KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

DEPARTMENT OF BIOCHEMISTRY (UG)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)
(2022 – 2023 ONWARDS)

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE- 641029

DEPARTMENT OF BIOCHEMISTRY (UG)

Vision:

- To promote goal-oriented innovative teaching, interdisciplinary research by interfacing biochemistry with modern and applied biology to address problems affecting human health and welfare.
- Training scholars to be the next generation scientists

Mission:

- To generate new knowledge by teaching and engaging in cutting edge research and to promote academic growth by offering state of the art under graduate, post graduate and doctoral programmes.
- To identify, based on an informed perception of regional and global needs, area of specialization upon which the department can concentrate.
- To undertake collaborative projects which offer opportunities for long term interaction with academia and industries

PROGRAMME OUTCOME (PO)

PO1: To presume, question and evaluate, solve problems, integrate knowledge and widenperspective.
PO2: To understand that communication comprises attentiveness and listening, reading and comprehension, to communicate and collect information through oral and written formats. PO3: To apply contemporary research methods, skills and techniques in a scientific discipline.
PO4: To reveal empathetic social concern and national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO5: To understand the issues of environmental contexts and sustainable development and toengage in independent and life-long learning.
PO6: To acquire a broad foundation in chemical processes that stresses scientific reasoning and analytical problem solving with a molecular and biological perspective.
PO7: To develop the ability to think logically and clearly by articulation of thoughts, criticalevaluation of experimental data and scientific literature.
PO8: To inculcate research culture in consonance with current trends in the field of biochemistry soas to develop broad scientific knowledge in the students.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1: Understanding of structure and metabolism of macromolecules, regulation and disorders of metabolic pathways.
PSO2: Investigate the impact of science in society and plan to pursue research

PSO3: Gain proficiency in laboratory techniques in both Biochemistry and Molecular biology and be able to apply the scientific method to the processes of experimentation and hypothesis testing.
PSO4: Understand the application of Biochemistry in clinical laboratory.
PSO5: Acquire thorough knowledge in biochemical techniques, immunology, physiology, molecular biology, genetic engineering and biotechnology.

UBC 1

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE – 641 029

Course Name: B.Sc Biochemistry

Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2022-2023)

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam	Credits
					CIA	ESE	TOTAL		
I	I	22TML101	Language I@	6	50	50	100	3	3
	II	22ENG101	English –I	6	50	50	100	3	3
	III	22UBC101	CorePaper1-Chemistryof Biomolecules	7	50	50	100	3	6
	III	-	Core Practical I- Biochemistry	2	-	-	-	-	-
	III	22UZO1A1	Allied Paper 1 –Zoology I	5	30	45	75	3	4
	III	-	Allied Practical I – Zoology	2	-	-	-	-	-
	IV	22EVS101	Environmental Studies **	2	-	50	50	3	2
	Total			**30**	-	-		-	
II	I	22TML202	Language II@	6	50	50	100	3	3
	II	22ENG202	English –II	6	50	50	100	3	3
	III	22UBC202	CorePaper2– Bio analytical Techniques	7	50	50	100	3	6
	III	22UBC2CL	Core Practical 1 – Biochemistry	2	50	50	100	3	2
	III	22UZO2A2	Allied A2 – Zoology II	5	30	45	75	3	4
	III	22UZO2AL	Allied Practical I – Zoology	2	25	25	50	3	2
	IV	22VED201	Value Education- Moral and Ethics**	2	-	50	50	3	2
	Total			**30**	-	-		-	
III	I	22TML303	Language III@	6	50	50	100	3	3
	II	22ENG303	English –III	6	50	50	100	3	3
	III	22UBC303	Core Paper 3–Enzyme and Enzymes Technology	4	50	50	100	3	5
	III	-	Core Practical 2 Biochemistry	3	-	-	-	-	-
	III	22UCH3A3	Allied Paper B1 – Chemistry I	5	30	45	75	3	4
		-	Allied Practical 2 – Chemistry	2	-	-	-	-	-
	IV	22UGC3S1	Skill Based subject 1- Cyber security*	2	100	-	100	2	3
	IV	22TBT301/22TAT 301/22UHR3N1	Basic Tamil* / Advanced Tamil**/ Non-major elective- I**	2	-	75	75	3	2
	Total			**30**	-	-		-	

IV	I	22TML404	Language IV@	6	50	50	100	3	3
	II	22ENG404	English –IV	6	50	50	100	3	3
	III	22UBC404	Core Paper 4– Intermediary Metabolism	4	50	50	100	3	4
	III	22UBC4CM	Core Practical 2 – Biochemistry	3	50	50	100	3	2
	III	22UCH4A4	Allied B2 – Chemistry II	5	30	45	75	3	4
	III	22UCH4AL	Allied Practical 2 – Chemistry	2	25	25	50	3	2
	IV	22UBC4S2	Skill Based Subject 2- Techniques in Biotechnology	2	50	50	100	3	3
	IV	22TBT402/22TAT 402/22UWR4N2	Basic Tamil* / Advanced Tamil**/ Non-major elective- II**	2	-	75	75	3	2
	Total			**30**				-	
	III	22UBC505	Core Paper 5- Human Physiology & Endocrinology	4	50	50	100	3	4
V	III	22UBC506	CorePaper6– Cell Biology	4	50	50	100	3	4
	III	22UBC507	Core Paper 7– Clinical Biochemistry	4	50	50	100	3	4
	III	22UBC508	Core Paper 8 – Molecular Biology	4	50	50	100	3	4
	III	22UBC5E1	Major Elective 1	4	50	50	100	3	5
	III	-	Core Practical 3 – Biochemistry	4	-	-	-	-	-
	III	-	Core Practical 4 – Biochemistry	2	-	-	-	-	-
	III	-	Core Practical 5 – Biochemistry	2	-	-	-	-	-
	IV	-	**Extra Departmental Course (EDC)***	2	100	-	100	3	3
	-	**22UBC5IT**	**Internship Training ******	Grade					
	Total			**30**	-	-		-	
VI	III	22UBC609	Core Paper 9– Plant Biochemistry	4	50	50	100	3	4
	III	22UBC610	Core Paper 10– Immunology and Immuno Techniques	4	50	50	100	3	4
	III	22UBC611	Core Paper 11– Genetic Engineering	4	50	50	100	3	4
	III	22UBC6E2	Major Elective 2	4	50	50	100	3	5
	III	22UBC6CN	Core Practical 3 – Biochemistry	4	50	50	100	4	3
	III	22UBC6CO	Core Practical 4 – Biochemistry	2	50	50	100	2	2
	III	22UBC6CP	Core Practical 5 – Biochemistry	2	50	50	100	2	2
	III	22UBC6Z1	Project***	4	50	50	100	-	5
	IV	22UBC6S3	Skill Based Subject 3- Techniques in Genomics and Proteomics	2	50	50	100	3	3
	Total			**30**	-	-		-	
	V	22NCC[$]/NSS/YRC/ PYE/ECC/RRC/ WEC101#	Co curricular Activities*	-	50	-	50	-	1
Grand Total				**-**	**1820**	**1980**	**3800**	**-**	**140**

UBC 2

Note :

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

$ For those students who opt NCC under Co curricular activities will be studying the prescribed syllabi of the UGC which will include Theory, Practical & Camp components. Such students who qualify the prescribed requirements will earn an additional 24 credits.

@ Hindi/Malayalam/ French/ Sanskrit – 22HIN/MLM/FRN/SAN101 - 404

***** - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

******- No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

*** Project Report – 30 marks; Viva voce – 20 marks; Internal-50 marks

**** The students shall undergo an Internship training / field work for a minimum period of 2 weeks at the end of the ~~fourth~~ semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the respective Faculty. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85 – 100	O
70 – 84	D
60 – 69	A
50 – 59	B
40 – 49	C
< 40	U (Reappear)

UBC 3

Major Elective Papers
(2 papers are to be chosen from the following 6 papers)

1. Microbiology
2. Basics of Bioinformatics
3. Biopharmaceuticals
4. Dairy Biochemistry
5. Biostatistics
6. Nutritional Biochemistry

Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

Sub. Code & Title of the Extra Departmental Course (EDC) :

22UBC5X1 – Human Diseases and Health care

 # List of Co curricular Activities:

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Note: In core/ allied subjects, no. of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below.

UBC 4

Tally Table:

S.No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/ French/ Sanskrit	400	12
2.	II	English	400	12
3.	III	Core – Theory/Practical	1600	60
		Allied	400	20
		Electives/Project	300	15
4.	IV	Basic Tamil / Advanced Tamil (OR) Non-major electives	150	4
		Skill Based subjects	300	9
		EDC	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Co curricular Activities	50	1
		Total	**3800**	**140**

- 50 % CIA is applicable to all subjects except JOC, SBS -1 & EDC.
- The students should complete a **SWAYAM-MOOC** before the completion of the 5th semester and the course completed certificate should be submitted through the HoD to the Controller of Examinations.
- Two extra credits will be given to the candidates who have successfully completed.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

UBC 5

Components of Continuous Internal Assessment (50 Marks)

Components		**Marks**	**Total**
Theory			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
Attendance		5	
Others*		5	
Practical			
CIA Practical		50 converted to 30	50
Observation Notebook		15	
Attendance		5	
Project			
Review		45	50
Regularity		5	

Components of Continuous Internal Assessment (30 Marks & 25 Marks)

Components		**Marks**	**Total**
Theory			
CIA I	45	(45) converted to15	30
CIA II	45		
Problem based Assignment**		5	
Attendance		5	
Others*		5	
Practical			
CIA Practical		25 converted to 10	25
Observation Notebook		10	
Attendance		5	

*****Class Participation, Case studies Presentation, Field work, Field Survey, Group Discussion, Term Paper, Workshop/ Conference Participation. Presentation of Papers in Conferences, Quiz, Report/ Content writing. etc.

****** Two Assignments to be given. (Each 5 marks).

UBC 6

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering; **K2**-Understanding; **K3**-Applying; **K4**-Analyzing; **K5**-Evaluating

1. Theory Examination - Part I, II& III

(i) CIA I & II and ESE:75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/Fill ups-5/One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 – K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive / Detailed	

****For 75 marks converted to 50 marks.**

(ii) CIA I & II and ESE: 45 Marks

Knowledge Level	Section	Marks	Description	Total
K1 – K2 Q1 to 10	A (Answer all)	10 x 0.5 = 5	MCQ	45
K2 – K5 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 5 = 25	Descriptive / Detailed	

2. Practical Examination:

(i) 50 Marks

Knowledge Level	Section	Marks	Total
K3	Experiments	40	50
K4	Record Work	10	
K5			

(ii) 25 Marks

Knowledge Level	Section	Marks	Total
K3	Experiments	20	25
K4	Record Work	5	
K5			

3. Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3 K4 K5	Project Report	30	50
	Viva voce	20	

UBC 8

22UBC101

Programme Code: 07		**B.Sc. Biochemistry**		
Course Code: 22UBC101		**Core Paper 1 – CHEMISTRY OF BIOMOLECULES**		
Batch 2022-2023	Semester I	Hours / Week 7	Total Hours 105	Credits 6

Course Objectives

i) To learn the chemistry and structure of different biomolecules
ii) To understand the biological significance of different biomolecules
iii) To learn the Elementary treatment on structure of proteins.

Course Outcomes (CO)

K1 to K5	CO1	Define the functions and properties of carbohydrates, lipids, amino acids, proteins and nucleic acids
	CO2	Classify the biomolecules according to their structures
	CO3	Sketch the basic structure of biomolecules and reactions involving them
	CO4	Distinguish different types of sugars, fats, amino acids and proteins based on the physical, chemical and biological aspects
	CO5	Describe the various types of nucleic acids and their structures

Total hours:105

UNIT I (21 hrs)

Carbohydrates

Carbohydrates: Definition and Classification. Monosaccharides – Structural aspects-asymmetric carbon atom, D and L isomers, anomers, optical activity and mutarotation. Epimers: pyranose and furanose forms, aldo and keto forms, classification, definition, structure and biological importance.

Hexoses: glucose, fructose, galactose and mannose. Pentoses: Ribose and deoxyribose. Disaccharides: Maltose, sucrose and lactose.

Polysaccharides: Homopolysaccharides:-Starch, glycogen, cellulose, inulin and chitin, Heteropolysaccharides:- Heparin, hyaluronic acid, chondroitin sulphates. Reactions of monosaccharides- Oxidation of glucose (aldonic acid, aldaric acid and uronic acid).

Action of alkalies with sugars, reducing action of sugars in alkaline solution and reaction with phenyl hydrazine.

UBC 9

UNIT II (21 hrs)

Lipids:

Classification, properties and functions of lipids. Types of fatty acids: saturated and unsaturated Essential fatty acids. Classification and significance of phospholipids: Phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl serine, phosphatidyl inositol and sphingomyelin.

Classification and significance of glycolipids: Cerebrosides and gangliosides. Classification and functions of lipoproteins*. Structure and biological functions of cholesterol.

UNIT III (21 hrs)

Amino acids:

Introduction; definition; classification of amino acids based on structure, side chain metabolism and nutritional requirements. Properties of amino acids – ampholyte and isoelectric point, optical activity. General reactions of amino acids: due to carboxylic group – decarboxylation and amide formation; due to amino group – transamination and oxidative deamination; due to side chain– transmethylation and ester formation.

UNIT IV (21 hrs)

Proteins:

Introduction, general properties, classification and functions. Bonds relating to protein structure – strong bonds (peptide and disulphide bonds) - weak bonds (hydrogen and hydrophobic bonds).

Basic concepts on structure of proteins – primary, secondary, tertiary and quaternary structure. Denaturation and Renaturation. The amino acid substitution disorder eg. Sickle cell anemia.

UNIT V (21 hrs)

Nucleic acids:

Introduction; Types of nucleic acids; Structure of purine (A and G) and pyrimidine (C,U,T, dihydrouridine and pseudo uridine) bases.

Structure of nucleotides – AMP, dAMP, GMP, dGMP, CMP, dCMP , TMP , UMP. Structure of DNA – Watson and Crick model.

Structure of RNA – mRNA, tRNA and rRNA. Denaturation and Renaturation.

UBC 10

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books

1. U. Satyanarayana and U. Chakrapani (2013). Biochemistry. Elsevier and Books & Allied (P)Ltd. Kolkata.
2. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7th ed., Published by the Author, Chennai – 600035.
3. Deb, A.C. (2011), Fundamentals of Biochemistry, 10th ed., New Central Book Agency Pvt. Ltd., Kolkata 700009.

Reference Books

1. Voet, D., Voet, J.G. and Pratt, C.W. (2013), Fundamentals of Biochemistry, Life at the Molecular Level, 4th ed., John Wiley & Sons, New Delhi,110002.
2. Harper, David a Bender (2015) ,Text book of Harper illustrated Biochemistry, Mc graw hill education, Newyork.
3. APA. Nelson, D. L., & Cox, M. M. (2017). Lehninger principles of biochemistry (7th ed.). W.H. Freeman, Chicago.
4. Vasudevan, DM., Sreekumari, S. and Kannan Vaidyanathan (2011), Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.
5. Robert K. Murray, Daryl K. Grannerand Victor W.Rodwell (2008), 29th ed.,Harper"sIllustrated Biochemistry. McGraw Hill Companies, Inc. New Delhi.
6. J.L.Jain, Sanjay Jain and Nitin Jain, 1997, "Fundamentals of. Biochemistry" (6th. Edition) New Delhi.

** Questions may also be taken from the self-study portion*

UBC 11

22UBC101

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	S	H	S	M	S
CO3	S	H	H	S	H
CO4	H	S	S	H	M
CO5	S	H	S	H	M

S– Strong **H** – High **M**– Medium **L** –Low

Programme Code: 07		B.Sc. Biochemistry		
Course Code: 22UBC202		Core Paper 2- BIOANALYTICAL TECHNIQUES		
Batch 2022-2023	Semester II	Hours / Week 7	Total Hours 105	Credits 6

Course Objectives

1. To know the various types of buffer systems in blood and plasma and its significance in the maintenance of blood pH
2. To understand the principle, materials, methods and applications of chromatography, electrophoresis and colorimetry.
3. To detect and measure the radioactivity and explore its role in biological and clinical fields.

Course Outcomes (CO)

K1 to K5	CO1	Recall the definition of acids, bases and buffers.
	CO2	Describe the various buffer systems present in blood and plasma, and their role in maintaining the blood pH and various bioanalytical techniques.
	CO3	Demonstrate the types and techniques of chromatography, electrophoresis and colorimetry.
	CO4	Analyze the separated/purified components from the samples by chromatography, electrophoresis and colorimetry.
	CO5	Describe the radioactivity types and their applications.

Total Hours: 105

UNIT I (21 hrs)

Acids, bases, pH scale, ionization-pKa, derivation of Henderson - Hassel Balch equation for acids and bases, buffer solutions, buffer systems of blood and RBC, hemoglobin buffer system. pH indicators.

pH meter. Various ways of expressing the concentrations of solutions – normality, molarity and percentage solution*

UNIT II (21 hrs)

Chromatography: Principle, technique and applications of paper, thin layer, column, ion exchange, molecular sieve and affinity chromatography. HPLC- technique and applications.

UNIT III (21 hrs)

Electrophoresis: Principle, factors affecting, instrumentation and applications of agarose gel, SDS-PAGE, isoelectric focusing and immune electrophoresis.

Centrifugation – Svedberg unit, Types-density gradient, differential and ultra-centrifuge.

UNIT IV (21 hrs)

Colorimetry –Derivation of Lambert's and Beer law, principle, components, instrumentation and working of a single cell photo electric colorimeter, UV and IR spectrophotometer. Comparison and applications of colorimeter and spectrophotometer. Gas Chromatography- Mass Spectrometry (GCMS)

UNIT V (21 hrs)

Radioactivity: Types of Radioactive decay, Units of radioactivity (Curie, Rutherford and Becquerrel), detection and measurement of radioactivity by scintillation counter – solid and liquid scintillators, counting efficiency and factors affecting counting efficiency. Advantages and disadvantages of scintillation counting. Autoradiography and applications. Applications of radioisotopes in medical diagnosis, archeology, industries and agriculture.

Chalk and Board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Teaching Method

Text Books:

1. Asokan, P (2006), Basics of Analytical Biochemical Techniques, Chinna Publications. Melvisharam, Tamil Nadu.
2. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7thed., Published by the Author, Chennai – 600035.
3. Jayaraman. J. (2011), Laboratory Manual in Biochemistry, 2nd edition, New age International Pvt, Delhi

Reference Books:

1. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New Age International Publishers Ltd, NewDelhi
2. Skoog. D.A., West. D.M, James H. F., Crouch. S.R., (2008), Fundamentals of Analytical Chemistry, 4th edition, Barkha Nath Printers, India.
3. Wilson. K. and Walker. J. (2011), Principles and Techniques of Biochemistry and Molecular Biology, 7thed, Cambridge University Press, New York.
4. David. T. Plummer, (2004), An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.
5. APA. Nelson, D. L., & Cox, M. M. (2017). Lehninger principles of biochemistry (7th ed.). W.H. Freeman, Chicago.
6. E.J.Wood (1989) Practical Biochemistry colleges, Elsevier, Pergamon.

**Question may also be taken from self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	H	S	M	S	S
CO3	S	H	H	S	H
CO4	H	H	S	S	H
CO5	H	H	S	S	H

S–Strong **H** – High **M**– Medium **L** – Low

UBC 15

22UBC2CL

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC2CL		**C.Pr.1. BIOCHEMISTRY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	I & II	2	60	2

Course Objectives

- To acquire skill of analyzing carbohydrates and amino acids.
- To provide practical knowledge about the characterization of lipids.
- To learn the methodology of separation of amino acids by paper chromatography.

Course Outcomes (CO)

K3 to K5	CO1	Learn the reagent preparation methods for qualitative analysis of biomolecules
	CO2	Practice the qualitative analysis of different carbohydrates and amino acids through individual experiments
	CO3	Practice the qualitative analysis of different amino acids through individual experiments
	CO4	Calculate iodine number of lipids, thereby characterizing them
	CO5	Assess the separation technique of amino acids through paper chromatography

Analysis of Biomolecules

I. Qualitative Analysis of Carbohydrates

a. Monosaccharides -Hexoses: Glucose and fructose. Pentose: Arabinose

b. Disaccharides -Sucrose and Lactose

c. Polysaccharides -Starch

22UBC2CL

II. Qualitative Analysis of Amino acids

a. Arginine

b. Histidine

c. Tyrosine

d. Tryptophan

e. Cysteine

III. Characterization of Lipids (Group Experiment)

Determination of Iodine number

IV. Separation Technique (Demonstration)

Separation of amino acids by paper chromatography

Reference Books:

1. Jayaraman. J. (2011), Laboratory Manual in Biochemistry, 2nd edition, New age International Pvt, Delhi
2. Gupta. R.C and Bharghava. S (2013), Practical Biochemistry, 5th edition, CBS Publishers and Distributors, New Delhi.
3. David. T. Plummer, (2004), An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill Publishing Company Ltd, NewDelhi.
4. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New Age International Publishers Ltd, NewDelhi.
5. E.J.Wood (1989) Practical Biochemistry colleges, Elsevier, Pergamon.
6. J.L.Jain, Sanjay Jain and Nitin Jain, 1997, "Fundamentals of. Biochemistry" (6th. Edition) New Delhi.

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22UBC2CL

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	S	M
CO2	S	S	S	S	H
CO3	S	S	H	S	H
CO4	H	S	S	H	S
CO5	S	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 18

22UBC303

Programme Code:07		**B.Sc. Biochemistry**		
Course Code: 22UBC303		**Core Paper III – ENZYMES AND ENZYME TECHNOLOGY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	III	4	60	5

Course Objectives

1. To perceive knowledge about enzymes and their kinetics.
2. To study about the coenzymes and their roles in the biological system.
3. To know about the recent enzyme technologies and their applications for diagnostic purpose.

Course Outcomes (CO)

K1 To K5	CO1	Remember the role of enzymes in biological system
	CO2	Acquire thorough knowledge on the enzyme kinetics and inhibition.
	CO3	Deploy the properties and functions of coenzymes and cofactors.
	CO4	Analyze the biological importance of immobilized enzymes and applications
	CO5	Understand the types of biosensors, and Artificial enzymes

Total Hours: 60

UNIT I (12 hrs)

Enzymes: Introduction, Definition, International Classification of enzymes, Numbering and nomenclature. Enzyme unit (IU). Principles of enzyme catalysis. Definition of active sites. Theories proposed – Lock and Key or template model and induced fit model, ordered and random binding of substrate. Enzyme specificity – Group specificity and optical specificity. Turnover number. Enzyme activity and factors affecting the rate of enzyme activity – effect of temperature, pH, enzyme concentration and substrate concentration.

UNIT II (12hrs)

Enzyme Kinetics: Derivation of Michalies -Mentons equation, transformation of MM equation, Line-Weaver Burk plot. Regulatory enzymes, allosteric enzymes. Enzyme inhibition: competitive, non-competitive and uncompetitive enzyme inhibition. Feedback inhibition.

22UBC303

UNIT III (12 hrs)

Coenzymes: Definition; structure and functions of thiamine pyrophosphate, nicotinamide adenine dinucleotide, nicotinamide adenine dinucleotide phosphate, Flavin mono nucleotide, Flavin adenine dinucleotide, coenzyme A, lipoic acid, biotin and folate coenzymes. Cofactors**:** Definition and Examples*

UNIT IV (12 hrs)

Enzyme technology: Immobilized enzymes: sources and techniques of immobilization – adsorption, entrapment, microencapsulation, covalent binding and cross linking. Choice of immobilization techniques. Industrial, analytical and medicinal applications of immobilized enzymes. Uses of enzymes in analysis: Enzymes of diagnostic importance, Isoenzymes: Definition with example– Lactate dehydrogenase. ELISA.

UNIT V (12hrs)

Biosensors: Principle, types and components of Colorimetric, potentiometric and optical immune sensors, Artificial enzymes: abzymes, synzymes and ribozymes.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

UBC 20

Text Books:

1. Anil Kumar & Sarika Garg, (2015), Enzymes and Enzyme Technology, Viva books, New delhi**.**

2. U. Sathyanarayana (2013). Biochemistry 4th edition. Elsevier health sciences. Elsevier India.

3. Martinek, R.: Practical Clinical Enzymology: *J. Am. Med. Tech., 31,* 162 (1969).

Reference Books:

1. D. Balasubramanyam, CFA. Bryce, K. Dharmalingham, J. Green, Kunthala Jayaraman, (2007), Concepts in Biotechnology, Universities Press (India) Pvt Ltd, Hyderabad.
2. Talwar. G.P (2012), Text book of biochemistry and Human Biology, 3rd edition, Prentice Hall of India Private Ltd, New Delhi.
3. EE. Conn and PK. Stumpf, G. Bruening and RY. Doi (2010), Outlines of biochemistry, 5th ed, John Wiley and Sons, New York, USA.
4. David L Nelson, Micheal M Cox(2008), Lehninger‟s Principles of Biochemistry, Replikapress (P) Ltd, India.
5. Palmer & Bonner (2007).Enzymes, Biochemistry, Biotechnology, Clinical Chemistry, 2nd Ed, Elsevier publications, India.
6. Nicholas C. Price and Lewis Stevens (2003). Fundamentals of enzymology. Oxford university press. New York. USA.

* *Questions may also be taken from the self-study portion*

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22UBC303

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	S
CO2	S	S	S	S	S
CO3	S	H	H	S	H
CO4	H	H	S	S	S
CO5	H	S	S	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 22

22UBC404

Programme Code: 07		**B. Sc Biochemistry**		
Course Code: 22UBC404		**Core Paper 4–INTERMEDIARY METABOLISM**		
Batch 2022-2023	Semester IV	Hours/Week 4	Total Hours 60	Credits 4

Course Objectives

1. To learn the fate of dietary carbohydrates, proteins and lipids.
2. To study the various catabolic and bio synthetic pathways of bio molecules and their significance.
3. To understand the inter relationship between carbohydrate, protein and fat metabolism.

Course Outcomes (CO)

K1 to K5	CO1	Understand the various metabolic pathways of carbohydrates, proteins, fat and nucleic acid metabolism
	CO2	Remember the glycolysis, TCA cycle, Glycogenesis, glycogenolysis, β-oxidation, phospholipid biosynthesis, Urea cycle, Nucleic acid biosynthetic pathway and degradation of purine and pyrimidine
	CO3	Assessment of Bio 25nergetic of various metabolism pathways, role of inhibitors and uncouple electron transport chain
	CO4	Analysis of regulation of various metabolic pathways and their significance
	CO5	Acquire the knowledge of purine and pyrimidine metabolism and biological significance of uric acid and β-amino isobutyrate.

Total Hours : 60

UNIT I (12hrs)

Overview of metabolism: Definition; types of metabolic pathways. Fate of absorbed carbohydrates. Glycolysis: definition; significance; pathway; energy yield from glycolysis; regulation of glycolysis. Cori's cycle. Metabolic fate of pyruvate.

TCA Cycle:-reactions of the cycle; bioenergetics; amphibolic pathway; anaplerotic role of TCA cycle.

Pathway of glycogenesis and glycogenolysis; gluconeogenesis: definition; significance; pathway; substrates for gluconeogenesis; regulation of gluconeogenesis.

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UNIT II (12hrs)

Biological oxidation: Introduction, high energy compounds, redox potentials; electron transport chain: overview; mitochondrial organization; structural organization of respiratory chain; oxidative phosphorylation; mechanism of oxidative phosphorylation–chemi osmotic hypothesis. Uncouples of oxidative phosphorylation. Transport of reducing equivalents – glycerol-phosphate shuttle and malate–aspartate shuttle.

UNIT III (12hrs)

Introduction to lipids. Oxidation of fatty acids: Carnitine cycle; Beta–oxidation, alpha oxidation and omega oxidation.

Biosynthesis of saturated fatty acids: Extra mitochondrial and microsomal system for synthesis of fatty acids. Inter conversion of fatty acids. Bio synthesis and degradation: Lecithin, cephalin, phosphatidylinositol and phosphatidylserine. Plasma lipoproteins (Composition).Bio synthesis of glycolipids.*

UNIT IV (12hrs)

Amino acid pool, overview of amino acid metabolism–deamination (oxidative and non- oxidative), transamination, de carboxylation. Urea cycle. Metabolism of individual amino acids – glycine, phenylalanine and tyrosine.

UNIT V (12hrs)

Interrelationship between carbohydrate fat and protein metabolism. Metabolism of purines: *de novo* synthesis, salvage pathway, catabolism and regulation. Metabolism of pyrimidines: *de novo* synthesis, salvage pathway, catabolism and regulation. Conversion of ribonucleic acid to deoxyribonucleic acid, allopurinol. Biological significance of uric acid and β-amino isobutyrate.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

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Text Books:

1. Deb, A.C. (2011), Fundamentals of Biochemistry, 10th ed., New Central Book Agency Pvt.Ltd., Kolkata700 009.
2. Satyanarayana, U.and Chakrapani, U. (2013) Biochemistry, 4th ed., Books and Allied Pvt. Ltd,Kolkata,700010.
3. Harper's (2018), Illustrated Biochemistry, 31st ed., Victor W. Rodwell publisher, New Delhi.

Reference Books:

1. Robert K. Murray, Daryl K. Granner and Victor W. Rodwell (2008), Harper's Illustrated Biochemistry,29thed,McGraw Hill Companies, Inc. New Delhi.
2. Vasudevan D.M., Sreekumari S. and Kannan Vaidyanathan (2011), Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.
3. Moran, Horton, Scrimgeour, Perry& Rawn (2013), Principles of Biochemistry, 5th edition. Pearson New International Edition, UK.
4. Jain J.L, Fundamentals of Biochemistry, (2018), S. Chand & Company Ltd, New Delhi.
5. Biochemistry, D. Voet and J.G. Voet (2004), 3rd ed.. John Wiley and Sons Inc
6. Biochemistry, J.M. Berg, J.L. Tymoczko and L. Stryer (2007), 5th ed., W.H. Freeman & Co.

**Questions may also be taken from the self-study portion*

UBC 25

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	H
CO2	H	S	S	H	S
CO3	S	S	S	H	S
CO4	S	S	S	S	S
CO5	S	H	S	H	S

S–Strong H–High M–Medium L–Low

UBC 26

22UBC4CM

Programme Code: 07		**B.Sc. Biochemistry**		
Course Code: 22UBC4CM		**Title: C.Pr.2 BIOCHEMISTRY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	III & IV	3	90	2

Course Objectives

1. To perceive knowledge about λ max of the substances.
2. To learn about the methods to quantify the components colorimetrically.
3. To learn about the factors influencing the enzyme activity.

Course Outcomes (CO)

K1 to K5	CO1	Recalling the preparation of reagents.
	CO2	Understanding the principles of techniques.
	CO3	Carrying out the experiments using various techniques.
	CO4	Techniques are used to analyze the components both qualitatively and quantitatively.
	CO5	Carrying out the experiments using various enzymes factors

List of Programs

1. COLORIMETRY

1. Estimation of glucose - Ortho-Toluidine method.

2. Estimation of Phosphorus - Fiske & Subbarrow method.

3. Estimation of urea – DAM – TSC method.

4. Estimation of protein - Lowry's method.

5. Estimation of creatinine – Alkaline- Picrate method.

6. Estimation of uric acid - Caraway method.

22UBC4CM

2. PREPARATION OF BUFFER SOLUTIONS [Group experiment]

1. Determination of pH using pH meter.
2. Preparation of buffer solutions.
   a. Acetate buffer - pH range- 3.6 -5.6.
   b. Phosphate buffer - pH range- 5.8 -8.0.

3. ENZYMOLOGY

a. Effect of pH on the activity of **acid phosphatase**

b. Effect of temperature on the activity of **acid phosphatase**

c. Effect of enzyme concentration on the activity of **acid phosphatase**.

d. Effect of substrate concentration on the activity of **acid phosphatase**

e. Determination of **acid phosphatase** activity

4. TECHNIQUE (Demonstration Experiments)

1. Determination of absorption maximum (λ max) of any two biochemical substances using UV-VISIBLE Spectrophotometer.
2. Identification of DNA using UV –VISIBLE Spectrophotometer.

Reference Books

1. Jayaraman. J. (2011), Laboratory Manual in Biochemistry, 2nd edition, New age International Pvt, Delhi
2. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New Age International Publishers Ltd, NewDelhi.
3. Martinek, R.: Practical Clinical Enzymology: *J. Am. Med. Tech., 31,* 162 (1969).
4. Gupta. R.C and Bharghava. S (2013), Practical Biochemistry, 5th edition, CBS Publishers and Distributors, New Delhi.
5. David. T. Plummer, (2004), An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.
6. E.J.Wood (1989) Practical Biochemistry colleges, Elsevier, Pergamon.

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22UBC4CM

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	S	S	H	S	H
CO3	S	S	S	S	H
CO4	H	S	S	H	S
CO5	H	S	S	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 29

22UBC505

Programme Code: 07		**B. Sc Biochemistry**		
Course Code: 22UBC505		**Core Paper 5 – HUMAN PHYSIOLOGY & ENDOCRINOLOGY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	V	4	60	4

Course Objectives

1. To understand the basic principles and mechanisms involved during the functioning of various organs of the physiological system.

2. To learn the mechanism of action of hormones, and their role under normal and abnormal conditions of the physiological system.

3. To learn the functions of organs and systems to the maintenance of Homeostasis.

Course Outcomes (CO)

K1 to K5	**CO1**	Recall of the structure of skeletal muscle, GI tract, lungs, nephrons, neurons and reproductive system
	CO2	Understanding the mechanism of muscle contraction, mechanism of buffer action , transport of gases between tissues and blood, formation of urine, propagation of nerve application ,mechanism of action of hormones.
	CO3	Explanation of sources of energy for muscle contraction, functions of hormones, spermatogenesis, ovarian cycle, chemical changes during muscle contraction.
	CO4	Synaptic transmission of neuro-muscular transmission, pathophysiology of hormones of pituitary, thyroid, parathyroid and adrenal glands.
	CO5	Understand the structure and function of male and female reproductive system

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UNIT I (12 hrs)

Blood and Body fluids: Composition and function, Red blood cells, Hemoglobin, White blood cells and platelets. Blood coagulation, blood groups and blood transfusion. Formation and functions of lymph. Body buffers.

Nervous system

Nervous system: Structure of neuron, resting potential and action potential, Propagation of nerve – impulses, Structure of synapse, synaptic transmission (electrical and chemical theory). Structure of Neuro muscular junction and mechanism of neuro muscular transmission, Neuro transmitters.

UNIT II (12 hrs)

Digestive System

Structure of GI tract. Secretion of digestive juices- composition and functions of saliva, gastric juice, pancreatic juice, bile and secretion of small intestine (succus entericus). Digestion and absorption of carbohydrates, Digestion and absorption of proteins. Digestion and absorption of fats.

Respiratory System Structure of lungs. Diffusion of gases in lungs. Transport of oxygen from lungs to tissues through blood and factors influencing the transport of oxygen. Transport of CO_2 from tissues to lungs through blood and factors influencing the transport of CO_2.

UNIT III (12 hrs)

Excretory System

Structure of kidneys. Structure of nephron. Mechanism of formation of urine, micturition and renal regulation of acid- base balance. Physical properties and composition of urine. Role of renin in renin-angiotensin-aldosterone system (RAAS).

Skeletal Muscle

Skeletal muscle- General structure and sarcomere unit. Structure of myosin, actin and regulatory proteins (tropomyosin and troponin). Mechanism of muscle fiber contraction. Chemical changes during muscle contraction. Sources of energy for muscle contraction.

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UNIT IV

(12 hrs)

Male Reproductive System

Structure of male reproductive system and spermatogenesis. Structure and functions of testosterone.

Female Reproductive System

Structure of female reproductive system and oogenesis. Ovarian cycle. Menstrual cycle. Menopause. Pregnancy andlactation. Structure and functions of estrogens and progesterone.

UNIT V (12hrs)

Endocrine System

Endocrine system: Chemical nature of hormones, mechanism of action of hormones – intracellular receptor mechanism and second messenger mechanism (cAMP, cGMP, Ca2+) Structure function and deficiency symptoms of hormones of pituitary, thyroid, parathyroid and adrenal glands. Functions of pancreatic hormones.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Book

1. Saradha Subramaniam, Madavan kutty K. and Singh H. D. (2012). Textbook of Human Physiology. 6th edition., S. Chand and company LTD. New Delhi.
2. H.S.Ravikumar Patil, H.K.Makari, H.Gurumurthy, S.V.Soumya, (2013). A text book of Human physiology. I.K. International Publishing house Pvt. limited.
3. Shembulingam K & Prema Shenbulingam, (2019). Essentials of Medical Physiology 8th edition, Jaypee publishers, New Delhi.

Reference Books

1. John E.Hall. Guyton & Hall., (2014). Textbook of Medical Physiology. A South Asian Edition.
2. Chatterjee. M.N. and Rana Shinde (2005). A Text book of Medical Biochemistry. Jaypee Brothers Medical Publishers Pvt. Ltd, Delhi.
3. C.C.Chatterjee., C.C.Chatterjee (2016). Human Physiology VI: 11th edition, Vol (1). CBS publishers & distributers.

4. Robert K. Murray., Granner D.K., Mayes P.A. and Rodwell V.W.,(2008).Harpers Illustrated Biochemistry, 27thed., Appleton and Lange Stanford, Connecticut, USA.
5. Talwar G.P. (2004), A Text book of Biochemistry and Human Biology, 3rd edition. Printice Hall of India Pvt Ltd, New Delhi.
6. John E. Hall, Michael E, Hall Guyton , (2020) Hall Textbook of Medical Physiology 14th edition. Elsevier Health sciences, South Asia.

* *Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 33

22UBC506

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC506		**Core Paper 6 – CELL BIOLOGY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	V	4	60	4

Course Objectives

1. To perceive knowledge about structure of animal cell membrane and its function.
2. To study about the mechanism of protein sorting and transport in the biological system.
3. To know about the cell cycle and about cancer development.

Course Outcomes (CO)

K1 to K5	CO1	Appreciates and understands the dynamic nature of the cell, including how it occurs and response to the information from its environment.
	CO2	Remembers the different mechanism of receptor activation and regulation.
	CO3	Explores the role of growth hormones in the biological system
	CO4	Predict how alterations or given drugs or chemical treatment would impact cell behavior
	CO5	Describe the Cancer and their types, Tumor suppressor genes function and their products

Total Hours :60

UNIT I (12 hrs)

Cell membrane–Introduction to cell and its organelles, cell theory, comparison between plant and animal cell. Fluid Mosaic Model: Biochemical composition (membrane carbohydrates, membrane proteins and membrane lipids) and functions. Membrane transport: Passive transport–simple diffusion and facilitated diffusion, Active transport–simple active transport and specific transporters antiport and symport, bulk transport-phagocytosis and endocytosis.

UNIT II (12 hrs)

Protein Sorting and Transport: The endoplasmic reticulum: Protein secretion, Targeting proteins to ER, Protein folding and processing. Smooth ER and post translational modification. Ribosomes: Organization, types and function. Golgi apparatus: Organization, protein glycosylation and transportation of proteins. Lysosomes: Acid hydrolases, endocytosis and lysosome formation. Autophagy and phagocytosis

22UBC506

UNIT III (12 hrs)

Cytoskeleton: Chemistry, Organization and function of Microtubules, Microfilaments and Intermediate filaments.

The nucleus: Structure of nuclear envelope; nuclear pore complex; Nucleolus RNA genes–transcription and processing of RNA. Cell division: mitosis and meiosis*.

UNIT IV (12hrs)

Cell signaling: Modes of cell – cell signaling, steroid hormones and nuclear receptor super family, nitric oxide, neurotransmitters, peptide hormones and growth factors. Functions of surface receptors: G- protein - coupled receptors. Pathways of intracellular signal transduction: The cAMP, cGMP, phospholipids and calcium ion pathways.

UNIT V (12hrs)

Cell cycle: Overview of cell cycle and its control. Cell cycle control in mammalian cells, check points in cell cycle regulation. Apoptosis-pathways, regulators and effectors in apoptosis.

Cancer: Types, properties, causes and development. Tumor suppress or genes and functions of their products. Carcinogenic effect of chemicals andradiation.

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Teaching Methods

Text Books:

1. Cooper. G.M.(2009), The Cell: A Molecular Approach, 5th ed., Boston university, ARM press, Washington D.C., USA
2. Verma.P.S. and Agarwal.V.K. (2014),Cell Biology, Genetics, Molecular biology, Evolution and Ecology, S. Chand and Company, New Delhi.
3. U. Satyanarayana and U. Chakrapani (2013). Biochemistry. Elsevier and Books & Allied (P)Ltd. Kolkata.

Reference Books:

1. Harvey Lodish, Baltimore David, Arnold Berk *et al*, (2007), Molecular Cell Biology, 6thed., Scientific American Books, USA.
2. Garrette R.H and Grisham, C. M (2012), Principles of Biochemistry, 5th ed, Saunders college publishers, US.

3. Alberts, Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Essential of Cell Biology. New York: Garland Science, 2019.
4. Pollard, Thomas D., William C. Earnshaw, Jennifer Lippincott-Schwartz, and Graham T. Johnson. Cell biology. 3rd Eds.2017.
5. Alberts, Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Molecular Biology of the Cell. New York: Garland Science, 2002.
6. Stephen R. Bolsover, Elizabeth A. Shephard, Hugh A. White, Jeremy S. Hyams. Cell Biology: A Short Course, 3rd Edition. Wiley and Blackwell. 2011.

** Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	S	S	H	S	S
CO3	S	H	H	H	S
CO4	H	H	S	S	H
CO5	S	H	S	H	S

S–Strong **H** –High **M**– Medium **L**–Low

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22UBC507

Programme Code: 07		**B.Sc. Biochemistry**		
Course Code: 22UBC507		**Core Paper 7- CLINICAL BIOCHEMISTRY**		
Batch 2022-2023	Semester V	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To provide students with a conceptual background in Clinical Biochemistry
2. To provide students with an understanding of various types of diseases and their causes, symptoms, prevention, management and treatment

Course Outcomes (CO)

K1 to K5	CO1	Recall the metabolism of carbohydrates, lipids and proteins
	CO2	Describe the disorders of carbohydrate, lipids, protein and amino acids metabolism & assess the gastric, intestinal, liver and kidney functions
	CO3	Demonstrate the types, clinical pathology and diagnosis of disorders of carbohydrate, lipids, protein and amino acids
	CO4	Analyze the blood and serum samples for the diagnosis and prognosis of Diseases
	CO5	Analyze the Liver and Kidney function tests

Total Hours : 60

UNIT I (12 hrs)

Disorders of carbohydrate metabolism: Normal glucose level in blood*, renal threshold value. Hypoglycemia: Definition and causes of hypoglycemia. Hyperglycemia: Definition and causes of hyperglycemia. Glycogen storage Diseases

Diabetes mellitus: Introduction, types of diabetes mellitus; clinical pathology and diagnosis. Glycosylated hemoglobin and its significance.

UNIT II (12 hrs)

Disorders of lipid metabolism: Plasma lipids and lipo proteins – Introduction; hyper lipo proteinemia. Type I, II, III, IV and V and A beta lipoproteinemia. Hypolipo proteinemia: α-β–lipo proteinemia, hypo beta lipoproteinemia, Tangier‟ disease and lecithin – cholesterol acyl-transferase deficiency. Hypercholesterolemia

22UBC507

UNIT III (12 hrs)

Plasma protein abnormalities. Hypoplasma proteinuria and hyper plasma proteinuria

Disorders of amino acid metabolism: Cystinuria, phenylketonuria and maple syrup diseases. Definition and causes of hypo and hyper uremia. Definition and causes of hypo and hyper uricemia.

UNIT IV (12 hrs)

Gastric and Intestinal functional tests:

Gastric functional tests – Introduction, tests of gastric function – The insulin stimulation test and tubeless gastric analysis. Intestinal functional tests – Introduction, tests used in the diagnosis of malabsorption – determination of total faecal fat (fat balance test), test of monosaccharide absorption (xylose excretion test) and determination of total protein (Lowry's method).Pancreatic function test.

UNIT V (12hrs)

Liver and Kidney function tests. Liver function tests, estimation of conjugated and total bilirubin in serum (diazomethod), detection of bilirubin and bile salts in urine (Fouchet"s test and Hay"s sulphur test) and marker enzymes: SGOT, SGPT, γ-glutamyl transferase.

Kidney function test: Urea clearance test, creatine clearance test and GFR.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books

1. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7th ed.,Published by the Author, Chennai – 600035.
2. Deb, A.C. (2011), Fundamentals of Biochemistry, 10th ed., New Central Book Agency Pvt. Ltd., Kolkata 700009.
3. Marshall, (2014), Clinical Biochemistry: Metabolic and Clinical Aspects, Elsevier Science Publishers.

Reference Books

1. Carl A. Burtis, Edward R. Ashwood, Norbert W. Tietz. (2012). Tietz Textbook of Clinical Chemistry and molecular diagnostics. 5th ed, Saunders college publishing, HarcourtBrace College Publishers, Philadelphia, Newyork,Tokyo.
2. Vasudevan D.M, Sreekumari S and Kannan Vaidyanathan, (2011), Text Book of Biochemistry for Medical Students,6th ed., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.
3. Thomas M. Devlin (2010) Textbook of Biochemistry with Clinical Correlations, 7th Edition, john Wiley & Sons, Inc,US.
4. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
5. Tietz Textbook of Clinical Biochemistry, Carl A. Burtis and Edward R. Ashwood (1998), 3rd ed.. Harcourt Brace & company Asia PTE LTD. W.B. Sauners Company.
6. Clinical Biochemistry, Geoffrey Beckett, Simon Walker, Peter Rae, Peter Ashby (2006), 7th ed., Blackwell Publication

** Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	H	S	M	S	S
CO3	S	H	H	S	H
CO4	H	H	S	S	H
CO5	H	S	H	S	H

S–Strong **H** – High **M**– Medium **L** – Low

22UBC508

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC508		**Core Paper 8 – MOLECULAR BIOLOGY**		
Batch 2022-2023	Semester V	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To understand the scientific process in the content of learning the fundamental biological and chemical factors of molecular biology.
2. To gain knowledge about DNA replication, DNA repair mechanism and mutation.
3. To understand the mechanism of transcription and reverse transcription.
4. To acquire the knowledge about gene regulation.

Course Outcomes (CO)

K1 to K5	CO1	Understand the dynamics of protein synthesis with respect to ribosome structure, function and accuracy of translation
	CO2	Remember the Genetic Code and the amino acid which it codes. the role of various enzymes and proteins in DNA replications, transcription and translation
	CO3	Advanced and integrated knowledge of the process on transcription and DNA recombination and repair process
	CO4	Explore the process of translation, genetic code and post translational modifications
	CO5	Describe the regulation of gene expression and types of operon and their regulation

Total Hours: 60

UNIT I (12Hrs)

Organization of eukaryotic chromosome, Nucleosomes are the fundamental unit of chromatin, types and properties of histones. Chromatin assembly. DNA carries genetic information, Transformation, Transduction, Conjugation, Griffith's Experiment, Avery's Experiment and Hershey – Chase experiment.

UNIT II (12Hrs)

DNA Replication: DNA Replication, semi conservative mechanism, The Meselson – Stahl experiment, enzymology of DNA replication, initiation, elongation and termination. DNA repair mechanism: excision repair, mismatch repair and SOS response. Inhibitors of DNA replication. Mutation: spontaneous and induced mutation.

UNIT III (12 Hrs)

Transcription: Central Dogma, Synthesis of RNA, DNA dependent RNA Polymerase, sigma factor, association of RNA polymerase with DNA, initiation, elongation, termination of transcription, post transcriptional modification of RNA, reverse transcription*, RNA directed RNA polymerase.

UNIT IV (12 Hrs)

Translation: Genetic Code: Features of genetic code, chemical composition of eukaryotic and prokaryotic ribosomes, and activation of amino acids, initiation, elongation and termination of protein synthesis in prokaryotes, post translational modification of proteins and inhibitors of protein synthesis.

UNIT V (12Hrs)

Gene Regulation:

Regulation of gene expression in E.coli. Terminology in regulation of gene expression. Types of control of operons ,lactose operon in E.coli, negative regulation and positive regulation, lac operon, arabinose operon and tryptophan operon and its regulation.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Ajoy Paul (2007),Text Book of Cell and Molecular Biology, Books and allied Pvt.Ltd. Kolkata.
2. G.P. Jayanthi (2009), Molecular Biology, MJP publishers, Chennai
3. Vasudevan D.M, Sreekumari S and Kannan Vaidyanathan, (2011), Text Book of Biochemistry forMedical Students,6th ed., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.

Reference Books:

1. Robert .H. Tamarin (2008), Principles of Genetics, 7th ed., Tata McGraw Hill Publishing Company Ltd, Kolkata.
2. Gardner and Simmon Snustad(2008),Principlesofgenetics,7th ed.,JohnWiley&SonsInc. USA.
3. DavidL.Nelson,MichealM.Cox(2008),Lehninger"sPrinciplesofBiochemistry,Replik a press (P) Ltd,India.

4. David Freifelder (2004). Molecular Biology. 5th edition. Jones & Bartlett Publishers.
5. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication.
6. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.

**Questions may also be taken from the self-study portion also*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	S	S
CO3	S	S	S	H	S
CO4	H	S	S	S	S
CO5	H	S	H	S	S

S– Strong H– High M – Medium L –Low

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22UBC609

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC609		**Core Paper 9 – PLANT BIOCHEMISTRY**		
Batch 2022-2023	Semester VI	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To understand the metabolic processes in plants and role of various biosynthetic pathways.
2. To acquire knowledge about photosynthetic apparatus, role of nitrogen in plants and plant growth regulators
3. To explore about the photo morphogenesis and secondary metabolites in plants.

Course Outcomes (CO)

K1 to K5	CO1	Recollect the structure and function of plant cell.
	CO2	Understand the mechanism of photosynthesis in plants.
	CO3	Execute the concept of role of minerals and growth hormones in plants.
	CO4	Acquire the Photo morphogenesis function and development of plant
	CO5	Analyze the nature and functions of secondary metabolites

Total Hours :60

UNIT I (12 Hrs)

Introduction to plant cell structure*. Photosynthesis**:** Overview, Pigments – chlorophylls, carotenoids and phycobillins. Photosynthetic apparatus. Photo system I and II – Mechanism of Photosynthesis-cyclic and non-cyclic photo phosphorylation. Light reactions–Red drop and Emerson‟s enhancement effect, Hill‟s reaction, Arnons work. Dark reactions: C3, C4 and CAM pathway.

UNIT II (12Hrs)

Role of nitrogen in plants. Nitrate reduction. Nitrogen cycle, Nitrogen fixation: non-biological, biological- symbiotic, non-symbiotic and associative. Biochemistry of nitrogen fixation and factors Mineral nutrition in plants: Major elements: Nitrogen, Phosphorus, Sulphur, Calcium, Magnesium and Potassium-specific roles and deficiency symptoms in plants.

Minor elements: Iron, manganese, copper, zinc, boron, molybdenum, chlorine and nickel-specific roles and deficiency symptoms in plants controlling biological nitrogen fixation.

22UBC609

UNIT III (12 Hrs)

Plant growth regulators: Chemistry, biosynthesis, physiological effects, applications of auxins, gibberellins, cytokinins, abscisic acid and ethylene.

Vitamins in plants**:** occurrence and biological functions.

UNIT IV (12 Hrs)

Photo morphogenesis: Photo periodism. Phytochrome - Function in growth and development of Plant. Biochemistry of seed germination. Biochemistry of fruit ripening. Seed storage proteins in legumes and cereals.

UNIT V (12Hrs)

Secondary metabolites: Classification, Biosynthetic pathways (structures not needed) and biological functions of terpenes, alkaloids, cyanogenic glycosides, phenolics, flavonoids (anthocyanins) and tannins.

Teaching Methods

Chalk and board/Powerpoint presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Jain. V. K. (2013)., Fundamentals of Plant physiology, 17th ed., S. Chand and Company Ltd, New Delhi,India.
2. Verma. P. K. (2005)., Text Book of Plant Physiology, 8th ed., EMKAY Publications, Bhopal.
3. Aggarwal Ayush. Plant biochemistry. Pacific Books International.

Reference Books:

1. Buchanan. B. B, Gruissem. W., Jones. R. (2015), Biochemistry and molecular biology of plants, 2nd edition, Wiley Blackwell publishers, USA.
2. Hopkins .W. G.(2008), Introduction to Plant Physiology, 2nd ed., John Wiley and sons Publishers, UK.
3. Heldt. H. W. (2005). Plant Biochemistry, 3rd edition. Academic Press, USA.
4. Hans-Walter Heldt, Birgit Piechulla. Plant Biochemistry. 2021. 5th Ed. Academic Press
5. Florence Gleason, Raymond Chollet, Jones and Bartlett. Plant Biochemistry. 2021. Jones and Bartlett
6. Caroline Bowsher, Alyson Tobin. Plant Biochemistry. 2021. 2nd Eds. Garland Science

**Questions may also be taken from the self-study portion*

UBC 44

22UBC609

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	S	S	S	H	H
CO3	S	S	H	S	S
CO4	H	S	S	H	M
CO5	H	S	H	S	H

S– Strong **H** – High **M**– Medium **L** –Low

UBC 45

22UBC610

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC610		**Core Paper 10 – IMMUNOLOGY AND IMMUNOTECHNIQUES**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	VI	4	60	4

Course Objectives

1. To learn about the basic principles of immunology, functioning of immune system, and immunological techniques in clinical and research laboratories.
2. To comprehend about the different types of immune mechanisms involving in various abnormal conditions and diseases.

Course Outcomes (CO)

K1 to K5	CO1	Learning the basics of immunity and immune system, formation role of cytokines, different features of antigens and antibodies.
	CO2	Understanding of the mechanism of antibody and cell mediated immunity, action of complement system.
	CO3	Learning the development of various clinical conditions during the different abnormal conditions.
	CO4	Define the Autoimmune diseases and AIDS development of clinical symptoms
	CO5	Applications of antigen – antibody reactions in the diagnosis of various infectious diseases using different techniques.

Total Hours:60

UNIT I (12Hrs)

Immunity- Definition and types. Innate immunity- Definition; Physical, biochemical, cellular and genetic factors. Acquired immunity - active and passive . Child Immunization chart*. Cells of the immune system- B and T lymphocytes , Natural Killer cells , Macrophages, Antigen presenting cells, Eosinophils, Basophils, Neutrophils, Dendritic cells and Mast cells. Lymphoid organs – Primary (Thymus, Bursa of Fabricius and Bone marrow) and Secondary lymphoid organs (Spleen , Lymph node and MALT).

UNIT II (12Hrs)

Antibody mediated immunity – Definition; Maturation of B – lymphocytes; Activation of B – lymphocytes by antigens and production of antibodies. Primary and secondary immune responses. Cell mediated immunity – Definition; Maturation and types of T-lymphocytes; Activation of TH cells; Cytokines–definition and types. Functions (any four) of Inter leukins (IL- 1, IL-2,IL-4,IL-12), Interferons(IFNs), Tumor necrosis factor(TNFs),Colony stimulating factors (CSFs). Cytotoxic activity of Tc, NK and K cells.

UNIT III (12 Hrs)

Antigens– Definition, Characteristic features of antigens, Cross reactivity, Haptens and adjuvants. MHC (Major Histocompatability Complex) - Definition with examples (HLA and H-2).

MHC antigens – Definition and Classification (structures not required).MHC Restriction. Antibodies – Definition. Structure of Immunoglobulin **(**with reference to IgG**);** Classification of immunoglobulins; Properties and biological functions of immunoglobulins (IgG, IgM, IgA, IgD and IgE); Complement system – Definition and components of complement system; Classical complement pathway, alternate pathway. Phagocytosis and Inflammation.

UNIT IV (12 Hrs)

Hypersensitivity – Definition, types, and clinical manifestation: Type I, II, III and IV and their clinical manifestations. Autoimmune diseases – Definition; Myasthenia gravis, Rheumatoid arthritis and Grave‟s disease. Transplantation – Definition and classification. Mechanism and complications of allograft rejection. AIDS **–**Definition**.** AIDS virus – structure. Mechanism of action of AIDS virus on T-cells, Development of disease and Clinical symptoms.

UNIT V(12Hrs)

Antigen antibody interactions –formation of precipitation, and agglutination- precipitin curve test. Agglutination- blood grouping and Widal test. Precipitation- Double immunodiffusion (Ouchterlony procedure), Radial immunodiffusion, Immunoelectrophoresis, Rocket immune diffusion, Counter current immune diffusion, Fluorescent antibody technique, Radio Immuno Assay (RIA), Enzyme Linked Immunosorbent Assay (ELISA), Western blotting technique, Immunohistochemistry.

UBC 47

Teaching Methods

Chalk and Board/Powerpoint presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Ananthnarayanan. R and Jayaraman Panikar C.K. (2009). Text book of Microbiology, 8th edition, Orient Longman Ltd, Madras.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwell Scientific Publication, Oxford.
3. Arvind Kumar. (2013)Textbook of immunology. TERI Publications.

Reference Books

1. David Male, Jonathan Brastoff, Roitt Ivan and David Roth (2012). Immunology, 8thed., Times mirror, International Gower Medical Publishing Ltd, printed by Grajos SA, Arts Sobrepapel, Barcelona, Spain.
2. Peter Delvis, Seamus Martin, Dennis Burton and Evan Roitt (2012). Roitt‟s Essential Immunology, Wiley Blackwell Publishers.
3. Judy owen, Jenni punt, Sharon Stanford, Patricia Jones (2018). Kuby Immunology. Macmillan learning.
4. B.Annadurai ,A Textbook of Immunology and Immunotechnology, (2008) S. Chand Limited India.
5. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
6. Ashim K. Chakravarty , Immunology and Immunotechnology, (2006) Oxford University Press, England, UK

**Questions may also be taken from the self-study portion*

UBC 48

22UBC610

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	M	M	H	H
CO2	S	S	S	S	S
CO3	H	M	H	H	H
CO4	S	S	S	S	S
CO5	S	H	S	S	H

S– Strong **H** – High **M**– Medium **L** –Low

UBC 49

22UBC611

ProgrammeCode:07		**B.Sc Biochemistry**		
Course Code:22UBC611		**Core Paper11–GENETIC ENGINEERING**		
Batch 2022-2023	Semester VI	Hours/Week 4	Total Hours 60	Credits 4

Course Objectives

1. Toprovidestudentswithabroadconceptualbackgroundinthefieldofgeneticengineering
2. TodescribethemethodsusedtocreaterecombinantDNAmoleculesandintroducethemintoprokaryotic cells
3. To expose the students to the application of genetic engineering in medicine and agriculture

Course Outcomes (CO)

K1 to K5	CO1	Recognize the concept of recombinant DNA technology or genetic engineering
	CO2	Describe arrange of techniques in gene manipulation, the cloning vectors available and the containment procedures
	CO3	UnderstandingthetechniquesofDNAsequencing,Geneticfingerprinting,andPCRapplications
	CO4	Examinethedifficultiesduringtheexpressionofeukaryoticdnainprokaryotesandhow to overcome these difficulties
	CO5	Demonstratetheapplicationoftransgenicplantswithherbicideresistance,virusresistance,pestresistanceandmaleinfertilityandtheproductionof recombinant insulin

Total Hours :60

UNIT I (12 hrs)

Genecloning-introduction,basicstepsingenecloning;methodstogeneratedesiredforeigngenes-isolationofprokaryoticgenebyrestrictionenzyme,isolationofeukaryoticgenebyDNAsynthesis.Joining DNAmolecules:ligases,linkersandhomopolymers.Cloningvectors-characteristicsofanideal vector molecule: natural vectors- *E.coli* plasmids; *in-vitro* vectors – pBR322; λ-phage; singlestrandedvector-M13.

22UBC611

UNIT II (12hrs)

Expression vectors of *E.coli*: Constituents; examples of promoters–expression cassettes–problems caused in expression of eukaryotic genes; fusion proteins. Production of recombinant insulin.Safety aspects,ethics and hazards of genetic engineering*,HGP:objectives and applications.

UNIT III (12hrs)

Introduction of rDNA into bacterial cells: Transformation of *E.coli*-preparation of competent cells and uptake of DNA by cells ; selection for transformed cells. Identification of recombinants – insertional inactivation, blue white selection. Genomic library and cDNA library. Identification of a clone from gene library-Southern, Northern and Western blotting techniques.

UNIT IV (12hrs)

DNA sequencing: Outline of Sanger's method. Genetic finger printing–technique and applications. *In vitro* mutagenesis: site directed mutagenesis, protein engineering. Basic PCR – Technique and applications;

UNIT V (12hrs)

Gene transfer in plants: Ti plasmid vectors; mechanism of T-DNA transfer, virulence genes, electro fusion, biolistics process. Applications of transgenic plants – herbicide resistance, male infertility, virus resistance, pest resistance, antisense RNA.

Teaching Methods

Chalkandboard/Powerpointpresentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. S.B. Primrose and R.M.Twyman (2001).Principles of Gene Manipulation andGenomics.7th ed. Blackwell Publishing, UK.
2. Satyanarayana,U.(2007),Biotechnology,BooksandAllied(P)Ltd,Kolkata, 700010.
3. Kumaresan,K(2010).Biotechnology,revisededition,SARASpublication,Kanniyakumari,India.

Reference Books:

1. T.A. Brown(2015),GeneCloningandDNAanalysis,7thed.,BlackwellpublishingLtd,UK.
2. BernardR.Glick,JackJ.Pasternak,CherylL.Patten(2010).MolecularBiotechnology:Principlesand ApplicationsofRecombinantDNA,4thed.,ASMPress,USA.

**Questions may also be taken from these self study portion*

UBC 51

22UBC611

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	S	S
CO2	S	H	S	S	H
CO3	S	S	H	S	H
CO4	H	S	S	H	M
CO5	H	S	S	H	S

S– Strong **H**– High **M**– Medium **L**–Low

UBC 52

22UBC6CN

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC6CN		**C.Pr.3. BIOCHEMISTRY**		
Batch 2022-2023	Semester V & VI	Hours / Week 4	Total Hours 120	Credits 3

Course Objectives

1. To make students learn the methods of collection of blood and urine samples and separation of serum

2. To analyze the biochemical parameters in urine and blood samples and indicate their clinical significance

3. To demonstrate the kit methods for the assay of bio chemical parameters

Course Outcomes (CO)

K3 to K5	CO1	Apply various techniques for the assay of important biochemical parameters and interpret their values
	CO2	Calculate the values from the graph obtained in the experiment
	CO3	Estimate the level of bilirubin, SGOT, SGPT, LDH, CKMB in the given sample using kit method
	CO4	Understanding the quantitative estimation of Glucose and Calcium in urine
	CO5	Analyze the quantitative estimation of biochemical parameters in blood

List of programs

I. Quantitative estimation of the following in urine

1. Glucose - Benedicts method
2. Calcium - Permanganate method3

22UBC6CN

II. Quantitative estimation of the following in the blood

1. Glucose - Ortho-Toluidine method.
2. Urea - DAM – TSC method.
3. Cholesterol - Zak's method
4. Phosphorus - Fiske and Subbarrow method
5. Uric acid - Caraway Method
6. Iron and Hemoglobin – Wong's method
7. Total protein, Globulin and A:G ratio

III. Group Experiments (kit method)

1. Bilirubin – Direct and Indirect.
2. SGOT.
3. SGPT.
4. LDH
5. CKMB

Reference Books

1. S.P. Singh (2013), Practical Manual of Biochemistry, 7th ed., CBS Publishers and Distributors, New Delhi.
2. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New Age International Publishers Ltd, New Delhi.
3. Shivaraja shankara, Y.M.(2018).Laboratory manual for practical Biochemistry, Jaypee Brothers Medical Publishers(P) Ltd, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	S	S
CO2	S	H	S	S	H
CO3	S	S	H	S	H
CO4	H	S	S	H	M
CO5	H	S	H	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 54

22UBC6CO

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC6CO		**C.Pr.4. BIOCHEMISTRY**		
Batch 2022-2023	Semester V & VI	Hours / Week 2	Total Hours 60	Credits 2

Course Objectives

1. To isolate plasmid DNA and genomic DNA, isolation and restriction digestion of DNA through demonstration experiments
2. To perform simple staining, gram staining and negative staining, isolation of microbes and biochemical tests for identifying bacteria
3. To demonstrate media preparation, callus initiation in plant tissue and mitosis in onion root tips

Course Outcomes (CO)

K3 to K5	CO1	Recall the methods of genetic technology and Employ molecular methods in isolation, restriction digestion and separation of DNA
	CO2	Recall the microbiological methods and performing of staining, plating techniques
	CO3	Analyze biochemical tests for identifying microorganisms
	CO4	Familiarize the techniques of plant tissue culture and cell biology through demonstrations
	CO5	Introducing bioinformatics tools and learning basic tools on proteomics and genomics

List of programs

GENETIC TECHNOLOGY

a. Estimation of DNA by diphenylamine method
b. Estimation of RNA by orcinol method
c. Preparation of buccal smear
d. Separation of DNA by agarose gel electrophoresis(Demo)
e. Isolation of Plasmid DNA from bacteria(Demo)
f. Isolation of Genomic DNA from liver/plant/bacterial source(Demo)

22UBC6CO

MICROBIOLOGY

a. Isolation of pure culture - serial dilution, pour plate, spread plate and streak plate.
b. Simple staining, Gram staining and Negative staining.
c. Biochemical tests for identification of Bacteria.
d. Isolation of microbes from samples – sewage/ water/ soil.
e. Antibiotic Sensitivity Test – Kirby Bauer Method

PLANT BIOTECHNOLOGY (Demonstration)

a. Preparation of media and sterilization.
b. Initiation of callus culture.

BIOINFORMATICS

a. Analytical tools for sequences databanks: BLAST, FASTA, Pair wise alignment- Multiple alignment- Clustal W.
b. Structural databanks: Protein databank(PDB)
c. *In silico* analysis of Proteins

Reference Books

1. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New Age International Publishers Ltd, New Delhi.
2. Ramnik Sood(2003), Medical Laboratory Technology, 5th ed., (reprint), Jaypee brothers, Medical Publishers Private Ltd, New Delhi.
3. Kannan. N. (2002), Laboratory Manual in General Microbiology, Panima publishing corporation, Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	M
CO2	S	S	S	H	H
CO3	H	S	H	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S–Strong **H** – High **M**– Medium **L** – Low

UBC 56

22UBC6CP

Programme Code: 07		**B. Sc Biochemistry**		
Course Code: 22UBC6CP		**C.Pr.5. BIOCHEMISTRY**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	V & VI	2	60	2

Course Objectives

1. To estimate chlorophyll, starch, total phenols and qualitatively analyze various secondary metabolites in plant sample
2. To determine RA and pregnancy tests using kit method
3. To demonstrate RBC count, total and differential count of WBCs and identifying blood groups

Course Outcomes (CO)

K3 to K5	CO1	Practice techniques of different plant component isolation and qualitative analysis of secondary metabolites
	CO2	Performing quantification methods of chlorophyll, starch and total phenols present in plant sample
	CO3	Recollecting the techniques antigen- antibody interactions in immunological kit methods
	CO4	Learning identification of blood groups
	CO5	Calculate the number of RBC and WBCs

List of programs

PLANT BIOCHEMISTRY

a. Qualitative Analysis of Secondary Metabolites - Alkaloids, Flavonoids, Saponins and Glycosides
b. Estimation of chlorophyll.
c. Estimation of starch.
d. Estimation of total phenols.

22UBC6CP

IMMUNOLOGY

a. Widal test (kit method)

b. Simple and double immunodiffusion test (kit method)

PHYSIOLOGY (Demonstration)

a. Identification of blood groups.

b. Enumeration of RBCs.

c. Enumeration of total WBCs.

d. Differential count of WBCs.

Reference Books

1. Sadhasivam. S. and Manickam. A. (2008). Biochemical Methods, 3rd ed., New age InternationalPublishers Ltd, NewDelhi.
2. Kannan. N. (2002), Laboratory Manual in General Microbiology, Panima publishingcorporation,Delhi.
3. Ramnik Sood (2003), Medical Laboratory Technology, 5th ed., (reprint), Jaypee brothers, MedicalPublishers Private Ltd, NewDelhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	H
CO2	S	S	S	H	H
CO3	S	M	H	S	H
CO4	H	S	S	H	S
CO5	S	H	S	S	H

S– Strong **H** – High **M**– Medium **L** –Low

UBC 58

Programme Code: 07		**B. Sc Biochemistry**		
Course Code: 22UBC6Z1		**PROJECT**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	VI	4	60	5

Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3 K4 K5	Project Report	30	50
	Viva voce	20	

ALLIED BIOCHEMISTRY

1. ALLIED BIOCHEMISTRY I

2. ALLIED BIOCHEMISTRY II

3. ALLIED PRACTICAL - 2

BIOCHEMISTRY

UBC 59

22UBC3A3

Programme Code: 07		**For B.Sc Zoology**		
Course Code: 22UBC3A3		**ALLIED BIOCHEMISTRY I**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	III	5	75	4

Course Objectives

1. To make the students to understand the basic principles of biochemistry.
2. To learn about the mechanism of action of enzymes in the biological system.
3. To learn the Structure and chemistry of different biomolecules

Course Outcomes (CO)

K1 to K5	CO1	Understands the properties, types and functions of carbohydrates, proteins, lipids, enzymes, nucleic acids and their and functions.
	CO2	Remembers the structures of monosaccharides, di saccharides and polysaccharides and amino acids
	CO3	Applies the concept of enzymatic activity in biological system.
	CO4	Acquire knowledge about the nuclear organization of prokaryotes in eukaryotes.
	CO5	Describe the Nucleic acid structure and their types, Denaturation and Renaturation of DNA

Total Hours :75

UNIT I (15 Hrs)

Carbohydrates

Carbohydrates**:** Definition and Classification*. Monosaccharides – Structural aspects-asymmetric carbon atom, D and L isomers, anomers, optical activity and mutarotation. Epimers: pyranose and furanose forms, aldo and keto forms, classification, definition, structure and biological importance.

Hexoses: glucose, fructose, galactose and mannose. Pentoses: Ribose and deoxyribose. Disaccharides: Maltose, sucrose and lactose.

Polysaccharides: Homopolysaccharides: Starch, glycogen, cellulose, inulin and chitin, Heteropolysacchrides: Heparin, hyaluronic acid, chondroitin sulphates. Reactions of monosaccharides- Oxidation of glucose (aldonic acid, aldaric acid and uronicacid).

Action of alcohols and alkalies with sugars, reducing action of sugars in alkaline solution and reaction with phenyl hydrazine.

22UBC3A3

UNIT II (15 Hrs)

Lipids: Classification and properties of lipids. Types of fatty acids: saturated and unsaturated: essential fatty acids. Classification and significance of phospholipids: Phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl serine, phosphatidyl inositol and sphingomyelin.
Classification and significance of glycolipids: Cerebrosides and gangliosides. Classification and functions of lipoproteins. Structure and biological functions of cholesterol.

UNIT III (15 Hrs)

Amino acids: Classification of amino acids (chemical nature). Essential and non-essential amino acids*. Reactions of amino acids: actions of amino group with benzoic acid, ninhydrin, fluorodinitrobenzene (FDNB), and oxidative deamination.
Reactions of carboxyl group – decarboxylation and amide formation.
Proteins: Definition, classification (chemical nature) and functions of proteins. Structure of proteins- Primary, secondary, tertiary (myoglobin) and quaternary (hemoglobin).
Denaturation and renaturation of proteins. Ampholytes and isoelectric pH.

UNIT IV (15 Hrs)

Enzymes: Definition, classification and nomenclature of enzymes by IUB , Enzyme units (IU) with examples. Enzyme kinetics- Derivation of Michealis- Menton Equation (single substrate),properties of enzymes, enzyme specificity, mechanism of enzyme action. Theories proposed for the enzyme action- Lock and Key model, induced fit mechanism. Active site and its characteristic features. Factors affecting enzyme activity. Enzyme inhibition and types. Coenzymes-definition with and any five examples. Cofactors- definition with and any five examples.

UNIT V (15Hrs)

Nucleic acids: Components, structure of purine bases: Adenine and guanine. Structure of pyrimidine bases: Cytosine, uracil and thymine. Structure of nucleoside and nucleotide. Double helical structure of DNA. Type of bonds of DNA molecule. Denaturation and renaturation of DNA. Structure and types of RNAs: mRNA, tRNA and rRNA.

Teaching Methods

Chalk and board/ Powerpoint presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. A.C. Deb (2011), Fundamentals of Biochemistry, 9th ed., New Central Book Agency Pvt.Ltd.Kolkata.
2. Ambika Shanmugam (2008), Fundamentals of Biochemistry for medical students. 7th ed., LippincottWiliams & Wilkins, Authur, III Cross Street, West C.I.T. Nagar, Chennai – 600035.
3. Lehninger. L.A(2008),Principles of Biochemistry ,W.H .Freeman publishers, India.

Reference Books:

1. M.N. Chatterjee and Rana Shinda (2005), Text book of Medical Biochemistry, Jaypee brother medical publishers Pvt Ltd. NewDelhi.
2. J.L. Jain, Sanjay Jain and Nitin Jain (2007), Elementary Biochemistry, 3rd ed., S Chand and company Ltd, New Delhi.
3. David L. Nelson, Micheal M.Cox(2008), Lehninger‟s Principles of Biochemistry, Replika press (P) Ltd, India.
4. Robert K. Murray, Daryl K. Garnerand Victor W. Rodwell (2008), Harper‟s Illustrated biochemistry, 29th ed., Appleton and Lange Stanford, Connecticut, USA.
5. Biochemistry, D. Voet and J.G. Voet (2004), 3rd ed.. John Wiley and Sons Inc
6. Principles of Biochemistry, D.L. Nelson and M.M. Cox (2008), 5th ed., W.H. Freeman & C

**Question for Examination may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	H	S	S	M	S
CO3	S	H	H	S	H
CO4	H	S	S	H	M
CO5	S	H	S	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 62

22UBC4A4

Programme Code: 07		**For B.Sc Zoology**		
Course Code: 22UBC4A4		**Title: ALLIED BIOCHEMISTRY II**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	IV	5	75	4

Course Objectives

1. To learn about the various biochemical techniques applicable in both research and clinical laboratories.
2. To provide knowledge on metabolic reactions involved in biological reactions.
3. To study the Interrelationship between various biomolecules.

Course Outcomes (CO)

K1 to K5	CO1	Remember the concept of pH and buffer system.
	CO2	Understand the idea about the working principle of various analytical techniques.
	CO3	Deploy the activity of radioisotopes and their applications in biological system.
	CO4	Interpret the metabolic pathways of various molecules.
	CO5	General pathway of lipid and protein metabolism

Total Hours: 75

UNIT I (15Hrs)

Buffers and buffer system:

Buffers: Definition. Concept of ionization, pKa, pH and derivation of Henderson-Hasselbalch equation, Acid- base indicators. Components and working of pH meter. Buffer systems of blood and body fluids; Hemoglobin buffer system. Various ways of expressing the concentration of solutions - Normality, Molarity and percentage solutions.*

UNIT II (15Hrs)

Colorimetry and Centrifugation.

Colorimetry – Beer and Lambert's law. Instrumentation and working of photoelectric colorimeter (single cell) and visible spectrophotometer. Comparison of colorimeter and spectrophotometer.

Centrifugation- Principle and types. Technique and applications of Ultra centrifuge- Density gradient centrifuge and Differential Centrifugation

22UBC4A4

UNIT III (15 Hrs)

Chromatography and Electrophoresis Chromatography- Definition, Rf factor, Principle and technique of paper chromatography with reference to separation of amino acids, Affinity chromatography with reference to separation of proteins.

Electrophoresis-Definition, factors affecting mobility of ions in electric field, principle and working of PAGE (polyacrylamide gel electrophoresis) with reference to separation of serum proteins.

UNIT IV (15 Hrs)

Metabolic pathways: Carbohydrate metabolism: Glycolysis, conversion of pyruvate into acetyl Co A. TCA cycle, Glycogenesis and glycogenolysis. Respiratory chain and oxidative phosphorylation.

Respiratory chain (Electron Transport Chain)- Mitochondrial organization of ETC and structural organization of ETC. Oxidative phosphorylation.

UNIT V

Metabolic pathways, lipid and protein metabolism. Lipid metabolism: Beta-oxidation, biosynthesis of saturated fatty acids- Palmitic acid. Protein metabolism: General pathway of amino acid metabolism – deamination, transamination and decarboxylation. Urea cycle. Interrelationship of carbohydrate, fat and protein metabolism (flow chart only)

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text books

1. P. Asokan, (2006), Basics of Analytical Biochemical Techniques, Chinna Publications, TamilNadu.

2. A.C. Deb (2011), Fundamentals of Biochemistry, 9th ed., New Central Book Agency Pvt. Ltd. Kolkata.

3. Satyanarayana.U and Chakrapani,U (2013),Biochemistry,4th ed., Books and allied pvt. Ltd, Kolkata.

Reference Books:

1. Keith Wilson and John walker (2011), Principles and Techniques of Biochemistry and Molecular Biology. 7th ed., Cambridge University Press, New York.

2. Robert K. Murray, Daryl K.Garner and Victor W. Rodwell (2008), Harper‟s Illustrated Biochemistry, 29th ed., Appleton and Lange Stanford, Connecticut, USA.

3. AmbikaShanmugam,(2008),FundamentalsofBiochemistryforMedicalStudents‟.7thed.,Lippincott Wiliams & Wilkins, Authur, III Cross Street, West C.I.T. Nagar, Chennai – 600035.

4.Garrette,R.H and Grisham,L.M.(2012),Principles of biochemistry, 5th ed, Saunders College Publishers, USA.

5.Principles and Techniques of Biochemistry and Molecular Biology, K. Wilson and J. Walker (2010) 7th ed., Cambridge University Press.

6.Biochemistry, J.M. Berg, J.L. Tymoczko and L. Stryer (2007), 7th ed., W.H. Freeman & Co

**Question for Examination may also be taken from the self-study portion*

UBC 64

22UBC4A4

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	M
CO2	S	S	S	S	S
CO3	S	S	H	S	H
CO4	H	S	S	H	S
CO5	S	M	S	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 65

22UBC4AL

Programme Code: 07		**For B.Sc Zoology**		
Course Code: 22UBC4AL		**A.Pr.2. BIOCHEMISTRY**		
Batch 2022-2023	Semester III & IV	Hours / Week 2	Total Hours 60	Credits 2

Course Objectives

1. To acquire the skill of analyzing carbohydrates and amino acids.
2. To provide practical knowledge about the quantitative analysis of carbohydrate and protein.
3. To learn the methodology of separation of amino acid by paper chromatography.

Course Outcomes (CO)

K3 to K5	CO1	Recall the classification of biomolecules and learn the preparation of reagents
	CO2	Practice the qualitative analysis of different carbohydrates through individual experiments
	CO3	Practice the qualitative analysis of various amino acids through individual experiments
	CO4	Calculate acid and iodine number of lipids, thereby characterizing them
	CO5	Assess the separation technique of amino acids through paper chromatography

Total Hours: 30

List of Programs

1. QUALITATIVE ANALYSIS

1. **Analysis of carbohydrates**:
   a. Monosaccharides- Pentose- Arabinose. Hexoses- Glucose and fructose
   b. Disaccharides- Sucrose, maltose and lactose
   c. Polysaccharide-Starch.
2. **Analysis of Amino acids:**
   a. Histidine b. Tyrosine. c. Tryptophan d. Arginine e. Cysteine

II. QUANTITATIVE ANALYSIS OF BIOMOLECULES [Group experiments]

- Estimation of glucose by anthrone method.
- Estimation of proteins by Lowry's method.

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III. SEPARATION TECHNIQUE [Demonstration]

Separation of amino acids by paper chromatography

Reference Books:

1. Sadhasivsam. S and Manickam. A. (2008), Biochemical Methods, revised 2nd ed., New age International Publishers, India.
2. Jeyaraman. J. (2007), Laboratory Manual in Biochemistry, New Age International Publishers, New Delhi.
3. David T Plummer. (2017), An Introduction to Practical Biochemistry, 3rd ed, Tata McGraw Hill publishing Co Ltd, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	S	S	S	H	S
CO3	S	S	H	S	H
CO4	H	S	S	H	M
CO5	H	S	H	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 67

MAJOR ELECTIVE COURSES

Programme Code: 07	**B.Sc Biochemistry**		
Major Elective – MICROBIOLOGY			
Batch 2022-2023	Hours/Week 4	Total Hours 60	Credits 5

Course Objectives

1. To provide students with a conceptual background in microbiology
2. To provide students with an understanding of various microbiological techniques
3. To make the students to be familiar with the relationship between microbes and human beings

Course Outcomes (CO)

K1 to K5	CO1	Recall the characteristics of bacteria, algae, fungi and viruses
	CO2	Describe the role of microbes as normal flora and as disease causing agents
	CO3	Demonstrate the microscopic techniques, staining and culturing methods
	CO4	Recollect the microbial diseases and their symptoms and prevention
	CO5	Analyze the bacteriological examination and purification of drinking water

Total Hours:60

UNIT I **(12 hrs)**

Introduction to microbiology, Microscopy Bright field microscopy, fluorescent microscopy, electron microscopy-transmission electron microscopy, scanning electron microscopy. Culture techniques for isolation of bacteria-streak plate technique, pour plate technique. Staining- Simple staining, flagella staining, gram staining, acid-fast staining.

UNIT II **(12 hrs)**

Prokaryotes: Morphology of bacteria, component parts, cell wall structure, growth curve, media composition**.** Eukaryotes: Morphology, characteristics and importance of algae and fungi.

UNIT III **(12hrs)**

Viruses: Cultivation of viruses using fertilized eggs and animal cell culture, structure of viruses, plaque assay.Bacteriophages–T_4 phage, stages in lifecycle; Lambda phage-lifecycle; switch between lysogeny and lyticcycle. Oncogenic viruses– oncogenicDNAviruses-SV40;oncogenic RNA viruses-HIV

UNIT IV **(12hrs)**

Microbial diseases: Normal human micro flora, host parasitic interaction, exo and endotoxins. Water borne diseases– Aetiology, pathogenesis and symptoms of cholera and dysentery. Air-borne diseases–Aetiology, causes, symptoms and prevention of TB and diphtheria. Direct contact disease–Aetiology and symptoms of rabies*.

UNIT V **(12 hrs)**

Water microbiology: Microbes in water; bacteriological examination of water; purification of drinking water. Soil microbiology**:** Rhizosphere and mycorrhiza. Microbiology of food borne diseases: Botulism, staphylococcal poisoning, salmonellosis and perfringens poisoning.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Micheal J. Pelczar, E.C.S. Chanand Noel R.Krieg (2008), Microbiology5th ed.,Tata McGraw -Hill Publishing Company Ltd, New Delhi.
2. R.C.Dubey and D.K.Maheshwari (2005),Text Book of Microbiology, S Chand and Company Ltd. New Delhi.

Reference Books:

1. Geetha Sumbali and R.S. Mehrotta (2009), Principles of Microbiology, Tata McGraw – Hill Education private limited, New Delhi.
2. Joanne Willey ,LindaSherwood, ChristopherJ. Woolverton(2016), Prescott's Microbiology 10th ed., McGraw-HillEducation,Chennai,Tamilnadu.

**Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	H	S	M	S	S
CO3	S	H	H	S	H
CO4	H	H	S	S	H
CO5	H	S	H	S	H

S–Strong **H** –High **M**– Medium **L**–Low

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Programme Code: 07	**B.Sc Biochemistry**		
Major elective- BASICS OF BIOINFORMATICS			
Batch	Hours / Week	Total Hours	Credits
2022-2023	4	60	5

Course Objectives

1. To know about various tools for data base search.
2. To acquire knowledge about different biological databases.
3. To provide knowledge about Gene prediction and drug designing.

Course Outcomes (CO)

K1 to K5	CO1	Recognize the available bioinformatics resources on web like DNA and protein databases
	CO2	Understand concepts of similarity searching databases and algorithms
	CO3	Construct genome annotations and algorithms
	CO4	Outline the concepts of structure based drug design, protein structure levels and databases
	CO5	Analyze the biological sequence databases and their tools

Total Hours: 60

UNITI (12Hrs)

Bioinformatics -Overview and application. Bioinformatics resources on web*. PubMed .Nucleic acid databases GENBANK, DDBJ and EMBL. Sequence submission and file formats. Protein sequence data bank SWISSPROT, UNIPROT. Data mining of biological database with ENTREZ.

UNIT II (12Hrs)

Data base similarity searching –Local and Global alignment. BLAST and FASTA. Similarity searching algorithms and program, dot plot.

UNIT III (12 Hrs)

Genome annotation- analysis of regulatory regions in genome- promoters, splice site, termination signals. ORF prediction. Algorithms for gene prediction.

UNIT IV (12 Hrs)

Protein structure-levels, basic physio chemical properties, Mol weight, amino acids, transmembrane region and tools in ExPASY. Secondary structure prediction: Chou–Fasman and GOR methods. Tertiary structure prediction.3D structure prediction-homology modeling.

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UNIT V (12Hrs)

Biological databases Nucleic acid sequence databases. Molecular visualization tools RasMol and Chime.

Teaching Methods

Chalk and board/Powerpoint presentation/Seminar/Quiz/Discussion/Assignment

Text books:

1. Rastogi. S. C, Namita – Mendiratta and Parag Rastogi, (2004) BioInformatics – Concepts, Skills and applications, Rastogi Publications, Meerut, India.
2. Ignatchimuthu, S, (2009), Basic Bioinformatics, Narosa Publishing House Pvt Ltd, New Delhi.
3. Ruchi Singh (2014). Bioinformatics: Genomics and Proteomics. S. Chand & Company Pvt. Ltd. NewDelhi.

Reference books:

1. Attwood. T. K. Parry D.J. and Smith (2001). Introduction to BioInformatics, Prentice Hall Publishers, Pearson Education, India.
2. Mani.K and Vijayaraja (2005), BioInformatics – A practical Approach, Aparna Publications, Coimbatore.
3. Dr. P. Shanmughavel, (2006), Trends in Bioinformatics, Pointer Publishers, Jaipur, India.

** Questions may also be taken from the self study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	S	S
CO2	S	H	S	H	S
CO3	S	H	H	S	H
CO4	H	S	S	H	S
CO5	H	S	H	S	H

S– Strong **H** – High **M**– Medium **L** –Low

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Programme Code: 07	**B.Sc Biochemistry**		
Major Elective – BIOPHARMACEUTICALS			
Batch 2022-2023	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To demonstrate the basics of biopharmaceutical to the under graduate students.
2. To motivate the undergraduate students in analyzing the drug metabolism and mode of action.
3. To elaborate basic of formulations of drugs and to apply them in clinical trials.

Course Outcomes (CO)

K1 to K5	CO1	Acquire knowledge on drug development, principles, mechanism of actions of drugs
	CO2	Outline on preparation of biotechnology oriented pharmaceutical products.
	CO3	Quality control tests and manufacturing, packaging of drugs
	CO4	Help them to analyze the pharmaceutical products available in the market and Evaluate the recent advances in drug manufacturing
	CO5	Relate the regulations in clinical trial and management.

Total Hours: 60

Unit I (12 Hrs)

Drugs: Introduction - Development of Drugs and Pharmaceutical Industry. Drug Metabolism and Pharmacokinetics - ADME – Physico-Chemical Principles –Pharmacodynamics – Routes of drug administration – enteral, parenteral and topical. Action of drugs in humans.

Unit II (12Hrs)

Manufacturing Principles: Compressed tablets – wet granulation, – Dry granulation – Direct compression – Tablet presses formulation – Coating – Pills – Capsules sustained, action dosage forms. Quality control tests for tablets and capsules. Packaging of solid dosage forms.

Unit III (12 Hrs)

Formulations: Manufacturing Principles – Parental, solutions – Oral liquids – injections – Ointments. Quality control tests for semisolid and liquid dosage forms. Packaging of semisolid and liquid dosage forms.

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Unit IV (12 Hrs)

Pharmaceutical Products – Vitamins and Antiseptics - Pharmaceutical Vitamins, Cold remedies, Laxatives, Analgesics, External Antiseptics, Antacids and Antibiotics, Biological hormones, recent advances in the manufacture of drugs using r-DNA Technology and monoclonal antibodies

Unit V (12 Hrs)

Trials & Regulations: Clinical Trials & Regulations - Clinical Trials – Design, double blind studies, placebo effects. FDA regulations (General) and Indian Drug regulations- highlight. Good Laboratory Practice, Good manufacturing practice.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books

1. DM Brahmankar, Sunil B Jaiswal, "Biopharmaceutics and Pharmacokinetics-A Treatise", Vallabhprakashan,2005.
2. Ansel, H., Allen, L., Popovich, N, "Pharmaceutical Dosage Forms and Drug Delivery Systems", Williams & Wilkins,1999.

Reference Books

1. Lippincott, "Remington's Science and Practice of Pharmacy", Williams & Wilkins publishers,2005.
2. Goodman & Gilman's, "The pharmacological basis of therapeutics" by Joel Griffith Hardman, Lee E. Limbird, Alfred G.Gilman.2005
3. Tripathi KD, "Essential of Medical pharmacology", Jaypee Brothers Medical Publishers2003.

* *Questions may also be taken from the self study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	H	S	M	S	S
CO3	S	H	H	S	H
CO4	H	H	S	S	H
CO5	H	S	H	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 73

Programme Code: 07	**B.Sc Biochemistry**		
Major elective- DAIRY BIOCHEMISTRY			
Batch 2022-2023	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To understand the basic concepts of dairy technology.
2. To provide knowledge about the milk processing techniques.
3. To learn the properties of Milk.

Course Outcomes (CO)

K1 to K5	CO1	Recognize the properties of milk.
	CO2	Recall the methods of testing density, fat content and acidity of milk.
	CO3	Analyze the carbohydrates, lipids, proteins and enzymes present in milk.
	CO4	Understand the non-fermented milk products
	CO5	Acquire knowledge about the various milk products available and milk processing techniques practiced.

Total Hours: 60

UNIT I (12Hrs)

Milk- Definition of milk*, physical properties-acidity, viscosity, freezing point and boiling point. Composition of milk, Nutritive value of milk. Vitamins and minerals in milk. Assessment of quality of milk- Density of milk (Lactometer), Determination of fat content (Butyrometer), Acidity of milk (Alcohol test).

UNIT II (12Hrs)

Carbohydrates- Types of sugars in milk and their importance. Lipids-Different types of lipids in milk, structure and size of fat globules, physical properties of milk fat.

UNIT III (12 Hrs)

Proteins- Milk protein chemistry. Different types of proteins-Caseins, Caesinate complex, Whey proteins. Production and forms of whey proteins-α-lactalbumin, β-lactoglobulin and other proteins. Determination of protein fraction in milk- Polyacrylamide gel electrophoresis.

UNIT IV (12 Hrs)

Enzymes of milk. Effect of heat on protein, fat and sugar - protein mixture of milk. Milk products : Non fermentable products-Whey protein concentrate, Skim milk, Evaporated milk, Sweetened condensed milk, Dry milk, Khoa, Rabri, Ice cream, Standardized milk, Toned milk, Double toned milk, Sterilized milk, Flavored milk, Cream and Colostrum. Fermentable milk products-Butter, Cheese and Curd.

UNIT V (12Hrs)

Processing of milk - clarification, pasteurization- HTST & UHTS, role of alkaline phosphatase in pasteurization, effects of pasteurization .Homogenization of milk. Microbial spoilage of milk - steps involved in spoilage of milk. General types of microorganisms of milk and their biological importance. Pathogenic microorganisms in milk (any five). Fermentation of milk.

Text Books

1. B. Srilakshmi (2007), Food Science, 4th ed., New age international (P) Limited Publishers, New Delhi, India.

Reference books

1. Dr. M. Swaminathan (2006), Handbook of Food and Nutrition, 5th ed., Bangalore Printing and Publishing Co. Limited, Bangalore.
2. R.C. Dubey and D.K. Maheshwari (2005), A Text book of Microbiology, S Chandand Company Ltd, NewDelhi.

** Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	S	H
CO2	S	S	S	S	S
CO3	S	H	H	S	H
CO4	H	S	S	H	S
CO5	H	S	H	S	H

S– Strong **H** – High **M**– Medium **L** –Low

UBC 75

Programme Code: 08	**B.Sc Biochemistry**		
Major elective- BIOSTATISITICS			
Batch 2022-2023	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To learn the different methods of collecting data and processing
2. Toknowaboutthedifferentstatisticalmethodstointerpretthecollectedstatisticaldata
3. To know the concept of article writing, report writing and thesis making soon

Course Outcomes (CO)

K1 to K5	CO1	The students get an idea on choosing the appropriate method of collecting data
	CO2	The students learn how to select the statistical method and process the collected data
	CO3	The students can device and standardize the statistical methods
	CO4	The students can understand the classification and tabulation data problems
	CO5	The students will be wellversed in preparing a report, publishing an article and writing a project dissertation.

Total Hours: 60

Unit I (12 Hours)

Research: Definition, Introduction, objectives, motivation, types, approaches, significance. Research Methods versus Methodology. Research process: formulating the research problem, extensive literature survey, developing the hypothesis, preparing the research design, determining sample design, collecting the data, execution of the project, analysis of data, hypothesis testing, generalizations and interpretation, and preparation of the report or presentation of the results.

Unit II (12 Hours)

Research design: Introduction, necessity, features, concepts relating to research design, types of research design, basic principles of experimental design (Principle of Replication, Principle of Randomization and Principle of Local Control).

Unit III (12Hours)

Methods of Data Collection: Collection of Primary Data: Observation Method, Interview Method, questionnaire method (merits, demerits and main aspects), schedules, difference between questionnaire and schedules. Collection of Secondary Data: characteristics, Selection of appropriate method, Case Study method.

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Unit IV (12 Hours)

Classification and tabulation of data*. Diagrammatic & graphic presentation of data. Problems involving arithmetic mean, median, mode, quartiles, deciles and percentiles.

Unit V (12Hours)

Interpretation and Report Writing: Introduction, Techniques and precautions in interpretation, Report writing – significance, different steps, layout, types (technical and popular), mechanics (with examples) and precautions. Publication in a scientific journal.

* denotes Self study

Text Books

1. C.R.Kothari. Research Methodology: Methods and Techniques (2004). New Age International (P) limited. Publishers.
2. N.Gurumani (2015). Introduction to Biostatistics. MJP Publishers.
3. S.P.Gupta. (2009). Statistical Methods, 28th edition, Sultan Chand & Sons

Reference Books

1. Sundar Rao, Jesudian Richard. (2009). An Introduction to Bio-Statistics. 4th edition, Prentice-Hall of IndiaPvt.Ltd.
2. Naren Kr. Dutta (2002). Fundamentals of Biostatistics: Practical Approach. Kanishka Publisher.
3. S.P.Gupta.(2016).FundamentalsofStatistics.6thedition,SultanChand.

** Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	H	S	H	S

S– Strong **H** – High **M**– Medium **L** –Low

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Programme Code: 09	**B.Sc Biochemistry**		
Major elective- NUTRITIONAL BIOCHEMISTRY			
Batch 2022-2023	Hours / Week 4	Total Hours 60	Credits 5

Course Objectives

1. To impart the knowledge on historical overview of nutrition, essential nutrients for metabolism
2. To provide an overview of the major macro and micro nutrients relevant to human health
3. To discuss the scientific rationale for defining nutritional requirements in healthy individuals and populations, with reference to specific conditions such as pregnancy, lactation, and older age

Course Outcomes (CO)

K1 to K5	CO1	Lean about the significance and role of nutrition in maintaining the health
	CO2	Describe the biochemical and physiological functions of the nutrients and their integrated role.
	CO3	Explore the nutritive value of carbohydrates, proteins and amino acids and their importance
	CO4	Learning about malnutrition and balanced diets
	CO5	Evaluate the therapeutic role of key nutrients in maintaining health.

Total Hours: 60

Unit I (12 Hours)

Introduction: Nutrition – concepts - role of nutrition in maintaining health, basic food groups - energy yielding, body building and protective foods. Basic concepts of energy expenditure, unit of energy – Kcal - energy requirements of different categories of people - RQ of foods - Body Mass Index (BMI) - Basal Metabolic Rate (BMR) – determination and factors influencing BMR.

Unit II (12 Hours)

Nutritional significance of dietary components: Physiological role and nutritional significance of carbohydrates, lipids, proteins, vitamins (water soluble and fat soluble) minerals and fiber, Dietary sources, Functions, Digestion, absorption and storage, metabolism of carbohydrates – lipids – proteins.

Unit III (12Hours)

Nutritive value of proteins: Essential amino acids, Biological values of Proteins (animal and plant proteins). Evaluation of proteins by nitrogen balance method-DC, BV, NPU and NAP of animal and plant proteins, single cell proteins, factors influencing protein requirements, Effect of excess protein intake

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Unit IV (12 hrs)

Protein calorie malnutrition: Protein malnutrition (Kwashiorkor) and under nutrition (marasmus) their preventive and curative measures – composition of balanced diet and RDA forinfants, children, adolescent, adult male and female, pregnant, lactating women and geriatrics

Unit V (12 hrs)

Nutrition and body defenses: Effect of drugs on food and nutrients, drug - nutrient interaction - nutritional therapy food preparation and management. Role of diet and nutrition in the prevention and treatment of diseases.

* denotes Self study

Text Books

1. , B. (2013) Nutrition Science Revised Fourth Edition, New Age International Publishers, NewDelhi.
2. Paul, S. (2005) A Textbook of Bio-nutrition – Curing Diseases through Diet, First Edition, CBSPublishers and Distributors, New Delhi.
3. Srilakshmi Swaminathan, M.(2004) Advanced Textbook of Food and Nutrition, Volume II,Second Edition, The Bangalore Printing and Publishing Co. Limited, India.

Reference Books:

1. Geissler, C. and Powers, H.(2010)Human Nutrition, Twelfth Edition, Churchill Livingstone,USA.
2. Brody, T. (2006) Nutritional Biochemistry, Second Edition, Academic Press, USA.
3. Eastwood, M. (2003) Principles of Human Nutrition, Second Edition, Wiley - Blackwell ScienceLtd Publishers, USA

** Questions may also be taken from the self-study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	H	S	S	S

S–Strong **H**–High **M**–Medium **L** –Low

NON MAJOR ELECTIVE COURSES

1. HUMAN RIGHTS

2. WOMEN'S RIGHTS

3. CONSUMER AFFAIRS

UBC 79

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B.Sc BIOCHEMISTRY				
PART IV -NON MAJOR ELECTIVE –I HUMAN RIGHTS				
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2022-2023	**III**	**2**	**30**	**2**

Course Objectives

1. To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.
2. To impart education on national and international regime on Human Rights.
3. To sensitive students to human suffering and promotion of human life with dignity.
4. To develop skills on human rights advocacy
5. To appreciate the relationship between rights and duties
6. To foster respect for tolerance and compassion for all living creature.

Course Outcomes (CO)

K1 to K5	CO1	Understand the hidden truth of Human Rights by studying various theories.
	CO2	acquire overall knowledge regarding Human Rights given by United Nations Organization. (UNO)
	CO3	gain knowledge about various organs responsible for Human Rights such as National Human Rights Commission and state Human Right commission (UNHCR)
	CO4	get habits of how to treat aged person, others and positive social responsibilities
	CO5	treat and confirm, child, refugees and minorities with positive social justice.

UNIT – I

Definition, Meaning, Concept ,Theories and Kinds of Human Rights- Evaluation and Protection of Human Rights in India- Development of Human Rights under the United Nations.

UNIT – II

United Nations Charter and Human Rights - U.N.Commission on Human Rights- Universal Declaration of Human Rights - International Covenant on

- Civil & Political Rights
- Economic, Social and Cultural Rights

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22UHR3N1

UNIT – III

Human Rights and Fundamental Rights (Constitution) - Enactments regarding Human Rights Laws in India - National Human Rights Commission and State Human Rights Commission.

UNIT – IV

Aged persons and their Human Rights - Human Rights of Persons with Disabilities - Tribal Human Rights in India - Three Generation Human Rights -Social Awareness and Responsibilities of Individuals.

UNIT – V

Rights of Women, Child, Refugees and Minorities –Social media and Human Rights - NGO's in protection of Human Rights - Right to Election

Books for Study:

1. Human Rights (2019) Published by Kongunadu Arts and Science College, Coimbatore –29.

Book for Reference:

1. Human Rights, (2018)Jaganathan,MA.,MBA.,MMM.,ML.,ML.,
Humanitarian Law and Refugee Lawlaw series. J.P.Arjun Proprietor,Usha Jaganathan 1st floor, Narmatha Nanthi street, Magathma Gandhi Nagar, Madurai – 625014.

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22UWR4N2

B.Sc BIOCHEMISTRY				
PART IV -NON MAJOR ELECTIVE –II **WOMEN'S RIGHTS**				
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2022-2023	**IV**	**2**	**30**	**2**

Course Objectives

1. To know about the laws enacted to protect Women against violence.
2. To impart awareness about the hurdles faced by Women.
3. To develop a knowledge about the status of all forms of Women to access to justice.
4. To create awareness about Women's rights.
5. To know about laws and norms pertaining to protection of Women.
6. To understand the articles which enables the Women's rights.
7. To understand the Special Women Welfare laws.
8. To realize how the violence against Women puts an undue burden on healthcare services.

Course Outcomes (CO)

After Completion of the Course the student will be able to

K1 to K5	CO1	Appraise the importance of Women's Studies and incorporate Women's Studies with other fields.
	CO2	Analyze the realities of Women Empowerment, Portrayal of Women in Media, Development and Communication.
	CO3	Interpret the laws pertaining to violence against Women and legal consequences.
	CO4	Contribute to the study of the important elements in the Indian Constitution, Indian Laws for Protection of Women.
	CO5	Spell out and implement Government Developmental schemes for women and create awareness on modernization and impact of technology on Women.

Syllabus

Unit I **(6 hrs)**

Women's Studies:

Basic concepts of Women's studies in Higher education, Women's studies perspectives- Socialization- Patriarchy- Women's studies as an academic discipline- Growth and development of Women's studies as a discipline internationally and in India.

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Unit II **(6 hrs)**

Socio-Economic Development of Women:

Family welfare measures, role of Women in economic development, representation of Women in media, status of Women land rights, Women Entrepreneurs, National policy forthe empowerment of women.

Unit III **(6 hrs)**

Women's Rights – Access to Justice:

Crime against Women, domestic violence – physical abuse- verbal abuse – emotional abuse

- economic abuse – minorities, dowry- harassment and death, code of conduct for workplace, abetment of suicide.

Unit IV **(6 hrs)**

Women Protective acts: Protective legislation for Women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention)Act.

Unit V **(6 hrs)**

Women and Child welfare:

Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage. Healing measures for the affected Women and child society by private and public sector, NGO and society.

Teaching Methods:

Smart Class Room / Powerpoint Presentation / Seminar / Quiz / Discussion / Flipped Class

Text Book:

1. **Women's Rights** (2021), Published by Kongunadu Arts & Science College, Coimbatore –641 029.

Reference Books:

1. **"Rights of Indian Women"** by Vipul Srivatsava. Publisher: Corporate Law Advisor, 2014.
2. **"Women's security and Indian law"** by Harsharam Singh. Publisher: Aabha Publishers andDistributors, 2015.
3. **"Women's Property Rights in India"** by Kalpaz publications, 2016.

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Programme Code :	**B.Sc BIOCHEMISTRY**		
Non- Major Elective – Consumer Affairs			
Batch	**Hours/Week**	**Total Hours**	**Credits**
2022-2023	2	30	2

Course Objectives

1. To familiarize the students with their rights and responsibilities as a consumer.
2. To understand the procedure of redress of consumer complaints.
3. To know more about decisions on Leading Cases by Consumer Protection Act.
4. To get more knowledge about Organizational set-up under the Consumer Protection Act
5. To impart awareness about the Role of Industry Regulators in Consumer Protection
6. To understand Contemporary Issues in Consumer Affairs

Course Outcomes (CO)

K1 to K5	CO1	Able to know the rights and responsibility of consumers.
	CO2	Understand the importance and benefits of Consumer Protection Act.
	CO3	Applying the role of different agencies in establishing product and service standards.
	CO4	Analyse to handle the business firms' interface with consumers.
	CO5	Assess Quality and Standardization of consumer affairs

UNIT I **6 Hours**

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000suite

UNIT II **6 Hours**

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III **6 Hours**

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT IV **6 Hours**

Role of Industry Regulators in Consumer Protection

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman
iii. Telecommunication: TRAI
iv. Food Products: FSSAI
v. Electricity Supply: Electricity Regulatory Commission
vi. Real Estate Regulatory Authority

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UNIT II **6 Hours**

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview.

Note: Unit 2 and 3 refers to the Consumer Protection Act, 2086. Any change in law would be added appropriately after the new law is notified.

Teaching Methods:

Smart Class rooms /Power Point Presentations / Seminars/Quiz /Discussion /Flipped Classrooms

SUGGESTED READINGS:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, UniversitiesPress.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications PvtLtd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, RegalPublications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, NewDelhi
5. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
7. E-books :-www.consumereducation.in
8. Empowering Consumers e-book,www.consumeraffairs.nic.in
9. ebook,www.bis.org
10. The Consumer Protection Act, 2086 and its later versions.

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PART IV – SEMESTER III and IV

NON – MAJOR ELECTIVES I AND II (2020 - 2021)

QUESTION PAPER PATTERN
(External only)

Duration : 3 hours **Max. Marks: 75**

Answer ALL Questions

SECTION A (5X5 = 25 marks)

Short answers, either or type, one question from each unit.

SECTION B (5 X 10 = 50 marks)

Essay type questions, either or type, one question from each unit.

PART IV - ENVIRONMENTAL STUDIES

UBC 87

ENVIRONMENTAL STUDIES

22EVS101

B.Sc BIOCHEMISTRY				
PART IV – ENVIRONMENTAL STUDIES				
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2022-2023	**I**	**2**	**30**	**2**

Course Objectives

- The course will provide students with an understanding and appreciation of the complex interactions of man, health and the environment. It will expose students to the multi-disciplinary nature of environmental health sciences
- To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.
- To shape students into good "Ecocitizens" thereby catering to global environmental needs.
- This course is designed to study about the types of pollutants including gases, chemicals petroleum, noise, light, global warming and radiation as well as pollutant flow and recycling and principles of environmental pollution such as air, water and soil
- The course will address environmental stress and pollution, their sources in natural and workplace environments, their modes of transport and transformation, their ecological and public health effects, and existing methods for environmental disease prevention and remediation.

Course Outcomes

On successful completion of the course, the students will be able to

K1 To K5	CO 1	Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities and ecosystems
	CO2	Develop an in depth knowledge on the interdisciplinary relationship of cultural, ethical and social aspects of global environmental issues
	CO3	Acquiring values and attitudes towards complex environmental socio-economic challenges and providing participatory role in solving current environmental problems and preventing the future ones
	CO4	To gain inherent knowledge on basic concepts of biodiversity in an ecological context and about the current threats of biodiversity
	CO5	To appraise the major concepts and terminology in the field of environmental pollutants, its interconnections and direct damage to the wildlife, in addition to human communities and ecosystems

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22EVS101

UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENT (6 hrs)

Definition : scope and importance – Need for public awareness - Natural resources – Types of resources – Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

UNIT II: ECOSYSTEMS (6 hrs)

Concept of an ecosystem – Structure and functions of an ecosystem – Procedures, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food web and ecological pyramids – Structure and function of the following ecosystem – Forest Ecosystem – Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

UNIT III: BIODIVERSITY AND ITS CONSERVATION (6hrs)

Introduction – Definition – Genetic – Species and ecosystem diversity- Bio geographical classification of India – Value of biodiversity – Biodiversity at global, national and local levels – India as a mega - diversity Nation - Hot spot of biodiversity – Threats to biodiversity - Endangered and endemic species of India – Conservation of Biodiversity – *In situ* Conservation of Biodiversity – *Ex situ* Conservation of Biodiversity

UNIT IV: ENVIRONMENTAL POLLUTION (6 hrs)

Definition - Causes, effects and control measures of : Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution – Solid Waste Management: Causes, effects, control measures of urban and industrial wastes – Role of individual in prevention of pollution – Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution – Disaster Management – Food, Drought, Earthquake, Tsunami, Cyclone and Landslide.

UNIT V: SOCIAL ISSUES AND THE ENVIRONMENT (6 hrs)

Sustainable Development – Smart City, Urban planning, Town Planning , Urban problems related to energy – Water Conservation: Rain Water Harvesting and Watershed Management – Resettlement and rehabilitation of people, its problems and concerns, case studies Narmatha Valley Project – Environmental ethics, issues and possible solutions – Climate change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl – Consumerism and waste products – Environmental Protection Act – Air Pollution Act (Prevention and Control) – Water Pollution Act (Prevention and control) – Wild Life Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness – Human Population and the environment – Population Growth and Distribution – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV/ AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health.

22EVS101

Text Book

1.P.Arul, A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velacherry main road, Velacheery, Chennai – 42, First Edition, Nov.2004.

References

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs.Saraswati Prohit, Student Education , Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering , Publisher S.K.Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi -110 006.
3.J.Glynn Henryand Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001

Part IV – I Semester
ENVIRONMENTAL STUDIES

21EVS101

Question Paper Pattern (External only)

Duration:3hours Total Marks: 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

PART IV - VALUE EDUCATION

MORAL AND ETHICS

UBC 90

VALUE EDUCATION – MORAL AND ETHICS

22VED201

B.Sc BIOCHEMISTRY				
PART IV – MORAL AND ETHICS				
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2022-2023	**II**	**2**	**30**	**2**

Course Objectives

- To impart Value Education in every walk of life.
- To help the students to reach excellence and reap success.
- To impart the right attitude by practicing self-introspection.
- To portray the life and messages of Great Leaders.
- To insist the need for universal brotherhood, patience and tolerance.
- To help the students to keep them fit.
- To educate the importance of Yoga and Meditation.

Course Outcomes (CO)

After completing the course the students:

K1 to K5	CO1	will be able to recognize Moral values, Ethics, contribution of leaders, Yoga and its practice
	CO2	will be able to differentiate and relate the day to day applications of Yoga and Ethics in real life situations
	CO3	can emulate the principled life of great warriors and take it forward as a message to self and the society
	CO4	will be able to Analyse the Practical outcome of practicing Moral values in real life situation
	CO5	could Evaluate and Rank the outcome of the pragmatic approach to further develop the skills

22VED201

UBC 91

UNIT I: (4 hrs)

Moral and Ethics: Introduction – Meaning of Moral and Ethics – Social Ethics – Ethics and Culture – Aim of Education.

UNIT II: (6 hrs)

Life and Teachings of Swami Vivekananda: Birth and Childhood days of Swami Vivekananda – At the Parliament of Religions – Teachings of Swami Vivekananda

UNIT III: (4 hrs)

Warriors of our Nation: Subhas Chandra Bose – Sardhar Vallabhbhai Patel – Udham Singh – V. O. Chidambaram Pillai – Bhagat Singh – Tiruppur Kumaran – Dheeran Chinnamalai – Thillaiaadi Valliammai – Velu Nachiyar – Vanchinathan

UNIT IV: (8 hrs)

Physical Fitness and Mental Harmony: Simplified Physical Exercise – Hand Exercises – Leg Exercises – Neuro Muscular Breathing Exercises – Eye Exercises – Kabalabathi – Maharasana A & B – Massage - Acupressure – Relaxation – Kayakalpa Yogam - LifeForce – Aim & Objectives – Principle – Methods. Introspection – Analysis of Thoughts – Moralization of Desires – Neutralization of Anger – Eradication of Worries

UNIT V: (8 hrs)

Yoga and Meditation – The Asset of India: Yogasanam – Rules & Regulations – Surya Namaskar – Asanas –Sitting – Stanging – Prone - Supine - Pranayama – Naadi Sudhi – Ujjayi – Seethali – Sithkari - Benefits. Meditation – Thanduvasudhi - Agna – Shanthi – Thuriyam – Benefits.

Text Books:

1. Value Based Education – Moral and Ethics – Published by Kongunadu Arts and Science College (Autonomous), First Edition (2020).

Reference Books:

1. Swami Vivekananda – A Biography, Swami Nikhilananda, Advaita Ashrama, India, 24th Reprint Edition (2010).
2. Gandhi, Nehru, Tagore and other eminent personalities of Modern India, Kalpana Rajaram, Spectrum Books Pvt. Ltd., revised and enlarged edition(2004).
3. Freedom Fighters of India, Lion M.G. Agrawal, Isha Books Publisher, First Edition (2008).
4. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication(2000).
5. Yoga Practices - 1 – The World Community Service Centre – Vethathiri Publications, Sixth Edition (2017),Erode.
6. Yoga Practices - 2 – The World Community Service Centre – Vethathiri Publications – Eighth Edition (2017),Erode.

22VED201

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Part IV – II Semester

Value Education – Moral and Ethics

<u>Question Paper Pattern</u> (External only)

Duration:3hours Total Marks:50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

SKILL BASED SUBJECTS

1. **CYBER SECURITY**
2. **TECHNIQUES IN BIOTECHNOLOGY**
3. **TECHNIQUES IN GENOMICS AND PROTEOMICS**

UBC 93

22UGC3S1

Programme Code : 07				
Course Code: 22UGC3S1		**Skill Based Subject 1 – Cyber Security**		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2022-2023	**III**	**2**	**30**	**3**

Course Objectives

1. The course introduces the basic concepts of Cyber Security
2. To develop an ability to understand about various modes of Cyber Crimes and Preventive measures
3. To understand about the Cyber Legal laws and Punishments

Course Outcomes (CO)

K1	CO1	To Understand the Concepts of Cybercrime and Cyber Frauds
K2	CO2	To Know about Cyber Terrorism and its preventive measures
K3	CO3	To Analyze about the Internet, Mobile Phone and E-commerce security issues
K4	CO4	To Understand about E-mail and Social Media Issues
K5	CO5	To Describe about various legal responses to Cybercrime

Unit I **6 hrs**

Introduction to Cyber Security: Definition of Cyber Security- Why is Cyber Security important? Layers of Cyber Security- Evolution of Cyber Security. Cyber hacking - Cyber fraud: Definition- Different modes of cyber fraud - Cyber fraud in India. Cyber pornography.

Unit II **6 hrs**

Cyber Terrorism: Modes of cyber terrorism. Cybercrime: What is Cybercrime? Cybercrime preventive methods - Preventive steps for individuals & organizations - Kinds of cybercrime - Malware and its types – Cyber attacks.

Unit III **5 hrs**

Internet Mobile Phone and E-commerce Security issues: Data theft - Punishment of data theft- Theft of internet hours - Internet safety tips for children & parents. Mobile phone privacy- E-Commerce security issues.

Unit IV **6 hrs**

Email and Social media issues: Aspects of Social Media - The Vicious Cycle of unhealthy social media use- Modifying social media use to improve mental health. Computer Virus - Antivirus – Firewalls.

Unit V **7 hrs**

Cyber Forensics and Digital Evidence: What does Digital Footprint Mean? - Web Browsing and Digital Footprints- Digital Footprint examples – How to Protect Your Digital Footprints? - How to erase your Footprints? - Browser Extensions and Search Engine Deletion - Cyber Crime and Cyber Laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

Teaching Methods:

Chalk and Talk, Presentation, Seminar, Quiz, Discussion & Assignment

Text Book:

1. **"Cyber Security", Text Book** prepared by "Kongunadu Arts and Science College", Coimbatore -29, 2022.

Reference Books:

1. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, **"Fundamental of Cyber Security",** BPB Publications, 1st Edition, 2017.
2. Anand Shinde, "**Introduction to Cyber Security-Guide to the world of Cyber Security**",Notion Press,2021.
3. Paul Grishman, "**Cyber Terrorism- The use of the Internet for Terrorist Purpose**",Axis Publication,1st Edition 2010.
4. Shilpa Bhatnagar, **"Encyclopaedia of Cyber and Computer Hacking**", Anmol Publications, 1st Edition 2009.

Web References:

1. http://deity.gov.in/ - Department of Electronics and Information Technology,
2. Govt. of India
3. http://cybercellmumbai.gov.in/ - Cybercrime investigation cell
4. http://ncrb.gov.in/ - National Crime Records Bureau
5. http://catindia.gov.in/Default.aspx - Cyber Appellate Tribunal
6. http://www.cert-in.org.in/ - Indian Computer Emergency Response Team
7. http://cca.gov.in/rw/pages/index.en.do - Controller of Certifying Authorities
8. www.safescrypt.com – Safescrypt
9. www.nic.in – National Informatics Centre
10. https://www.kaspersky.com/resource-center/definitions/what-is-a-digital-footprint
11. https://geekflare.com/digital-footprint/

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Mapping **22UGC3S1**

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	H	S	S	H	S
CO3	M	H	M	S	H
CO4	S	H	H	M	H

S – Strong **H** – High **M** – Medium **L** – Low

Programme Code: 07		B. Sc Biochemistry		
Course Code: 22UBC4S2		Skill Based Subject 2- TECHNIQUES IN BIOTECHNOLOGY		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	IV	2	30	3

Course Objectives

1. To provide a broad overview of the common and important techniques in Biotechnology
2. To provide sufficient knowledge about the overall biotechnology skills
3. To address the aspects of developmental biology, plant and animal tissue culture, fermentation, bioprocessing and bio nanotechnology

Course Outcomes (CO)

K1 to K5	CO1	Recollect the basics of developmental biology
	CO2	Understand the techniques of plant tissue culture
	CO3	Describe the process and introduce about bioprocess techniques
	CO4	Acquire knowledge fermentation and its role in biotechnology
	CO5	Remember Bio Nanotechnology and their materials applications

Total Hours :30

UNIT I (6 hrs)

History & basic concepts of development : Overview of how the modern era of developmental biology emerged through multidisciplinary approaches, stages of development- zygote, blastula, gastrula, neurula, cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation

UNIT II (6 hrs)

Plant tissue culture - History, Laboratory organization, Sterilization methods, Media preparation, Plant Growth Regulators, Micro propagation, Callus culture, Cell Culture, Organogenesis and Somatic embryogenesis. Haploid production: - Anther, Pollen, Embryo and ovule culture.

UNIT III (6 hrs)

Animal Biotechnology - History of animal cell culture*, Different types of cell culture media, growth supplements, serum free media, balanced salt solution, Different types of cell culture media, growth supplements, serum free media, balanced salt solution, Culture of different tissues and its application.

UNIT IV (6 hrs)

Fermentation & bioprocessing - Introduction to fermentation technology, fermentation processes; Microbial culture; Fermentation media; Natural media; synthetic media, Types of Fermentation: Solid Substrate fermentation and submerged fermentation. Introduction to biomass, downstream processing and upstream processing.

UNIT V (6 hrs)

Bio nanotechnology - Nanomaterial in biotechnology - nanoparticles, quantum dots, nanotubes and nanowires. Development of Nano biotechnology. Biological nanoparticles production - plants and microbial. Nano biotechnological applications in health and disease - infectious and chronic.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Michael J.F. Barresi and Scott F. Gilbert. (2019), Developmental Biology. 12th ed. Oxford University Press
2. An introduction to Plant Tissue culture by MK Razdan. M.K. 2003. Oxford & IBH Publishing Co, New Delhi, 2003.
3. Plant tissue culture by Bhojwani. S.S and Razdan. M.K 2004.
4. Portner R. 2007. Animal Cell Biotechnology. Humana Press.
5. Peter F Stanbury, Allan Whitaker, Stephen J Hall. Principles of Fermentation Technology. (2016)

Reference Books:

1. Butterworth-Heinemann Press. UK. ¬ H. J. Peppler, D. Perlman. Microbial Technology: Fermentation Technology. (2014). Academic Press.
2. Nalwa HS. 2005. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology. American Scientific Publ.
3. Nanobiotechnology - II more concepts and applications. (2007) - Chad A Mirkin and Christof M. Niemeyer (Eds), Wiley VCH.

*Questions may also be taken from the self-study portion

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MAPPING **22UBC4S2**

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	H
CO2	S	S	S	S	S
CO3	S	S	H	S	H
CO4	H	H	S	S	H
CO5	H	S	S	H	S

S–Strong **H** – High **M**– Medium **L** – Low

UBC 99

22UBC6S3

Programme Code: 07		**B.Sc Biochemistry**		
Course Code: 22UBC6S3		**Skill Based Subject 3– TECHNIQUES IN GENOMICS AND PROTEOMICS**		
Batch	Semester	Hours / Week	Total Hours	Credits
2022-2023	VI	2	30	3

Course Objectives

1. To perceive knowledge about structure of animal cell membrane and its function.
2. To study about the mechanism of protein sorting and transport in the biological system.
3. To know about the cell cycle and about cancer development.

Course Outcomes (CO)

K1 to K5	CO1	Recollect the organization of the nuclear DNA and mapping
	CO2	Get thorough knowledge about human genome project and sequencing
	CO3	Update the knowledge about comparative genomics
	CO4	Understanding the transcriptomics and Pharmacogenomics applications
	CO5	Analyze the applications of proteomics in various diseases

Total Hours:30

UNIT I (12 Hrs)

Genomics : Definition, omics and its importance. Organization of nuclear DNA and mitochondrial DNA in eukaryotes. Telomeres, Centromeres* and Transposons. RFLP and RAPD. BAC libraries and cDNA libraries**.** Mapping of genome- molecular markers, cytogenetic maps, physical mapping- Restriction mapping, Fluorescent *in situ* hybridization technique, Radiation hybrid mapping, sequence tagged site mapping. Gene editing- Crispr/Cas 9.

UNIT II (12 Hrs)

Sequencing techniques: High throughput sequencing and shotgun sequencing. PCR and RT-PCR. Complementary DNA (cDNA). Human Genome Project (HGP) - features. Positional cloning. Identifying disease genes and Gene therapy

UNIT III (12 Hrs)

Comparative genomics – Definition and its importance. Ortholog and Paralog. Comparative genomics of model organisms- bacteria, *C.elegans* and Drosophila. Synthetic genomes and their applications.

UNITIV (12 Hrs)

Transcriptomics-Definition and applications; DNA microarray and RNA – Seq analysis .Messenger RNA (mRNA) in the cell. Northern blot. Expression profiling and microarray data analysis. Pharmacogenomics.-Introduction and applications. Drug designing and Genetic tests.

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22UBC6S3

UNIT V (12Hrs)

Proteomics- Definition, structural genomics-MALDI-ToF Mass spectrometry (MS), PFGE. Functional genomics: 2D gel electrophoresis. Protein microarray. Peptide finger printing.

Teaching Methods

Chalk and board/Power point presentation/Seminar/Quiz/Discussion/Assignment

Text Books:

1. Brown T.A. (2015). Gene Cloning and DNA analysis, 7th ed., Blackwell publishing Ltd, UK.
2. Primrose S.B and Twyman (2006).Principles of Gene Manipulation and Genomics. 7th ed., Blackwell Publishing, USA.

Reference Books:

1. Stracham.T and Read.A.P.(2004), Principles of Human Molecular Genetics, 3rd edition. Garland Science Publication, NewYork.
2. Clark. D. P. and Pazdernik.N. J (2009). Biotechnology applying the Genetic revolution, Elseiver Academic Press, USA.

** Questions may also be taken from the self study portion*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	S	H	S	H	S
CO3	S	S	S	S	H
CO4	H	S	S	S	M
CO5	H	S	H	S	H

S– Strong **H** – High **M**– Medium **L** –Low

EXTRA DEPARTMENTAL COURSE (EDC) -

HUMAN DISEASES AND HEALTH CARE

UBC 101

22UBC5X1

Programme Code: 07		**For all UG programmes**		
Course Code: 22UBC5X1		**EDC - HUMAN DISEASES AND HEALTH CARE**		
Batch **2022-2023**	**Semester** **V**	**Hours / Week** **2**	**Total Hours** **30**	**Credits** **3**

Course Objectives

1. To learn the importance of nutrients and functions of various organs.
2. To provide sufficient knowledge about the pathogenesis of common human diseases
3. To address the aspects of diseases, diagnosis and treatment essential to maintain human health

Course Outcomes (CO)

K1 to K5	CO1	Recollect the functions of various biological systems.
	CO2	Understand the diseases of circulatory, endocrine and hepatic system.
	CO3	Describe and understand the pathophysiology of diseases.
	CO4	Acquire knowledge about the diseases, diagnosis and treatment essential to maintain human health.
	CO5	Understand the diseases of brain and lungs

Total Hours :30

Unit – I

Infectious and Non infectious diseases – Introduction. Food – Constituents, balanced diet, exercise, therapy – antibiotics (penicillin, streptomycin) and vaccines. Cancer - causative factors, diagnosis, prevention.

Unit – II

Pancreas - functions and disease (Diabetes Mellitus)- causative factors, diagnosis, prevention, diet and control. Liver- functions and diseases (Cirrhosis and Jaundice)- causative factors, diagnosis, prevention, diet and control.

Unit – III

Heart- functions, diseases (Myocardial infarction; Atherosclerosis) -causative factors, diagnosis, prevention, diet and control

Unit – IV

Kidney - functions and diseases (Nephrotic syndrome, Calculi)- causative factors, diagnosis, prevention, diet and control

UBC 102

22UBC5X1

Unit – V

Brain – functions and disease (Alzheimer's Disease) - causative factors, diagnosis, prevention, diet and control – Lungs – functions and Disease (Respiratory disease – Asthma & COVID- 19)

REFERENCES

1. Kumar, Abbas and Fausto. (2002). ―Pathological basis of Diseases.‖ Elsevier Publishers 7th Edition.
2. Errol C. Friedbnerg. (1986). ―Cancer Biology‖. W.H. Freeman and Company. G J Tortora (1982) ―Principles of Human Physiology‘‘, Harper & Row, New York, 2nd Edition

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	H
CO2	S	H	S	H	S
CO3	S	S	S	S	H
CO4	H	S	S	S	M
CO5	H	S	H	S	H

S– Strong **H** – High **M**– Medium **L** –Low

CERTIFICATE P R O G R A M M E S

1. **MUSHROOM TECHNOLOGY**
2. **INDIGENOUS FOODS AND NUTRACEUTICALS**
3. **PHARMACOVIGILENCE AND REGULATORYAFFAIRS**

UBC 103

CERTIFICATE PROGRAMME IN MUSHROOM TECHNOLOGY

Subject code/ Question paper code	Title of the Paper	Lecture hours/ week	Exam marks			Duration of exam	Credits
			CIA	ESE	Total		
22CBCA101	Mushroom Science	2	50	50	100	3	2
22CBCA102	Mushroom Cultivation	2	50	50	100	3	2
22CBCA1CL	Practical	2	50	50	100	3	2
Total		**90**			**300**		**6**

CIA- Continuous Internal Assessment; ESE- End of Semester Examinations

UBC 104

22CBCA101

Programme Code:07	B.Sc Biochemistry		
Course Code: 22CBCA101	**MUSHROOM SCIENCE**		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives:

1. To learn the basics of mushroom biology
2. To learn the nutritional and medicinal properties of mushrooms
3. To learn the morphology and life cycle of mushrooms

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	To learn the mushrooms and its properties
	CO2	To study the growth factors and cultivation technologies
	CO3	To acquire the knowledge about Composting
	CO4	To learn the Knowledge of mushroom culture technology
	CO5	To explore the mushroom spawn production process

Total Hours:60

UNIT – I (6 Hours)

Mushrooms:

Introduction, biodiversity, edible and non-edible species, variations in morphology. Nutrient Profile - Protein, amino acids, calorific values, carbohydrates , fats, vitamins & minerals. Health benefits of mushroom.

UNIT – II

Growth Factors: (6 Hours)

Environmental factors (Hydrogen Ion Concentration (pH), Temperature, Aeration, Light, and Gravity), Nutritional Factors (Concentration of Nutrients, Nature of Carbohydrate, Nitrogen, Mineral Nutrition, Vitamins) and Chemical Factors. Overview of Cultivation Technologies

UNIT – III (6 Hours)

Compost & Composting:

Principles of composting, machinery required for compost making, materials for compost preparation.

Methods of Composting- Long method of composting (LMC) & Short method of composting (SMC).

UNIT – IV (6 Hours)

Mushroom Tissue Culture Technology: Commonly used growth media, preparation of media, methods of isolation of mushroom tissue, inoculation, mycelial growth, storage and preservation of cultures. Revival of cultures, sub culturing methods. Factors affecting the growth of mycelial cultures. Equipment's for mushroom tissue culture process.

UNIT – V (6 Hours)

Mushroom Spawn Production Technology:

Definition – Spawn, types of substrates used for spawning. Facilities required for spawn preparation, Preparation of spawn substrate, preparation of pure culture, media used in raising pure culture, culture maintenance, and storage of spawn.

Text Book:

1. Better life with mushrooms (2014), S. Krishnakumari and S. Kathiravan, Kongunadu Arts and Science College, Coimbatore – 641029, Tamil Nadu, India.

References:

1. Mushroom Cultivation, Tripathi, D.P. (2005) Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
2. PathakYadavGour (2010). Mushroom Production and Processing Technology, Published by Agrobios(India).
3. Nita Bahl, 2002. Hand Book on Mushroom 4th edition. Vijay Primlani for oxford and IBH Publishing Co. Pvt. Ltd., NewDelhi.
4. Training Manual on Culture Techniques & Spawn Production (2017), S. Krishnakumari, S. Kathiravan, M. Karthik, V. Suganthi, and B. Krishna, Kongunadu Arts and Science College, Coimbatore – 641029, Tamil Nadu, India.
5. Shu-Ting Chang and Philip G. Miles (2004) Mushrooms -Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact.2nd edition. CRC PressLLC.
6. Philip G. Miles and Shu-Ting Chang. Mushroom Biology Concise Basics and Current Developments (1997). World Scientific Publishing Co. Pte.Ltd.

UBC 106

22CBCA101

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 107

22CBCA102

Programme Code:07	B.Sc Biochemistry		
Course Code: 22CBCA102	MUSHROOM CULTIVATION		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives:

1. To learn the various aspects of mushroom tissue culture technology.
2. To know about the processes involved in mushroom spawn production.
3. To learn the technology of oyster and milky mushroom cultivation.
4. To create an awareness on management of post mushroom substrate.
5. To get involved in value added product production from mushrooms.

Course Outcomes: (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Learn the process of oyster mushrooms cultivation
	CO2	Learn the process of milk mushroom cultivation
	CO3	Study the biotic and abiotic factors responsible for disorders
	CO4	Learn to manage post mushroom cultivation
	CO5	Affairs business and entrepreneurial skill in mushroom

UNIT –I (6 Hours)

Technology of Oyster Mushroom Cultivation: Infrastructural facilities required for cultivation, Process of cultivation: Sterilization, selection of substrate, processing, packing of substrate, spawn inoculation, spawn running, maintenance of temperature and humidity, harvest of mushrooms andpacking of mushrooms.

UBC 108

22CBCA102

UNIT – II (6 Hours)

Technology of Milky Mushroom Cultivation:

Infrastructural facilities required for cultivation, Process of cultivation: Sterilization, selection of substrate, processing, packing of substrate, spawn inoculation, spawn running, maintenance of temperature and humidity, harvest of mushrooms and packing of mushrooms.

UNIT –III (6 Hours)

Mushroom Disease Management:

Biotic factors responsible for disorders: Nematodes, Parasitic fungi, Antagonistic fungi, Pathogenic bacteria, virus, Viroids, mycoplasmas, and rickettsias. Abiotic factors responsible for disorders.

UNIT-IV (6 Hours)

Management of Post Mushroom Substrate (PMS):

Use of Post Mushroom Substrate in soilreclamation, organic fertilizer, source for biogas production, animal feed, casing material for mushroomcultivation, vermi compost production and other uses. Societal and Environmental impact of PMS management.

UNIT–V (6 Hours)

Strategies for successful Mushroom Business

Economics of Spawn and mushroom cultivation. Storage and shelf life of mushroom after harvest – Mushroom recipes. Mushroom in industrial perspectives. - Production of various mushroom based value based products.

Text Book:

1. Better life with mushrooms (2014), S. Krishnakumari and S. Kathiravan, Kongunadu Arts and Science College, Coimbatore – 641029, Tamil Nadu, India.

Reference Books:

1. Mushroom Cultivation, Tripathi, D.P. (2005) Oxford & IBH Publishing Co. Pvt. Ltd, NewDelhi.
2. PathakYadavGour (2010). Mushroom Production and Processing Technology, Published by Agrobios(India).
3. Nita Bahl, 2002. Hand Book on Mushroom 4th edition. Vijay Primlani for oxford and IBH Publishing Co. Pvt. Ltd., NewDelhi.
4. Training Manual on Culture Techniques & Spawn Production (2017), S. Krishnakumari, S. Kathiravan, M. Karthik, V. Suganthi, and B. Krishna, Kongunadu Arts and Science College, Coimbatore – 641029, Tamil Nadu, India.
5. Elaine Marshall and N. G. (Tan) Nair. (2009) make money by growing mushrooms. Rural Infrastructure and Agro-Industries Division, Food and Agriculture Organization of the United Nations. Rome.
6. Shu-Ting Chang and Philip G. Miles (2004) Mushrooms -Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact.2nd edition. CRC PressLLC.
7. Philip G. Miles and Shu-Ting Chang. Mushroom Biology Concise Basics and Current Developments (1997). World Scientific Publishing Co. Pte.Ltd.
8. Marian Petre (2016). Mushroom Biotechnology. Developments and Applications. 1st edition. Academic Press.USA.

UBC 109

22CBCA102

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 110

22CBCA1CL

Programme Code:07	B.Sc Biochemistry		
Course Code: 22CBCA1CL	PRACTICAL - MUSHROOM CULTIVATION		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives:

1. To provide a hands-on training on the technologies of mushroom tissue culture, spawn production and cultivation.
2. To equip the students with the different techniques and instrumentation.

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	To understand the mushroom tissue culture
	CO2	To study the different techniques and instruments
	CO3	To learn the Spawn production technology
	CO4	Acquire skills in mushroom cultivation technology
	CO5	Analyze the primary and secondary metabolites in mushroom

I. Tissue culture, spawn and mushroom production techniques

1. Sterilization of tissue culture and spawn productionutensils.*
2. Media preparation for mushroom tissue culture.*
3. Inoculation of the tissue/culture into the culture media.
4. Sub culturing of mycelia from slant/petri plate.
5. Mushroom spawn preparation*
6. Preparation of F1 and F2 generation from mother spawn*
7. Substrate processing for mushroom production.*
8. Making of mushroom beds.*

Text Book:

1.S.Sadasivam and A.Manikam (2005). Biochemical Methods. 2nd edition. New Age International (P) Limited Publishers. New Delhi.

References:

1. Mushroom Cultivation, Tripathi, D.P. (2005) Oxford & IBH Publishing Co. Pvt.Ltd, NewDelhi.
2. PathakYadavGour (2010). Mushroom Production and Processing Technology, Published by Agrobios(India).
3. Training Manual on Culture Techniques & Spawn Production (2017), S. Krishnakumari, S. Kathiravan, M. Karthik, V. Suganthi, and B. Krishna, Kongunadu Arts and Science College, Coimbatore – 641029, Tamil Nadu, India.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 112

CERTIFICATE PROGRAMME IN INDIGENOUS FOODS AND NUTRACEUTICALS

Subject code/ Question paper code	Title of the Paper	Lecture hours	Exam marks			Duration of exam	Credits
			CIA	ESE	Total		
22CBCB101	Nutraceuticals	2 hrs	50	50	100	3	2
22CBCB102	Indigenous Food	2hrs	50	50	100	3	2
22CBCB1CL	Practical	2 hrs	50	50	100	3	2
Total		**90**			**300**		**6**

CIA- Continuous Internal Assessment; ESE- End of Semester Examinations

UBC 113

22CBCB101

Programme Code:07	**B.Sc Biochemistry**		
Course Code: 22CBCB101	**NUTRACEUTICALS**		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To learn the basics of nutraceutical Sciences
2. To learn the Nutrition related diseases and disorders
3. Impart knowledge of specialty nutraceuticals their technology requirements.

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Describe the basics of nutraceutical Sciences
	CO2	To study the different types of Nutrition related disorders
	CO3	To learn the nutraceuticals technology and their requirements
	CO4	To learn the nutrition related diseases and disorders
	CO5	Acquire the knowledge about prebiotics and probiotics nutraceuticals

UNIT I (6 hrs)

Nutrients

Basics of energy balance - Basal Metabolic Rate (BMR), Body Mass Index (BMI) and Standard Dynamic Action (SDA) with special reference to nutraceutical industry. Energy Carbohydrates, lipids and proteins Fat soluble vitamins-A, D, E and K Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C Minerals – calcium, iron, iodine, fluorine, copper and zinc.

UNIT II

Nutritional significance of dietary components (6 hrs)

Physiological role and nutritional significance of carbohydrates, lipids, proteins, vitamins (water soluble and fat soluble) minerals and fibre. Dietary sources. Functions. Digestion, absorption and storage, metabolism of carbohydrates – lipids – proteins.

UNIT III **(6 hrs)**

Phytonutraceuticals

Introduction to free radicals, Reactive oxygen species, Free radicals involvement in other disorders. Antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress. Plant secondary metabolites- Alkaloids, phenols, Flavonoids Terpenoids and their role in maintaining good health. Algae as source of omega - 3 fatty acids.

UNIT IV **(6 hrs)**

Nutrition related diseases and disorders

Carbohydrates, Protein, amino acids, Fat, vitamins and minerals - excess and deficiency, symptoms, prevention and management. Role of nutraceuticals with special reference to the prevention and treatment of diabetes mellitus, hypertension, hypercholesterolemia and cancer. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.

UNIT V **(6 hrs)**

Microbial nutraceuticals

Concept of prebiotics and probiotics - principle, mechanism, production and technology involved, applications - examples of bacteria used as probiotics, use of prebiotics in maintaining the useful microflora - extraction from plant sources. Bio fortification and nutritional enhancement.

Text Books:

1. Swami Nathan, M.(2004) Advanced Textbook of Food and Nutrition, Volume II, SecondEdition, the Bangalore Printing and Publishing Co. Limited, India.

References Books

1. Srilakshmi, B. (2013) Nutrition Science Revised Fourth Edition, New Age International Publishers, New Delhi.
2. Israel Goldberg (Ed.) (1999) Functional foods, designer foods, pharma foods, Nutraceuticals, Aspen publishers Inc., USA
3. L. Rapport and B. Lockwood (2002) Nutraceuticals, 2nd Edition, Pharmaceutical Press, London.
4. M. Maffei (Ed.) (2003) Dietary Supplements of Plant Origin, Taylor & Francis, London.
5. Shahidi and Weerasinghe (Ed.) (2004) Nutraceutical beverages Chemistry, Nutrition and health Effects, American Chemical Society, Washington.5. Richard Neeser & J. Bruce German (2004) Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Jean, Marcel Dekker,Inc
6. Frei, B. (1994) Natural antioxidants in human health &disease. Academic Press, USA.
7. San Diego, Tannock, G.W. (1999) Probiotics: A critical review, Horizon Scientic Press, UK.
8. H. Panda, Herbal beauty products with formulation & processes, Asia Pacific Business PressInc.

21CBCB101

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MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 116

22CBCB102

Programme Code:07	**B.Sc Biochemistry**		
Course Code: 22CBCB102	**INDIGENOUS FOODS**		
Batch	Hours / Week	Total Hours	Credits
2022-2023	2	30	2

Course Objectives

1. To learn the food processing and product development
2. Training in the formulation, processing, manufacture and packaging requirements of food products
3. To learn Food laws and Regulations

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Describe the basics of Food processing and product development
	CO2	To Understand the formulation and packaging of food products
	CO3	Using statistical analytical techniques and their applications
	CO4	Using the software tools quality control equipment's and applications
	CO5	To study about the Food laws and regulations

UNIT I (6 hrs)

Introduction to food processing industry

Introduction and scope of food processing industry – Indian scenario; Opportunities and domains of food processing sectors; Skills required in the different sectors: Dairy, Vegetable, Fruits, Beverages, Spices processing sectors; Government policies: FICSI.

UNIT II (6 hrs)

Product development

Activity screening, formulations of products from minor millets, energy drinks, bars, sports drinks, fortified products, geriatric products, veterinary products, immune boosters, and bioavailability.

Packaging Principles of packaging; Types of packaging; Special packaging: Vacuum, gas and shrinkage packaging; Function of packaging; Packaging materials: structural qualities, performance, moisture and gas transmission; Interaction between food and packaging material; Shelf life testing.

UNIT III (6 hrs)

Quality Assurance

Quality checks - quality assurance samples, master sample, internal controls, statistical analysis of test data, techniques and concepts of statistical quality control and statistical process control, non-conformities. Operational aspects – calibration, accuracy checks of quality control equipment's and applications of software used in quality analysis.

UNIT IV (6 hrs)

Reporting and documentation

Quality analysis Reporting of different products, Documentation – methods and procedures of writing and maintaining lab, research records, research performance reports, schemes and guidelines, power point presentations, tables, charts, word documents, development of research objectives and proposal writing for funding and contractual purposes, publications and technical writing, Regulatory compliance of the final documents.

UNIT V (6 hrs)

Food Laws and Regulations

FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. Regulations and Claims – Current Products: Label Claims, Nutrient Content Claims, Health Claims, Dietary Supplements Claims. FSSAI Roles and responsibilities.Marketing and regulatory issues for functional foods and nutraceuticals recent developments and advances in the area of nutraceuticals and functional foods.

Text Books

1. Anjaneyulu, Y. and Marayya, R. (2005). Quality assurance and quality management in pharmaceutical industry. Hyderabad, A.P.: Pharma Book Syndicate.

Reference Books

1. Jameel, F., Hershenson, S., Khan, M. and Martin-Moe, S. (n.d.). Quality by design for biopharmaceutical drug product development.

2. Reklaitis, G., Garcí́a-Munoz, S. and Seymour, C. (n.d.). Comprehensive quality by design for pharmaceutical product development and manufacture.

3. Abraham, J. and Lawton Smith, H. (2003). Regulation of the pharmaceutical industry. Hound mills, Basingstoke, Hampshire: Palgrave Macmillan.

4. Haider, S. (2002). Validation standard operating procedures. Boca Raton [Fla.]: St. Lucie Press, London New York.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 119

22CBCB1CL

Programme Code:	**B.Sc. Biochemistry**		
Course Code: 22CBCB1CL	**PRACTICAL- INDIGENOUS FOODS AND NUTRACEUTICALS**		
Batch	Hours/Week	Total Hours	Credits
2022-2023	2	30	2

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Understand the food processing and product development
	CO2	Impact the knowledge of formulation and packaging of food products
	CO3	Study about the Food laws and regulations
	CO4	Skills in Preparation of labeling food products
	CO5	Study the evaluation probiotic/prebiotic foods

1. Identification of food sources for various nutrients using food composition tables.
2. Principle and practice of various extraction procedures used in herbal industry. Phytochemical profiling of plant sample and extract.
3. Record diet of self using 24 hour dietary recall and its nutritional analysis.
4. Nutritional labelling of food products.
5. Estimation of BMI and other nutritional status parameters.
6. Formulation of a health drink.
7. Industry visit to a food processing and nutraceutical unit.
8. Preparation of certificate of analysis of processed food.
9. Preparation and evaluation of various food samples- cookies/ biscuits/ snack foods
10. Preparation and evaluation of probiotic/prebiotic foods.

UBC 120

22CBCB1CL

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	H	S
CO2	S	S	S	H	S
CO3	S	S	H	S	H
CO4	H	S	S	S	M
CO5	H	S	H	H	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 121

CERTFICATE PROGRAMME IN PHARMACOVIGILENCE AND REGULATORYAFFAIRS

Subject code/ Question paper code	Title of the Paper	Lecture hours	Exam marks			Duration of exam	Credits
			CIA	ESE	Total		
22CBCC101	Pharmacovigilance	2 hrs	50	50	100	3	2
22CBCC102	Regulatory affairs	2 hrs	50	50	100	3	2
22CBCC1CL	Practical	2 hrs	50	50	100	3	2
Total		**90**			**300**		**6**

CIA- Continuous Internal Assessment; ESE- End of Semester Examinations

UBC 122

22CBCC101

Programme Code:07	**B.Sc Biochemistry**		
Course Code: 22CBCC101	**PHARMACOVIGILANCE**		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives:

Upon completion of this course the student should be able to:

1. Understand the Adverse Drug Reactions
2. Understand the Reporting Database.
3. Eligible to understand the role of clinical pharmacist in Pharmacovigilance.

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Describe the basics of Drug reactions
	CO2	To Understand the reporting Database
	CO3	To study about the clinical pharmacist in Pharmacovigilance.
	CO4	Acquire the knowledge about the Pharmacovigilance scope and opportunities
	CO5	To study about the Pharmacovigilance software tools

Total hours:30

UNIT I

Introduction to Pharmacology and Pharmacovigilance (6 hrs)

History of pharmacology, ADME properties and mechanism of drug absorption and its metabolism, Pharmacokinetics, materials and formulations, drug delivery system. History and development of Importance of safety monitoring of Medicine WHO international drug monitoring programme, Pharmacovigilance Program of India (PvPI) and milestones.PV- Pharmacovigilance,
- Master key for drug safety monitoring – Types of PV – Role of pharmaceutical profession in PV.

UNIT II (6 hrs)

Methods, ADR reporting and tools used in pharmacovigilance

International classification of diseases, International Non-proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, Vigi Flow, Statistical methods for evaluating medication safety Data.

UNIT III (6 hrs)

Case Processing

Pharmacovigilance Database. ICSR narrative process of uploading ICSRs in software to PVPI. Case Processing- Global Perspective of Pharmacovigilance. Case Narrative Writing. Pharmacovigilance- Auditing and Inspection. Quality System in Pharmacovigilance. SOPs in Pharmacovigilance.

UNIT IV (6 hrs)

The scope of Pharmacovigilance and opportunities

PV a career path for health care professional Pharmacovigilance planning -Need PV in Industry-Example of case studies of Pharma companies & PV audits – Future of PV in India

UNIT V **(6 hours)**

Pharmacovigilance Software Tools

Pharmacovigilance communications and Pharmacoepidemiology. Pharmacoepidemiology; main sources of epidemiological pharmacovigilance information. An overview and applications of Pharmacovigilance Software.

Text Books

1. Textbook of Pharmacovigilance by SK Gupta. Publisher: Jaypee Brothers, Medical Publishers Pvt. Limited.
2. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi, Ajay Prakash. Publisher: Jaypee Brothers, Medical Publishers Pvt. Limited.
3. Stephens' Detection of New Adverse Drug Reactions by John Talbot, Patrick Waller. Publisher: John Wiley & Sons.

Reference Books

1. Cobert's Manual of Drug Safety and Pharmacovigilance by Barton Cobert. ISBN-13: 9780763791599. 5. Mann's Pharmacovigilance, 3rd Edition by Elizabeth B. Andrews and Nicholas Moore. ISBN-13: 9780470671047.
2. An Introduction Pharmacovigilance by Patrick Waller. Publisher: Wiley-Blackwell

UBC 124

22CBCC101

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 125

22CBCC102

Programme Code:07	**B.Sc Biochemistry**		
Course Code: 22CBCC102	**REGULATORY AFFAIRS**		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

Upon completion of this course the student should be able to:

1. Understand the Regulatory affairs
2. Learn Documentation reviews
3. Learn to the Clinical trails

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Understanding the Principles and guidelines of ethical committee
	CO2	Study about the Regulatory activities and laws
	CO3	Learn about the drug safety pharmacovigilance
	CO4	Acquire the knowledge about the Clinical trial reports
	CO5	Study about the controlled drug regulation

UNIT- I: (6 hrs)

Regulatory Perspectives of Clinical Trials:

Origin and Principles of International Conference on Harmonization – Good Clinical Practice (ICH-GCP) guidelines Ethical Committee: Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant-Schedule Y, ICMR, Informed Consent Process: Structure and content of an Informed Consent Process Ethical principles governing informed consent process.

UNIT II (6 hrs)

Regulatory activities PV laws and Guideline

Regulatory and procedural guidelines involved in Global PV – Good Pharmacovigilance practices (GVP) Expectations of regulatory authority towards industry – Brief introduction on PVGI – PV guidelines of India.

UNIT- III: (6 hrs)

Clinical Trial Documentation:

Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring-Safety Monitoring in CT Adverse Drug Reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment. Predictability and preventability assessment. Management of adverse drug reactions; Terminologies of ADR. The role of the pharmaceutical professional in drug safety and pharmacovigilance.

UNIT- IV: (6 hrs)

Documents overviews:

Integration of regulatory affairs in pre- & post-marketing company activities; planning and reviewing product strategy. Prescription-Only-Medicines (POM) & Over-The-Counter (OTC) medicines; OTC switching strategies. Generics and biosimilar. Parallel imports, Common Technical Document (CTD & eCTD). Overviews; aggregate clinical trial report reviews, including annual reports and CTD summaries.

UNIT- V: (6 hrs)

Clinical Trials:

Types and Design: Experimental Study- RCT and Non RCT, Observation Study: Cohort, Case Control, Cross sectional Clinical Trial Study Team Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management. Controlled Drug regulation.

Text Books

1. Textbook of Pharmacovigilance by SK Gupta. Publisher: Jaypee Brothers, Medical Publishers Pvt. Limited.
2. Cobert's Manual of Drug Safety and Pharmacovigilance by Barton Cobert. ISBN-13: 9780763791599. 5. Mann's Pharmacovigilance, 3rd Edition by Elizabeth B. Andrews and Nicholas Moore. ISBN-13: 9780470671047.

Reference Books

1. Pharmacovigilance Medical Writing: A Good Practice Guide by Justina Orleans-Lindsay. Publisher: John Wiley & Sons.
2. ICH of technical requirements for registration of pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for GCP.E6
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. ICMR, New Delhi

UBC 127

22CBCC102

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	S	S
CO2	S	S	S	H	S
CO3	S	S	M	S	H
CO4	H	S	S	H	M
CO5	H	S	H	S	S

S– Strong **H** – High **M**– Medium **L** –Low

UBC 128

22CBCC1CL

Programme Code:07	B.Sc Biochemistry		
Course Code: 22CBCC1CL	**PRACTICAL- PHARMACOVIGILENCE AND REGULATORY AFFAIRS**		
Batch	Hours/Week	Total Hours	Credits
2022-2023	2	30	2

Course Outcomes (CO)

On successful completion of the course, the students will be able to

K1 to K5	CO1	Understand the Documentation of drug monitoring
	CO2	Impact the knowledge of Regulatory authority sources
	CO3	Study about the medical coding
	CO4	Learn about the Pharmacovigilance Software
	CO5	Study the Clinical safety data management reports

The practical will include case studies on topics covered in the theory above

Passive surveillance • Spontaneous Reports • Case series • Stimulated Reporting • Active surveillance • Sentinel sites • Drug event monitoring • Registries • Comparative Observational Studies • Cross-Sectional Study (Survey) • Case-Control Study Cohort Study • Targeted Clinical Investigations • Descriptive Studies • Natural History of Disease • Drug Utilization Study.

Medical coding • QC review • Medical review • Different Pharmacovigilance Software Contractual agreements Regulatory authority sources • Call centers • Triage of cases the minimum information required for reporting purpose • Case processing • Data entry into safety database. Clinical Safety Data Management: Data Elements for Transmission of Individual Case Safety Reports.

UBC 129

22CBCC1CL

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	H	S
CO2	S	S	S	H	S
CO3	S	S	H	S	S
CO4	H	H	S	S	M
CO5	H	S	S	H	H

S– Strong **H** – High **M**– Medium **L** –Low

UBC 130

QUESTION PAPER PATTERN FOR PART III PRACTICAL BIOCHEMISTRY

Core Practical 1 - Biochemistry

22UBC2CL

Time: 3 hrs **Max. Marks: 50**

a. Analyse systematically the given unknown sugar solution and write the systematic procedure (15+5marks).

b. Analyse systematically the given unknown amino acid solution and write the systematic procedure (15+5marks).

c. Record – 10marks

Valuation of answer scripts:

A. Core Biochemistry Practical 1

For qualitative analysis, the following samples shall be given

I –Carbohydrate

Glucose, Fructose, Arabinose, Sucrose, Lactose and Starch

II –Aminoacid

Arginine, Histidine, Tyrosine, Tryptophan and Cysteine

ESE Marks

Qualitative Analysis I

Procedure	05
Test and Results	15
Analysis II	
Procedure	05
Test and Results	15
Record	10
Total	**50**

CIA Marks

Attendance	05
Observation Note book & Regularity	**15**
CIA model Practical Test	30 (50 marks will be converted to 30)
Total	**50**

UBC 131

22UBC4CM

Core Practical 2- Biochemistry

Time: 3 hours **Max. Marks: 50 marks**

I. a) Estimate the amount of phosphorus present in 100ml of given unknown solution. (Odd numbered candidates)

(OR)

b) Determine the Km value of the enzyme acid phosphatase by Michaelis- Menton method (Even numbered candidates) (30)

II. Write the procedures assigned to the above experiments. (10)

III. Record submitted (10)

ESE Marks

Colorimetric Experiment

No	**Details**	**Marks (Biochemical parameters & Enzymology)**
1	Tabular Column	5
2	Graph	5
3	Calculation	5
4	Accuracy of Result	15
5	Procedure	10
6	Record	10
	Total	**50**

CIA Marks

Attendance	05
Observation notebook & Regularity	15
CIA model Practical Test	30 (50 marks will be converted to 30)
Total	**50**

UBC 132

Core Practical 3 Biochemistry **22UBC6CN**

Time : 6 hours

Max. Marks: 50 marks

I. For odd numbered candidates. Estimate the amount of glucose present in 100ml of the urine sample by Benedict'ss method. **(or)**

For even numbered candidates. Estimate the amount of calcium present in 100ml of the given urine sample by permanganate method. (15)

II. For odd numbered candidates. Estimate the amount of urea present in 100 ml of the given serum sample by DAM-TSC method. **(or)**

For even numbered candidates. Estimate the amount of uric acid present in 100 ml of the given serum sample by caraway method. (15)

III. Write the procedures assigned to the above experiments.(10)

IV. Record submitted(10)

UBC 133 **22UBC6CN**

Quantitative analysis

ESE Marks

No	Details	Marks
	I Urine Analysis	
1	Procedure	5
2	Tabular Column	5
3	Calculation	5
4	Accuracy of Results	5
	Total	**20**
	II Blood Analysis	
1	Procedure	5
2	Tabular Column	2
3	Graph	3
4	Calculation	5
5	Accuracy of Results	5
	Total	**20**
	Record	10
	Total	**50**

CIA Marks

Attendance	05
Observation notebook & Regularity	15
CIA model Practical Test	30 (50 marks will be converted to 30)
Total	**50**

UBC 134

Core Practical 4 –Biochemistry

22UBC6CO

Time: 4 hours **Max. marks : 50marks**

I. a) Estimate the amount of DNA present in the given sample by Diphenylamine method

(or)

b) Estimate the amount of RNA present in the given sample by Orcinol method **30marks**

II. a) Using simple staining method determine the microorganism in the given sample

(or)

b) Identify the microorganism in the given sample by the method of gram staining **10marks**

III. Record **10marks**

UBC 135

CORE PRACTICAL 4 – BIOCHEMISTRY

ESE Marks **22UBC6CO**

No	Details	Marks
	I. GeneticTechnology	
1	Procedure	5
2	Tabular Column	5
3	Graph	5
4	Calculation	5
5	Accuracy of Result	10
	Total	**30**
	II Microbiology	
1	Procedure	5
2	Report	5
	III Record	10
	Total	**20**
	Total ESE	**50**

CIA Marks

Attendance	05
Observation notebook & Regularity	15
CIA model Practical Test	30 (50 marks will be converted to 30)
Total	**50**

UBC 136

Core Practical 5 –Biochemistry

22UBC6CP

Time:4hours **Max. marks: 50marks**

I. a) Estimate the amount of starch present in the given sample (or)

b) Estimate the amount of total phenols present in the given sample **30marks**

II. a) Examine the given urine sample whether it contains HCG Hormone (or)

b) Analyze the serum sample for RA Factor **10marks**

III. Record **10marks**

UBC 137

Core Practical 5 – Biochemistry

22UBC6CP

ESE

No	Details	Marks
	I. Plant biochemistry	
1	Procedure	5
2	Tabular Column	5
3	Graph	5
4	Calculation	5
5	Accuracy of Result	10
	Total	**30**
	II Immunology	
1	Procedure	5
2	Report	5
	III Record	10
	Total	**20**
	Total ESE	**50**

CIA

Attendance	05
Observation notebook & Regularity	15
CIA model Practical Test	30 (50 marks will be converted to 30)
Total	**50**

UBC 138

Allied Practical 2 - Biochemistry

22UBC4AL

Time : 3 hours

Total: 25 marks

I. Qualitatively analyze the given unknown sugar sample and give the systematic procedure (10).

II. Analyse systematically the given unknown amino acid solution and write the procedure (10).

III Record – 5 marks

Allied Practical 2 Biochemistry

For qualitative analysis, the following samples shall be given.

II. Carbohydrate

Pentose, glucose, fructose, sucrose, lactose and starch.

III. Amino acids

Histidine, Tyrosine, Tryptophan, Arginine and cysteine.

UBC 139

22UBC4AL

Qualitative Analysis

No	Details	Marks
	ESE	
	Analysis I	
1	Procedure	5
2	Test and Results	5
	Analysis II	
1	Procedure	5
2	Test and Results	5
	Record	5
	Total (ESE)	**25**
	CIA	
1	Attendance	5
2	Observation notebook & Regularity	10
3	CIA model Practical Test	10 (25 marks will be converted to 10)
	Total	**25**
	Grand Total	**50**

KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)

COIMBATORE – 641029

SCHEME AND SYLLABUS FOR

DEPARTMENT OF BIOCHEMISTRY (PG) AND RESEARCH

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2022 - 2023 and onwards)

PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY

PG PROGRAMME OUTCOMES

PO1: To presume, question and evaluate, solve problems, integrate knowledge and widen perspective.

PO2: To understand that communication comprises attentiveness and listening, reading and comprehension, to communicate and collect information through oral and written formats.

PO3: To apply contemporary research methods, skills and techniques in a scientific discipline.

PO4: To reveal empathetic social concern and national development, and the ability to act with an informed awareness of issues and participate in civic life through Volunteering.

PO5: To understand the issues of environmental contexts and sustainable development and to engage in independent and life-long learning.

PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY

PROGRAMME SPECIFIC OUTCOMES

PSO1: Understanding of structure and metabolism of macromolecules, regulation and disorders of metabolic pathways.

PSO2: Investigate the impact of science in society and plan to pursue research

PSO3: Gain proficiency in laboratory techniques in both biochemistry and molecular
biology and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.

PSO4: Understand the application of biochemistry in clinical laboratory.

PSO5: Acquire thorough knowledge in biochemical techniques, immunology, physiology, molecular biology, genetic engineering and biotechnology.

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE – 641029, TAMIL NADU, INDIA.
Course Name: M.Sc. Biochemistry
Curriculum and Scheme of Examination under CBCS

Semester	Subject code	Title of the paper	Instruction hours/cycle	Exam Marks			Duration of Exam (H_{rs})	Credits
				CIA	ESE	Total		
I	22PBC101	C.P.1 Biomolecules and Biopolymers	5	50	50	100	3	4
	22PBC102	C.P.2 Bioanalytical Techniques	5	50	50	100	3	4
	22PBC103	C.P.3 Enzymes and Enzyme Technology	5	50	50	100	3	4
	22PBC104	C.P.4 Cellular Biochemistry	5	50	50	100	3	4
	22PBC1CL	C.Pr.1 Biomolecules, Bioinstrumentation, Enzymology and Cell Biology	5	50	50	100	6	4
	22PBC1E1	Major Elective- I	5	50	50	100	3	5
Total Hours			**30**	**300**	**300**	**600**		**25**
II	22PBC205	C.P.5 Plant Biochemistry	5	50	50	100	3	4
	22PBC206	C.P.6 Metabolism and Metabolic Regulation	5	50	50	100	3	4
	22PBC207	C.P.7 Molecular Biology	5	50	50	100	3	4
	22PBC208	C.P.8 Drug Biochemistry	5	50	50	100	3	4
	22PBC2CM	C.Pr.2 Plant Biochemistry, Genetics and Molecular Biology	5	50	50	100	5	4
	22PBC2E2	Major Elective- II	5	50	50	100	3	5
Total Hours			**30**	**300**	**300**	**600**		**25**
III	22PBC309	C.P.9 Advanced Immunology and immunological techniques	6	50	50	100	3	5
	22PBC310	C.P.10 Biostatistics and Research Methodology	6	50	50	100	3	4
	22PBC311	C.P.11 Advanced Clinical Biochemistry	7	50	50	100	3	4
	22PBC3CN	C.Pr.3 Immunology, Genetic Engineering and Clinical Biochemistry	5	50	50	100	5	4
	22PBC3N1	Non-Major Elective –I	4	50	50	100	3	4

	22PBC3ST	Summer training*	-	Grade				-
		EDC	2	100	-	100	3	2
Total Hours			**30**	**350**	**250**	**600**		**23**
IV	22PBC412	C.P.12 Hormonal Biochemistry	5	50	50	100	3	4
	22PBC413	C.P.13 Genetic Engineering	5	50	50	100	3	4
	22PGI4N2	Non-Major Elective –II	5	100	-	100	3	4
	22PBC4Z1	Project and Viva-voce	15	50	50	100	-	3
		SWAYAM – MOOC	-	-	-	-	-	**2**
Total Hours			**30**	**250**	**150**	**400**		**17**
GRAND TOTAL			**120**	**1200**	**1000**	**2200**		**90**

(Applicable for the Students Admitted during the Academic Year 2022-2023)

Note:

CBCS – Choice Based Credit system
CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

Major Elective Papers
(2 papers are to be chosen from the following 4 papers)

1. Nanobiotechnology
2. Microbiology
3. Bioinformatics
4. Bioethics, Biosafety and IPR

Non Major Elective Papers
(2 papers are to be chosen from the following 4 papers)

1. Information security #
2. Competitive Sciences
3. Bioprocess Technology
4. Cancer Biology

 # - To be offered by Department.

Sub. Code & Title of the Extra Departmental Course (EDC):

22PBC3X1 – EDC Paper 1 - Nutritional Biochemistry

Tally Table:

Subject	No. of Subjects	Total Marks	Credits
Core – Theory / Practical / Project	17	1700	68
SWAYAM – MOOC	-	-	2
Major Elective Papers	2	200	10
EDC Paper	1	100	2
Non Major Elective Paper	2	200	8
Grand Total	**22**	**2200**	**90**

- 50 % CIA is applicable to all subjects except EDC, NME, JOC, and COP.
- The students should complete a **SWAYAM-MOOC** before the completion of the 3rd semester and the course completed certificate should be submitted through the HOD to the Controller of Examinations. Two credits will be given to the candidates who have successfully completed. In case the students have completed more than one online course, the appropriate 2 extra credits shall be awarded to such candidates upon the submission of certificate through the HOD to the Controller of Examinations.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

Components of Continuous Internal Assessment (50 Marks)

Components		Marks	Total
Theory			
CIA I	75	(75+75) converted to 30	50
CIA II	75		
Problem based Assignment**		10	
Attendance		5	
Others*		5	
Practical			
CIA Practical		50 (Converted to 30)	50
Observation Notebook		15	
Attendance		5	

Project		
Review I	22.5	50
Review II	22.5	
Regularity	05	

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering; **K2**-Understanding; **K3**-Applying; **K4**-Analyzing; **K5**-Evaluating

Theory Examination

i) CIA I & II and ESE: 75 Marks

Knowledge Level	**Section**	**Marks**	**Description**	**Total**
K1 – K2 Q1 to 20	A (Answer all)	20 x 1 = 20	MCQ-10/ Fill ups-5/ One word-5	75**
K2 – K5 Q21 to 28	B (5 out of 8)	5 x 5 = 25	Short Answers	
K2 – K5 Q29 to 33	C (3 out of 5)	3 x 10 = 30	Descriptive/ Detailed	

****For ESE 75 marks converted to 50 marks.**

ESE Practical Examination:

Knowledge Level	**Section**	**Marks**	**Total**
K3	Experiments	40	50
K4	Record Work	10	
K5			

ESE Project Viva Voce:

Knowledge Level	**Section**	**Marks**	**Total**
K3	Project Report	30	50
K4	Viva voce	20	
K5			

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 1 – Biomolecules and Biopolymers			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn about the chemistry and structures of Biomolecules
2. To know the properties of different Biomolecules
3. To know the physiological functions of Biomolecules

Course Outcomes (CO)

K1 ↑ ↓ K5	CO1	Correlate the classification and functions of Biomolecules in energy Production.
	CO2	Apply the link between the structure and function of amino acids and Proteins in biological system.
	CO3	Able to know about execute of Biomolecules in human health
	CO4	Analyze and study the chemical and biochemical properties pharmacogenetics field
	CO5	Apply the structural studies to biological processes like replication, transcription and translation.

Unit I **(15 Hours)**

Carbohydrates: Structure, occurrence, properties and biological functions of Monosaccharides, Disaccharides, O-linked and N-linked oligosaccharides, Polysaccharides: Homoglycans: Structure, occurrence, properties and biological functions of starch, cellulose, glycogen and chitin. Heteroglycans: Structure, occurrence, properties and biological functions of glycosaminoglycans. Structure and biological role of peptidoglycans, lipopolysaccharides and proteoglycans.

Unit II **(15 Hours)**

Amino acids and water: Structure, nomenclature, classification, acid-base behavior and chemical reactions of amino acids; Stereoisomerism and optical properties of amino acids; Non-protein amino acids. Amino acid derivatives. Water and its physicochemical properties, Ionization of water, pH scale, Henderson-Hasselbalch equation.

Unit III **(15 Hours)**

Proteins: Structural organization of protein: Primary structure. Determination of protein structure: Ramachandran plot. Polypeptide synthesis. Secondary structures – α-helix, β-

sheet and β-turns, Pauling and Corey model for fibrous proteins, Reverse turns and super secondary structures, Collagen triple helix. Tertiary structure – α and β domains. Conformational properties of silk fibroin. Quaternary structure of proteins: Structure and functions of myoglobin and hemoglobin.

Unit IV **(15 Hours)**

Lipids: *Classification, structure, functions and properties of lipids. Fatty acids - saturated and unsaturated. Structure and functions: Phospholipids and glycolipids. Eicosanoids-structure and biological role of prostaglandins, thrombaxanes and leucotrienes. Steroids: structure and functions of cholesterol. Lipoproteins- classification and composition. Amphipathic lipids-emulsions and liposomes.

Unit V **(15 Hours)**

Nucleic acids: Structure of nucleic acids, DNA double helical structure– Watson and Crick model. A, B and Z DNA, Palindromes, Inverse repeats, cruciform and hairpins, Triple and quadruple structures. DNA sequencing Methods: – House Stream Geometry method and Sanger's Dideoxy chain termination method. Properties of DNA: UV absorption spectra, buoyant density, denaturation and renaturation, cot curves, DNA hybridization, DNA super coiling and linking number. Chemical synthesis of DNA. Structure and biological functions of major forms of RNA: mRNA, rRNA and tRNA.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Nelson, David L. and Cox. (2017). Lehninger Principles of Biochemistry.7th edition,W.H.Freemanand Co.,NY

2. U.Sathayanarayana. (2017). Biochemistry. 5th edition, Books and allied (P) Ltd., India

Reference Books.

1. Voet, D, Voet, J.G. and Pratt, C.W. (2013). Principles of Biochemistry. 4th edition, John Wiley & Sons, New Delhi -10002.
2. Garrette R. Hand Grisham, C. M. (2013). Principles of Biochemistry. 5th edition, Saunders college publishers.

3. Eric E.Conn, P.K. Stump f, G.Brueins and Ray H.Doi, John. (2005). Outlines of Biochemistry. 5thedition. Wiley and sons, Singapore.
4. Moran, Horton, Scrimgeour, Perry & Rawn (2013). Principles of Biochemistry, 5th edition Pearson New International Edition, UK.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	H	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07		**Programme Title:** M.Sc Biochemistry	
Title of the paper Core Paper 2 – Bio analytical Techniques			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn the principle and instrumentation of various separation techniques
2. To know the applications of various separation techniques in biological fields
3. To learn the concept of radioactivity and explore its role in various fields.

Course Outcomes (CO)

K1 ↑	CO1	Recall the principle and applications of bioinstrumentation
	CO2	The students will discern the principle, Instrumentation of different types of Bio analytical techniques
	CO3	The students also discern about applying the instrumentation techniques of Centrifugation, Electrophoresis and Chromatography in various research
↓ K5	CO4	The students will determine the knowledge and practice concerning modern analytical instrumentation and students can able to enter into large scale Industries.
	CO5	Appreciate the principle, instrumentation and difference between various spectroscopic methods.

Unit I **(15 Hours)**

Introduction: Extraction, Pre-treatment, Stabilization and preparation methods of bio products for analysis. Electrophoretic Techniques: Principle, equipment and process, Agarose gel electrophoresis, gradient electrophoresis, horizontal and vertical gel electrophoresis, electrophoresis techniques, isoelectric focusing, capillary electrophoresis and application of electrophoresis in analyzing macromolecules.

Unit II **(15 Hours)**

Chromatography and purification: *Classification, principles, techniques and applications of adsorption, reverse phase, ion exchange, size exclusion, TLC, Paper chromatography, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques. Sophisticated chromatographic technique: Principle, techniques and applications of HPLC, GCMS, LC-MS,

Unit III **(15 Hours)**

Spectroscopy: Overview of introduction to spectroscopy. Principles, techniques and applications of UV-Visible spectroscopy, FTIR, Spectro fluorimetry, Flame photometry, Fluorescence spectroscopy, Raman spectroscopy, NMR Spectroscopy.

Unit IV **(15 Hours)**

Microscopic and nanomechanical microscopic Characterization: *overview of microscopy, Morphology and identification of cells using Cell fractionation and flow cytometry, SEM, TEM and Confocal Microscopy, EDAX, Elemental mapping, - Differential Scanning Calorimeter (DSC).

Unit V **(15 Hours)**

Clinical instrumentation: Diagnostic and therapeutic equipments – Blood pressure monitor, electrocardioscope, pulse ox meter, pH meter- autoanalyser, Pace makers, ultra sound imaging system-micro and macro, CT scan.

*** denotes Self study**

Teaching Methods

Power point presentation/ Seminar/ Quiz/ Discussion/ Assignment/ Google Classroom/ Google Classroom

Text Books

1. Upadhyay, Upadhyay and Nath. (2012). Biophysical Chemistry – Principles and Techniques, 4th Revised edition, Himalaya Publishing House Pvt. Ltd.

2. Keith Wilson, John Walker. (2000). A biologist's guide to Principles and Techniques of Practical Biochemistry, 5thedition, Cambridge University Press, New York.

3. Analytical techniques in biochemistry and molecular biology R. Katoch Springer, New York, 2011

4. Biological spectroscopy I. D. Campbell Benjamin/Cummings Pub. Co 1984

5. Separation Processes in Biotechnology Asenjo, Juan A. CRC / Taylor & Francis 1990

Reference Books

1. D.J. Homie and H. Peck. (2003). Analytical Biochemistry. 1st edition, Rastogic CBS Publisher.

2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch (2008). Fundamentals of Analytical Chemistry. 4th edition, Barkha Nath Printers, India.

3. Keith Wilson and John Walker. (2011). Principles and Techniques of Biochemistry and Molecular Biology.7th edition, Cambridge University Press, NewYork.

4. Chatwal, Gand Anand, S. (2005). Instrumental methods of chemical analysis. Himalaya Publishing House.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	H	M
CO2	H	S	M	M	S
CO3	H	M	S	H	M
CO4	M	S	S	H	S
CO5	M	S	H	S	S

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Core Paper 3 – Enzymes and Enzyme Technology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To know the classification and properties of enzymes
2. To learn about the mechanism of enzyme action
3. To know the applications of enzymes in clinical and diagnostic fields

Course Outcomes (CO)

K1 ↑	CO1	Remember the fundamentals of enzyme properties
	CO2	Conceive the different procedures involved in enzyme technology
	CO3	Able to assay the enzyme and their kinetics and also apply to this in the industry and other technological field
	CO4	Estimate enzyme technology for the commercialization purpose of biotechnological products
↓ K5	CO5	Apply purification techniques of enzymes and immobilization techniques.

Unit I **(15 Hours)**

Classification, Purification And Active Site: Nomenclature and classification of enzymes, isolation and purification of enzymes – by different methods, criteria of purity - specific activity. Enzyme units - Katal, IU. Measurement of enzyme activity - two point assay, kinetic assay, using radiolabelled substrates. Active site - determination of active site amino acids - chemical probe, affinity label, and site-directed mutagenesis, intrinsic and extrinsic regulations. Investigation of 3-D structure of active site. A brief account of non protein enzymes – ribozymes.

Unit II **(15 Hours)**

Mechanism of Enzyme Action and Regulation :Enzyme specificity, Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, proximity and orientation effects, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lysozyme, and ribonuclease.

Regulation of enzyme activity- covalently modified regulated enzymes, allosteric enzymes, multienzyme complex - occurance, isolation and properties. Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthase. Isoenzymes-LDH.

Unit III **(15 Hours)**

Enzyme kinetic and inhibition : Kinetics of single substrate enzyme - catalysed reactions - Michaelis - Menten equation, importance of Vmax, Km, turnover number; Line weaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot and Eisenthal and Cornish - Bowden plot.

Kinetics of Allosteric enzymes - MWC and KNF models Hill' equation coefficient. Kinetics of multi - substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism. Reversible inhibition -competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition. Irreversible inhibition. Feedback inhibition

Unit IV **(15 Hours)**

Coenzymes: Coenzymes - prosthetic group, classification - vitamin and non vitamin coenzymes, thiamine pyrophosphate - mechanism of oxidative and non oxidative decarboxylation, transketolase reaction, FMN and FAD - flavoprotein enzymes, mechanism of oxidation and reduction of: flavin enzymes, NAD and NADP role in enzyme catalysis, PALP and PAMP - role of PALP in transamination and decarboxylation reaction, ***Coenzyme A involved reactions**, biotin - carboxylation reaction, folate coenzymes, coenzyme role of vitamin Bl2 .

Unit V **(15 Hours)**

Enzyme Technology : Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerase, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production.

Clinical enzymology - Enzymes as thrombolytic agents, anti-inflammatory agents, digestive aids. Therapeutic use of asparginase, streptokinase. Diagnostic enzymes. Immobilization of enzymes and their applications. Abzymes

Immobilization techniques and applications: Adsorption, microencapsulation, entrapment, covalent and ionic bonding. Biosensors: Calorimetric, Potentiometric, Amperometric, immunosensors and optical biosensors. Ribozyme, abzyme. Purification of protein.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Text Books

1. Trevor Palmer. (2001). Enzymes: Biochemistry, Biotechnology and Clinical chemistry. Horwood Chemical Science Series. Horwood Publishers.

2. Anil Kumar & Sarika Garg, (2015), Enzymes and Enzyme Technology, Viva books, Newdelhi.

Reference Books

1. Talwar. G.P (2012), Text book of biochemistry and Human Biology, 3rd edition, Prentice Hall of India Private Ltd, New Delhi.

2. Balasubramanian *et al*., (2015). Concepts in Biotechnology, Universities Press India Ltd.

3. EE. Conn and PK. Stump f, G. Bruening and RY. Doi (2010), Outlines of biochemistry, 5thed, John Wiley and Sons, New York,USA.

4. Robert J. Whitehurst, Maarten Van Oort. (2010). Enzymes in Food Technology.2ndedition, John Wiley and SonsLtd.

5. David L Nelson, Micheal M Cox. (2013). Lehninger's Principles of Biochemistry, 6thedition, Replika Press (P) Ltd, India.

6 .Julio Polainaand Andrew P. (2007). Industrial Enzymes: Structure, Function and Applications (Springer). MacCabe (Editors).

MAPPING

PSO / CO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	H	M	M	H	S
CO2	S	H	M	S	H
CO3	M	S	H	M	M
CO4	S	H	S	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub. Code: 22PBC104

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Core Paper 4 – Cellular Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn the models and functions of biological membrane
2. To learn about the structure and functions of cytoplasmic organelles
3. To learn the mechanism of membrane transport in cells

Course Outcomes (CO)

K1 ↕ K5	CO1	Recall the basic concepts of cells.
	CO2	Understand the knowledge of cell structure and function
	CO3	Employ their knowledge of cell biology to selected examples of changes or Losses in cell function.
	CO4	Analyze the cell structure, cell signaling and cell functions
	CO5	Decipher the intracellular signaling modes in mitochondria

Unit I **(15 Hours)**

Cellular organization: Membrane models, chemical composition of membrane, membrane proteins, Transport and bulk transport across the cell membrane (osmosis, diffusion, endocytosis, phagocytosis, artificial liposomes) and its application.

Unit II **(15 Hours)**

Sub-cellular organelles: Structure and functions of intracellular organelles such as cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, mitochondria, chloroplasts, lysosomes, peroxisomes, glyoxisomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin)

Unit III **(15 Hours)**

Cell division and interactions: Over view of Cell division - mitosis and meiosis. Cell cycle – stages of interphase and M-phase – cell synchrony and its applications. Cell-Cell interactions - Metabolic cooperation, electrical coupling, contact inhibition, autocrine, paracrine and endocrine signalling.

Ecological amplitude of cells in high altitude, sediments, arctic, hot springs, arid, brackish and fresh water environments.

Unit IV **(15 Hours)**

Cell locomotion: Cytoskeletal elements - Microtubules, ***microfilaments** (actin and myosin), intermediary filaments - cell locomotion (amoeboid, flagella and ciliary), muscle and nerve cells as terminally differentiated cells, muscle cells, general structure of skeletal and smooth muscles, microfilament organization in skeletal and smooth muscles – sliding filament mechanism of contraction. Nerve cells – general structure of a neuron – synapses – types (electrical and chemical).

Unit V **(15 Hours)**

Cell differentiation, senescence and death Cell differentiation in plants: Fertilization, initial divisions, seed formation, germination, primordial layer formation, organogenesis (only sources of organs from each layer). **Cell differentiation in animals**: fertilization, implantation, blastula formation, gastrulation, primordial germ layers, organogenesis (only sources of organs from each layer). **Cell senescence**: Biochemical changes during senescence – role of telomere and telomerase. **Cell death** – necrosis and programmed cell death (apoptosis, paraptosis and autophagy).

***denotes self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom/

Text Books

1. Dr.Veer Bala Rastogi (2018). A Textbook of Cell Biology and Genetics. KNRN Publishers. Meerut.

2. P.S. Vermaand V.K. Agarwal. (2014). Cell Biology, Genetics, Molecular biology, Evolutionand Ecology, S.Chand and Company,New Delhi.

Reference Books

1. Harvey Lodish, Arnold Berk *et al*., (2007). Molecular Cell Biology. 6thedition, W H Freeman and Company, New York.

2. Garrette R.H and Grisham, C. M. (2013). Principles of Biochemistry. 5thedition, Saunders College Publishers.

3. Alberts *et al*., (2014). Molecular biology of the cell. 6th edition, Garland Publishers.

4. David E Sadava. (2004). Cell Biology-Organelle structure and Function. Panima

publishing Corporation, New Delhi.

5. G. Karp. (2001). Cell and Molecular Biology. 3rd edition, John Wiley & Sons publisher.

6. Geoffrey M.Cooper and Robert E. Hausman. (2009). The Cell: A Molecular Approach. 5th edition, ASM Press, Washington D.C.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	S
CO2	H	S	S	M	M
CO3	S	H	S	S	M
CO4	S	M	M	H	S
CO5	S	M	M	S	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code: 22PBC1CL

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title : Core Practical 1 – Biomolecules, Bioinstrumentation, Enzymology and Cell Biology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To get practical experience in analyzing the biochemical metabolites in biological samples, bioinstrumentation, enzyme technology and cell biology techniques
2. To have hands on experience on chromatography, electrophoresis, enzyme and cell biology techniques
3. To develop familiarity with bioanalytical techniques and applications of enzyme and cell biology in research and industries

Course Outcomes (CO)

K1 ↑	CO1	Reproduce various concepts in Biomolecules, enzyme and cell biology.
	CO2	Conceive the amount of Biomolecules, isolation, purification and determination of enzyme, preparation of buccal smears
	CO3	Apply the enzyme technology and cell biology skill in basic research projects
	CO4	Assign the principles of Biomolecules, enzyme and cell biology techniques to discovery novel drug development
↓ K5	CO5	Be competent to perform various biochemical analysis.

Biomolecules

1. Estimation of Starch

2.Estimation of Fructose

3.Estimation of Glycogen

4. Estimation of Ascorbic acid

5. Estimation of Total Free Amino acids by Ninhydrin method

6.Extraction of total carotenoids and estimation of β-Carotene

7.Separation of plant pigments by paper chromatography

8.Separationofaminoacidsbythinlayerchromatography

9. PCR and Agarose gel electrophoresis (Demo)

10.Gel Documentation (Demo)

11. GC and HPLC (Demo)

12 .Determination of Alanine transaminase activity

13. Determination of Lactate dehydrogenase activity

14 .Isolation of mitochondria and estimation of succinate dehydrogenase

15. Animal cell types(Demo)

16. Cell Counting – RBC and WBC

17. Buccal smear – Identification of Barr body

18.Mitosis in onion root tip

Teaching Methods

Demonstration/Video lectures/Laboratory visits/Institutional visits

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	M
CO2	H	S	S	M	M
CO3	M	H	H	S	S
CO4	M	M	M	S	S
CO5	M	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code: 22PBC205

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 5–Plant Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn the mechanism and importance of photosynthesis in plants
2. To learn the role of hormones in the growth metabolism of plants
3. To know the latest genetic engineering techniques for plant development

Course Outcomes (CO)

K1 ↕ K5	CO1	Recall the biosynthesis of primary and secondary metabolites, nitrogen metabolism involved in plants
	CO2	Understand the concept of plant tissue culture and plant transformation techniques
	CO3	Know about applications of phytoconstituents in development of new Drug
	CO4	Experiment on new technologies in plant biotechnology
	CO5	Evaluate various gene transfer techniques

Unit I **(15Hours)**

Pigments: Introduction to the Structure, function and mechanisms of action of phytochromes (pigment system I and II), cryptochromes and phototropins, stomatal movement, transpiration, photoperiodism and biological clocks, plant movement. Importance of photosynthesis (c3, c4 and CAM), cellular respiration and photorespiration pathways and their significance.

Unit II **(15Hours)**

Nitrogen metabolism: Role of micro and macronutrients .Significance of nitrogen. Ammonification, nitrification, nitrate reduction, Physical and biological nitrogen fixation-symbiotic, non-symbiotic. Symbiotic nitrogen fixation in leguminous plants, biochemistry of nitrogen fixation, denitrification and nitrogen cycle.

Unit III **(15Hours)**

Plant hormones: Factors affecting the growth of plants, characteristics and classification of plant hormones. Chemistry, biosynthesis, physiological effects, applications of auxins, gibberellins, cytokinins, abscicicacid, ethylene.

Unit IV **(15Hours)**

Secondary metabolites and plant tissue culture: Biosynthesis and functions of terpenoids. Functions of alkaloids, anthocyanins, Tannins and lignin. Applications of secondary metabolites. Plant tissue culture-Micropropagation, Callus induction, cell and protoplast culture, organogenesis and somatic embryogenesis. Haploid production-Anther, pollen, embryo and ovule culture and their applications. Applications of plant tissue culture.***Soma clonal variation.**

Unit V **(15Hours)**

Techniques for plant transformation: Agrobacterium mediated gene transfer and its applications, Ti plasmid, the process of T-DNA transfer to plants: Mechanism. Agrobacterium mediated gene transfer in tobacco. Bt-crops and golden rice production. Drought and herbicide resistance. Transformation methods: Particle bombardment, polyethyleneglycol (PEG) mediated transformation and electroporation. Validation of transformation – resistance genes, marker genes and transgene DNA.

*** denotes Self study Teaching Methods**

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. V.K. Jain. (2016). Fundamentals of Plant Physiology, 18 thedition, S.Chand and Company Pvt.Ltd, New Delhi.

2. S.K.Verma and Mohit Verma. (2008). A Textbook of Plant Physiology, Biochemistry and Biotechnology. 2ndedition. S.Chand and Company Pvt.Ltd, New Delhi.

Reference Books

1. Plant Biochemistry, Dey J.B. Harborne, (2000). Academic Press.

2. Adrian Slater, Nigel W. Scott, Mark R. (2008). Plant Biotechnology: The genetic manipulation of plants. Fowler Oxford University Press.

3. C. Neal Stewart. (2008). Plant Biotechnology and Genetics-Principles, Techniques and Applications. Jr. John Wileyand sons Publishers, UK.

4. William G. Hopkins. (2008). Introduction to Plant Physiology, 2 ndedition, John Wiley and sons Publishers,UK.

5. RazdanM.K. (2003). An introduction to Plant Tissue culture. 2ndedition, Oxford & IBH Publishing Co, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	H	S	M
CO2	H	S	M	M	M
CO3	M	H	M	S	S
CO4	S	M	S	H	M
CO5	S	M	H	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme C ode: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 6 – Metabolism and Metabolic Regulation			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	4

Course Objectives

1. To learn the metabolism of various Biomolecules in our system
2. To provide a basic understanding of the biochemical reactions of molecules
3. To study the interrelationship of various metabolic pathways

Course Outcomes (CO)

K1	CO1	Remember commemorate the overall concept of cellular metabolism
↕	CO2	Explain the metabolism of various biochemical pathways
	CO3	Execute the diseases associated with defective nucleotide biosynthesis
	CO4	Analyze the role of fat in energy production and membrane synthesis
K5	CO5	Define and explain the metabolism in various nutritional status and starvation.

Unit I **(15 Hours)**

Overview of metabolism

Interconversion of food stuffs. Metabolic profile of the liver, adipose tissue and brain. Integration of metabolic pathways- overview. Feedback and reciprocal regulation of metabolic pathways. Metabolic variations under altered nutritional/physiological status- starvation, well fed and pregnancy. Compartmentalization of metabolic pathway in the cell. Metabolic fuels: definition and Caloric value of metabolic fuels.

UNIT II **(15 Hours)**

Carbohydrate metabolism and regulation

Introduction to metabolism of cells, Aerobic glycolysis & Fermentation - Energetics of glycolysis. Gluconeogenesis, substrate cycle & reciprocal regulation of glycolysis & gluconeogenesis. Metabolism of glycogen & regulation. Maintenance of blood sugar by liver.

Citric acid cycle and energetics. The amphibolic nature of the Citric acid cycle – Anaplerotic mechanism, HMP shunt, Uronic acid pathway, Cori's cycle, Glyoxalate pathway. Metabolism of fructose, Galactose & Mannose.

UNIT III **(15 Hours)**

Fatty acid metabolism and regulation

Oxidation of saturated & unsaturated fatty acids. Oxidation of fatty acids with even & odd numbered carbon atoms. Alpha, Beta & Omega oxidation. Ketogenesis, Biosynthesis of saturated & unsaturated fatty acids. Regulation of fatty acid metabolism. Mitochondrial and microsomal chain elongation. Metabolism of triacyl glycerol, phospholipids & sphingolipids. Cholesterol biosynthesis & regulation. Degradation of cholesterol, lipoprotein metabolism. Cyclic & linear pathways of Arachidonic acid metabolism – Prostaglandins, Prostacyclins and thrombaxenes metabolism.

UNIT IV **(15 Hours)**

Amino acid metabolism and regulation

Degradation of amino acids – transamination, oxidative and non - oxidative deamination, decarboxylation - Urea cycle and regulation. Catabolism of amino acids - carbon skeleton of amino acids to amphibolic intermediates, key role of glutamate dehydrogenase in nitrogen metabolism. Conversion of amino acids to specialized products: Serotonin, Gamma amino butyric acid, Dopamine, Epinephrine, Nor - Epinephrine, Melanin, Creatinine, Creatine. Integration of Metabolism - Interrelationship of Carbohydrates, Protein and Fat metabolism. Metabolism of individual amino acids; few important amino acids.

UNIT V **(15 Hours)**

Nucleotide Metabolism

Metabolism of Porphyrin - Biosynthesis and degradation of Porphyrin, Heme formation, Biosynthesis of Bilirubin, transport and excretion of bile pigment.

Metabolism of Nucleotides, De novo synthesis and Salvage pathway of Purine nucleotides, degradation of Purine nucleotides, De novo synthesis and Salvage pathway of Pyrimidine nucleotides. Degradation of Pyrimidine nucleotides, Inhibitors of Nucleotide metabolism

***denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Satyanarayana, U and Chakrapani, U. (2013). Biochemistry. 4 thedition, Books and Allied Pvt. Ltd, Kolkata, 700010.

2. Robert K. Murray, Daryl K. Granner and Victor W. Rodwell. (2008), Harper's illustratedBiochemistry.29thedition,McGraw HillCompanies,Inc.New Delhi.

Reference Books

1. Voet, D., Voet, J.G. and Pratt, C.W. (2013). Fundamentals of Biochemistry, Life at theMolecularLevel.4thedition, John Wiley&Sons,NewDelhi,110002

2. Garrette R.H and Grisham, C. M. (2012), Principles of Biochemistry. 5th edition, Saunders college publishers.

3. David L. Nelson, Micheal M. Cox. (2008). Lehninger's Principles of Biochemistry. Replika press (P) Ltd, India

4. Vasudevan D.M., Sreekumari S. and KannanVaidyanathan (2011). Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical PublishersPvt. Ltd., New Delhi, 110002.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	S	H	M	S	M
CO3	M	S	H	S	S
CO4	H	S	S	M	H
CO5	S	H	S	M	H

S-Strong **H**–H igh **M**–Medium **L** –Low

Sub.Code: 22PBC207

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 7 –Molecular Biology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To understand the molecular organization of genes and chromosomes
2. To learn the process of DNA synthesis, repair and function
3. To learn the various molecular events occurring in DNA with proposed theories

Course Outcomes (CO)

K1 ↑	CO1	Able to define the basic concepts of gene
	CO2	Recognize the different processes involved in replication, transcription and Translation
	CO3	Integrate scientific and technological knowledge on the use of genetics and molecular biology for industrial products on the cell and process level
	CO4	Examine the molecular mechanisms behind DNA damage and repair
↓ K5	CO5	Appraise the various concepts of regulation of genes.

Unit I **(15Hours)**

Concept of gene: Molecular structure of gene and chromosomes. Mendelian Principles: Mono and dihybrid cross. Incomplete Dominance, over dominance, Codominance, Epistasis. Linkage and crossing over, Sex determination and Sex linkage in diploids. Polygenic inheritance. Chromosomal aberrations .Karyotyping. Human Genetic Diseases - Down's syndrome, Turner's syndrome, Klinefelter's syndrome.

Unit II **(15Hours)**

Gene mutation and recombination: Gene Mutation-Classification of mutations, DNA as a genetic material (Transformation, Conjugation and Transduction).

Genetics of viruses: Lytic and Lysogenic life cycles of phages. Genetic Recombination (Homologous recombination-Holliday model). Modern concept of genes. Population genetics: Hardy-Weinberg law. Quantitative genetics and multifactorial interactions, causes of variation and artificial selection.

Unit III **(15Hours)**

Replication: Mechanism of replication in prokaryotes and eukaryotes, Theta and rolling circle model, Enzymology of replication. Replication of RNA genome- replicase and reverse transcriptase. Termination of replication-circular and linear replications.

Unit IV **(15Hours)**

Transcription and Translation: Universal genetic code and its feature. Prokaryotic and eukaryotic transcription. RNA processing and post- transcriptional modification. Regulatory sequences in protein coding genes. Transcription initiation by RNA polymerase I, II and III. Processing of eukaryotic pre mRNA, RNA splicing, snRNA, spliceosome.RNA editing.

Translation- activation of amino acids, initiation, elongation, termination in prokaryotes and eukaryotes. Translational proof-reading- Posttranslational processing of protein.

Unit V **(15Hours)**

Regulation of transcription and translation: Positive and negative control, Repressor and Inducer, concept of operon, lac-, ara-, trp operons. Catabolic repression, attenuation, anti- termination and methylation. Macromolecular transport across thenuclear envelope.Synthesis andtargeting of peroxisomal proteins.Overview of secretory pathway. Translocation of secretory products across ER membrane.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. P.S. Verma and V.K. Agarwal. (2014). Cell Biology, Genetics, Molecular biology, Evolution and Ecology.S.Chandand Company, New Delhi.
2. Lodish, D. *et al*., (2007). Molecular Cell Biology. 6th edition, Scientific American Books,Inc.

Reference Books

1. De Robertis. (2001). Cell and Molecular Biology. 8th Edition, Dhanpat Rai Publisher.
2. Nalini Chandar, Susan Viselli. (2010). Lippincott Illustrated Reviews: Cell and Molecular Biology. LWW: North American Edition.
3. Robert Franklin Weaver. (2011). Molecular Biology. 5th edition, Mc-Graw Hill science.
4. Alberts *et al., (*2014). Molecular Biology of the Cell. 6th edition, Garland Publishers.
5. Benjamin Lewin. (2007). Genes IX. 9th edition, Jones & Bartlett Learning.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	S	M	M	S	H
CO3	S	M	M	H	S
CO4	M	S	H	M	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 8– Drug Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn the mechanism of drug action in various diseases
2. To learn about different drugs available for treatment
3. To learn about the designing mechanisms for drug development

Course Outcomes (CO)

K1 ↑ K5	CO1	Repeat the concept of pharmacology
	CO2	Describe the mechanism of action of drug inside the system
	CO3	Employ the drug discovery and drug design procedures.
	CO4	Examine the treatment of various disorders using drug molecules
	CO5	Contribute in understanding the mode of action of antibiotics.

Unit I **(15 Hours)**

General Pharmacology

Introduction to pharmacology**,* sources of drugs**, Classification of drugs, dosage forms, route of administration, site of action of drugs. Mechanism of action, concept of receptors, combined effect of drugs, factors modifying drug action. Dose response curve- ED50 and LD50.

Unit II **(15 Hours)**

Pharmacodynamics

Definition. Drug receptors: Types, classification, drug- receptor interaction (binding and affinity, signal transduction, efficacy, receptor regulation and drug tolerance). Dose-response relationships (gradal and quantal).

Pharmacological activities: consequences of non-specific interaction. Drug metabolism; Chemical pathways of drug metabolism– Biotransformation reactions- Phase I and phase II

reactions – Microsomal and non-microsomal metabolism of drugs – role of cytochrome p450 enzyme subtypes.

Unit III: (15 Hours)

Drug Therapeutics

Biochemical mode of action of antibiotics- penicillin and chloramphenicol, actions of alkaloids, antiviral and antimalarial substances. Biochemical mechanism of drug resistance- sulphonamides. Drug potency and drug efficacy. General principles of chemotherapy: chemotherapy of parasitic infections, fungal infections, viral diseases. Introduction to immunomodulators and chemotherapy of cancer.

Unit IV: (15 Hours)

Screening for pharmacological activity

Analgesic, anti-inflammatory and antipyretic agents, gastrointestinal drugs, antiulcer and laxatives, antioxidants, anticancer and anti-fertility agents. Drugs for metabolic disorders like antidiabetic, anti-hyperlipidemic, anti-obesity and hepatoprotective agents.

Unit V: (15 Hours)

Clinical Toxicology

Definition, classification of toxicity – occupational, environmental and pharmaceutical. Types of toxins and their mechanism of action. Factors affecting toxicity- Drug tolerance, intolerance, addiction, allergy, hypersensitivity, antagonism and synergism. Methods of detection. Drug abuses and their biological effects. Rational prescription of drugs. Toxicity of anticancer drugs. Clinical symptoms of toxicity and marker parameters.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text books:

1. Richard.D.Howland, Mary. J.Mycek. Lippincott William and Wilkins. (2006). Lippincott's illustrated reviews: pharmacology. 3rdedition, Wolters Kluwer health (India) Pvt. Ltd., New Delhi.

2. R.S.Satoskar, Nirmala N. Reje, S. D.Bhandarkar. (2011). Pharmacology and Pharmacotherapeutics. 22ndedition, Popular Prakashan Pvt.Ltd.

Reference Books:

1. H L Sharma and K K Sharma. (2011). Principles of Pharmacology 2ndedn. Paras Medical Publisher, India.

2. George M.Brunner, Craig W. Stevans. (2011). Pharmacology. 3rdedition, Saunders, an imprint of Elsevier Inc.

3. James Ritter, Rod Flower, Graeme Henderson and Humphrey Rang (2011). Rang & Dale's Pharmacology. 7th Edition. Churchill Livingstone.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	M	S
CO2	S	M	S	H	L
CO3	H	S	M	S	M
CO4	S	H	M	M	H
CO5	S	H	M	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Practical 2 – Plant Biochemistry, Microbiology, Genetics and Molecular Biology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn the techniques of plant tissue culture
2. To get an hands-on-training on molecular techniques
3. To implement the applications of plant tissue culture, microbes, genetics and molecular techniques in research and industries

Course Outcomes (CO)

K1 ↑	CO1	Correlate the principles of plant biochemistry, microbes, molecular biology and genetic techniques
	CO2	Demonstrate the technical skills involved in plant tissue culture, counting cells, identification of gene and its expressions
	CO3	Develop and apply the modern technology of plant biochemistry, microbial techniques, molecular biology and genetics in industries and research
	CO4	Examine the results obtained using plant biochemistry, sterilization techniques, molecular biology and genetics
↓ K5	CO5	Be competent in handling the microbial cultures and plant samples.

Plant Biochemistry

1. Preparation of plant tissue culture media and sterilization*
2. Estimation of chlorophyll
3. Estimation of flavonoids
4. Estimation of total phenols
5. Maintenance of microbial cultures
6. Isolation and biochemical identification of bacteria from soil

7. Motility test
8. Bacterial growth curve(Demo)
9. Antibiotic susceptibility test by Kirby-Bauer method
11. Isolation of Genomic DNA from onion and Agarose gel electrophoresis*
12. Isolation of Plasmid DNA from bacteria*
13. Extraction of total RNA*
14. Estimation of DNA by Diphenyl amine method
15. Estimation of RNA by Orcinol method
16. SDS-PAGE*
17. Blotting techniques (anyone)*
18. Animal housekeeping, care, feed preparation and breeding of common laboratory animal-mice
19. Laboratory ethics (IAEC guidelines)

*Denotes group experiments

Teaching Methods

Demonstration/Video lectures/Laboratory visits/Institutional visits

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	M	M
CO2	H	S	M	H	M
CO3	M	H	H	S	S
CO4	H	M	M	S	H
CO5	S	H	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :22PBC309

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 9 – Advanced Immunology and immunological techniques			
Batch 2022-2023	Hours / Week 6	Total Hours 90	Credits 5

Course Objectives

1. To learn about the various cells of immune system and their functions
2. To know about the specificity of antigen-antigen interaction and their possible mechanisms
3. To know the role of immunological cells in the treatment of different diseases

Course Outcomes (CO)

K1	CO1	Recall the types and functions of different immune cells
↑	CO2	Employ the mechanism of action of different immune cells and their resultant reaction responses
↕	CO3	Decipher the underlying causes of inherited or autoimmune diseases and consequences
↕	CO4	Experiment the new technologies involving immune cells in treating many diseases
K5	CO5	Contribute in understanding the important concepts of recombinant Vaccine.

Unit I **(18 Hours)**

Lymphoid organs and cells: Introduction to immunology and immune system, **organs:** primary and secondary lymphoid organs. Cells - lymphoid and myeloid lineages. Differentiation and maturation of B-cells and T-cells. Primary and secondary immune responses. Phagocytosis, inflammation, NK activity, ADCC, fever, chemical defenses.

Unit II **(18 Hours)**

Antigens, antibodies and complement Antigens – types and properties of antigens and requirement for antigenicity. Antigen processing and presentation cells (TCRs and BCRs). Antibodies - general structure, classes, properties and functions of immunoglobulins. Complement – Outlines of classical and alternative pathways, intermediates formed and biological functions.

Unit III **(18 Hours)**

Cell mediated immunity and immune response – innate and acquired immunities: Humoral and cell – mediated immunities. Mechanism of T cell and NK cell mediated lysis, antibody dependant cell mediated Cytotoxicity and macrophage mediated Cytotoxicity, Cytokines and their role in immune regulation, Immune suppression and immune tolerance.

Unit IV **(18 Hours)**

Disorders of the Immune System: Hypersensitivity – elementary concepts of hypersensitivities – Types I-IV, Autoimmunity – basic concepts, causes and types of auto immune diseases, organ specific - Hashimoto's thyroiditis and Systemic Lupus - Erythomatosis. Transplantation immunology – organ and bone marrow, immunity to infectious diseases- bacteria and virus.

Unit V **(18 Hours)**

Vaccine technology: Over view of Recombinant vaccines and Immunization procedures. Role pf B and T epitopes for vaccine development. Vaccines – killed, attenuated, toxoids, recombinant, DNA, synthetic peptide vaccines.

Immune techniques – Features of antigen–antibody interactions. Precipitation reactions – immune diffusion, immune electrophoresis. Agglutination reactions – blood grouping, haem agglutination. Assays with tagged antigen/antibody – RIA, ELISA, immune blotting, immune fluorescence. Separation of lymphocytes.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Text Books

1. J.Kuby. (2018). Immunology. 10th edition, W.H. Freeman and Company, Newyork.

2. C.V.Rao. (2002). An Introduction to Immunology. Narosa Publishing House, Chennai.

Reference Books

1. Roitt, I., Brostoff, J. and Male, D. (2012). Essential Immunology, Twelfth Edition, Wiley Blackwell Publishers, New York. 2. Tizard, I.R. (2005).

2. Immunology – An Introduction, Fourth Edition, Saunders College Publishing, New York.

3. Rao, C.V. (2006). An Introduction to Immunology, Second Edition, Narosa Publishing House, Delhi, Chennai, Mumbai, Kolkata.

4. Immunology 5th ed Janis Kuby, W.H.Freeman & Co Ltd; 5th Revised edition.

5. Fundamental Immunology 5th edition (August 2003): by William

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme C ode: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper: Core Paper 10-Biostatistics and Research Methodology			
Batch 2022-2023	Hours / Week 6	Total Hours 90	Credits 4

Course Objectives

1. To learn the different methods of collecting data and processing
2. To know about the different statistical methods to interpret the collected statistical data
3. To know the concept of article writing, report writing and thesis making soon

Course Outcomes (CO)

K1	CO1	State an idea on choosing the appropriate method of collecting data
↑	CO2	Employ the statistical method and process the collected data
↕	CO3	Illustrate the device and standardize the statistical methods
↕	CO4	Discriminate the concept in preparing a report, publishing an article and writing a project thesis
K5	CO5	Contribute the research knowledge in report writing.

Unit I **(18 Hours)**

Research: Definition, Introduction, objectives, motivation, types, approaches, significance. Research Methods versus Methodology. **Research process:** formulating the research problem, extensive literature survey, developing the hypothesis, preparing the research design, determining sample design, collecting the data, execution of the project, analysis of data, hypothesis testing, generalizations and interpretation, and preparation of the report or presentation of the results. Criteria of a good research. Problems encountered by researchers in India.

Unit II **(18 Hours)**

Research problem: Selection, necessity and techniques (statement of the problem in a general way, understanding the nature of the problem, surveying the available literature, developing the ideas through discussions and rephrasing the research problem into a working proposition).

Research design: Introduction, necessity, features, concepts relating to research design, types of research design, and basic principles of experimental design (Principle of Replication, Principle of Randomization and Principle of Local Control).

Unit III **(18 Hours)**

Methods of Data Collection: Collection of Primary Data: Observation Method, Interview Method, questionnaire method (merits, demerits and main aspects), schedules, difference between questionnaire and schedules. Other methods of primary data collection (Warranty cards, Distributor or store audits, Pantry audits, Consumer panels, Use of mechanical devices, Projective techniques). **Collection of Secondary Data:** characteristics, Selection of appropriate method, Case Study method.

Unit IV **(18 Hours)**

Classification and tabulation of data. Diagrammatic & graphic presentation of data. Problems involving arithmetic mean, median, mode, quartiles, deciles and percentiles.

Measure of variation - range, quartile deviation, mean deviation, standard deviation, Coefficient of variation. Student's "t" distribution and its applications. **ANOVA:** Principle, technique, setting ANOVA table, short cut method, coding method (necessary illustrations) for one way ANOVA. Two way ANOVA: Principle, technique, setting ANOVA table (necessary illustrations). ANOVA in Latin-Square design (necessary illustrations).

Unit V **(18 Hours)**

Interpretation and Report Writing: Introduction, Techniques and precautions in interpretation, Report writing – significance, different steps, layout, types (technical and popular), mechanics (with examples) and precautions. Publication in a scientific journal. Project proposal writing to funding agencies, Career opportunities in research.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Text Books

1. C.R.Kothari. Research Methodology: Methods and Techniques (2004). New Age International (P) limited. Publishers.

2. N.Gurumani (2015). Introduction to Biostatistics. MJP Publishers. S.P.Gupta. (2009). Statistical Methods, 28th edition, Sultan Chand & Sons

Reference Books

1. SundarRao, Jesudian Richard. (2009). An Introduction to Bio-Statistics.4th Edition, Prentice-Hall of India Pvt.Ltd.

2. Naren Kr. Dutta (2002). Fundamentals of Biostatistics: Practical Approach. Kanishka Publisher.

3. S.P.Gupta. (2016). Fundamentals of Statistics. 6 th edition, SultanChand.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	S	M	H	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code: 22PBC311

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Core Paper11– Advanced Clinical Biochemistry			
Batch 2022-2023	Hours / Week 7	Total Hours 105	Credits 4

Course Objectives

1. To learn the methodologies for the detection of abnormalities in blood
2. To learn the process of different sample collection and processing
3. To know about the markers in the various metabolic disorders like cancer

Course Outcomes (CO)

K1 ↕ K5	CO1	Correlate the important laboratory biochemical tests
	CO2	Employ the methods of specimen collection and processing and analyzing the results
	CO3	Investigate the role of enzymes in clinical diagnosis of diseases
	CO4	Criticize the diagnostic procedures for tumor development
	CO5	Evaluate the role of free radicals in various diseases.

Unit I **(21 Hours)**

Clinical chemistry/biochemistry: concept, definition and scope; Biological samples: types, collection, processing, stability and storage; **Collection of urine:** Timed urine specimens, urine preservatives. Clinical significance of urinary components with reference to sugars, proteins, ketone bodies, and bilirubin. Microscopic examination of urine, Abnormal and normal constitute of urine. Body fluids-CSF, gastricjuice, ascitic fluid, synovial fluid and amniotic fluid: Composition, collection and analysis. Metabolic disorders of amino acid metabolism – phenyl ketonuria, alkaptonuria, albinism, Lesch-Nyhan syndrome, disorders of nucleic acids metabolism.

Unit II **(21 Hours)**

Serology and hematology: Introduction. Anti serum, anti sera raising, chick and snake venom antibody. Principle of agglutination and precipitation.C-reactive protein and pregnancy test, Rhumatoid arthritis (RA) test. ESR, Coagulation test, prothrombin test. WIDAL test, ELISA, chemiluminescence, CMIA, ECLIA, flow cytometry. **Hemoglobin:** Normal and abnormal Hb, Separation of hemoglobin by electrophoresis. Hemoglobinopathies and its types. Glycated Hb. Erythrocyte metabolic pathways, Disorder of erythrocyte metabolic pathways, Porphyrins and porphyrias.

Unit III **(21 Hours)**

Clinical enzymology and endocrinology: Factors affecting enzyme levels in blood. Principle, assay and clinical significance of liver markers: AST, ALT, gamma-glutamyl transferase, amylase and lipase. Cardiac markers: creatine kinase, CKMB, lactate dehydrogenase, troponin (I and T). Bone markers: ALP. Prostate marker: ACP. Clinical significance of pancreatic hormones and TFT.

Unit IV **(21 Hours)**

Organ function test and related disorders: Jaundice, cirrhosis, hepatitis (HBV virus and types), fatty liver and gall stones. Renal function test and related disorder: Acute renal failure, glomerular disease. Gastric and pancreatic function test. Estimation of GFR and cystatin C in serum. Hyper and hypo lipoproteinemias and diagnostic test for lipoprotein disorders. Diabetes mellitus. Fatty acid disorder – atherosclerosis.

Unit V **(21 Hours)**

Free radicals and Antioxidants: Introduction, ***Types of free radicals**. Generation of free radicals and lipid peroxidation Antioxidants: Role of free radicals, (Enzymic: SOD, Catalase, Glutathione Peroxidase, Glutathione Reductase; Non Enzymic: Vitamin A, Ascorbic acid, Tocopherol, Reduced Glutathione).

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7th edition
2. Stevans, C.D. (2016). Clinical Immunology and Serology: A Laboratory Perspective. 4thedition. F.A. Davis Company

Reference Books

1. Carl A. Burtis, Edward R. Ashwood, Norbert W. Tietz. (2012).Tietz Textbook of Clinical Chemistry and molecular diagnostics. 5th ed, Saunders college publishing, Harcourt Brace College Publishers, Philadelphia, Newyork, Tokyo.

2. Vasudevan D.M, SreekumariS and KannanVaidyanathan, (2011), Text Book of Biochemistry for Medical Students,6thed., Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi,110002.

3. Thomas M. Devlin (2010) Textbook of Biochemistry with Clinical Correlations, 7th Edition, john Wiley &Sons, Inc , US.

4. Larry Jameson *et al*., (2015). Harrison's Principles of internal medicine Vol. I and II. 14th edition, McGraw Hill Publishers

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code : 22PBC3CN

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Core Practical 3 – Immunology, Genetic Engineering and Clinical Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To enhance the students to have practical experience on techniques in immunological tests
2. To learn the methods of estimation of clinical parameters
3. To have hands on experience in genetic engineering

Course Outcomes (CO)

K1 ↕ K5	CO1	Recall the basic principles involved in immunology, clinical biochemistry and genetic engineering
	CO2	Demonstrate the techniques involved in immunology, clinical biochemistry and genetic engineering
	CO3	Develop and apply the recent technology involved in diagnostic techniques of immunology, clinical biochemistry and genetic
	CO4	Examine and analyze the results involved in immune techniques, clinical biochemistry and genetic engineering
	CO5	Be competent in handling the blood and urine samples.

Immunology

1. ELISA method
2. WIDAL test
3. Single radial immuno diffusion
4. Double immune diffusion
5. Ouchterlorny double diffusion
6. Immuno electrophoresis
7. Rocket immune electrophoresis
8. Restriction digestion and ligation*

9. cDNA synthesis*
10. Bacterial transformation*

Estimation of the following parameters in urine

11. Urea
12. Uric acid
13. Creatinine
14. Glucose by Benedicts method
15. Bilirubin
16. Sodium

Estimation of the following parameters in blood

17. Hemoglobin
18. Total cholesterol
19. Glucose tolerance test
20. Glucose by GOD/POD method

*Denotes group experiments

Teaching Methods

Demonstration/Video lectures/Laboratory visits/Institutional visits

MAPPING

PSO / CO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	S	M	S	M	S
CO2	H	S	S	S	M
CO3	M	M	H	M	S
CO4	S	H	M	H	M
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :22PBC412

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Core Paper 12 – Hormonal Biochemistry			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To learn about the system of hormonal functioning in biological systems
2. To know the regulation and action of different hormones at different conditions
3. To get an in depth knowledge on diabetes mellitus

Course Outcomes (CO)

K1 ↑	CO1	List the diverse group of hormones and their specific mechanism of action in the bodily metabolism
	CO2	Understand the regulatory functions of various hormones and their interrelationship in the endocrine disorders
	CO3	Discuss the pathophysiology, diagnosis, treatment and management of endocrine disorders
	CO4	Differentiate the role of hormones in various biological organs
↓ K5	CO5	Evaluate the biological action of different hormones.

Unit I **(15 Hours)**

Concepts of endocrinology: History, definition and classification of hormones, normal range, Scope of Endocrinology, Hormone Secretion, Transport, and Degradation. Functions of Hormones – Growth, Maintenance of Homeostasis and Reproduction. Hormonal Feedback Regulatory Systems-Paracrine and autocrine control, Hormonal Rhythms.

Unit II **(15 Hours)**

Hormone Receptor - Receptor Families, hormone Action through Receptors – Membrane, Nuclear and Cytosolic Receptors.

Hypothalamus and pituitary hormones: Hypothalamic and pituitary axis hormones-

Chemistry &biochemical functions; Hypothalamic releasing factors. Pituitary gland: hormones of the pituitary gland- Chemistry& biochemical functions.

Pineal gland- hormones of the pineal gland- Chemistry & biochemical functions.

Unit III **(15 Hours)**

Pancreatic hormones: Chemistry and biochemical functions. Parathyroid hormone: Calcitonin and its functions. Pancreatic hormone: Insulin, glucagon, somatostatin, pancreatic polypeptide-chemistry and biochemical functions.

Unit IV **(15 Hours)**

Adrenal gland: Hormones of adrenal gland-chemistry and biochemical functions; FSH, TSH, Gastrointestinal hormones-cholecystokinin, Substance P, summary of the neuroendocrine control of GI; Neurohormones- the brain-renin-angiotensin and urotensin.

UnitV **(15 Hours)**

Reproductive endocrinology: Male reproductive system: androgens: Source, synthesis, chemistry, metabolism, Physiological roles, mechanism of action and patho physiology. Female reproductive system: Synthesis, physiological role and mechanism of action of ovarian steroid hormones. Endocrinology of pregnancy, parturition and lactation, ***Hormonal contraception**, menopause and patho physiology.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Text Books

1. Mac E. Hadley (2009).Endocrinology.4th edition.Prentice Hall International Inc

2.Harrison's Endocrinology, (2017). 4nd edition, Edited by J. Larry Jameson, The Mc Graw Hill Companies, Inc.USA.

Reference Books

1. A. Long staff. (2002). Instant notes: Neuroscience. 1 stIndian edition, BIOS Scientific Publishers Ltd, UK John E. Hall, Mario Vaz, Anura Kurpad, Tony Raj. (2016).

2. Guyton & Hall (2016). Textbook of Medical Physiology. 2ndSouth Asian edition,

Elsevier publications.

3. Shlomo Melmed *et al*., (2011). William's Textbook of endocrinology. 12th edition, Philadelphia:Elsevier/Saunders.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	H
CO2	M	H	H	S	M
CO3	S	M	S	H	H
CO4	S	H	S	M	H
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code : 22PBC413

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper : Core Paper 13 –Genetic Engineering			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To enable the students to learn the principle and application of genetic engineering
2. To implement and transmission of a genetic material at molecular and cellular levels.

Course Outcomes (CO)

K1 ↕ K5	CO1	Enshrine the principles of genetic engineering and the vectors used in cloning and expression
	CO2	Grasp the different cloning strategies and their expression
	CO3	Demonstrate about implementation of genetic engineering for different purposes
	CO4	Investigate the different strategies of rDNA technology and resolve the problems encountered
	CO5	Analyze the various techniques of gene therapy.

Unit I **(15 hours)**

Scope of Genetic Engineering: Milestones in Genetic Engineering, Cloning and patenting of life forms. Genetic engineering guidelines, Molecular tools (Restriction enzymes, modification enzymes, DNA and RNA markers, Linker, adaptors, and homopolymers), Gene isolation, ***purification and yield analysis.**

Unit II **(15 hours)**

Cloning vectors: Plasmids (pBR322 and pUC18), Phages (l phage and M13 vectors), Phagemids (pBluescript, pGEM), Cosmids (pJB8) and Artificial Chromosomes (BAC and YAC). Plant and Animal viruses as vector, binary and shuttle vectors, expression vectors for prokaryotes and eukaryotes, expression cassettes

Unit III **(15 hours)**

Gene transfer methods: preparation of competent cells and selection. Calcium phosphate coprecipitation, electroporation, lipofection, viruses, biolistics, microinjection. Screening of recombinants: marker inactivation (antibiotic resistance, blue-white selection), colony hybridization, immunological screening.

Unit IV **(15 hours)**

Cloning Strategies: Cloning and expression of cloned genes Construction of genomic and cDNA libraries. Differences between genomic and cDNA libraries. Chromosome walking, chromosome Jumping, HRT and HART. Reporter genes – CAT, GFP, luciferase.

Basic principle and application of PCR – DNA Polymorphism –***RFLP,** RAPD, VNTR, SSR, AFLP, STS, SCAR, SNP. DNA sequencing and fingerprinting. DNA microarrays.

Unit V **(15 hours)**

Application: Transgenic animals as models in the prevention of human diseases like muscular dystrophy and anticancer therapy. Production of recombinant insulin, vaccines and growth hormone. Gene therapy: Stem cell gene therapy, Somatic cell gene therapy, Antisense RNA therapy, gene therapy for inherited diseases; familial hypercholesterolemia, hemophilia, ADA deficiency (SCID), SCP and Cystic fibrosis.

*** denotes Self study Teaching Methods**

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Twyman, B. Old and S. B. Primrose (2001). Principles of Gene manipulation: An Introduction to Genetic Engineering, 6th ed., John Wileyand sons Publishers,UK.

2. Primrose *et al*., (2001). Principles of gene manipulation. 6th edition, Blackwell Scientific Publishers.

Reference Books

2. Brown, T.A. (2010).Gene cloning - An Introduction, Sixth Edition, Wiley Publishers, USA.

3. Lucia, L.A. and Rojas O.J. (2009).The Nanoscience and Technology of Renewable Biomaterials,

Wiley and Sons Publishers, New York.

4. Primrose, S.B., Twyman, R.M. and Old, R.W. (2006).Principles of Gene Manipulation, Seventh Edition, Blackwell Publishing Company, USA.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	S	M
CO2	H	S	H	M	M
CO3	M	H	H	H	H
CO4	M	S	M	S	M
CO5	M	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub. Code: 22PBC4Z1

PROJECT VIVA-VOCE EXAMINATION

Maximum marks: 100

Continuous Internal Assessment (CIA)

Project review I&II	– 45 marks
Regularity	– 5 marks
Total	–50 marks

End of Semester Examination (ESE)

Project report	– 35 marks
Viva-voce	– 15 marks
Total	– 50 marks

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CIA	– 50 marks
ESE	– 50 marks
Total	– 100 marks

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Major Elective: Nanobiotechnology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To get an idea about the application of nanotechnology in biological research
2. To learn the properties and functions of nanomaterials in biological systems
3. To learn the applications of nanomaterials in drug delivery and treatment

Course Outcomes (CO)

K1	CO1	Insight about the nanotechnology concepts
↕	CO2	Explain the methods of Nanoparticle synthesis
	CO3	Use properties of nanoparticles
	CO4	Apply the knowledge of nanotechnology in biological research
K5	CO5	Employ and apply the knowledge of nanotechnology in waste water treatment, agriculture and diseases.

Unit I **(15 Hours)**

Introduction to Nanotechnology: Introduction to nanoparticles. Nanoscience and its importance. Definition: Nanotechnology – Nanobiotechnology- Nanomaterial - Nanocomposites- Classification of nanostructures – Top down and Bottom Up approach - Quantum dots -Bio-inspired nano materials.

Unit II **(15 Hours)**

Herbonanotechnology: Physical synthesis - Ball Milling - Thermal evaporation - Chemical synthesis – Solgel Process - Hydro thermal Synthesis-Biological Synthesis – Plant, Microbial compound based synthesis

Unit III **(15 Hours)**

Properties of Nanomaterials: Preparation of nanoparticles Physical properties- Optical, Magnetic, Surface Plasmon resonance - Electrochemical Properties of Nanoscale Materials, Intramolecular bonding, Inter-molecular bonding,

***Nanocatalysis**, Self-assembly – DNA, Protein.

Unit IV **(15 Hours)**

Characterization methods: UV - Visible Spectrophotometer, X-ray diffraction (XRD), Scanning Electron Microscope (SEM) Transmission, Electron Microscope (TEM), Fourier Transform Infra Red Spectrometer (FTIR), EDAX, Dynamic Light Scattering(DLS).

Unit V **(15 Hours)**

Applications of Nanoparticles: Nanoparticles in waste water treatment, cancer therapy, Biosensors- DNA Microarrays – Cell Biochips - Nanoparticles for Bioimaging– Textile and pharma industries. Application in environment, agriculture and pesticide diagnosis. Nanorobotics. Military applications of Nanotechnology – Nanomaterials for food Applications. Diagnosis and Nano-toxicity of Nanoparticles - Future Perspectives.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. T.Pradeep. (2008). Nano: The Essentials: Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan. (2005). Nanoscale Science and Technology. John Wiley & Sons, Ltd., UK.

Reference Books

1. Guozhong Gao. (2004). Nanostructures & Nano materials: Synthesis, Properties &Applications, and Imperial College Press.

2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse. (2005). Nanotechnology: Basic Science and Emerging Technologies. Overseas Press.

3. Vladimir P Torchilin. (2006). Nanoparticles as Drug carriers. Imperial College Press,USA.

4. M.Niemeyer, Chad A.Mirkin. (2004). Nanobiotechnology: Concepts, Applications and Perspectives. Wiley-VCH, Weinheim.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	M	M	M
CO2	S	M	H	S	H
CO3	H	S	M	M	S
CO4	S	M	S	S	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Major Elective – Microbiology			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To learn about the microbiological techniques for microbial studies
2. To learn the energy process taking place in microbes
3. To learn about the food poisoning and pathogenicity of microbes

Course Outcomes (CO)

K1 ↑	CO1	Commemorate the general bacteriology and microbial techniques.
	CO2	Understand the basic microbial structure and function
	CO3	Implement the handling techniques and staining procedures in laboratory
	CO4	Resolve the microbial techniques and its applications
K5 ↓	CO5	Employ the role of microbes in pathogenicity.

Unit I **(15 Hours)**

Morphology and Ultrastructure: History of microbiology. Classification of microbes. Ultra structure and characteristics of bacteria, fungi, algae and protozoa. cell wall, cell membrane, intra cytoplasmic structures and external structures-bacterial growth curve, synchronous growth, continuous culture. Factors affecting bacterial growth. Staining techniques-simple Differential Special staining techniques and negative staining.

Unit II **(15 Hours)**

Microbiological techniques: Culture techniques: Isolation of microbes from various sources, serial dilution techniques, pure culture techniques, Anaerobic culture methods-chemical and physical methods. Culture preservation techniques.

Nutritional requirements: different kinds of media, composition of media -carbon sources, nitrogen sources, vitamin and growth factors, mineral, inducers, precursors and inhibitors. Sterilization methods. Anaerobic fermentation- Alcoholic fermentation, propionic acid fermentation, formic acid fermentation.

Unit III **(15 Hours)**

Food Microbiology: Food poisoning – Food borne diseases- Bacterial and Non-Bacterial. Microbial quality and safety – Determining microorganisms in food culture, Microscopy and sampling methods-Chemical and immunological methods. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.

Unit IV **(15 Hours)**

Medical Microbiology: Infectious Diseases process-Diagnosis-Process of sample collection, transport and examinations of the specimens. Antibiogram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Gram positive organisms-*Staphylococcus aureus*, Mycoplasma; Gram negative organisms: *E.coli*.

Unit V **(15 Hours)**

Pathogenicity and Laboratory Diagnosis: ***Virology-Basic concepts of virology**. General properties of Human viruses, Approaches to viral diagnosis-Serological and Molecular techniques of viral infections-Hepatitis. Mycology: General properties and approaches to laboratory diagnosis. Mycosis-Superficial, Subcutaneous and Systemic infections-*Candida allbicans*. Parasitology: Pathogenicity and laboratory diagnosis of *Plasmodium vivax*.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Prescott. (2003). Microbiology. 3rd edition, Magrawhill, Boston
2. Pelczar M.J., Ried, RD and Chan, ECS. (2000). Microbiology. 5 th edition, Mc Graw Hill.

Reference Books

1. Anantha narayanan and Jayaram Paniker. (2005). Text Book of Microbiology.6th Edition Orient Longman, Hyderabad.
2. Standby and Wittaker. (2008). Principles of Fermentation Technology. 2nd edition.
3. Davis *et al*., (2001). Microbiology. 4th edition, Lippincott Williams and Wilkins.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	S	H
CO2	S	H	S	H	H
CO3	M	S	M	H	S
CO4	H	M	H	S	M
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
Title of the paper Major Elective: Bioinformatics			
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To learn the role of computer programmes in studying the biological processes
2. To know about the different software's for data analysis
3. To learn about the methods of data retrieval from various databases

Course Outcomes (CO)

K1 ↑ ↓ K5	CO1	Learn about the basics and beginning developments in computer usage
	CO2	Employ the basics of bioinformatics
	CO3	Differentiate various bioinformatics soft wares
	CO4	Apply the role bioinformatics in biological science research
	CO5	Apply bio informatics in proteomics and human genome project.

Unit I **(15 Hours)**

Bioinformatics: Introduction, fields related to bioinformatics, objectives, scope, genome mapping as a source of bioinformatics. Applications of bioinformatics in various fields*. Chronological history of events in bioinformatics. Role of computers in bioinformatics. Major categories of bioinformatics tools. Applications of programmes in bioinformatics.

Unit II **(15 Hours)**

Biological databases: database, database management system and its advantages. Biological databases and information resources. Classification of biological databases: general databases, protein families & sequence motif database, signal sequence databases, protein – protein interaction databases, pathways databases, structural databases, SNPs database, histology database, standards, PUBMED, ENTREZ. Searching and retrieving data from databases- FASTA and BLAST. Linking databases with sequence retrieval systems (SRS).Advantages of SRS.OMIM, ExPASy, EMBL-Bank, ENSEMBL and its advantages.

Unit III **(15 Hours)**

Genomics: gene, genome, genomics: genome mapping & genome projects, methods of gene sequence analysis: Genbank, Genbank assembly, genome annotation, genome similarity. Types of genomics: comparative, structural and functional genomics. Gene functions: analysis of gene expression, DNA microarray or DNA chip, serial analysis of gene expression.

Unit IV **(15 Hours)**

Proteomics: Introduction, methods of studying proteins: determining the post translational modified proteins, determining the existence of proteins in complex mixtures, establishing protein-protein interactions. Protein structure classification: CATH, SCOP, DALI, FSSP, SSAP, protein structure bioinformatics resource. Protein structure prediction: ROSETTA, protein folding, protein folding disorders. Protein function prediction: automated protein function prediction, diversity in protein function.

Unit V **(15 Hours)**

Human Genome Project: Milestones, types of sequences in Human Genome Project, impact, potential benefits, ethical, legal and social issues. **Gene therapy:** Principles, current status of gene therapy research. Factors affecting gene therapy. Recent developments in gene therapy. **Drug designing:** Objectives, rational drug design, computer assisted drug design, drug development. **Pharmacogenomics:** prospects, uses, barriers to progress.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Prakash S.Lohar (2009). Bioinformatics. MJP Publishers.

2. Jean-Michel Claverie and Cedric Notredame. (2012) Bioinformatics-A beginner‟ s guide. 1st edition, Wiley- Dream Tech India Pvt. Ltd.

Reference Books

1. David. W. Mount. (2001). Bioinformatics. CBS publishers and distributors.

2. D.R. Westhead, J. H. Parish and R. M. Twyman. (2002). Instant notes in bioinformatics. Oxford,UK.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	M	S
CO2	S	M	S	M	S
CO3	S	H	M	S	H
CO4	H	M	H	M	M
CO5	S	M	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07		**Programme Title:** M.Sc Biochemistry	
Title of the paper Major Elective - Bioethics, Biosafety and IPR			
Batch	Hours / Week	Total Hours	Credits
2022-2023	5	75	5

Course Objectives

1. To learn about the demerits of biotechnological applications in recent research
2. To know the ethical issues to be concerned in the course of biological research
3. To know about the intellectual property rights of individual researchers

Course Outcomes (CO)

K1	CO1	Remember the ethical issues of scientific research
↕	CO2	Employ the various regulations in Biosafety and bioethics
	CO3	Decipher the awareness of the intellectual property rights
	CO4	Experiment the secured and ethical way of research
K5	CO5	Contribute the knowledge in filing the patents.

Unit I **(15 Hours)**

Ethics/bioethics: Introduction, framework for ethical decision making; biotechnology and ethics-benefits and risks of genetic engineering-ethical aspects of genetic testing-ethical aspects relating to use of genetic information-genetic engineering and biowarfare.

Unit II **(15 Hours)**

Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socioeconomic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research-GM crops and GMO's – biotechnology and biopiracy– ELSI of human genome project.

Unit III **(15 Hours)**

Biosafety: Introduction, biosafety issues in biotechnology – risk assessment and risk Management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment.

Unit IV **(15 Hours)**

Introduction to intellectual property and intellectual property rights: types: patents, copy rights, Trade marks, design rights, geographical indications– importance of IPR - world intellectual Property rights organization (WIPO).

Unit V **(15 Hours)**

What can and what cannot be patented?: Patenting life – legal protection of biotechnological Inventions – Patenting in India: ***Indian patent act.**

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Jose Cibelli, Robert P. lanza, Keith H. S. (2002). Principles of cloning, Campbell, Michael D.West, Academic Press.

2. Sasson A. (2000). Biotechnologies in developing countries present and future, UNESCO Publishers

Reference Books

1. Singh, K. (2000). Intellectual Property Rights on Biotechnology. BCll, New Delhi. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd.,

2. Kankanala C., (2007) Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd.,

3. Gurumani, N. Research Methodology (2006). For Biological Sciences. MJP Publishers, Chennai

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	M	M	S
CO2	S	S	H	M	H
CO3	H	M	S	H	M
CO4	S	M	S	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	Programme Title: M.Sc Biochemistry		
	Title of the paper :Non-Major Elective : Information Security		
Batch 2022-2023	Hours/Week 4	Total Hours 60	Credits 4

Course Objectives

1. Students will identify the core concepts of Information security.
2. To examine the concepts of Information Security.
3. To design and implement the security features for IT and Industrial sectors.

Course Outcomes (CO)

K1	CO1	To Learn the principles and fundamentals of information security.
K2	CO2	To Demonstrate the knowledge of Information security concepts
K3	CO3	To Understand about Information Security Architecture.
K4	CO4	To Analyze the various streams of security in IT and Industrial sector.
K5	CO5	To know about Cyber Laws and Regulations.

UNIT I **12 Hours**

Information Security basics: Definition of Information Security - History of Information Security - Characteristics of Information Security - Components of Information Security - Security System Development Life Cycle (SDLC).

Information Security for technical administrators: Server Security – Network security- Social Media Security.

UNIT II **12 Hours**

Cryptography: Basic concepts - plain text - Cipher text - Encryption Principles - CRYPT Analysis - Cryptographic Algorithms - Cryptographic Tools – Authentication -Biometrics* - passwords - Access Control Devices - Physical Security - Security and Personnel.

Language-based Security: Analysis of code for security errors, Safe language and sandboxing techniques.

UNIT III **12 Hours**

Firewalls, Viruses & Worms & Digital Rights Management : Viruses and Worms-Worms - Digital Rights Management – Firewalls - Application and Circuit Proxies - Stateful Inspection - Design

Principles of Firewalls.

Logical Design: Access Control Devices- Physical Security-Security and Personnel - NIST Models- VISA International Security Model- Design of Security Architecture-Planning for Continuity.

UNIT IV **12 Hours**

Hacking : Introduction – Hacker Hierarchy – Password cracking – Phishing - Network Hacking - Wireless Hacking - Windows Hacking - **Web Hacking***- Ethical Hacking.

Security Investigation: Need for Security- Business Needs-Threats- Attacks- IP Addressing and Routing - Social Media

UNIT V **12 Hours**

Cyber Laws : What is Cyber Law? - Need for Cyber laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

***Self study.**

Teaching Methods

Power.Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

TEXT BOOK:

Information Security –Textbook is prepared by KONGUNADU ARTS AND SCIENCE COLLEGE, Coimbatore -29, 2022.

REFERENCE BOOKS:

1 Charles P Pfleeger and Shai Lawrence Pfleeger, **"Security in Computing",** Fourth & Third Edition, Prentice Hall, 2007 & 2011.

2 Ross J. Anderson and Ross Anderson, "Security Engineering: A guide to building Dependable Distributed System", Wiley,2009.

3 Thomas R. Peltier, Justin Peltier and John Bleckley, "Information Security Fundamentals",2nd Edition, Prentice Hall 1996.

4 Gettier, Urs E. Information Security: Strategies for Understanding and Reducing Risks John Wiley & Sons, 2011.

5 "Principles of information security". Michael Whiteman and Herbert J. Mattord,2012.

6 Information security -Marie wright and John kakalik, 2007.
7 Information security Fundamentals- Thomas R. Peltier, Justin Peltier and John Blackley-2005.
8 Information Security theory and practical PHI publication, Dhiren R. Patel-2008.
9 Debby Russell and Sr.G.T. Gangemi," computer Security Basics, 2nd edition, O'Reilly Media, 2006.

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
	Title: Non Major Elective – Competitive Science		
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To insist the various facts of life sciences in detail
2. To learn the various information regarding the biological processes
3. To expose the students to the online examination

Course Outcomes (CO)

K1	CO1	Recall all concepts of biochemistry in detail
↕	CO2	Explain the consolidated view of life science subjects
↕	CO3	Develop the analytical capability by learning the objective type questions
↕	CO4	Undertake competitive examinations will necessary preparation
K5	CO5	Apply the knowledge of various fields of biochemistry.

Unit I **(15 Hours)**

Molecules and their Interaction relevant to Biology: Structure of atoms, molecules and chemical bonds - Composition, structure and function of biomolecules - Stabilizing interactions - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties) - Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes - Conformation of proteins - Conformation of nucleic acids – Stability of proteins and nucleic acids - Metabolism of carbohydrates, lipids, amino acids nucleotides and

***vitamins.**

Unit II **(15 Hours)**

Cellular Organization: Membrane structure and function - Structural organization and function of intracellular organelles - Organization of genes and chromosomes - Cell division and cell cycle - Microbial Physiology. Fundamental Processes: DNA replication, repair and recombination - RNA synthesis and processing – Protein synthesis and processing - Control of gene expression at transcription and translation level.

Unit III **(15 Hours)**

System Physiology –Plant: Photosynthesis -Respiration and photorespiration – Nitrogen metabolism - Plant hormones – Sensory photobiology - Solute transport and photo assimilate translocation – Secondary metabolites - Stress physiology.

System Physiology –Animal: Blood and circulation - Cardiovascular System - Respiratory system - Nervous system - Sense organs - Excretory system -Thermoregulation -Stress and adaptation - Digestive system - Endocrinology and reproduction.

Unit IV **(15 Hours)**

Cell Communication and Cell Signalling: Host parasite interaction - Cell signalling - Cellular communication - Cancer - Innate and adaptive immune system. Methods in Biology: Molecular Biology and Recombinant DNA methods - Histochemical and Immuno techniques- Biophysical Methods - Statistical Methods - Radiolabelling techniques - Microscopic techniques - Electrophysiological methods - Methods in field biology.

Unit V **(15 Hours)**

Applied Biology: Microbial fermentation and production of small and macro molecules - Application of immunological principles, vaccines, diagnostics - Tissue and cell culture methods for plants and animals - Transgenic animals and plants, molecular approaches to diagnosis and strain identification - Genomics and its application to health and agriculture, including gene therapy - Bioresource and uses of biodiversity - Breeding in plants and animals, including marker – assisted selection - Bioremediation and phytoremediation- Biosensors.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Textbooks:

1. Kumar. (2016). Arihant Publications. 3rd edition.
2. Nithin Sharma (2020). Ace The Race: CSIR-UGC NET Life Sciences (JRF & LS) 2nd Edition.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	S	M	S
CO2	S	S	M	H	M
CO3	M	M	S	S	H
CO4	S	S	M	S	M
CO5	S	S	M	M	S

S – Strong **H** – High **M** – Medium **L** – Low

Programme Code: 07	Programme Title: M.Sc Biochemistry		
	Title of the paper Non Major Elective – Bioprocess Technology		
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To understand the basics of fermentation techniques
2. To learn the concepts of screening, optimization and maintenance of cultures
3. To provide the basics of bioprocess technology

Course Outcomes (CO)

K1 ↑	CO1	Remember the basics of bioreactors
	CO2	Understanding of the various aspects of bioprocess techniques
	CO3	Employ in biotechnological industries
	CO4	Distinguish the fermentation process and its kinetics
K4 ↓	CO5	Appraise the role of bioreactors in various industries.

Unit I **(15 Hours)**

Introduction: Basic principles*, Historical development in fermentation, strain improvement and inoculum development. Types of fermentation: batch, fedbatch and continuous. Isolation, screening, and maintenance of microbes for industrial process. Strain selection and improvement methods.

UNIT II **(15 Hours)**

Bioreactor: Components design, parts and its functions. Types of bioreactors: CSTR, packed bed, batch, Air lift bioreactor, Bioreactors for immobilized cells, animal cells, waste water and effluent treatment. Specialized bioreactors: pulsed, fluidized and photo bioreactors.

UNIT III **(15 Hours)**

Upstream processing: Introduction, principles of microbial nutrition, Media formulation and optimization. Sterilization: Methods of sterilization- Batch and

Continuous sterilization. Air sterilization, design and air filters, aseptic operation of fermentor. Inoculum development for Industrial fermentations, Scale up and scale down.

UNIT IV **(15 Hours)**

Transport phenomena: Mass and heat transfer mechanism. Mass, heat and oxygen transfer coefficients. Rheological properties of a fermentation broth. Bioprocess monitoring and control: On-line and Off-line analysis. Monitoring variables: pH, temperature, DO_2, agitation and foam level. PID control and computer aided control.

UNIT V **(15 Hours)**

Downstream processing: Overview. Primary separation - Cells, Solid matter and foam- precipitation, filtration, centrifugation, cell disruptions (Mechanical, enzymatic and chemical).Product isolation - solvent extraction, adsorption, aqueous two-phase system and precipitations. Purification techniques: Chromatography (ion - exchange, gel-permeation and affinity), membrane separation (microfiltration, Ultra filtration and reverse osmosis). Product recovery; product polishing (drying and crystallization).

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Textbooks:

1. El – Mans, E.M.T., and Bryce, C.F.A. (2002). Fermentation Microbiology and biotechnology. Taylor &Francis group

2. Stanbury, P. F. & A. Whitaker. (2003). Principles of Fermentation Technology. Pergamann Press, Oxford.

Reference books:

1. M.L.Shuler and F. Kargi. (2003). Bioprocess engineering: Basic Concepts. Prentice Hall, Engelwood Cliffs.

2. W. Cruger & A. Cruger. (2003). A Textbook of Industrial Microbiology. Panima Pub. Corp., New Delhi.

3. R.K. Rajput. (2003). Heat and Mass Transfer in SI units. S Chand and Co.Ltd.,New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	S
CO2	H	S	S	H	M
CO3	S	H	S	M	S
CO4	M	S	H	S	S
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme code: 07	**Programme Title:** M.Sc Biochemistry		
	Title of the paper Non Major Elective – Cancer Biology		
Batch 2022-2023	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To know the biology of cancer development
2. To know the features of various cancer types
3. To know about the mechanism of cancer cell cycle
4. To learn the screening and diagnosis methods for cancers
5. To learn the treatment strategies for various cancers

Course Outcomes (CO)

K1	CO1	Remember the basic knowledge on cancer development
↕	CO2	Understand the molecular mechanisms of cancer cell cycle
	CO3	Apply the techniques for diagnosis of various cancers
	CO4	Contribute the role of different treatment strategies and its application
K5	CO5	Employ various strategies in the treatment of cancer

Unit I **(15 Hours)**

Cancer: Introduction, Normal cells and tissues, Control of growth in normal Tissues, Tumour growth, the process of carcinogenesis*, Genes involved in carcinogenesis, Factors influencing the development of cancers. **Risk factors for cancer:** Tobacco, infections, dietary-related factors, reproductive and hormonal factors, radiation, occupational carcinogens, medical carcinogens (non-radiation), environmental pollution, genetic predisposition, mutagens and mutational spectra in relation to cancer types.

Unit II **(15 Hours)**

Epidemiology, Etiology, pathology, Clinical Features, Diagnosis and Evaluation, Management of breast, oral, cervical, gastric, lung and skin cancer. Role of tumour suppressor genes (Rb, p53, NF1, BRCA 1 & 2) in cancer prevention and the mechanism leading to loss of function.

Unit III **(15 Hours)**

Cancer cell cycle: Introduction, cell cycle events in normal and neoplastic cells, restriction point control and its loss, initiation of DNA replication, completion of DNA replication, checkpoint responses to DNA damage in G1 and S phase, from G2 to mitotic metaphase, checkpoints controlling mitotic entry, centrosome duplication and the maintenance of ploidy, the metaphase–anaphase transition and exit from mitosis, cell cycle proteins as prognostic markers and drug targets.

Unit IV **(15 Hours)**

Screening of cancer: Introduction, Types of screening tests, Safety and acceptability, Evaluation of screening (Evaluating the test, Potential biases, Randomized trials, Screening programmes), Types of screening test (Visual inspection, Palpation, Analysis of exfoliated cells, Imaging, Serum and urine markers, screening for and treatment of infections), Screening for specific cancers (Cervix cancer, Breast cancer, Colorectal cancer, Prostate cancer).

Unit V **(15 Hours)**

Local treatment of cancer: Introduction, Skin cancers, Breast cancer, Lung cancer, Prostate cancer, Colo rectal cancer. **Chemotherapy:** Mechanisms of action and resistance to traditional cytotoxic drugs, Therapeutic principles of traditional cytotoxic chemotherapy. **Radiotherapy. Immunotherapy of cancer:** Introduction, Specific Immunotherapy (Human

tumour antigens & genetically enhanced T cells), Non-specific immunotherapy (Immunotherapy with cytokines).

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/GoogleClassroom

Textbook:

1. Introduction to the Cellular and Molecular Biology of Cancer. Margaret A.Knowles Peter J. Selby. Oxford University Press 2005, Fourth Edition.

Reference books:

1. Franco Cavalli, Stan B. Kaye, Heine, H.Hansen, James O. Armitage, Martine J. Piccart-Gebhart (2009). Textbook of Medical Oncology. Fourth Edition. Informa Healthcare.
2. Raymond W. Ruddon (2007). Cancer Biology Fourth Edition, Oxford University Press.
3. Arthur B. Pardee. Gary S. Stein (2009). The Biology and Treatment of Cancer. Understanding Cancer by John Wiley & Sons, Inc.
4. Harvey Lodish, Arnold Berk *et al*., (2007). Molecular Cell Biology. 6thedition, W HF reeman and Company, New York.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	M	S
CO2	M	H	M	H	M
CO3	S	M	S	M	H
CO4	S	H	M	H	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub.Code :22PBC3X1

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
	Title of the paper : EDC – Nutritional Biochemistry		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 5

Course Objectives

1. To impart the knowledge on historical overview of nutrition, essential nutrients for metabolism
2. To provide an overview of the major macro and micronutrients relevant to human health
3. To discuss the scientific rationale for defining nutritional requirements in healthy individuals and populations, with reference to specific conditions such as pregnancy, lactation, and older age

Course Outcomes (CO)

K1 ↕ K5	CO1	Assess the nutritional status of community in order to determine the type magnitude and distribution of malnutrition
	CO2	Describe the biochemical and physiological functions of the nutrients and their Integrated role.
	CO3	Evaluate the therapeutic role of key nutrients in maintaining health.
	CO4	Discriminate the diseases caused due to protein deficiency
	CO5	Employ the role of diet in various diseases.

Unit I **(6 Hours)**

Introduction: Nutrition – concepts - role of nutrition in maintaining health, basic food groups - energy yielding, body building and protective foods. Basic concepts of energy expenditure, unit of energy – Kcal - energy requirements of different categories of people - RQ of foods - Body Mass Index (BMI) - Basal Metabolic Rate (BMR) – determination and factors influencing

Unit II **(6 Hours)**

Nutritional significance of dietary components: Physiological role and nutritional significance of carbohydrates, lipids, proteins, vitamins (water soluble and fat soluble) minerals and fiber, Dietary sources, Functions, Digestion, absorption and storage, metabolism of carbohydrates – lipids – proteins.

Unit III **(6 Hours)**

Nutritive value of proteins: Essential amino acids, Biological values of Proteins (animal and plant proteins). Evaluation of proteins by nitrogen balance method-DC, BV, NPU and NAP of animal and plant proteins, single cell proteins, factors influencing protein requirements, Effect of excess protein intake

Unit IV **(6 Hours)**

Protein calorie malnutrition: Protein malnutrition (Kwashiorkor) and under nutrition (marasmus) their preventive and curative measures – composition of balanced diet and RDA for infants, children, adolescent, adult male and female, pregnant, lactating women and geriatrics

Unit V **(6 Hours)**

Nutrition and body defenses: Effect of drugs on food and nutrients, drug - nutrient interaction - nutritional therapy food preparation and management. Role of diet and nutrition in the prevention and treatment of diseases – Diabetes mellitus, hypertension, infections, CVD, liver and kidney disorders.

Teaching Methods

PowerPoint presentation/Seminar/Quiz/Discussion/Assignment, Model preparation

Text Books

1. Srilakshmi, B. (2013) Nutrition Science Revised Fourth Edition, New Age International Publishers, New Delhi.

2. Paul, S. (2005) A Textbook of Bio-nutrition – Curing Diseases through Diet, First Edition, CBS Publishers and Distributors, New Delhi.

3. Swaminathan, M. (2004) Advanced Textbook of Food and Nutrition, Volume II, Second Edition, The Bangalore Printing and Publishing Co. Limited, India.

Reference Books:

1. Geissler, C. and Powers, H.(2010)Human Nutrition, Twelfth Edition, Churchill Livingstone,USA.

2. Brody, T. (2006) Nutritional Biochemistry, Second Edition, Academic Press,USA.

3. Eastwood, M. (2003) Principles of Human Nutrition, Second Edition, Wiley - Blackwell Science Ltd Publishers, USA.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	S	M
CO2	H	S	H	M	M
CO3	M	H	H	H	H
CO4	M	S	M	S	M
CO5	M	S	M	S	H

S–Strong **H**–High **M**–Medium **L** –Low

KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

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College of Excellence (UGC)

COIMBATORE – 641029, TAMIL NADU, INDIA.

QUESTION PAPER PATTERN FOR CIA & END OF SEMSTER EXAMINATION

M. Sc., BIOCHEMISTRY Time = 3.00hrs

1. THEORY Max Marks =75

SECTION-A (20 x 1=20marks)

Choose the correct answer type.

Q.No. 1 to 10: Multiple choice types **alone**.

Questions with four alternative (distracter) answers each (Two questions from each unit).

Q.No. 11 to 15: Fill in the blanks **alone**.

Q.No. 16 to 20: one word answer **alone**.

SECTION-B (5 x 5=25marks)

Short answer questions

Q.No. 21-28: Answer any 5 out of 8

SECTION-C (3x 10=30marks)

Essay type of questions:

Q.No. 29-33: Answer any 3 out of 5

2. BREAK UP OF INTERNAL MARKS (50marks)

Internal marks (50) = CIA (out of 30**) + problem based Assignment (**out of 10**) + Attendance (**out of 5**) +others (**out of 5**)**

***CIA marks (out of 30 marks) = I CIA marks + II CIA marks / 150 X 15 PBC 79**

2. PRACTICALS–Question Pattern & Break-up of marks

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 50

Duration: 3hrs

I. Major	(One question)	(1 x 15= 15)
II. Minor	(One question)	(1 x 10 = 10)
III. Spotters		(3 x 5=15)

Examine, identify and comment on the spotters A, B, C, D and E.

IV. Viva - voce	(05)
V. Record/Observation*	(05)

*Record for ESE; Observation for CIA exam.

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	30
Observation	-	15
Attendance	-	5
Total	-	**50**

PRACTICALS – Question Pattern & Break-up of marks

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 50

Duration: 3hrs

I. Major	(One question)	(1 x 15 =15)
II. Minor	(One question)	(1 x 10 = 10)
III. Spotters		(3 x 5 = 15)

Examine, identify and comment on the spotters A,B,C,D and E.

IV. Viva - voce (05)

V. Record/Observation* (05)

*Record for ESE; Observation for CIA exam.

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	30
Observation	-	15
Attendance	-	5
Total	**-**	**50**

Sub code: 22PBCOD1

Programme Code: 07	**Programme Title:** M.Sc Biochemistry
Title of the paper ALC – Forensic Science	
Batch 2022-2023	Credits 2

Course Objectives

1. To deals with the forensic aspects like legal procedures and types of trauma.
2. To assist and develops regulation in forensic science
3. To give students with a sound basis in forensic science

Course Outcomes (CO)

K1 ↑	CO1	Define the basic concepts of forensic science
	CO2	Understand the identification procedures employed under forensics Science
	CO3	Apply the fingerprint analysis and interpretations in research fields
	CO4	Examine and analyze the results involved in fingerprinting technique
K5 ↓	CO5	Evaluate the physical analysis and injuries.

Unit I

Crime scene management and investigation: Collection, preservation, packing and forwarding of physical and trace evidences for analysis. Legal and court procedure related to expert testimony. Consumer Protection Act: rights and liabilities of doctors, medical indemnity insurance; human rights and violation; duties of medical practitioners to victims of torture; Human organ transplantation Act.

Unit II

Identification of the living and the dead: Forensic thanatology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico legal Death in vestigation; exhumation. Examination and identification of hair, semen, saliva, urine, faecal matter and milk. DNA fingerprinting and HLA typing.

Unit III

Physical analysis: Soil, glass, paints, lacquers, cement, inks, paper, tool and tyremarks shoeprints. Forensic examination of vehicles in cases of accident. Identification of individualization from foot prints and teeth.

Unit IV

Injuries: Mechanical injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries; medico legal aspects of wounds. General aspects; patho-physiology and classification; mechanical asphyxia; hanging; strangulation; drowning; smothering, choking, garroting, burking, yoking.

Unit V

Medico legal aspects: Medico legal aspects of wounds. Post mortem examination and changes, asphyxia death, sexual offences, infanticide, forensic psychiatry and lye detection. History, classification, search, lifting and examination of fingerprints.Various methods for the development of latent fingerprints, ***Crime records and computerization.**

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Narayana reddy K. S. (2007). The Essentials of Forensic Medicine &Toxicology. 26th edition, K. Sugana Devi publishers, Hyderabad.
2. Basu, R. (2009). Fundamentals of forensic medicine and toxicology. 2nd Edition, Books and Allied (P) Ltd. Kolkata.

Reference Books

1. PillayV.V. (2009). Text book of Forensic Medicine, Paras Publication. Hyderabad.
2. JB Mukherjee's. (2007). Forensic Medicine and Toxicology-Volume I and II (combined)-edited by Karmakar, 3rd edition.
3. R.Saferstein.(2004).Criminalistics.8th edition,PrenticeHall,NewJersey.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	M	S
CO2	S	H	M	S	H
CO3	H	S	S	M	H
CO4	M	S	H	M	M
CO5	S	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Programme Code: 07	**Programme Title:** M.Sc Biochemistry
Title of the paper ALC – Nutraceuticals and Functional Foods	
Batch 2022-2023	Credits 2

Course Objectives

1. To learn the concept of nutraceuticals and functional foods
2. To know the available biochemical compounds in our system
3. To prepare functional foods from nutraceutical compounds

Course Outcomes (CO)

K1 ↕ K5	CO1	Remember the complete history of nutraceuticals
	CO2	Classify the different nutraceuticals
	CO3	Illustrate the formulation methods of functional foods
	CO4	Distinguish the role of functional foods in disease prevention and management
	CO5	Employ the role of nutraceuticals in various disorders.

Unit I

Introduction to Nutraceuticals as Science: Nutraceutical- Definition, Classification - Dietary supplements, Functional foods, Historical perspective, scope &future prospects. Applied aspects of the Nutraceutical Science. Sources and its relation with other sciences: Medicine, Human physiology, genetics, food technology, ***chemistry and nutrition (brief description).**

Unit II

Classification, Properties and structure of various Nutraceuticals: Alkaloids, Terpenoids, Glycosides, Natural phenols, Isoprenoid derivaties, Glucosamine, Octacosanol, flavonoids, carotenoids, polyunsaturated fatty acids, lecithin, choline and spingolipids, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate as neutraceuticals. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals.

Unit III

Nutraceuticals of plant and animal origin: Plant metabolites - Functions, sources - Alkaloids, phenols, Terpenoids. Applications with specific examples with reference to skin, hair, eye, bone, muscle, heart, brain, liver, kidney, general health and stimulants. Concept of cosmoceuticals and aquaceuticals. Animal metabolites – Functions, Sources - chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin. Uses and applications in preventive medicine and treatment.

Unit IV

Functional Foods: Definition. Applications of herbs to functional foods, Concept of free radicals and antioxidants; Nutritive and Non-nutritive food components with potential health effects. Soy proteins and soy isoflavones in human health; Role of nuts in cardiovascular disease prevention. Functional foods from wheat and rice and their health effects. Role of Dietary fibers in disease prevention. Vegetables, Cereals, milk and dairy products as Functional foods. Health effects of common beans, Capsicum, annum, mustards, Ginseng, garlic, citrusfruits, fishoils, and sea foods.

Unit V

Food as remedies: Nutraceuticals bridging the gap between food and drug, Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books:

1. Swaminathan M. (2014).Essentials of Food and Nutrition.2nd edition.Bappco.

2. C. Gopalan, B. V. Rama Sastri & S.C. Balasubramanian, (Reprinted 2007, 2011) Nutritive Value of Indian Foods (NVIF),

Reference Books:

1. Todd and others. Clinical Diagnosis and Management. 17th edition, W.B.Saunders, Philadelphia.
2. Clinicaldieteticsandnutrition20014thEdition,Oxford Univ Press.
3. Sizer, F. &Whitney, E. (2000). Nutrition-Concepts &Controversies. 8thedition, Wadsworth Thomson Learning.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	S
CO2	M	S	S	M	M
CO3	S	H	M	S	H
CO4	M	S	H	H	S
CO5	M	S	M	H	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code: 22PBCOD3

Programme Code: 07	**Programme Title:** M.Sc Biochemistry
	Title of the paper ALC –Stem Cell Biology
Batch 2022-2023	Credits 2

Course Objectives

1. To learn about the technology of stem cells preparation
2. To learn the properties of stem cells
3. To prepare stem cells for gene therapy

Course Outcomes (CO)

K1 ↕ K5	CO1	Recall the different types of stem cells and its applications
	CO2	Explain the importance of gene therapy in various diseases
	CO3	Interpret implement the stem cell in therapies
	CO4	Examine the molecular concepts of stem cell
	CO5	Appraise the role of stem cells in various disorders.

Unit I

Introduction and Scope of stem cells: Definitions, Concepts of stem cells, differentiation, maturation, proliferation, pluripotency, self maintenance and self renewal, significations in measuring stem cells, preservation and storage protocols

Unit II

Types of stem cells: Intestinal stem cells, Mammary stem cells, Skeletal muscle stem cell, keratinocyte, stem cells of cornea, skin and hair follicles, tumor stem cells. Factors influencing proliferation and differentiation of stem cells. Role of hormone in differentiation.

Unit III

Embryonic stem cells: Blastocyst, inner cell mass, Culturing of ES cells in lab, laboratory tests to identify ES cells, stimulation ES cells for differentiation, properties of ES cells, human ES cells, Monkey and Mouse ES cells.

Unit IV

Application of stem cell: Identification, Manipulating differentiation pathways, stem cell therapy vs. cell protection, stem cell in cellular assays for screening, stem cell based drug discovery platforms, drug screening and toxicology, stem cell banking.

Unit V

Gene therapy: Genetically engineered stem cells, stem cells and animal cloning, transgenic animals and stem cells, Therapeutic applications, Parkinson's disease, Neurological disorder, limb amputation, heart disease, spinal cord injuries, diabetes, burns. Matching the stem cell with transplant recipient, HLA typing Alzheimer's disease, spinal cord injuries tissue engineering application, production of complete organ, kidney, eyes, heart, and brain. ***Stem cell case study.**

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Kursad and Turksen. (2002). Embryonic Stem cells, Humana Press.

Reference Books

1. Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research. (2002). National Academic press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	H	S
CO2	S	S	M	H	S
CO3	M	H	S	M	H
CO4	H	S	S	M	M
CO5	H	S	H	M	S

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code:22PBCOJ1

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
	Title of the paper JOC –Bio-Entrepreneurship		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

Course Objectives

1. To learn about the concepts of entrepreneurship
2. To study the various opportunities in launching and running a business
3. To know the various strategies of effective entrepreneurship

Course Outcomes (CO)

K1 ↕ K5	CO1	List the concepts of entrepreneurship
	CO2	Report the different strategies adopted for a better entrepreneurship
	CO3	Discriminate the various biological entrepreneurship programmes
	CO4	Apply the quipped enough to become an entrepreneur
	CO5	Employ in understanding about the marketing of products.

Unit I **(6 Hours)**

Basics of Bio entrepreneurship Introduction to bioentrepreneurship– Biotechnology in a global scale, Scope in Bioentrepreneurship, Importance of entrepreneurship. Meaning of entrepreneur, function of an entrepreneur, types of entrepreneur, and advantages of being entrepreneur. Innovation – types, out of box thinking, opportunities for Bioentrepreneurship. Entreprenuership development programs of public and private agencies (MSME, DBT, BIRAC, Startup and Makein India). Patent landscape, IP protection and commercialization strategies.

Unit II **(6 Hours)**

Management, Accounting and Finance Management principles of Henry Fayol. Business plan preparation: business feasibility analysis by SWOT, socio-economic costs benefit analysis, Sources of financial assistance – making a business proposal, approaching loan from bank and other financial institutions, budget planning and cash flow management, basics in accounting practices - balance sheet, P&L account,

Double entry book keeping, estimation of income, expenditure and Income tax. Collaborations and partnerships, information technology for business administration and expansion.

Unit III **(6 Hours)**

Knowledge Centre and R&D Knowledge centers - Universities, innovation centre, research institutions and business incubators. R&D - technology development and upgradation, assessment of technology development, managing technology transfer, industry visits to successful bio-enterprises, regulations for transfer of foreign technologies, quality control, technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GLP, GCP & GMP)

Unit IV **(6 Hours)**

Medium &Small Scale Industry Definition, characteristics, need and rationale, objectives, scope and advantages of small scale industries. Types of bioindustries– Pharma, Agri and Industry. Biofertilizers production - *Azospirillium, Azolla, Cyanobacteria and its applications. Biopecticides production- Bacterial, fungal, viral and plant insecticides. Sericulture. Apiculture. Dairy farming. Single Cell Protein Production and applications. Vermi composting and its applications. Mushroom cultivation and its application. Ancillary and tiny industries

Unit V **(6 Hours)**

Marketing and Human Resource Development Assessment of market demand for potential product(s) of interest, Market conditions, segments, prediction of market changes, identifying needs of customers including gaps in the market. Branding issues, developing distribution channels – franchising policies, promotion, advertising, branding and market linkages. Marketing of agro products. Recruitment and selection process, leadership skills, managerial skills, organization structure, training, team building and teamwork.

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/Assignment/Google Classroom

Text Books

1. "Entrepreneurship and Business of Biotechnology", S. N. Jogdand, Himalaya Publishing Home, 2007.

Reference Books

1. Stephon, Robbins. (2003). Management.17th edition, Pearson Education.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	M	S	H
CO3	S	M	S	H	S
CO4	H	M	M	M	S
CO5	H	M	S	H	M

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code: 22PBC0J2

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
	Title of the paper JOC - Food Safety and Quality Control		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

Course Objectives

1. To learn the principles of food quality control
2. To learn the methodologies to standardize and ensuring food safety
3. To gain knowledge on the framed food safety regulations

Course Outcomes (CO)

K1	CO1	Repeat the various steps in the quality control of food items
↑	CO2	Classify the various food standards
↑	CO3	Illustrate the various methods to determine the quality of foods
↑	CO4	Examine the various regulations concerned with the food quality issues
K5	CO5	Evaluate the methods in standardization of quality control of foods.

Unit I **(6 Hours)**

Principles of Quality control of food: Raw material control, processed control and finished product inspection. Leavening agents, classification, uses and optimum levels. Food additives - Preservatives, colouring, flavouring, sequestering agents, emulsifiers, antioxidants.

Unit II **(6 Hours)**

Standardisation systems for quality control of foods: National and International standardization system, Food grades, Food laws-compulsory andvoluntarystandards. Food adulteration - Common adulterants in foods and tests to detect common adulterants.

Unit III **(6 Hours)**

Standards for foods: Cereals and pulses, sago and starch, milk and milk products, Coffee, tea, sugar and sugar products.

Unit IV **(6 Hours)**

Methods for determining quality: Subjective and objective methods. Sensory assessment of food quality-appearance, color, flavour, texture and taste, different methods of sensory analysis, preparation of score card, panel criteria, sensory evaluation room.

Unit V **(6 Hours)**

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. Chemical hazards associated with foods**. *FSSAI.**

*** denotes Self study**

Teaching Methods

Power point presentation/Seminar/Quiz/Discussion/ Assignment/Google Classroom

Text Books

1. Food Science -Srilakshmi (2001). 2nd edition, new age international publishers- (2001)

Reference Books

1. Swaminathan M. (2014). Essentials of Food and Nutrition. 2 nd edition. Bappco.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	S	M	M
CO2	H	S	S	M	S
CO3	M	M	M	S	H
CO4	S	S	M	M	M
CO5	S	M	S	M	H

S–Strong **H**–High **M**–Medium **L** –Low

Sub Code:22PBCOJ3

Programme Code: 07	**Programme Title:** M.Sc Biochemistry		
	Title of the paper JOC –Clinical and Therapeutic Nutrition		
Batch 2022-2023	Hours / Week 2	Total Hours 30	Credits 4

Course Objectives

1. To enable the basic principles of clinical nutrition
2. To understand the clinical significance of biochemical findings
3. To develop skills in planning and preparation of therapeutic diets for various diseases

Course Outcomes (CO)

K1 ↕ K5	CO1	Commemorate the basics of nutritional care
	CO2	Explain the relation between nutrition and health
	CO3	Interpret the lifestyle and nutritional assessment techniques
	CO4	Analyze the main nutrients and its functions in the body
	CO5	Appraise the role of probiotics in diet.

Unit I **(6 Hours)**

Guidelines for dietary planning: ***Weights and Measures.** Nutritional Assessment. Nutritional care process. Nutritional intervention: Objectives of diet therapy, Therapeutic modification of the normal diet: diet prescription. Routine Hospital diet - regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake, Enteral nutrition, parenteral nutrition, Refeeding syndrome, Transitional feeding. Medical and nutritional care record types and uses. Format for medical and nutrition charting and documentation record.

Unit II **(6 Hours)**

Dietician and Nutrition counselling: Role of dietician on hospitalized and outdoor patients and development of nutritional care plan. Specific functions of atherapeutic, administrative and consultant dietician. Team approach in patient care.

Psychological considerations in feeding the patients. Inter personal relationship with patients. Nutrition counseling- concept, components, activities for behavior changes, intervention counseling models, types of counseling session in patients.

Unit III **(6 Hours)**

Weight imbalances, anorexia nervosa and Bulimia nervosa, cardiovascular disorders, Diabetes mellitus-Type I, II, GI Tract Disorders, Liver and gall bladder, Pancreatic disorders, renal disorder, gout, cancer, Musculo-skeletal disorders (Rheumatoid Arthritis, Osteoarthritis, Osteoporosis), Respiratory problems, hyper metabolic conditions- Burns, Sepsis, Surgery.

Unit IV **(6 Hours)**

Pro and prebiotics: Probiotics: Taxonomy and important features of probiotic microorganisms. Health effects of probiotics with mechanism of action. Probiotics in various foods: fermented milk products, non-milk products etc. **Prebiotics**: Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases. Perspective for food applications for the-Non-digestible carbohydrates/oligosaccharides, Dietary fiber, Resistant starch, Gums. Palliative diet and nutritional care.

Unit V **(6 Hours)**

Food- Drug Interaction: Effect of Food on Drug Therapy. Effect of Drug on Food and Nutrition. Modification of Drug action by Food and Nutrition. Effect of Drug on Nutritional Status. Excipients and Food-Drug Interaction.***Medical nutritional therapy**.

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Teaching Methods

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Text Books

1. Mahan, L.K. and Escott-Stump, S. (2008). Krause's Food Nutrition and Diet-Therapy. 12th edition, W-13 Saunders Ltd.,Canada.

2. Garrrow J.S, James W. P.T, Ralph A. (2000). Human Nutrition and Dietetics. 10th Edition, Churchill Livingstone, London.

Reference Books

1. Antia F.P. and Philip Abraham. (2001). Clinical Nutrition and Dietetics. Oxford Publishing Company, New Delhi.

2. Williams, S.R. (2003). Nutrition and Diet Therapy. 7th edition, Times Mirror/Mosby College Publishing

3. Esther A. Winter feldt, Margret L. Bogle, Lea L. Ebro. (2011). Dietetics: Practice &FutureTrends.3rdedition, Jones and Barlet Publishers.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	S	S
CO2	M	S	S	M	M
CO3	S	H	M	S	H
CO4	M	S	H	H	S
CO5	S	M	H	S	M

S–Strong **H**–High **M**–Medium **L** –Low