cancer:</b>	DN	A methylation, hist	one	
modifications and chromatin modelling, Rol	le o	f non-coding RNAs	in	
development and cancer - miRNA, lncRNAs, circ	CRN.	As		
Major signaling pathways in development and their dysregulation in cancer,				
Drosophila development and its regulation: Various stages of oogenesis,				
blastulation, gastrulation to form three cell layers, morphogen gradient, details of				
three classes of pattern control genes like eg	g-po	larity genes, segment	ation	
genes, homeotic selector genes and imaginal disc	s.		-	
		Total Contact I	lours 60	
Suggested Evaluation	on IV	lethods		
Internal Assessment: 30		End Term Exa	amination: 70	
> Theory	30	Theory:	70	
Class Participation:	5	Written Ex	amination	
• Seminar/presentation/assignment/quiz/class test etc.:	10			
• Mid-Term Exam:	15			
Part C-Learning I	Reso	ources		
<b>Recommended Books/e-resources/LMS:</b>				
1. Principles of Gene Manipulation, R.W. Old, S B Prim	ose d	& R Twyman, 7 <sup>th</sup> edition	1.	
2. Principles of Genetics, Snustadet. al., 8 <sup>th</sup> edition.				
3. Molecular Cell Biology, Lodish et al, 9 <sup>th</sup> edition.				
4. Molecular Biology of the Gene, Watson et al, 7 <sup>th</sup> Edit	ion.			
5. Nucleic acids in Chemistry and Biology, G M Blackburn & M.J. Gait, 3 <sup>rd</sup> edition.				

Session: 2024-25				
Part	A – Introduct	ion		
Name of the Programme	M.Sc. Bioche	mistry		
Semester	Semester – II	I		
Name of the Course	PC-5	-		
Course Code	M24-BCH-30	7		
Course Type	PC-5			
Level of the course	400-499			
Pre-requisite for the course (if any)				
Course Learning Outcomes (CLO)	CLO 1: Learn about the antigen- antibody reactions.			
After completing this course, the learner will	CLO 2: Quantify the clinically important ions and ESR which are			
be able to:	CLO 3: Learn about the linkage dis-equilibrium and Hardy			
	Weinberg equilibrium			
	CLO4: Understand the basic principles of immunology and genetics			
Credits	Theory	Practical	Total	
	0	4	4	
Teaching Hours per week	0	8	8	
Internal Assessment Marks	0	30	30	
End Term Exam Marks	0	70	70	
Max. Marks	0	100	100	
Examination Time		4 hours		
Part B- C	contents of th	e Course		
Practic	als		Contact	
1 Antigen-antibody reactions			120	
2. Purification of IgG from serum				
3. ELISA				
4. Immunoprecipitation				
5. Immunoblotting				
6. Immunodiffusion				
7. Determination of ESR by West	ergen method			
8. Determination of chiorde in the	e given serum se	imple		
10 To understand the linkage dis-	auilibrium betw	een genes		
11. To understand the Hardy Wein	berg equilibrium	in a population		
	0 1			
*As per feasibility of practical(s), teacher	concerned may co	onduct additional practical(s)	in	
addition to the present list, which will also	be the part of sylla	ibus for evaluation.		
Suggester	d Evaluation N	lethods		
Internal Assessment: 30		End Term Exam	ination: 70	
Practicum	30	Practicum	70	
<ul> <li>Class Participation:</li> </ul>	5	Lab record, Viva-Voc	e, write-up and	
Seminar/Demonstration/Viva-voce/Lab regimested	cords etc.: 10	execution of the	practical	
• Mid-Term Exam:	15			
Part C-I	Learning Res	ources		
Recommended Books/e-resources/LMS	:			
1. Introductory Practical Biochemistry by Sawhn	ey, S.K. and Sing	h, R. (2000), Narosa Publishin	g House, India	
2. Principles and Techniques of Practical Bioch	emistry, 6 <sup>m</sup> editio	on by Keith Wilson and John	Walker (2000),	
3. Practical Manual of Biochemistry (2022) (F	or medical Dent	al and Medical Lab Technol	ogy Studies by	
Sadhna Sharma and Reema Sharma. MedhT	ech Science Pres	s	-6, 2000100 09	
4 Principles of Genetics (2005) 8 <sup>th</sup> ed Gardene	er et al John Wile	v New York		

Principles of Genetics (2005), 8<sup>th</sup> ed., Gardener *et al*, John Wiley, New York.
 Essential Genetics: A Genomic Perspective (2002), 3<sup>rd</sup> ed., Hart and Jones, Jones and Bartlett.

- 6. Kuby Immunology, 4<sup>rd</sup> ed. by R.A. Goldsby et al, W.H. Freeman & Co.
- 7. Immunology: an introduction, 4<sup>th</sup> Edition by Ian R Tizard, (1995), Saunders College Publishing.

Session: 2024-25				
Part A – Introduction				
Name of the Programme M.Sc. Biochemistry				
Semester	Semester – III			
Name of the Course	PC-6			
Course Code	M24-BCH-30	8		
Course Type	PC-6			
Level of the course	400-499			
Pre-requisite for the course (if any)				
Course Learning Outcomes (CLO)	CLO 1: Detect th	e adulterants in food		
After completing this course, the learner will	CLO 2: Learn an	d practice the techniques like iso	olation of plasmid	
be able to:	to: DNA, ligation of vector, colony PCR, RT-PCR			
	CLO 3: Understand the basics of gene expression			
	Used in Protein Engineering			
Credits	Theory Practical Total			
Credits			10tal	
	0	4	4	
Teaching Hours per week	0	8	8	
Internal Assessment Marks	0	30	30	
End Term Exam Marks	0	70	70	
Max. Marks	0	100	100	
Examination Time	0	4 hours		
Part B- C	Contents of th	e Course		
Practicals Contact Hours				
1. Estimation of lactose from milk			120	
2. Biochemical testing of food additives				
3. Isolation of Plasmid DNA				
4. Digestion of vector using restric	ction enzymes			
5. Ligation of vector and insert				
6. Screening of recombinant color	nies using Color	y PCR.		
7. To demonstrate cDNA synthesi	s and Transcrip	expression by RT-PCR		
8. Construction of restriction map	of plasmid DN.	A		
9. Gene Expression in <i>E. coli</i>	_			
10. Purification of protein using His	s-Tag			
*As per feasibility of practical(s), teacher co	oncerned may cor	duct additional practical(s) in		
addition to the present list, which will also b	be the part of sylla	abus for evaluation.		
Suggested Evaluation Methods				
Internal Assessment: 30		End Term Examin	nation: 70	
> Practicum	30	> Practicum 7	0	
Class Participation:	5	Lab record, Viva-Voce	, write-up and	
Seminar/Demonstration/Viva-voce/Lab rec	cords etc.: 10	execution of the p	oractical	
• Mid-Term Exam:	15			
Part C-L	earning Res	ources		
Recommended Books/e-resources/LMS				
1. Introductory Practical Biochemistry by Sawh	ney, S.K. and Sin	gh, R. (2000), Narosa Publishing	House, India	
2. Principles and Techniques of Practical Biochemistry, 6 <sup>th</sup> edition by Keith Wilson and John Walker (2000), Cambridge University Press				
3. Biophysical Chemistry: Principles and Tech (1998) Himalaya Publishing House Delhi	niques, 2 <sup>nd</sup> editio	n by A Upadhyay, K Upadhya	y and N Nath	
(1990), Innuugu I uonsining House, Delli.				

- 5. Principles of Gene Manipulation, R.W. Old, S B Primose & R Twyman, 7<sup>th</sup> edition.
- 6. Molecular Biotechnology Principles & applications of Recombinant DNA, 4<sup>th</sup> ed., <u>Bernard R.</u> <u>Glick, Cheryl L. Patten</u> (2018), ASM Press.

Session: 2024-25					
Part A – Introduction					
Name of Programme	Name of ProgrammeM. Sc. Biochemistry				
Semester	Semester- III				
Name of the Course	Food Biochemistry				
Course Code	M24-OEC-302				
Course Type	OEC				
Level of the course	400-499				
Pre-requisite for the course (if any)					
Course Learning Outcomes (CLO)	CLO 1: Acquire basic knowledge regarding biological basis				
After completing this course, the learner	of nutrition and how	w diet influences health.	0		
will be able to:	CLO 2: Focus on	the health benefits of typic	al nutrients		
	including macro an	d micro minerals and vitamin	<b>.</b> S.		
	CLO 3: Know the	basic concepts of food toxicit	y and safety		
	and various applica	ations of major enzymes in foo	od industry		
	CLO 4: Understan	d the relationship between n	utrition and		
	cardiovascular dise	ases and cancer	T ( 1		
Credits	Theory	Practical	Total		
	2	0	2		
Teaching Hours per week	2	0	2		
Internal Assessment Marks	15	0	15		
End Term Exam Marks	35	0	35		
Max. Marks	50	0	50		
Examination Time	3 hours				
Part B	- Contents of the	e Course			
<b>Instructions for Paper- Setter:</b> The example	miner will set 9 qu	uestions asking two question	ons from each		
unit and one compulsory question by takin	g course learning (	outcomes (CLOs) into cons	ideration. The		
examine will be required to attempt 5	auestions selection	ast 4 parts covering entire	synabus. The		
compulsory question All questions will ca	rry equal marks	ig one question from each	unit and the		
Unit	Contact				
	1		Hours		
I Classes and sources of nutrients	(overview), energy	value of foods, Basal	8		
metabolic rate, specific dynam	nic action, nutrit	ional importance of			
carbohydrates, Glycemic index, f	ibers in nutrition,	nutritional importance			
of lipids, essential fatty acids, nu	tritional importance	e of proteins, nitrogen			
balance, mutual supplementation of	of proteins, concept	of balanced diet	7		
11 <b>Vitamins</b> : major functions, dietar	y sources, deficien	cy symptoms of fat soluble	/		
Minerals, major functions, dista	vitaminosis of fat so	oluble vitamins			
symptoms of major and trace mine	rals	icy symptoms and toxicity			
III Food toxicity and safety:	Microbial cont	amination environmental	8		
contamination, natural food tox	kins and antinutrie	ents, agricultural residues,			
intentional food additives		, , , , , , , , , , , , , , , , , , , ,			
Food borne infections and intoxic	ations				
IV Nutritional disorders: Lipoprot	eins and cardiovas	scular disease: 'good' and	7		
'bad' cholesterol, risk factors for c	cardiovascular disea	ase.			
Nutrition and Cancer: Associat	ions between nutri	tional factors and common			
cancer sites; effect of different fo	ods, beverages, phy	ysical parameters and other			
additional factors on cancer.		Total Contact Hours	30		
Sugge	sted Evaluation N	Tethods	30		
Jugge Internal Assessments 14	Sicu Evaluation IV	Fnd Tarm Framin	ation: 35		
internal Assessment: 1:	3		au011. 33		

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> Theory	15	> Theory:	35	
Class Participation:	4	Written Examination		
• Seminar/presentation/assignment/quiz/class test etc.:	4			
• Mid-Term Exam:	7			
Part C-Learning Resources				
Recommended Books/e-resources/LMS:				
1. Biochemistry by U. Satyanarayana (2017). Books and allied (P) Ltd.				
2. Essentials of Human Nutrition by J. Mann and A.	S. Tr	uswell (2015) 5 <sup>th</sup> ed. Oz	xford University	
Press Inc., New York.				
3. Contemporary Nutrition by Wardlaw Smith (2016) 9 <sup>th</sup> ed. McGraw Hill Inc., New York.			New York.	
4. Nutritional Biochemistry by S. Ramakrishnan and	4. Nutritional Biochemistry by S. Ramakrishnan and S. Venkat Rao (1995) T. R. Publications.			
5. Food Chemistry by Owen Fennema (2017) 5 <sup>th</sup> ed.	CRC	Press.		
6. Food Science Chemistry and Experimental Foods	by N	I. Swaminathan (1990)	. The Bangalore	
Printing and Publishing Co. Ltd.	-		-	

	Session: 2024-25			
P	art A – Introduct	ion		
Name of Programme	M. Sc. Biochemis	stry		
Semester	Semester- IV			
Name of the Course	Omics in Biology	7		
Course Code	M24-BCH-401			
Course Type	CC-11			
Level of the course	400-499			
Pre-requisite for the course (if any)				
Course Learning Outcomes (CLO) After completing this course, the learner will be able to:	CLO1: Understand the structure, function and evolution of genomes, technologies and applications of genomic research in different fields like medicine, biotechnology and evolutionary studies. CLO 2: Understand the study of RNA transcripts, their regulation patterns of expression and functional significance in vario			
	<ul> <li>biological processes.</li> <li>CLO 3: Proteomics will help in understanding the structu function and interactions of proteins in biological system and a techniques for analysis of proteins and their applications research</li> <li>CLO 4: Learn the comprehensive analysis of metabolites, role cellular processes and application in disease research a biomarker selection.</li> </ul>			
Credits	Theory	Practical	Total	
	4	0	4	
Teaching Hours per week	4	0	4	
Internal Assessment Marks	30	0	30	
End Term Exam Marks	70	0	70	
Max. Marks	100	0	100	
Examination Time	3 hours			
Part F	<b>B-</b> Contents of the	e Course		
<b>Instructions for Paper- Setter:</b> The exa unit and one compulsory question by takin compulsory question (Question No. 1) w examinee will be required to attempt 5 compulsory question. All questions will ca	miner will set 9 q ng course learning ill consist of at le questions, selectin rry equal marks.	uestions asking two quest outcomes (CLOs) into con ast 4 parts covering entire ag one question from eac	ions from each isideration. The e syllabus. The h unit and the	
Unit	Topics		Contact Hours	
I Introduction to Omics: Overview of omics: Definition and scope of genomics, transcriptomics, proteomics, metabolomics Genomics: Structural genomics-construction of cytological maps based on banding pattern, physical maps based upon contigs, sequence-tagged sites (STSs), expressed-sequence tags (ESTs), genetic maps based upon RFLP, microsatellites, variable number tandem repeats, Map position- based cloning of genes, The human genome project, Annotation of genome, functional genomics, DNA microarray, serial analysis of gene expression (SAGE), comparative genomics- prokaryotic, chloroplast, mitochondria and eukaryotic genomes, evolutionary insights Application of genomics in genome wide association studies (GWAS) and perconalized medicine.			15	
II <b>Transcriptomics:</b> Transcriptome binding site, RNA sequencing quantification and differential ex	e analysis, search o techniques, Analys opression analysis,	of transcription factor is of data, Mapping, Transcriptomics of a	15	

single cell, Microarrays, characterization and a	nalys	is of s	mall RNA like	e	
microRNAs and phasiRNAs, Analysis of long non-coding RNAs, Target					
production and functional production for small RNAs, Applications of					
transcriptomics in understanding gene expression	ı and	regula	tory networks		
III <b>Proteomics:</b> Overview and tools, Two-dimens	siona	PAG	E, Protein spo	t	15
detection, Mass spectrometry: matrix assisted	laser	desorp	otion ionization	ı	
MS, Electrospray ionization MS, and tandem MS for protein identification					
Quantitative proteomics and multiplexing, Ident	ificat	ion an	d quantification	ı	
of proteins, post-translational modifications,	Iden	tificati	on of protein	-	
protein interactions, Protein complexes,	X-	ray o	crystallography	,	
Transmembrane domains, Functional prote	eomi	es, A	pplications of	f	
proteomics in biomarker discovery and drug deve	elopr	nent			
IV Metabolomics: Fundamental concepts of	meta	bolomi	cs, metabolite	e	15
profiling and flux analysis, techniques of metabo	lomi	cs, mas	s spectroscopy	,	
NMR spectroscopy, data analysis and inter	preta	tion,	applications of	f	
metabolomics					
Degradomics: Basic concepts of degradomic	es, aj	pproac	nes to identify	/	
protease and protease-substrate repertoires					
Integrative omics: Integrating genomics, tra	inscri	ptomic	s, proteomics	,	
metabolomics and degradomics					
			Total Contact	Hours	60
Suggested Evaluati	ION N	lethoo		<u> </u>	
Internal Assessment: 30			End Term Ex	xamina	ation: 70
> Theory	30	$\triangleright$	Theory:	70	
Class Participation:	5		Written E	xamina	ation
• Seminar/presentation/assignment/quiz/class test etc.:	10				
• Mid-Term Exam:	15				
Part C-Learning	Res	ources	5		
<b>Recommended Books/e-resources/LMS:</b>					
1. Molecular Biology of Gene (2008), 6 <sup>th</sup> ed., Watson, Bak	ker <i>et</i>	al, Lev	vine and Losick	, Pearso	n education
Inc.					

- 2. Genome 4 (2018), 4<sup>th</sup> ed. T.A. Brown, Taylor and Francis Group
- 3. Proteomics in Practice: A Laboratory Manual of Proteome Analysis by Reiner Westermeier and Tom Naven
- 4. Metabolomics: From Fundamentals to Clinical Applications by Ute Roessner

Session: 2024-25				
Part	A – Introduct	ion		
Name of Programme	M.Sc. Biocher	nistry		
Semester	Semester – IV	7		
Name of the Course	Biotechniques and Bioinformatics			
Course Code	M24-BCH-402			
Course Type	CC-12			
Level of the course	400-499	400-499		
Pre-requisite for the course (if any)				
Course Learning Outcomes (CLO)	CLO 1: Understand the basic statistical techniques and			
After completing this course, the learner will	various techniq	ues of molecular biology	and relate modern	
be able to:	DNA technolog	y for disease diagnosis and	d therapy.	
	CLO 2: Know	the antigen antibody intera	actions, experimental	
	methods of me	onoclonal antibody synt	hesis and types of	
	vaccines.			
	CLO 3: Unders	tand the fundamentals of	bioinformatics.	
	CLO 4: Know	v how to use biological	databases, retrieve	
	information and	link the wet and dry lab	knowledge for better	
	understanding	of biological phenomene	on. To learn about	
	Genome data-hi	gh throughput sequencing	(NGS Platform).	
Credits	Theory	Practical	Total	
	4	0	4	
Teaching Hours per week	4	0	4	
Internal Assessment Marks	30	0	30	
End Term Exam Marks	70	0	70	
Max. Marks	100	0	100	
Examination Time	3 hours			
Part B- Contents of the Course				

**Instructions for Paper- Setter:** The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will consist of at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

Unit		Contact
Omt	Topics	Hours
т		15
1	Statistical techniques: Arithmetic mean, median, mode: measures of	15
	variation: standard deviation, variance, coefficient of variation; properties;	
	correlation: types and methods; simple, multiple, linear and non-linear	
	correlation, spearman's correlation, rank correlation; regression: linear and	
	curvilinear regression (for X and Y only), regression lines by least square	
	method, regression equations of X on Y and Y on X only; sample size;	
	power of study	
	Molecular biology techniques: DNA sequence analysis methods: Sanger	
	dideoxy method, Maxam Gilbert chemical method and Fluorescence	
	method; Polymerase chain reaction: principles, process, design and	
	optimization; different types of PCR: allele specific, nested, multiplex and	
	real-time PCR; ligase chain reaction; SNP and application in molecular	
	diagnostics; DNA fingerprinting: applications and prospects; restriction	
	fragment length polymorphism (RFLP) and its uses.	
II	Immunotechniques: Preparation of antigens and antibodies, purifications	15
	of antibodies, preparation and uses of various types of vaccines - role of	
	vaccines in prevention of diseases, Immunoprecipitation, agglutination,	

RIA, ELISA, ELISPOT, Immunofluoresc Immunohistochemistry, flow cytometry and data	cence, analy	Im sis, F	munoblotting, ACS analysis,	
hybridoma technology for monoclonal antibod	dy pr	oducti	on- principle,	
techniques, application, catalytic antibodies, and	ntiboc	ly imi	nunotherapy',	
antibody engineering-designing chimeric and hur	nanise	ed anti	bodies.	1.5
<b>Fundamentals of Bioinformatics:</b> Definition, s	scope,	and a	pplications of	15
bioinformatics, Concept of databases; Biologic	cal da	tabase	s: Nucleotide	
(GenBank, EMBL, DDBJ) and Protein datab				
Sequence-based database retrieval tools: BLAST				
SRS. Different version of BLAST and FASTA				
Applications of Bioinformatics: Pairwise and m	nultipl	e sequ	ence alignment	
of DNA and RNA, Cluster W, Phylogenetic and	hbour- Joining,			
Maximum Likelihood, Phylogenetic trees and van	of trees.			
IV Gene and Genome Characterization: Comp	outatio	nal a	pproaches for	15
gene identification for finding open reading frame				
Genome high-throughput sequencing (NGS):	: Gen	ome	sequencing and	
assembly, mapping of reads. Annotation	with	funct	ional features,	
identification of origin of replication, tRNA,	rRNA	and	protein-coding	
genes. Identification and annotation of COG	s (lus	sters of	of Orthologous	
Groups)				
Protein structure prediction: Protein secon	ıdary	struct	ure prediction,	
homology modelling (principle and procedure	e) an	d stru	cture analysis,	
Protein-ligand interactions and docking studies				
~		Te	otal Contact Hours	60
Suggested Evaluation	on M	ethod	<u>s</u>	
Internal Assessment: 30			End Term Exar	nination: 70
> Theory	30	$\triangleright$	Theory:	70
Class Participation:	5		Written Exa	mination
• Seminar/presentation/assignment/quiz/class test etc.:	10			
• Mid-Term Exam:	15			
Part C-Learning 1	Resou	irces		
Recommended Books/e-resources/LMS:				
1. Kuby Immunology, 10 <sup>th</sup> Edition				
2. Principles and Techniques of Practical Biochemistry,	8 <sup>th</sup> edi	tion by	Keith Wilson and	d John Walker.
3. Physical Biochemistry, 2nd edition, by D Friefelder.				

- 4. Statistical Methods by S P Gupta 46<sup>th</sup> ed. (2017), Sultan Chand and Sons. New Delhi
- 5. Fundamentals of Mathematical Statistics, S C Gupta and V K Kapoor (2014), Sultan Chand and Sons.
- Essential Bioinformatics, JinXiong (2007), Cambridge University Press.
   Introduction to Bioinformatics, 5<sup>th</sup> ed., Arthur M. Lesk (2019) Oxford University Press.
- 8. Fundamental Concepts of Bioinformatics (2003), Dan E. Krane, Michael L Raymer.

	Se	ssion: 2024-25			
	Part	A – Introduction			
Name of	Programme	M.Sc. Biochemistry			
Semester		Semester- IV	•		
Name of	the Course	Industrial Bio	ochemistry		
Course (	Code	M24-BCH-40	3		
Course 7	Гуре	DEC-3			
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course 1	Learning Outcomes (CLO)	CLO 1: Understa	and the principles of enzy	me function, production	
After cor	npleting this course, the learner will	and their industrial and biomedical use in different biochemical an			
be able to	ר ר ר	biotechnological j	processes.		
		CLO 2: Underst	and the use of microbes	in industrial processes,	
		and also plant ce	Ill tissue and organ cultur	e for plant propagation	
		genetic improvem	nent and biochemical applic	ations	
		CLO 3: Underst	and the processes and ap	plications of microbial	
		fermentation for p	producing bio-based goods,	scaling up of biological	
		processes for in	dustrial applications, bio	reactor operations and	
		downstream proce	essing	1	
		CLO 4: Understa	and the production of biopo	olymers and bioplastics,	
		in industries	esses in 1000 system and et		
Credits		Theory	Practical	Total	
		4	0	4	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Terr	m Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	tion Time	3 hours			
	Part B- C	Contents of the	e Course		
Instructi	ons for Paper- Setter: The examin	er will set 9 qu	uestions asking two qu	lestions from each	
unit and c	one compulsory question by taking co	ourse learning of	outcomes (CLOs) into	consideration. The	
compuiso	ry question (Question No. 1) will c	consist of at least	ast 4 parts covering el	ntire syllabus. The	
	will be required to attempt 5 que	suons, selecun	ig one question from	each unit and the	
Unit	Ty question. An questions win early	nics		Contact Hours	
I	Enzyme Technology: Applications of	enzymes in diffe	rant industrias Enzyma	15	
1	engineering for improved industrial and	olications Appre	paches for identification	15	
	and screening of novel enzymes for	industrial appli	cations (by employing		
	homology-based and structure-guid	led strategies.	advanced screening		
	techniques, and targeted mutagenesis).	Large-scale prod	duction and formulation		
	of enzymes.	0 1			
II	Microbial Technology			15	
	Immobilization of enzymes: Techniqu	es of immobiliza	ation and applications of		
	immobilized enzymes. Screening an	d isolation of	industrially important		
	microorganisms. Aerobic and anaerobi	c microbial ferm	nentation. Improvement		
	of microbial strains and genetic enginee	ring for enhance	d productivity.		
	Plant Tissue Culture: General principl	les, techniques, a	and applications of plant		
	and animal tissue culture. Microprop	agation, protop	last fusion, and use of		
	plant tissue culture in the production of	ot useful tree pr	oducts and transgenics.		
	Transformation using eggs, production	of various comp	ounds using animal cell		
III	Fermentation Technology Principles	of fermentation	1 Types of fermenters	15	
	Batch, fed-batch, and continuous. Down	nstream processi	ng for product recovery	10	

	and purification. Large-scale production of ant	ibioti	cs, organic acids, and	
vitamins. Economics of fermentation and scale-up challenges.				
117	fermentation vs. Submerged fermentation	15		
IV	Biopolymer and Bioplastic production, Food Bi	oche	mistry: Factors causing	g 15
	food spoilage during food ripening. Fruit and ve	le maturation and them		
	control. Post-slaughter changes in meat and			
microorganisms in food using different methods: High and low-temperature				
dehydration, Freezing, Freeze-drying, Irradiation, Use of preservatives				
Industrial Biochemistry and Business Aspects: Intellectual Property Rights				3
(IPR) and its types (Patents, Trademark, Copyright, and related rights).				
	Patentable and non-patentable IPR.			
	Introduction to ethics and bioethics. Startups and e	entrep	preneurship in industria	
	biochemistry.		Total Contact Hours	
	Conservated Events			60
	Suggested Evaluati	on N	lethods	• • • • •
	Internal Assessment: 30		End Term Ex	amination: 70
	Гheory	30	Theory:	70
• Cl	ass Participation:	5	Written Ex	amination
•Se	minar/presentation/assignment/quiz/class test etc.:	10		
• Mi	id-Term Exam:	15		
	Part C-Learning	Reso	ources	
Reco	mmended Books/e-resources/LMS:			
1.	Fermentation Technology (2 <sup>nd</sup> ed.) Standury (Pergman	Press	s)	
2.	Biotechnolgy: Textbook of Industrial microbiology 2nd	ed. b	by Creuger and Creuger	(2000)
3.	3. Principles of Gene Manipulation: An introduction to Genetic Engineering (5 <sup>th</sup> ) R.V. Old and S.B.			R.V. Old and S.B.
	Timespies of Gene multiplication fin introduction to			
4. Principles of Biotechnology (1985) Alen Weisman (Surrey University Press)				
4.	Primrose (Blackwell Scientific Publications) Principles of Biotechnology (1985) Alen Weisman (S	urrey	University Press)	
4. 5.	Primrose (Blackwell Scientific Publications) Principles of Biotechnology (1985) Alen Weisman (S Industrial Enzymology 2 <sup>nd</sup> edition by Godfrey and Wei	urrey st (19	v University Press) 196) (Nature Publishing (	Group)
4. 5. 6.	Primrose (Blackwell Scientific Publications) Principles of Biotechnology (1985) Alen Weisman (S Industrial Enzymology 2 <sup>nd</sup> edition by Godfrey and Wei Concepts in Biotechnology (1996) by D. Balasubrama	urrey st (19 miam	v University Press) 96) (Nature Publishing ( , K. Djarmalingam, J. C	Group) Freen and K. Jayaraman
4. 5. 6.	Primose (Blackwell Scientific Publications) Principles of Biotechnology (1985) Alen Weisman (S Industrial Enzymology 2 <sup>nd</sup> edition by Godfrey and Wes Concepts in Biotechnology (1996) by D. Balasubrama (University Press)	urrey st (19 miam	v University Press) 196) (Nature Publishing ( 1, K. Djarmalingam, J. C	Group) Green and K. Jayaraman
4. 5. 6. 7.	<ul> <li>Primose (Blackwell Scientific Publications)</li> <li>Principles of Biotechnology (1985) Alen Weisman (S Industrial Enzymology 2<sup>nd</sup> edition by Godfrey and Weisman Concepts in Biotechnology (1996) by D. Balasubrama (University Press)</li> <li>Enzyme Technology by M.F. Chaplin and D.C. Bucks</li> </ul>	urrey st (19 iniam (199	v University Press) 196) (Nature Publishing ( 1, K. Djarmalingam, J. C 0) (Cambridge Universit	Group) Freen and K. Jayaraman y Press)
4. 5. 6. 7. 8.	<ul> <li>Primose (Blackwell Scientific Publications)</li> <li>Principles of Biotechnology (1985) Alen Weisman (S Industrial Enzymology 2<sup>nd</sup> edition by Godfrey and Weisman (University Press)</li> <li>Enzyme Technology by M.F. Chaplin and D.C. Bucks Enzymes in Industry: Production and applications, 1</li> </ul>	urrey st (19 iniam (1990 Editeo	v University Press) 96) (Nature Publishing ( , K. Djarmalingam, J. C 0) (Cambridge Universit d by Wolfgang Aehle,	Group) Freen and K. Jayaraman y Press) (2007) 3 <sup>rd</sup> Completely

	Session: 2024-25				
	Part .	A – Introduction			
Name of	Programme	M.Sc. Biochemistry			
Semester Semester- IV			v		
Name of the CourseClinical Biochemistry					
Course (	Code	M24-BCH-404	4		
Course Type DEC-3					
Level of	the course	400-499			
Pre-requ	isite for the course (if any)				
Course I	Learning Outcomes (CLO)	CLO 1: Know	the principles and practic	ce of quality control,	
After cor	npleting this course, the learner will	handling of biolo	gical fluids and their signi	ficance in maintaining	
be able to	o:	good nealth; und and blood disorde	erstand clinical significan	ce of plasma proteins	
		CLO 2: Explain	the role of enzymes a	nd other biochemical	
		markers in clinic	al diagnostics and organ	function tests; use the	
		knowledge of	metabolism of xeno	biotics in various	
		CLO 3. Learn	ourses.	ders associated with	
		carbohydrates, an	mino acids, lipids, nucle	ic acids, vitamins &	
		minerals metaboli	ism.		
		CLO 4: Understa	nd and explain disorders a	ssociated with various	
		hormones, disord	ers of acid-base and elect	rolytes balance in the	
Credits		Theory	Practical	Total	
		4	0	4	
Teachin	g Hours per week	4	0	4	
Internal	Assessment Marks	30	0	30	
End Terr	m Exam Marks	70	0	70	
Max. Ma	arks	100	0	100	
Examina	ition Time	3 hours	~		
	Part B- C	contents of the	e Course		
Instructio	ons for Paper- Setter: The examin	er will set 9 qu	lestions asking two qu	lestions from each	
unit and c	one compulsory question by taking conversion (Question No. 1) will conversion	ourse learning (	outcomes (CLOS) into	consideration. The	
examinee	will be required to attempt 5 que	stions, selectin	g one question from	each unit and the	
compulso	ry question. All questions will carry	equal marks.			
Unit	To	pics		<b>Contact Hours</b>	
Ι	Clinical biochemistry and quality a	ssurance: biolo	gical samples (blood,	15	
	urine and cerebrospinal fluid): chemica	al composition,	collection, processing,		
	stability and storage; serum separation	on; quality ass	urance; accuracy and		
	precision; factors influencing the accura	icy of results.	notoine (ellerenin and		
	globuling): Disorders of hemoglobin:	is or plasilia p thalassemia and	mia (different types)		
	porphyrias, thrombosis	unanassenna, and	lina (different types),		
II	Disorders of Carbohydrate Metabolism: Glycohemoglobins Diabetes 15				
	mellitus, various types of glucose t	olerance tests,	diabetic ketoacidosis,		
hypoglycemia, glycogen storage diseases, galactosemia					
	Disorders of lipid metabolism: Refsur	m's disease, fatt	y liver and lipotrophic		
	factors, hypo- and hyperlipoproteinem	ia, Atherosclero	osis: pathogenesis and		
	risk factors, Tay-Sachs disease (Gang	liosidosis), Gau	cher's disease, ketone		
	Disorders of nucleic acid metaboli	sus Gout Les	ch- Nyhan syndrome		
	hypouricemia and orotic aciduria	5111. OOut, LOS	en rynan synarollic,		
III	Disorders of amino acid metabo	lism: Maple	syrup urine disease,	15	
	phenylketonuria, alkaptonuria, cysti	nuria, homocys	stinuria, tyrosinemia,		

	albinism and aminoaciduria disorders in uras bios	mtha		
	Flectrolyte and acid base balance di	ors of electrolytes		
	(hypernatremia hyponatremia hypoka			
	hyperchloremia, hypochloremia): water and acid	1 bas	e balance (metabolic	
	and respiratory acidosis, metabolic and respirator	v alk	calosis)	
	<b>Neuropsychiatric disorders:</b> Alzheimer's & Pa	rkins	on's disease.	
Ι	V Clinical enzymology: Enzymes as diagnostic	tool,	enzymes of clinical	15
	significance: acid phosphatase, alkaline phosphatas	e, cre	eatine kinase, aldolase,	
	LDH, AST, ALT, Lipase, amylase and 5'-nucleotic	lase,	Isoenzymes of clinical	
	significance			
	Organ function tests: Liver function tests, kidn	ey fu	inction tests, exocrine	
	pancreas, GI tract function test, myocardial functio	n		
	Markers of clinical significance: Hormones (T3,	T4, 7	TSH), Cancer markers	
	(Carcinoembryonic antigen, $\alpha$ -fetoprotein, total	and	free prostate specific	
	antigen, CA 19-9, CA-125), normal values	of ir	nportant biochemical	
	constituents of blood, urine, cerebrospinal fluid (C	SF)		(0)
	Suggested Evoluet	on N	Total Contact Hours	60
	Suggested Evaluati	on M	Iethods	60
	Suggested Evaluati Internal Assessment: 30	on N	Iethods End Term Exa	mination: 70
>	Suggested Evaluati Internal Assessment: 30 Theory	on N 30	Iethods End Term Exa ≻ Theory:	60 amination: 70 70
> •(	Suggested Evaluati Internal Assessment: 30 Theory Class Participation:	on N 30 5	Iethods End Term Exa ≻ Theory: Written Ex	amination: 70
> •(	Suggested Evaluati Internal Assessment: 30 Theory Class Participation: Seminar/presentation/assignment/quiz/class test etc.:	on N 30 5 10	Iethods End Term Exa → Theory: Written Ex	amination: 70 70 amination
()	Suggested Evaluati Internal Assessment: 30 Theory Class Participation: Seminar/presentation/assignment/quiz/class test etc.: Mid-Term Exam:	<b>30</b> 5 10 15	Iethods End Term Exa ➤ Theory: Written Ex	60       umination: 70       70       amination
)• ( • ( • ( • (	Suggested Evaluati Internal Assessment: 30 Theory Class Participation: Seminar/presentation/assignment/quiz/class test etc.: Mid-Term Exam: Part C-Learning	on M 30 5 10 15 Reso	Iethods         End Term Exa         ➤ Theory:         Written Exa	amination: 70 70 amination
> •( • • ! Re	Suggested Evaluati Internal Assessment: 30 Theory Class Participation: Seminar/presentation/assignment/quiz/class test etc.: Mid-Term Exam: Part C-Learning Tommended Books/e-resources/LMS:	on N 30 5 10 15 Reso	Iethods End Term Exa ➤ Theory: Written Ex Ources	amination: 70 70 amination
> • ( • S • I • I 1.	Suggested Evaluati         Internal Assessment: 30         Theory         Class Participation:         Seminar/presentation/assignment/quiz/class test etc.:         Mid-Term Exam:       Part C-Learning Tommended Books/e-resources/LMS:         Textbook of Biochemistry for Medical student by Vas	<b>30</b> 5 10 15 <b>Reso</b>	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         van DM (2019), 9 <sup>th</sup> edit	60       amination: 70       70       amination       ion, Jaypee Brothers
> • ( • ? • ! • ! • ! • ! • ! • ! • !	Suggested Evaluati         Internal Assessment: 30         Theory         Class Participation:         Seminar/presentation/assignment/quiz/class test etc.:         Mid-Term Exam:       Part C-Learning         Commended Books/e-resources/LMS:         Textbook of Biochemistry for Medical student by Vas         Medical Publishers	<b>30</b> 5 10 15 <b>Reso</b>	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ran DM (2019), 9 <sup>th</sup> edit	amination: 70 70 amination
> •( • • • • • • • • • • • • • • • • • •	Suggested Evaluati         Internal Assessment: 30         Theory         Class Participation:         Seminar/presentation/assignment/quiz/class test etc.:         Mid-Term Exam:       Part C-Learning 1         Commended Books/e-resources/LMS:         Textbook of Biochemistry for Medical student by Vas         Medical Publishers       Teitztext book of clinical Chemistry (2016), 6 <sup>th</sup> edition, 0	<b>30</b> 5 10 15 <b>Reso</b> Sudev	Iethods         End Term Exa         ➤ Theory:         Written Ex         Ources         van DM (2019), 9 <sup>th</sup> edit         A. Burtis and Edward R.	60 mination: 70 70 amination ion, Jaypee Brothers Ashwood, W. B.
> •( •S •N Re 1. 2.	Suggested Evaluati         Internal Assessment: 30         Theory         Class Participation:         Seminar/presentation/assignment/quiz/class test etc.:         Mid-Term Exam:       Part C-Learning 2         Commended Books/e-resources/LMS:         Textbook of Biochemistry for Medical student by Vas         Medical Publishers       Teitztext book of clinical Chemistry (2016), 6 <sup>th</sup> edition, O         Saunders Company.	on M 30 5 10 15 Reso Sudev Carl A	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         van DM (2019), 9 <sup>th</sup> edit         A. Burtis and Edward R.	60 mination: 70 70 amination ion, Jaypee Brothers Ashwood, W. B.

Textbook of Biochemistry with Clinical Correlations, 6<sup>th</sup> edition by T.M. Devlin (2005).Wiley-liss.
 Biochemistry by U. Satyanarayana (2019). Books and allied (P) Ltd.
 Text Book of Biochemistry & Human Biology by G.P. Talwar (1989) Prentice Hall, New Delhi

Part A – Introduction           Name of Programme         M.Sc. Biochemistry           Semester         Semester IV           Name of the Course         Microbial Biochemistry           Course Code         M24-BCH-405           Course Code         M24-BCH-405           Course Code         M24-BCH-405           Course Learning Outcomes (f1 any)         CO curse Learning Outcomes (CLO)           Course Learning Outcomes (CLO)         ClO 1: Understand the general characteristics of different microbial antibues equatification and interes quantification and interes quantinteres quantification and interes quantificatin an		Session: 2024-25				
Name of Programme         M.Sc. Biochemistry           Semester         Name of the Course         Microbial Biochemistry           Course Code         M24-BCH-405         Course Code           Course Type         DEC-4         Level of the course         Microbial Biochemistry           Course Learning Outcomes (CLO)         Course Learning Outcomes (CLO)         Course (Cateria, algae, fungt, protzon, viruses, viroids, and prions)           After completing this course, the learner will be able to:         CLO 2: Learn about the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods           CLO 3: know the basics of pathogenicity and antiintrobial drugs.         CLO 4: Gci an insight about microbial genomics and diagnostic microbiology           Credits         Theory         Practical         Total           Teaching Hours per week         4         0         4           Internal Assessment Marks         30         0         30           End Term Exam Marks         100         0         100           Examination Time         3 hours         3         1           Data         Walks, duity of fields in microbiology, Major cell         15           Internal Assessment Marks         100         0         100           Examinatin Time         3 hours         3		Part	A – Introduct	ion		
Semester         Semester         IV           Name of the Course         Microbial Biochemistry           Course Code         M24-BCH-405           Course Type         DEC-4           Level of the course         400-499           Pre-requisite for the course (if any)         CL0 1: Understand the general characteristics of different microbial groups (bacteria, algae, fungl, protozoa, virues, virols, and princip)           Course Learning Outcomes (CLO)         CL0 1: Understand the general characteristics of antimicrobial themotherapy and various types of nathogenicity and antimicrobial chemotherapy and various types of nathogenicity and antimicrobial antivirul drugs.           Credits         Theory         Practical         Total           Teaching Hours per week         4         0         4           Therry         Practical         Total           Teaching Hours per week         100         0         30           End Tern Exam Marks         100         0         100           Examination Time         3 hours         Part B- Contents of the Course         Enseminer will set 9 questions asking two questions from each unit and one comp	Name of	Programme	M.Sc. Biocher	nistrv		
Name of the Course         Microbial Biochemistry           Course Code         M24-BCH-405           Course Type         DEC-4           Level of the course         400-499           Pre-requisite for the course (if any)         CLO 1: Understand the general characteristics of different microbial groups (bacteria, algae, fungl, protozoa, viruses, viroids, and prions)           After completing this course, the learner will groups (bacteria, algae, fungl, protozoa, viruses, viroids, and prions)           be able to:         CLO 2: Learn about the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods           CLO 4: Get an insight about microbial genomics and diagnostic microbiology         CLO 4: Get an insight about microbial genomics and diagnostic microbiology           Credits         Theory         Practical         Total           4         0         4         0         4           Internal Assessment Marks         30         0         30         End Term Exam Marks         30         0         100           Examination Time         3 hours         Part B- Contents of the Course         Instructions for Paper- Setter:         The examiner will set 9 questions asking two questions. From each unit and the compulsory question No. 1) will consist of a least 4 parts covering entire syllabus. The examiner will set 70 question from each unit and the compulsory question by taking course learning outcomes (CLOS) into cons	Semester		Semester- IV	<u> </u>		
Course Code         M24-BCH-405           Course Type         DEC-4           Level of the course         400-499           Pre-requisite for the course (if any)         Course Learning Outcomes (CLO)           After completing this course, the learner will         course and the general characteristics of different microbial proprogrammes, trinds, and prions)           After completing this course, the learner will         course and the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods           C10 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antiviral drugs.         C10 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antiviral drugs.           Credits         Theory         Practical         Total           Haremal Assessment Marks         30         0         30           Examination Time         3 hours         Image: Sign and	Name of	f the Course	Microbial Bio	chemistry		
Course Type         DEC-4           Level of the course         400-499           Pre-requisite for the course (if any)         CL0 1: Understand the general characteristics of different microbial groups (bactria, algae, fung), protozoa, viruses, viroids, and prions)           Caurse Learning Outcomes (CLO)         CL0 1: Understand the general characteristics of different microbial groups (bactria, algae, fung), protozoa, viruses, viroids, and prions)           be able to:         CLO 2: Learn about the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods           Credits         Theory         Practical         Total           Credits         Theory         Practical         Total           Internal Assessment Marks         30         0         30           Ead Term Exam Marks         70         0         70           Marks         100         0         100           Examination Time         3 hours         100         100           Examination virue science, vir	Course (	Code	M24-BCH-40	5		
Course Type         DPC-4           Level of the course         400-499           Pre-requisite for the course (if any)         CO I: Understand the general characteristics of different microbial drifter completing this course, the learner will groups (bacteria, algae, fung), protozoa, viruses, viroids, and prions) CLO 2: Learn about the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods           CLO 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antiviral drugs.           CLO 4: Get an insight about microbial genomics and diagnostic microbiology           Credits         Theory         Practical         Total           4         0         4           Internal Assessment Marks         30         0         30           End Tern Exam Marks         100         0         100           Examination Time         3 hours         Internal Assessment Marks         100           Instructions for Paper- Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question. All questions will carry equal marks.           Unit         Topics         Contact Hours           I         Microbial diversity: Physiological diversity of microorganisms, prokaryotic and eukaryotic diversity, Major fields in microbiology; Major cell morphologies, CLI wall of Gram -ve b	Course	Type	DEC 4	0		
Development       100-499         Pre-requisite for the course (if any)       CL0 1: Understand the general characteristics of different microbial         Course Learning Outcomes (CLO)       CL0 1: Understand the general characteristics of different microbial         After completing this course, the learner will       CL0 2: Learn about the pure culture techniques, quantification and         be able to:       influence of various environmental factors on growth and their         Cl0 3: know the basics of pathogenicity and antimicrobial       chemotherapy and various types of antibacterial, antifungal and         antivirial drugs.       CL0 4: Get an insight about microbial genomics and diagnostic         Microbiology       Practical       Total         Teaching Hours per week       4       0       4         Teaching Hours per week       30       0       30         End Term Exam Marks       70       0       70         Max, Marks       100       0       100         Examination Time       3 hours       Image: splatistrastrastrastrastrastrastrastrastrastra	Level of	the course	DEC-4 400-400			
Intercupation of the Course (CLO)       CLO 1: Understand the general characteristics of different microbial groups (bacteria, algae, fungi, protozoa, viruses, viroids, and prions)         be able to:       CLO 2: Learn about the pure culture techniques, quantification and influence of various environmental factors on growth and their control methods         CLO 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antiviral drugs.         CLO 4: Get an insight about microbial genomics and diagnostic microbiology         Credits       Theory         Practical       Total         4       0       4         Teaching Hours per week       4       0       4         Teaching Hours per week       4       0       4         Internal Assessment Marks       30       0       30         End Term Exam Marks       100       0       100         Examination Time       3 hours       100       100         Examinet will be required to attempt 5 questions, selecting one question from each unit and the compulsory question No. 1) will consist of at least 4 parts covering entire syllabus. The examiner will set 9 questions growt and the compulsory question. All questions will carry equal marks.       101         Initer Colial diversity: Physiological diversity of microorganisms, prokaryotic and eukaryotic diversity. Major fields in microbiology; Major cell morphologies, Cell wall of Gram +ve and Gram –ve bacteria; cel	Dra raqui	isite for the course (if any)	400-499			
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De able to:       influence of various environmental factors on growth and their control methods         CLO 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antivirial drugs.         Credits       Theory       Practical       Total         Teaching Hours per week       4       0       4         Internal Assessment Marks       30       0       30         End Term Exam Marks       70       0       70         Max, Marks       100       0       100         Examination Time       3 hours		inpleting this course, the learner will	CLO 2: Learn ab	out the pure culture techn	iques, quantification and	
control methods       CLO 3: know the basics of pathogenicity and antimicrobial chemotherapy and various types of antibacterial, antifungal and antiviral drugs.       CLO 4: Get an insight about microbial genomics and diagnostic microbiology         Credits       Theory       Practical       Total         4       0       4         Teaching Hours per week       4       0       4         Internal Assessment Marks       30       0       30         End Term Exam Marks       100       0       70         Max. Marks       100       0       100         Examination Time       3 hours	be able to	0:	influence of var	ious environmental factor	rs on growth and their	
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Initial drugs       CLO 4: Get an insight about microbial genomics and diagnostic microbiology.         Credits       Theory       Practical       Total         4       0       4         Teaching Hours per week       4       0       4         Internal Assessment Marks       30       0       30         End Term Exam Marks       70       0       70         Max. Marks       100       0       100         Examination Time       3 hours       100       100         Examination Time       3 hours       100       100         Examination Time       100       0       100       100         Examination Time       100       0       100       100       100         Examination Time       100       0       100			CLO 3: know	the basics of pathogen	icity and antimicrobial	
CLO 4: Get an insight about microbial genomics and diagnostic microbiology           Credits         Total           Total           4         0         4           Teaching Hours per week         4         0         4           Internal Assessment Marks         30         0         30           End Term Exam Marks         70         0         70           Max. Marks         100         0         100           Examination Time         3 hours			antiviral drugs.	iu various types of antit	acteriai, antifuligar and	
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II       Microbial growth: Microbial growth curve, growth arrest, biofilms:       15         formation and heterogeneity, quorum sensing, culture media, types of media, cultivation of anaerobes, enrichment and isolation of pure cultures, direct measurement of cell numbers, viable counting methods, measurement of cell mass, influence of environmental factors on microbial growth: osmolarity, temperature, pH, oxygen concentration Control of microorganisms by physical and chemical methods       15         III       Antimicrobial chemotherapy: General characteristics of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc       15		PHONS Bacterial Constics: Transformation T	ransduction & C	onjugation		
Improved a growth whereon growth curve, growth unest, oronnalformation and heterogeneity, quorum sensing, culture media, types of media, cultivation of anaerobes, enrichment and isolation of pure cultures, direct measurement of cell numbers, viable counting methods, measurement of cell mass, influence of environmental factors on microbial growth: osmolarity, 	II	Microbial growth: Microbial grow	th curve grou	wth arrest biofilms.	15	
cultivation and neurogeneously, quotient sensing, culture intensity, ppos of intensitycultivation of anaerobes, enrichment and isolation of pure cultures, directmeasurement of cell numbers, viable counting methods, measurement of cellmass, influence of environmental factors on microbial growth: osmolarity,temperature, pH, oxygen concentrationControl of microorganisms by physical and chemical methodsIIIAntimicrobial chemotherapy:General characteristics of antimicrobialdrugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc		formation and heterogeneity, quorum s	ensing, culture r	media, types of media.		
measurement of cell numbers, viable counting methods, measurement of cell mass, influence of environmental factors on microbial growth: osmolarity, temperature, pH, oxygen concentration Control of microorganisms by physical and chemical methods111IIIAntimicrobial chemotherapy: General characteristics of antimicrobial drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc15		cultivation of anaerobes, enrichment and isolation of pure cultures. direct				
mass, influence of environmental factors on microbial growth: osmolarity, temperature, pH, oxygen concentration Control of microorganisms by physical and chemical methods111IIIAntimicrobial chemotherapy: General characteristics of antimicrobial drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc15		measurement of cell numbers, viable c	ounting methods	s, measurement of cell		
temperature, pH, oxygen concentration       Control of microorganisms by physical and chemical methods         III       Antimicrobial chemotherapy: General characteristics of antimicrobial drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc       15		mass, influence of environmental fact	ors on microbia	al growth: osmolarity,		
Control of microorganisms by physical and chemical methods15IIIAntimicrobial chemotherapy: General characteristics of antimicrobial drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc15		temperature, pH, oxygen concentration				
IIIAntimicrobial chemotherapy: General characteristics of antimicrobial15drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc15	TTT	Control of microorganisms by physical	and chemical me	ethods	1.5	
drugs, Factors affecting effectiveness of antimicrobial drugs, Measurement of antimicrobial activity: dilution susceptibility test, disc		Antimicrobial chemotherapy: Gen	eral characteris	tics of antimicrobial	15	
weasurement of antimicrobial activity: dilution susceptibility test, disc		drugs, Factors affecting effecti	veness of a	ntimicrobial drugs,		
diffusion test Etest Machanism of action of antibactorial drugs inhibitors		diffusion test Etest Mechanism of a	ity: dilution substitution of antibast	sceptibility test, disc		

IV	Ministration DNA and a state of the day	0		15
1 V	<b>Witcrobial genomics:</b> DNA sequencing methods:	San	ger DNA sequencing,	15
	reversible chain termination sequencing, Genome s	eque	ncing methods: whole	
	genome shotgun sequencing, next generation geno	omic	sequencing and single	
	cell genomic sequencing, Shotgun metagenomics	c	1 1 .	
	Diagnostic microbiology: Isolation of pathogens	s fro	m clinical specimens:	
	blood, urine, feces, wounds and abscesses, g	enital	specimens, Growth	
	dependent identification methods, various clinical of	liagn	ostic tests for bacteria,	
	antimicrobial drug susceptibility testing			
Food borne infection and food intoxication				
Total Contact Hours				60
	~	_		
	Suggested Evaluation	on N	lethods	
	Suggested Evaluatie Internal Assessment: 30	on N	<u>lethods</u> End Term Exa	mination: 70
> The	Suggested Evaluation Internal Assessment: 30 ory	on N 30	fethods End Term Exa ≻ Theory:	mination: 70 70
<ul><li>The</li><li>Class</li></ul>	Suggested Evaluation Internal Assessment: 30 Ory Participation:	on M 30 5	fethods End Term Exa ≻ Theory: Written Exa	mination: 70 70 amination
<ul> <li>The</li> <li>Class</li> <li>Semin</li> </ul>	Suggested Evaluation Internal Assessment: 30 Ory Participation: har/presentation/assignment/quiz/class test etc.:	on N 30 5 10	Iethods End Term Exa ➤ Theory: Written Exa	mination: 70 70 amination
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> </ul>	Suggested Evaluation Internal Assessment: 30 Ory Participation: har/presentation/assignment/quiz/class test etc.: Cerm Exam:	<b>30</b> 5 10 15	Iethods End Term Exa ➤ Theory: Written Exa	mination: 70 70 amination
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> </ul>	Suggested Evaluation Internal Assessment: 30 ory Participation: har/presentation/assignment/quiz/class test etc.: Ferm Exam: Part C-Learning	on N 30 5 10 15 Reso	Iethods End Term Exa ➤ Theory: Written Exa	mination: 70 70 amination
<ul> <li>The</li> <li>Class</li> <li>Semini</li> <li>Mid-T</li> <li>Recomministic sector (Sector (Sect</li></ul>	Suggested Evaluation Internal Assessment: 30 Ory Participation: Mar/presentation/assignment/quiz/class test etc.: Term Exam: Part C-Learning Intended Books/e-resources/LMS:	on N 30 5 10 15 Reso	Iethods End Term Exa ➤ Theory: Written Exa Durces	mination: 70 70 amination
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> </ul>	Suggested Evaluatie           Internal Assessment: 30           ory           Participation:           part/presentation/assignment/quiz/class test etc.:           Term Exam:           Part C-Learning I           nended Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D./	on N 30 5 10 15 Reso	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow	mination: 70 70 amination n Publishers.
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> </ul>	Suggested Evaluatie           Internal Assessment: 30           ory           Participation:           aar/presentation/assignment/quiz/class test etc.:           Cerm Exam:           Part C-Learning I           nended Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D./           Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M	on N 30 5 10 15 Reso A. Klo	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow         Madigan, J.M. Martinko,	n Publishers. J. Parker (2000)
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> </ul>	Suggested Evaluation           Internal Assessment: 30           ory           Participation:           part/presentation/assignment/quiz/class test etc.:           Perm Exam:           Part C-Learning Improvement/Quiz/class test etc.:           Perm Exam:           Part C-Learning Improvement/Quiz/class test etc.:           Part C-Learning Improvement/Quiz/class           Microbiology by L.M. Prescott. J. P. Harley and D.A           Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M           Prentice Hall International, Inc.	on N 30 5 10 15 Resc A. Klo	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow         Madigan, J.M. Martinko,	n Publishers. J. Parker (2000)
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> <li>3.</li> </ul>	Suggested Evaluation           Internal Assessment: 30           ory           Participation:           part/presentation/assignment/quiz/class test etc.:           Term Exam:           Part C-Learning Improvement/Quiz/class test etc.:           Mathematical Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D.//         Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M         Prentice Hall International, Inc.         The Microbial World, 5th ed. by R.Y. Stainer, J.	on N 30 5 10 15 Reso A. Klo .T. N . L. I	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow         Adigan, J.M. Martinko,         Ingraham, M.L. Wheelis	n Publishers. J. Parker (2000) and P.R. Painter
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> <li>3.</li> </ul>	Suggested Evaluation           Internal Assessment: 30           ory           Participation:           participation:           part/presentation/assignment/quiz/class test etc.:           "erm Exam:           Part C-Learning I           mended Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D.A           Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M           Prentice Hall International, Inc.           The Microbial World, 5th ed. by R.Y. Stainer, J.           Prentice-Hall of India, New Delhi.	on N 30 5 10 15 Resc A. Kla .T. N . L. I	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow         Aadigan, J.M. Martinko,         Ingraham, M.L. Wheelis	n Publishers. J. Parker (2000) and P.R. Painter
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> </ul>	Suggested Evaluatie           Internal Assessment: 30           ory           Participation:           aar/presentation/assignment/quiz/class test etc.:           Term Exam:           Part C-Learning I           aended Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D.A           Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M           Prentice Hall International, Inc.           The Microbial World, 5th ed. by R.Y. Stainer, J.           Prentice-Hall of India, New Delhi.           Microbiology, 5th ed. by M.J. Pelczar, E.C.S. Chan	on N 30 5 10 15 Resc A. Klo .T. N . L. I et al.	Iethods         End Term Exa         ➤ Theory:         ➤ Written Exa         Ources         ein (1990), W M.C. Brow         Adigan, J.M. Martinko,         Ingraham, M.L. Wheelis         Mcgraw-Hill Book Comp	n Publishers. J. Parker (2000) and P.R. Painter bany.
<ul> <li>The</li> <li>Class</li> <li>Semin</li> <li>Mid-T</li> <li>Recomm</li> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> </ul>	Suggested Evaluatie           Internal Assessment: 30           ory           Participation:           aar/presentation/assignment/quiz/class test etc.:           Cerm Exam:           Part C-Learning I           mended Books/e-resources/LMS:           Microbiology by L.M. Prescott. J. P. Harley and D.A           Brock Biology of Microorganisms 9 <sup>TH</sup> ed. by M           Prentice Hall International, Inc.           The Microbial World, 5th ed. by R.Y. Stainer, J.           Prentice-Hall of India, New Delhi.           Microbiology, 5th ed. by M.J. Pelczar, E.C.S. Chan           Microbiology: Fundamental and Applications, 2	on N 30 5 10 15 Resc A. Klo .T. N . L. I et al. cnd e	Iethods         End Term Exa         ➤ Theory:         Written Exa         Ources         ein (1990), W M.C. Brow         Adigan, J.M. Martinko,         Ingraham, M.L. Wheelis         Mcgraw-Hill Book Comp         Max         Max         Max         Mcgraw-Hill Book Comp	n Publishers. J. Parker (2000) and P.R. Painter pany. xwell Macmillan

Session: 2024-25				
	Part .	A – Introduct	ion	
Name of	Programme	M.Sc. Biocher	nistry	
Semester	•	Semester – IV		
Name of	the Course	Pharmacovigi	lance	
Course Code M24-BCH-406				
Course 7	Course Type DEC-4			
Level of	the course	400-499		
Pre-requ	isite for the course (if any)			
Course I	Learning Outcomes (CLO)	CLO 1: Unders	tand the Basics and Terminol	ogy of Adverse
After cor	npleting this course, the learner will	drug reactions a	nd importance of Clinical The	erapeutics.
be able to	):	CLO 2: Learn a	bout Pharmacovigilance and	Clinical Trials.
		CLO 3: Unders	tand the Pharmacovigilance S	System &
		Regulations and	Pharmacovigilance-Sources	of ADRs
		(ICSRs).		
		CLO 4: Learn a	bout MedDRA and Pharmac	ovigilance Risk
	Management.			
Credits	Credits Theory Practical			
	4 0			
Teachin	Teaching Hours per week40			
Internal	Assessment Marks	30	0	30
End Terr	m Exam Marks	70	0	70
Max. Ma	arks	100	0	100
Examina	ttion Time	3 hours	~	
	Part B- C	contents of the	e Course	
Instructio	ons for Paper- Setter: The examin	er will set 9 qu	lestions asking two questions	ons from each
unit and c	me compulsory question by taking computer and the second s	ourse learning of at low	outcomes (CLOs) into cons	sideration. The
evaminee	will be required to attempt 5 que	stions selection	g one question from each	synabus. The
compulso	ry question All questions will carry	equal marks	g one question nom cael	i unit and the
Unit	//////////////////////////////////////	<b>Topics</b>		Contact
		1		Hours
Ι	Adverse Drug Reactions (ADRs) and	<b>Clinical Therap</b>	peutics: Basics and	15
	Terminology representing Adverse drug	g reactions, Type	s of ADRs, Seriousness and	
	severity in ADR, Causality assessment	of ADR, Differen	nce in Expectedness and	
	labelledness, PV plans-National, EMA,	FDA, Significar	ice and Importance of ADR	
тт	reporting, Clinical Therapeutics: Basics	and Its Importan	ice.	15
11	Pharmacovigilance and Clinical Trial	Is: Overview of J	Pharmacovigilance, Standard	15
	Clinical trials: bioethics of drug s	afety pharmac	action of Clinical Research,	
	applications for marketing authorization	n Clinical Trial	Phases Drug Development	
	and Launch. Importance of pharmac	ovigilance in C	linical Trials-Outcome and	
	clinical implications, Pharmacological I	Principal of Clini	cal Research	
III	Pharmacovigilance System & Regula	ations: ICH: Ba	sics and its ImportanceGVP	15
	Guidelines, ICMR, 21 CFR, CION	MS and its in	nportance, NPP (National	
	Pharmacovigilance Program) program	nmes in India,	Awareness regarding NPP	
	programmes			
	Pharmacovigilance-Sources of ADRs	(ICSRs): Adve	rse Event Reporting System	
	and Form, Adverse event reporting-C	nobally, Advers	and NIP/NIS Current status	
	sources of ADKS: Clinical trial, sponta	heous, interature	and MIP/INIS, Current status	
	and knowledge about ADK reporting, C	arrier opportuni	les as Ammales	

IV MedDRA: History and Structure, MedDRA browser, versioning and updating, 15											
terminologies used in MedDRA, MedDRA coding, MedDRA baskets, Use of											
MedDRA in PV databases, Importance of having Global MedDRA terminologies											
Pharmacovigilance Risk Management: Introd	uction	n, Aim	of the R	MP, 1	Risk						
management cycle, Characterization of risks, RM	P coi	ntent ai	nd contribu	tors, F	RMP						
review process, EU RMP versus Core RMP											
			Total Con	tact H	ours	60					
Suggested Evaluati	on N	lethod	s								
<b>Internal Assessment: 30</b>			End Tern	n Exa	minatio	n: 70					
> Theory	30	$\checkmark$	Theory:		70						
Class Participation:	5		Writte	en Exa	aminatio	n					
• Seminar/presentation/assignment/quiz/class test etc.:	10										
• Mid-Term Exam:	15										
Part C-Learning	Reso	ources									
<b>Recommended Books/e-resources/LMS:</b>											
1. Textbook of Pharmacoepidemiology, Edited by	Brian	L. St	orm and	Stephe	en K. K	immel;Wiley					
Blackwell;5th Edition											
2. Pharmacovigilance by Ronald D. Mann, Elizabeth Andrews; Wiley Blackwell; 3rd Edition											
3. Principles and practice of Clinical Research by John.	I Gal	lin.; Ac	ademic Pre	ss;3rd	Edition						
4. Principles and practice of clinical trial medicine by	Richa	rd Cin	and Bruce	Y. Le	e; Acade	mic Press; Ist					
Edition						Edition					

Session: 2024-25				
Part	A – Introduct	ion		
Name of the Programme	M.Sc. Biocher	mistry		
Semester	Semester – IV			
Name of the Course	PC-7			
Course Code	M24-BCH-407			
Course Type	PC-7			
Level of the course	400-499			
Pre-requisite for the course (if any)				
Course Learning Outcomes (CLO)	CLO 1: Learn to	echniques of immunological rel	levance	
After completing this course, the learner will be	CLO 2: Use v	arious bioinformatics tools re	lated to primer	
able to: designing and sequence alignment CLO 3: Understand Homology modelling and 3D- struct determination of proteins			d 3D- structure	
Credits	Theory	Practical	Total	
	0	4	4	
Teaching Hours per week	0	8	8	
Internal Assessment Marks	0	30	30	
End Term Exam Marks	0	70	70	
Max. Marks	0	100	100	
Examination Time   0   4 hours				
Part B- (	Contents of the	Course	Carata at	
Pracu	cais		Hours	
<ul> <li>2. To demonstrate Flow cytometery and Data analysis</li> <li>3. Separation of poly RNA on oligodT column</li> <li>4. Two dimensional gel electrophoresis</li> <li>5. To perform RFLP using restriction enzymes</li> <li>6. Preparation of Master Mix for PCR analysis</li> <li>7. To perform amplification of genes by PCR</li> <li>8. Nucleotides and protein sequence alignment</li> <li>9. Construction of phylogenetic tree and its analysis</li> <li>10. Homology based modelling and structure prediction of a protein</li> <li>11. Finding ORF for a gene</li> <li>12. Primer design using bioinformatic tools</li> <li>13. Molecular docking</li> <li>14. Analysis of gene expression using bioinformatics tools</li> <li>*As per feasibility of practical(s), teacher concerned may conduct additional practical(s) in addition to the present list, which will also be the part of syllabus for evaluation.</li> </ul>				
Internal Assessment: 30	ed Evaluation M	ethods	ion: 70	
Practicum	30	<ul> <li>Practicum</li> <li>70</li> </ul>	10II. / U	
• Class Participation:	5	Lab record, Viva-Voce, v	vrite-up and	
Seminar/Demonstration/Viva-voce/Lab re	cords etc.: 10	execution of the pra	actical	
• Mid-Term Exam:	15			
Part C-I	Learning Reso	burces		
<ol> <li>Recommended Books/e-resources/LMS:</li> <li>Introductory Practical Biochemistry by Sawhney, S.K. and Singh, R. (2000), Narosa Publishing House, India</li> <li>Principles and Techniques of Practical Biochemistry, 6<sup>th</sup> edition by Keith Wilson and John Walker (2000), Cambridge University Press.</li> <li>Physical Biochemistry, 2nd edition, by D Friefelder (1983), W H Freeman and Co., USA.</li> <li>Biophysical Chemistry: Principles and Techniques, 2<sup>nd</sup> edition by A Upadhvav. K Upadhvav and N Nath (1998).</li> </ol>				

4. Biophysical Chemistry: Principles and Techniques, 2<sup>nd</sup> edition by A Upadhyay, K Upadhyay and N Nath (1998),

- Modern Experimental Biochemistry, 3<sup>rd</sup> edition by Boyer, R. (2002), Pearson India 5.
- Fundamentals of Mathematical Statistics, S C Gupta and V K Kapoor, Sultan Chand and Sons. 6.

7. Essential Bioinformatics, Jin Xiong (2007), Cambridge University Press.					
Session: 2024-25					
Part A – Introduction					
Name of the Programme M.Sc. Biochemistry					
Semester	Semester – IV	7			
Name of the Course	PC-8				
Course Code	M24-BCH-40	8			
urse Type PC-8					
Level of the course	ourse 400-499				
Pre-requisite for the course (if any)					
Course Learning Outcomes (CLO) CLO 1: Know the guidelines and equipments for th					
After completing this course, the learner will microbiology laboratory.					
the pure culture techniques					
CLO 2: Get acquainted with the various microbiologic			microbiological		
methods including pure culture techniques and antimicrob			d antimicrobial		
testing					
CLO 3: Quantitatively estimate several metabolites an					
enzymes of clinical relevance					
Credits	Theory	Practical	Total		
	0	4	4		
Teaching Hours per week	0	8	8		
Internal Assessment Marks	0	30	30		
End Term Exam Marks	0	70	70		
Max. Marks	0	100	100		
Examination Time	0	4 hours			
Part B- C	Contents of th	e Course			
Practi	cals		Contact Hours		
1. To study Microbiology laboratory sa	fety rules and gu	idelines	120		
2. To study some of the routinely used of	equipments in m	icrobiology laboratory			
3. Storage of microorganisms and Main	ntenance of pure	culture.			
4. Preparation of solid and liquid media for growth of microorganisms					
5. Isolation of bacteria from soil and maintenance of microorganisms by plating,					
streaking and serial dilution method					
6. To perform slant and stab culture					
[/. To perform Gram staining					
8. Antimicrobial susceptibility testing a	ind MICs determ	ination.			
9. To demonstrate preparation of <i>E. col</i>	<i>i</i> competent cells	s and bacterial transformation			
10. Collection, preservation and physics	ai examination o	t urine sample			

11. Tests for analysis of abnormal urine constituents

12. To determine the blood group and Rh factor of the blood sample

13. Collection, preservation and separation of blood plasma and serum

14. Estimation blood sugar by o-toluidine method

15. To estimate urea in the given blood sample

16. To estimate creatinine in the given serum sample

17. To estimate uric acid in the given serum sample

18. To determine albumin-globulin ratio in blood.

19. Quantitative estimation of SGPT and SGOT in the given serum sample

20. Quantitative estimation of LDH in the given serum sample

\*As per feasibility of practical(s), teacher concerned may conduct additional practical(s) in addition to the present list, which will also be the part of syllabus for evaluation.

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Internal Assessment: 30		End Term Examination: 70			
Practicum	30	Practicum	70		
Class Participation:	5	Lab record, Viva-V	Voce, write-up and		
• Seminar/Demonstration/Viva-voce/Lab records etc.:		execution of	the practical		
• Mid-Term Exam: 15					
Part C-Learning Resources					
Recommended Books/e-resources/I MS·					

## sources/LMS:

1. MicrobiologybyL.M.Prescott.J.P.Harleyand. D.A.Klein7<sup>th</sup> ed.WM.C.BrownPublishers.

- 2. Brock Biology of Microorganisms 15thed. by M.T. Madigan, J.M. Martinko, J. Parker (2015) Prentice Hall International, Inc.
- Laboratory Manual of Microbiology and Biotechnology 2<sup>nd</sup> ed by K.R.Aneja. Scientific International Pvt. Ltd. Manual of Industrial Microbiology and Biotechnology 2<sup>nd</sup> ed. by Demain and Davies (2004) Panima 3.
- 4.
- Practical Manual of Biochemistry (2022) (For medical, Dental and Medical Lab. Technology Studies by 5. Sadhna Sharma and Reema Sharma. MedhTech Science Press
- 6. Microbiology, A laboratory manual 7th ed. Cappuccino and Sherman (2005) Pearson Education Inc.

Session: 2024-25					
	Part	A – Introduct	ion		
Name of	Programme	M. Sc. Bioche	mistry		
Semester	r	Semester- IV			
Name of	f the Course	Entrepreneurship skills in Biochemistry			
Course	Code	M24-EEC-409			
Course '	Гуре	EEC			
Level of	of the course 400-499				
Pre-requisite for the course (if any)					
Course	Learning Outcomes (CLO)	CLO 1: Learn the	basics of Entrepreneurship and	their types	
After con	mpleting this course, the learner will	CLO 2: Understa	nd the business models and mapp	ping of key	
be able t	0:	components of bi	ochemistry business	1	
		CLO 3: Learn the CLO 4: Know ab	out the regulatory considerations	and regulatory	
<i>a</i> 11		bodies			
Credits		Theory	Practical	Total	
		2	0	2	
Teachin	ng Hours per week	2	0	2	
Internal	Assessment Marks	15	0	15	
End Ter	m Exam Marks	35	0	35	
Max. M	arks	50	0	50	
Examina	ation Time	3 hours	~		
	Part B- C	Contents of the	e Course		
unit and o compulso examinee compulso	one compulsory question by taking corry question (Question No. 1) will corry will be required to attempt 5 que bry question. All questions will carry	ourse learning of consist of at le stions, selectin equal marks.	outcomes (CLOs) into cons ast 4 parts covering entire ag one question from each	ideration. The syllabus. The unit and the	
Unit		Topics		Contact	
				Hours	
Ι	Introduction: Definition and importan	ce of entreprene	eurship in biochemical/ life	8	
	sciences and technological fields.		_		
	<b>Types of entrepreneurships:</b> Academentrepreneurship	mic, social, cor	porate and small business		
	Identification of needs and market	gaps in bioch	emistry related fields by		
	competitive analysis and customer iden	ntification in dif	ferent segments of society.		
	Checking and evaluating the feasibility	of any potent bu	siness idea.	_	
II	Business models: B2B, B2C, Licensing	and partnership	s, Customer value creation	7	
	Mapping of key components of biocher	mistry business,	Vision and mission for any		
TTT	business idea, SWOT analysis			0	
<b>Funding:</b> types of funding and financial plan, preparing financial statements,			0		
	<b>Product development:</b> from idea to	et and cash now	ict role of research and		
development in biochemistry start ups, quality control of product(s), marketing					
distribution and scaling of the business. Networking and leveraging with industries					
IV	Regulatory considerations and regu	ilatory bodies:	FDA, EMA, FSSAI and	7	
	others	<b>j</b>	, ,		
	IPR and ethics: Licensing and techn	nology transfer	agreements, sustainability,		
	green technologies and start-ups				
	~ ~ ~		Total Contact Hours	30	
	Suggester	1 Evaluation N	lethods		
	Internal Assessment: 15		End Term Examin	ation: 35	

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> Theory	15	$\succ$	Theory:	35
Class Participation:	4		Written Ex	amination
• Seminar/presentation/assignment/quiz/class test etc.:	4			
• Mid-Term Exam:	7			
Part C-Learning Resources				
Recommended Books/e-resources/LMS:				
1. Practical Skills in Biochemistry by Ghalaut and Dahiya (2014) (Saurabh Medical Publishers)				
2. Zero to One: Notes on Startups, or How to Build the Future by Peter Thiel & Blake Masters				
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