ADAMAS UNIVERSITY

SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY

Department of Biological Sciences

M.Sc. Biochemistry (2 Years) Course Structure
Total Credits –88

(Program Code: BIC4201)

(2024-26)

VISION OF THE UNIVERSITY

To be an internationally recognized university through excellence in inter-disciplinaryeducation,research and innovation, preparing socially responsiblewell-groundedindividuals contributing to nation building.

MISSION STATEMENTS OF THE UNIVERSITY

M.S 01: Improve employability through futuristic curriculum and progressive pedagogy

with cutting-edge technology

M.S 02: Foster outcomes based education system for continuous improvement in

education, research and all allied activities

M.S 03: Instill the notion of lifelong learning through culture of research and innovation

M.S 04: Collaborate with industries, research centers and professional bodies to stay

relevant and up-to-date

M.S 05: Inculcate ethical principles and develop understanding of environmental and

social realities

CHANCELLOR / VICE CHANCELLOR

ADAMAS UNIVERSITY, KOLKATA SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

VISION OF THE SCHOOL

To achieve global standard and **excellence in research**on various **interdisciplinary andmultidisciplinary domains**of biological sciences through**biotechnological innovation**along with **producing global citizens**as graduates by**intensive teaching learning process**who would be vanguard to **sustainable societal development**.

MISSION STATEMENTS OF THE SCHOOL

M.S 01: To disseminate knowledge of life science and biotechnology for scholarly progression, intellectual development and strive for innovation.

M.S 02: To enable latest skill sets in the domain of microbiology, biotechnology, biochemistry (biological sciences) with ability to evolve multidisciplinary functionality and engage in learn-unlearn and relearn, being a lifelong learner.

M.S 03: To establish state of art infrastructure and research ambiance in attracting the best minds to serve under the single roof of school of life science and biotechnology in undertaking scientific investigation of social relevance.

04: To inculcate values, culture along with scientific knowledge to foster the spirit of self-reliance and entrepreneurshipdevelopment.

DEAN / SCHOOL CONCERNED

ADAMAS UNIVERSITY, KOLKATA SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

VISION OF THE DEPARTMENT

To achieve **excellence in education and research on biochemistry** for **societaldevelopment** through **innovation** and producing **technologically sound graduates** as **globalcitizen** fostering **life-longlearning.**

MISSION STATEMENTS OF THE DEPARTMENT

M.S 01: Adopt and implement latest curriculum in biochemistry with futuristic approach and innovative pedagogy fostering knowledge, intellectual and skill development.

M.S 02: To enable and enhance skill in biochemistry sets through rigorous training and research through multidisciplinary approach.

M.S 03: To cater professional and societal need of cutting-edge research in biochemistry through collaboration and industry-academic partnership.

M.S 04: To inculcate values, culture along with knowledge about biochemistry to foster the spirit of self-reliance and entrepreneurship development.

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

Name of the Programme: M.Sc. in Biochemistry

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO01 **:** Ability to do research, comprehend fundamentals and expertise in the domain.

PEO 02 **:** Acquainted with modern tools and technology related to the field of

PEO 03 **:** Ability to find routes of solution of existing scientific problems of the domain

PEO04 **:** Develop as professional aspirants and sustainable learners**.**

PEO05

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

Name of the Programme: M.Sc. Biochemistry

GRADUATE ATTRIBUTE / PROGRAMME OUTCOME (PO)

GA 01/ PO 01: Research and analysis -Develop research approaches to meet the scientific gaps on biochemistry and allied interdisciplinary or multidisciplinary fields.

GA 02/ PO 02: Academic excellence -Foster the knowledge and skills in biochemistry to identify and approach towards suitable solution.

GA 03/ PO 03: Data mining -Ability to salvage significant biological data for meaningful solution.

GA 04/ PO 04: Skill- Develop skill set related to biochemistry and allied fields

GA 05/ PO 05: Modern tools uses- Familiarized with latest and advanced tools and techniques of biochemistry.

GA 06/ PO 06: Development of solution- Investigate an existing problem to find a suitable solution, beneficial to the society**.**

GA 07/ PO 07: Diversity- Strong basic knowledge to support diversification in applied field of biochemistry.

GA 08/ PO 08: Professional Development- Ability to set career and professional goals based on a proper career planning process.

GA 09/ PO 09: Collaboration- Develop capacity to uphold integrity and collaborative approach in workplace.

GA 10/ PO 10: Sustainable Learning- To accept and implement changes in learning towards a sustainable development through learn, unlearn-relearn approach.

GA 11/ PO 11: Ethics- Practice ethical philosophies and systems in creating and partnering a progressive society.

GA 12/ PO 12: Global perspectives-Develop as global citizen to contribute in the greater benefits of humanity.

HOD **DEAN / SCHOOLCONCERNED**

ADAMAS UNIVERSITY, KOLKATA SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

Name of the Programme: M.ScinBiochemistry

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO 01: Students will be able to analyse the consequence of key principles of biochemistry in the living organisms at cellular and molecular level for supporting the life.

PSO 02: Students will be able to design the experimental work, interpret the data and present their work through oral and visual presentation.

PSO 03: Students will be able to focus on a scientific problem and to develop an original research proposal on it and also able produce substantial original research of significance and quality sufficient for publication and patent.

PSO 04: Students will be able to develop skills for establish themselves in the field like pclinical and forensic research labs, agriculture, pharmaceutical and biotechnology industries.

HOD **DEAN / SCHOOL CONCERNED**

Semester-I							
Type of the Course	**New Course Code**	**Course Name**	**Contact Hours Per Week**	**L**	**T**	**P**	**Credit**
CORE (Theory)	**BIC21501**	**Biomolecules and Biomolecular Interaction**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21503**	**Biophysical Chemistry and Bio-analytical Techniques**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21528**	**Plant Biochemistry**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21507**	**Enzymology and Physiological Biochemistry**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21541**	**Ecology and Evolution**	**3**				**3**
CORE (Practical)	**BIC22542**	**Biophysical Chemistry and Bio-analytical Techniques Lab**	**4**	**0**	**0**	**4**	**2**
CORE (Practical)	**BIC22557**	**Enzymology and plant biochemsity Lab**	**4**	**0**	**0**	**4**	**2**
CORE (Theory)	**BIC21534**	**Bioethics and Intellectual Property Rights**	**3**	**3**	**0**	**0**	**3**
Foundation	**BIC22570**	**Professional Development Course 1**	**1**	**0**	**0**	**1**	**1**
Total			**23**	**12**	**1**	**9**	**23**

Semester-II							
Type of the Course	**New Course Code**	**Course Name**	**Contact Hours Per Week**	**L**	**T**	**P**	**Credit**
CORE (Theory)	**BIC21511**	**Molecular Biology**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21512**	**Recombinant DNA Technology**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21543**	**Bioinformatics and Biostatistics**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21544**	**Genomics and Proteomics**	**3**	**3**	**0**	**0**	**3**
CORE (Practical)	**BIC22545**	**Molecular Biology & Recombinant DNA Technology Lab**	**4**	**0**	**0**	**3**	**2**
CORE (Practical)	**BIC22546**	**Bioinformatics and Biostatistics Lab**	**4**	**0**	**0**	**3**	**2**
CORE (Practical)	**BIC22547**	**Genomic and Proteomics Lab**	**4**	**0**	**0**	**3**	**2**
CORE (Theory)DisciplineSpecific Elective-I	**BIC21517 BIC21518 / BIC21509 /BIC21510**	**Any One of the following*: Cancer Biology / Nano biotechnology / Drug Design and Development/ Food and Dairy: Food Safety and Quality Control**	**3**	**3**	**0**	**0**	**3**
Foundation	**BIC22571**	**Professional Development Course 2**	**1**	**0**	**0**	**1**	**1**
Total			**27**	**15**	**0**	**10**	**22**

Semester-III							
Type of the Course	**Course Code**	**Course Name**	**ContactHours Per Week**	**L**	**T**	**P**	**Credit**
CORE (Theory)	**BIC21522**	**Immunology**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21536**	**Microbiology**	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21550 / BIC21551**	**Forensic Biology#/ Nutrition and toxicology***	**3**	**3**	**0**	**0**	**3**
CORE (Theory)	**BIC21513**	**Bioenergetics and Metabolism**	**3**	**3**	**0**	**0**	**3**
CORE (Practical)	**BIC22523**	**Immunology Lab**	**4**	**0**	**0**	**3**	**2**
CORE (Practical)	**BIC22552 / BIC22553**	**Forensic Biology Lab#/ Nutrition and toxicology lab***	**4**	**0**	**0**	**3**	**2**
CORE (Practical)	**BIC22549**	**Microbiology Lab**	**4**	**0**	**0**	**3**	**2**
CORE (Theory) Discipline Specific Elective-II	**BIC21554 /BIC21555/ BIC21532 / BIC21556 /BIC21558/ BIC24530**	**Any One of the following*: Applied toxicology*/ Environmental toxicology*/ Clinical Biochemistry / Advanced DNA Forensics#/ Advanced Forensic Chemistry#/ Research**	**3**	**3**	**0**	**0**	**3**
FOUNDATION	**BIC24535**	**Industry Internship**	0	0	0	2	**2**
Foundation	**BIC22572**	**Professional Development Course 3**	**1**	**0**	**0**	**1**	**1**
Total			**27**	**15**	**1**	**12**	**24**

*Nutrition and Toxicology Specialization
#Forensic Biology Specialization

Type of thePaper	New Course Code	Theory/Practical	Contact Hours Per Week	L	T	P	Credit
CORE (Theory)	**BIC25539**	**Comprehensive Viva**		**3**	**0**	**0**	**4**
CORE (Theory)	**BIC25540**	**Dissertation**	**15**	**0**	**0**	**15**	**15**
Total			**21**	**3**		**15**	**19**

*Offering of DSE subjects will vary from year to year, subject to the availability of faculty

Total credit distribution semester -wise:

Semester	I	II	III	IV	Total
Credits	23	22	24	19	88

NB: 1 credit ~ 15 contact hours

BIC21501	**Biomolecules &Biomolecular interaction (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	UG level knowledge of Biochemistry and Cell Biology				
Co-requisites	--				

Course Objectives

The cells of living organisms encompass thousands of biomolecules. From this course the students will identify the structure-function relationship of these biomolecules, and their importance with respect to maintenance and perpetuation of the living systems.

Course Outcomes

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

CO1. Remembering-Recall the various types of weak interactions between the biomolecules and water.

CO 2. Understanding-Comprehend how the polysaccharides and complex carbohydrates are made from the simple precursors.

CO 3. Applying-Apply the structure-function relationships of the proteins and utilization of different techniques for elucidation of protein structure.

CO 4. Analyzing-Describe a sequencing techniques and principle of NGS, and Biosynthesis of purine and pyrimidine.

CO 5. Evaluate-Develop the concept of lipidomics and the processes of fatty acid oxidation and cholesterol biosynthesis to relate various interrelated physiological and metabolic events.

Catalog Description

The core-course of 'Biomolecules &Biomolecular interaction' will help to understand the structure and function of biomolecules: synthesis and properties of cellular macromolecules, basic properties of enzymes, principles of metabolism, bioenergetics, signal transduction, regulation of gene expression and function of biomolecules in cell structure and differentiation. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject viaexercise and discussions with thecoordinator.

Course Content

Biomolecules &Biomolecular interaction (BIC 21501)

Unit 1 Bonding and interactions: Structure of atoms, molecules and chemical bonds, Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc.).

Unit 2 Carbohydrate: Classification, structure, general properties and functions of polysaccharides and complex carbohydrates; amino sugars, proteoglycans, glycoproteins and its significance. Hexose metabolism: pathways and energy metabolism. Metabolic labelling and glycomics.

Unit 3 Amino acids and Proteins: Structure and functional group properties, peptides and covalent structure of proteins, elucidation of primary and higher order structures, Ramachandran Plot, evolution of protein structure. Protein folding and its kinetics, chaperones and folding pathways, Structure determination using X-ray crystallography, CD- ORD, NMR and CryoEM. Overview of amino acid biosynthesis. Techniques and concepts in proteomics: LC-MS/MS and peptide mass fingerprinting.

Unit 4 Nucleic acids: Nucleic acids as genetic information carriers, Structure and function of various orders of nuclei acid organizations: forms and conformations, Sequencing techniques and principle of NGS. Denaturation of DNA.Biosynthesis of purine andpyrimidine.

Unit 5 Lipids: Classification, structure, properties and functions of fatty acids, essential fatty acids, fats, phospholipids, sphingolipids, cerebrosides, steroids, bile acids, prostaglandins, glycolipids. Fatty acid oxidation and cholesterol biosynthesis.Biosynthesisof saturated & unsaturated fatty acids and cholesterol.Lipidomics: sample preparation andanalysis.

Textbook:

1. Nelson, D.L.; Cox, M.M. *Lehninger principles of biochemistry*. W.H. Freeman:2013.

Reference books:

- Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
- Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by ChurchillLivingstone
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
- Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Willey MJ, Sherwood, LM &Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed.,McGrawHill
- Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley andSons
- Biochemistry by Jeremy M. Berg, John L. Tymoczko, LubertStryer,2007
- Fundamentals of Biochemistry: Life at the Molecular Level, 4th Edition: Life at the Molecular Level by Voet, 2012
- Biochemistry by LubertStryer (8th Ed)2015

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Mid Term	Attendance	Class Assessment	End Term
Weightage (%)	20	10	30	40

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: SBC21501 - BIOMOLECULES & BIOMOLECULAR INTERACTION(THEORY)
Program:M.Sc.Biochemistry **Time: 03Hrs.**
Semester:Odd 2020-21 **Max. Marks:40**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)

1.	**Analyze** the role of water in biological processes.	**An**	**CO1**
2.	**Explain** why is cellulose insoluble, while starch, which appears to have a very similar structure, is soluble? **Identify** the tools used to characterize the glycome.	**U**	**CO2**
3.	**Illustrate** why do proteins fold? What is peptide mass fingerprinting?	**R**	**CO3**
4.	**Describe** the principle of Next Generation Sequencing (NGS) technology.	**U**	**CO4**
5	**Develop** a mass spectrometry-based lipid analysis protocol.	**AP**	**CO5**
	SECTION B (Attempt any Two questions) (10X2=20)		
6.	What is the role of chaperones in protein folding? How do chaperones recognize unfolded proteins? **Illustrate** one of the pathways of chaperone-mediated protein folding in the cytosol. **3+2+5**	**U**	**CO3**
7.	A sugar($C_6H_{10}O_5$) was treated by a method that reduces aldehyde groups and gave a product that was optically inactive. Assuming the sugar was D,**identify**the two possible structures of the product? **Analyze** the role of non- covalent interactions for determining the folding rate of two- state proteins. **Explain** regulation of glucokinaseactivity by glucokinaseregulatoryprotein. **2+4+4**	**U,AN**	**CO1** **CO2**
8.	What is allowed region in Ramachandran plot? Which amino acid residue can occupy the greatest area in a Ramachandran plot? Identifythe purpose of a Ramachandran plot. **Illustrate** the role of glycoprotein in cell membrane. **2+1+3+4**	**AN,AP, U**	**CO3**

9	Which amino acid is required for both purine and pyrimidine synthesis? How much ATP is used in purine synthesis? Describe that small local variations in B-form DNA lead to a large variety of global geometries which can accommodate most DNA-binding protein motifs. **Describe**the steps of oxidation of odd-chain fatty acids**.** **1+1+5+3**	**AN,AP, U**	**CO4** **CO5**

BIC21503	**Biophysical Chemistry &Bioanalytical Techniques (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	Contact hours = 45	3	0	0	3
Pre-requisites/Exposure	BSc. level Biochemistry knowledge				
Co-requisites	-				

Course Objectives

To develop the skills of the application of basic and advanced techniques employed in quantitative and qualitative analysis of biomolecules. To be able to communicate and discuss the various methods available to purify and characterize biological molecules based on their physical and chemical properties. To be able to choose from the various methods available for purifying and characterizing biological moleculesbased on their physical and chemical properties. To provide scientific understanding of analytical techniques and detail interpretation ofresults.

Course Outcomes

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

1. **CO1.Comprehension of Thermodynamic Principles in Biological Systems**:
   Students will be able to apply the laws of thermodynamics to biological systems, understanding how free energy, enthalpy, and entropy drive biological processes and membrane dynamics.
2. **CO2.Mastery of Water's Physicochemical Properties**:
   Students will gain insights into the unique properties of water, including its ionic product, pH, and buffering capacity, and will understand their impact on enzyme catalysis and biological reactions.
3. **CO3.Proficiency in Quantum Chemistry and Spectroscopy**:
   Students will be able to explain the fundamental concepts of quantum chemistry and electromagnetic radiation and apply techniques such as UV-visible, fluorescence, and IR spectroscopy to analyze biomolecules.
4. **CO4.Expertise in Advanced Separation Techniques**:
   Students will develop a solid understanding of various separation techniques, including centrifugation, chromatography (TLC, HPLC, FPLC, and affinity chromatography), and ion-exchange chromatography, and apply these in experimental setups for biomolecular purification.
5. **CO5.Application of Radioactivity and Tracer Techniques in Biological Studies**:
   Students will learn the principles of radioactivity and tracer techniques, mastering the use of radiotracers, isotope dilution, and radioimmunoassay in metabolic and distribution studies within biological systems.

Catalog Description

This course contains bioanalytical techniques along with their theory, working principal, common instrumentation and possible applications. This course will be equally beneficial to various scientific areas including, lifescience, chemical science, material science and environmental science. The information presented in this course will provide the student with valuable insight into the characterization and separation of biological macromolecules. By the end of this course, the student should be able to choose the correct method or combination of methods to characterize and separate biological macromolecules based on the physical and chemical properties of the molecules.

Course Content

Unit 1 (10 lecture hours).

Thermodynamics equilibrium; Laws of Thermodynamics and its application in biological processes; Concepts of enthalpy, entropy and free energy.Gibb's free energy; Bioenergetics; Application of thermodynamics in coupled reactions and biological systems.

Unit 2 (6 lecture hours).

Electromagnetic spectrum and transition energies. Quantum mechanicalpostulates, Operators, Eigenvalue and Eigenfunction, Schrodinger Equation, Set up of Hamiltonian in Particle in box , simple harmonic oscillator: energy quantization and wave functions, Approximate methods , Central concepts in spectroscopy. Scattering absorption anddispersion.

Unit 3 (8 lecture hours)

Spectroscopy I: Concept of electromagnetic radiations - UV, visible, IR, microwave region. Molecular Orbitaltheory: Bonding and antibonding ; UV Visible Absorption Spectroscopy, Fluorescence Spectroscopy: Determination of Quantum yield of Fluorescence of a fluorophore and a protein, Emission of Protein, Quenching of emission of protein by acrylmide and KI, Protein LigandInteraction.

Unit 4 (4 lecture hours).

Spectroscopy II Magnetic Resonance Spectroscopy, Basic principles and instrumentation in NMR Spectroscopy, Application to structure of biomolecules ; Basics of ESR Spectroscopy and Application.

Unit 5 (4 lecture hours).

Method of conformational analysis and prediction of conformation: Structure determination using Circular Dichroism, Spectroscopy, X-ray diffraction.

Unit 6 (3 lecture hours).

Centrifugation: Principle of centrifugation and different types of centrifuge. Differential & density gradient centrifugation.

Unit 7 (7 lecture hours).

Chromatography Techniques—TLC, HPLC, HPTLC & FPLC, Size-exclusion Chromatography, Determination of void volume, Determination partition coefficient, Separation of two components in a sample.Affinitychromatography, Ion-exchange Chromatography.Nature of exchanger, capacity of column, Separation of amino acids.

Unit 8 (3 lecture hours).

Radioactivity--: Radioactive & stable isotopes; Units of radioactivity; Measurement of radioactivity; Measurement of stable isotopes; Falling drop method; Radiotracer techniques; Distribution studies; Isotope dilution technique.

Reference Books:

1. Lakowicz, J. R. (2006) Principles of Fluorescence Spectroscopy. 3rdedition.Springer.
2. PhysicalChemistryfortheLifeSciences.PeterAtkins, JuliodePaulabyPeterAtkins, Julio de Paula,2011

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Mid Term	Attendance	Class Assessment	End Term
Weightage (%)	20	10	30	40

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC21503 - Biophysical Chemistry &Bioanalytical Techniques (THEORY)
Program: M.Sc. Biochemistry Time: 03 Hrs.
Semester:Odd 2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)			
1.	**Explain** two different models of enzyme action.	**R**	**CO3**
2.	**Describe** (i) Reaction orders and (ii) Carnot Engine.	**U**	**CO1**
3.	(i) **Explain** the Rate Law. (ii) **Describe** the factors that influence reaction rate	**R**	**CO2**
4.	(i) **Explain** Arrhenius equation? (ii) **Interpret** Transition State theory.	**AP**	**CO2**
5	At 1000˚C, cyclobutane (C_4H_8) decomposes in a first-order reaction, with the very high rate constant of 87 s^{-1}, to two molecules of ethylene (C_2H_4). (i) If the initial C_4H_8 concentration is2.00M,**find**outtheconcentrationafter0.010s?(ii)**Find**the fraction of C_4H_8 that has decomposed in this time?	**R,U,AN**	**CO5**
	SECTION B (Attempt any Three questions) (10X3=30)		
6.	Draw and **explain** Perrin-Jablonski diagram of fluorescence and phosphorescence.	**R**	**CO3**
7.	**Describe** the important characteristics of fluorophores? **Explain** quantum yield? **Explain** intrinsic fluorescence of proteins and peptides.	**U**	**CO2** **CO3**
8.	**Explain** the electrophoresis process? **Illustrate** the differences between SDS and non-SDS electrophoresis.	**R**	**CO1** **CO5**
9	**Explain** the mechanism of gel-exclusion chromatography. **Describe** how one can find out molecular weight of an unknown protein using gel-exclusion chromatography.	**U,R**	**CO4**

BIC21507	**Enzymology and Physiological Biochemistry**	L	T	P	C
Version 1.0	Contact Hours -45	3	0	0	3
Pre-requisites/Exposure	BSc. level Biology knowledge				
Co-requisites	-				

Course Objectives

1. To **classify** the enzymes according to the basis of their catalysedreactions.
2. To **analyse**and **evaluate** the kinetic behaviour ofenzymes
3. **To develop** the concept and **determine** about different patterns of inhibitions of enzyme activity.
4. Will **build** the concept about the structures of active site of the enzymes and their mechanism of actions and their clinicalapplication.
5. To **develop** the idea about regulation of enzymeactivity.

Course Outcomes

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

CO1 Remembering-**Recall** the enzymes according to the basis of their catalyzed eactions.

CO2: Understanding-**Comprehend** the kinetic behaviour of enzymes.

CO3: Applying- **Apply** the concept and **determine** about different patterns of inhibitions of enzyme activity.

CO4: Analysing-**Build** the concept about the structures of active site of the enzymes and their mechanism of actions and their clinical application.

CO5 Evaluate-**Develop** the idea about regulation of enzyme activity.

Catalog Description

Nomenclature and classification of enzymes Holoenzyme, apoenzyme , cofactors, coenzyme, prosthetic groups ,metallo enzymes, monomeric and oligomeric enzymes Activation energy and transition state theory, enzyme activity, specific activity, common features of active sites, enzyme specificity: types and theories Factors affecting enzyme activity, E, S, temp and pH Enzyme substrate complex: Concept of E-S complex, binding sites, active site, specificity, kinetics of enzyme activity Michaelis- Menten equation and its derivation Different plots for the determination of KM and Vmax and their physiological significance Two substrate reactions (random, ordered and ping pong mechanisms), enzyme inhibition, types of inhibition, determination of Ki, suicideinhibiton.

Course Content

1. Enzyme classification, isoenzymes, multienzyme; factors affecting enzymateactivities; feedback and allosteric inhibition.Purification and characterization ofenzymes.single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbomoylase).

[6 hours lecture]

2. E
nzymes kinetics: One substrate reactions, effect of pH, temperature and inhibitions. Two substrate reactions. Theory, order analysis, pre-steady state kinetics, stopped flow technique, Relaxationmethods.

[7 hours lecture]

3. M
echanism of enzymes action: Theoretical background, Factors leading to rate enhancement of enzyme catalyzed reactions: Acid-base catalysis, proximity and orientation effects, covalent catalysis, strain or distortion and change in environment. Experimental approaches of determination of enzymes mechanism: Kinetics studies, detection of intermediates, X-ray crystallographic studies, Chemical modification of amino acid side chain and affinity labeling, site directed mutagenesis. Examples of chymotrypsin, triose phosphate isomerases, aldolaseetc.

[7 hours lecture]

4. Control of enzyme activity: Control of activities of single enzyme: inhibitor molecules, availability of substrate or cofactor. Product inhibition. Control by changes in covalent structure ofenzymes. **[7 hou**

5. Z
ymogen activation and phosphorylation dephosphorylation ligand induced changes: Allosteric enzymes, Theoretical models, Hill equation, Adair equation, M.W.C. and K.N.F. Models, usefulness of the models. Significance of allosteric and cooperative behavior inenzymes.

[7 hours lecture]

6. C
ontrol of metabolic pathways: Amplification of signals, substrate cycles andInterconvertible enzymecycles.

7. Multienzyme complex: Properties, pyruvate dehydrogenase system, (*E.COLI* and mammalian), Tryptophan synthetase, multienzyme complex from E.coli, fatty acid synthetase, glycogen particle. **[4 hou**

8. E
nzyme turnover: Kinetics of enzyme turnover. Measurement of enzyme turnover, Ks and Kd. Correlation between the rates of enzyme turnover and structure and function of enzymes.Mechanism of enzyme degradation.Significance of enzyme turnover. **[3 hourslecture]**

9. Clinical aspects of enzymology: LDH isozymes, SGOT, SGPT, creatine kinase, alphaamylase, phosphatase, inbornerrors. **[4hourslecture]**

Reference Books

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-42923414-8.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York),ISBN:978-0-470-28173-4.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Mid Term	Attendance	Class Assessment	End Term
Weightage (%)	20	10	30	40

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**			
Course: BIC21504 Enzymology **Program:M.SCBiochemistry** **Time: 03Hrs.** **Semester: Even2019-20** **Max. Marks:50** **Instructions:** **Attempt any four questions from Section A (each carrying 5 marks); any two Questions from Section B (each carrying 10 marks).**			
Section A (Attempt any FOUR) **(5X4=20)**			
1	**What** is active site of enzyme? Give its function?()	**U**	**CO2**
2	**What** is allosteric regulation?	**R**	**CO3**
3	**What** are the difference between sequential and symmetry model of allosteric regulation	**R**	**CO1**
4	**What** are the advantages of allosteric regulation?	**U**	**CO3**
5	**Why** an enzyme having an allosteric regulation show a sigmoid curve instead of a regular hyperbolic curve?	**AN, U**	**CO4**
Section B **(3X10=30)**			
6	**Which** of these two cases is allosteric regulation? i. 'Phosphorylation of an amino acidsomewhere other than the active site' ii. 'The non-covalent binding of cAMP somewhere other than the activesite'	**AN, R**	**CO3**
7	**Differentiate** between apoenzyme and holoenzyme. What is induced fit Model? Give its significance.	**AP, U**	**CO5**
8	What is activation energy? How is it lowered? Explain the limitation of key and lock model.	**U,R**	**CO2**

BIC21528	PLANT BIOCHEMISTRY (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	FUNDAMENTALS OF PLANT BIOCHEMISTRY FROM GRADUATION				
Co-requisites	--				

Course Objectives

- To provide students the basic understanding of plant cell structure with emphasis to some specialorganelles.
- To provide wholesome knowledge on plant specific biochemical pathways like photosynthesis and nitrogenmetabolism.
- Elaborating roles of phytohormones and secondary metabolites in growth and development of plants.
- General overview of plant tissueculture.

Course Outcomes

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

1. Knowledge: Define and explain the basic principles of plant biochemistry including photosynthesis, respiration, and nitrogen metabolism.
2. Comprehension: Interpret and explain the impact of various abiotic and biotic stressors on plant physiology and biochemistry.
3. Application: Apply knowledge of plant transport processes to describe how nutrients and other molecules are transported within plants.
4. Analysis: Analyze the molecular mechanisms underlying plant stress responses at the biochemical level.
5. Evaluation: Critically evaluate the current research on plant stress responses and propose future directions for investigation.

Catalog Description

The core-course of 'plant biochemistry' deals with the modern aspects of plant biochemistry..This course deals with plant cellular structure with emphasis to special organelles related to plant cells. It also includes topics related to plant specific biochemical pathways like photosynthesis, respiration and nitrogen fixation. Furthermore, it deals with the roles of phyto-hormones and secondary metabolites in plant growth and development. It also encompasses the very important industrially important plant tissue culture technique. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject viaexercise and discussions with the coordinator.

Course Content

Course Content

1) Stress Physiology: Plant responses to abiotic & biotic stresses.

2) Secondary metabolites: Biosynthesis of nitrogenous compounds, phenols, and terpenes& their roles.

3) Solute Transport & Photo assimilate Translocation: Mechanisms of unloading & loading of photo assimilates, transpiration, translocation, transport & uptake of macromolecules, solutes & ions via phloem & xylem, across membranes, and through cells.

4) Sensory Photobiology: Biological clocks, photo periodism, stomatal movement, mechanism of action, function & structure of phytochromes, phototropin&cryptochromes.

5) Plant Hormones: Mechanism of action & physiological effects, transport & breakdown, storage, biosynthesis.

6) Nitrogen Metabolism: Amino acid biosynthesis, ammonium & nitrate assimilation.

7) Respiration & Photorespiration: Photo respiratory pathway, alternate oxidase, ATP synthesis & plant mitochondrial electron transport, citric acid cycle.

8) Photosynthesis: CO2 fixation-CAM, C4, and C3 pathways, photo protective mechanisms, mechanisms of electron transport, light-harvesting complexes.

REFFERNCE BOOKS:

1. Plant Biochemistry (2008), Caroline Bowsher, Martin steer, Alyson Tobin, Garland science ISBN978-0-8153-4121-5

2. Biochemistry and molecular Biology of plant-Buchanan. (2005) 1 edition. Publisher: I K International. ISBN-10: 8188237116, ISBN-13:978-8188237111.

3. Plant Biochemistry by P.M Dey and J.B. Harborne (Editors) (1997) Publisher: Academic Press ISBN-10:0122146743, ISBN-13:978-0122146749

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC21528 – PLANT BIOCHEMISTRY (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2019-20 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)

1.	**What** are peroxisomes? **Explain** its role in plant cell.	**U,R**	**CO1**
2.	**Summarize** the light reactions in photosynthesis. What is cyclic photophosphorylation?	**U,R**	**CO2**
3.	What are the genes involved in nitrogen fixation in plants? **Summarize** nitrogen uptake and assimilation in plant cells briefly.	**U,R**	**CO3**
4.	**Compare** cell suspension culture and protoplast culture. What is totipotency?	**U,R**	**CO5**
5	**Explain** the molecular pathway of auxin response. What is the precursor of auxin?	**U,R**	**CO4**

SECTION B (Attempt any 3 questions) (10X3=30)

6.	**Illustrate** the technique of post-harvest technology with its potential application. How ethylene regulates fruit ripening? What are the role of GA class of hormones? Which one is called stress hormone?	**AP, U,R**	**CO4**
7.	**Explain** dark reactions in photosynthesis. Describe the CAM pathway in detail. **Compare** between C3 & C4 pathway.	**AN, U**	**CO2,CO3**
8.	**Illustrate** the role of nitrogenase complex in nitrogen fixation. What is the role of vacuoles in plant cell? What is somatic embrugenesis and somaclonal variation? Mention its significance.	**AP, R**	**CO1** **CO3** **CO5**

BIC21541	**Ecology and Evolution (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	UG LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. Provide students with the scope to develop knowledge base covering all attributes of the environment and enable them to attain scientific/technological capabilities to find answers to the fundamental questions before the society with regards to human action and environmental effects with duediligence.
2. Enhance the ability to apply this knowledge and proficiency to find solutions relating to environmental and ecological concerns of varied dimensions of present times through researchactivities.
3. Provide with a direction and technical capability to carry on collaborative endeavour, and decisionmaking.
4. Help graduates appreciate requirement of framing environmental policy guidelines.
5. Motivate graduates to appreciate that they are an integral stakeholder in the environmental management of India irrespective of their future jobs or working.

Course Outcomes

Upon completion of this course, students will be able to:

1. Remember: Recall and identify key concepts and terms related to ecology and evolution such as population dynamics, succession, evolutionary genetics, theories of evolution, and population genetics.
2. Understand: Explain the fundamental principles of ecology and evolution, including the mechanisms of natural selection, genetic drift, and gene flow.
3. Apply: Apply ecological and evolutionary concepts to analyze and interpret data related to population dynamics, genetic variation, and evolutionary processes.
4. Analyze: Critically evaluate scientific literature on ecology and evolution to draw conclusions and generate hypotheses related to population dynamics and evolutionary patterns.
5. Create: Design and conduct research projects to investigate ecological and evolutionary patterns in natural populations.

Catalog Description

This course covers ecological and evolutionary principles on population, community, ecosystem and biodiversity. The very nature of ecology and evolution requires students to view role of evolutionary process on modern human life. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniquesled by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with thecoordinator.

Course Content

DIVERSITY OF LIFE FORMS AND ECOLOGICAL PRINCIPLES

3 Lecture Hours

1. **Principles and methods of taxonomy:** Concepts of species and hierarchical taxa, biological nomenclature, classical and quantititative methods of taxonomy of plants, animals and microorganisms.

3 Lecture Hours

2. **Levels of structural organization:** Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparativeanatomy.

3 Lecture Hours

3. **Outline classification of plants, animals and microorganisms:** Important criteria used for classification in each taxon; classification of plants, animals and microorganisms; evolutionary relationships amongtaxa.

3 Lecture Hours

4. **Natural history of Indian subcontinent:** Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of thesubcontinent.

3 Lecture Hours

5. **Organisms of health and agricultural importance:** Common parasites and pathogens of humans, domestic animals andcrops.

3 Lecture Hours

6. **The Environment:** Physical environment; biotic environment; biotic and abiotic interactions.

3 LectureHours

7. **Habitat and niche:** Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; characterdisplacement.

4 LectureHours

8. **Population ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection); conceptof metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

4 Lecture Hours

9. **Species interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination,symbiosis.

3 Lecture Hours

10. **Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges andecotones.

3 LectureHours

11. **Ecological succession:** Types; mechanisms; changes involved in succession; concept ofclimax.

4 LectureHours

12. **Ecosystem:** Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine,estuarine).

3 Lecture Hours

13. **Biogeography:** Major terrestrial biomes; theory of island biogeography; bio geographical zones ofIndia.

1 **3 LectureHours**

14. **Conservation biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Reference books:

1. Diversity of Life: The Five Kingdoms by Lynn Margulis,1992
2. The Diversity of Living Organisms by Richard Stephen Kent Barnes,2009
3. Ecology by Michael L. Cain, William D. Bowman,2008
4. Fundamentals of Ecology by Odum and Barrett,2005
5. Biodiversity: an introduction by Kevin J. Gaston,2004

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

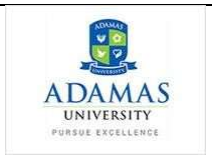
Components	Class Assessment	End Term
Weightage (%)	50	5 0

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21535 – DIVERSITY OF LIFE FORMS AND ECOLOGICAL PRINCIPLES
Program:M.Sc.Biochemistry **Time: 03Hrs.**
Semester: Odd2020-21 **Max. Marks:40**

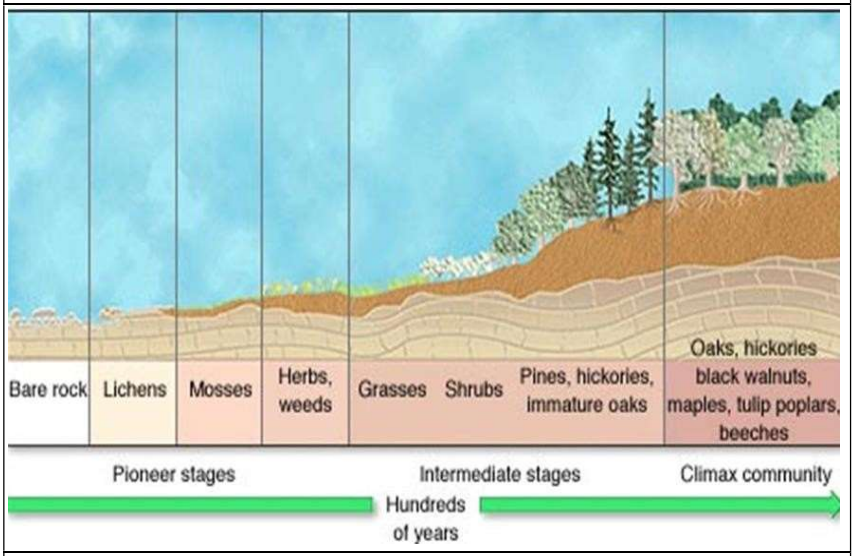
Instructions:
Attempt any three questions from Section A (each carrying 4 marks); any four questions from Section B (each carrying 7 marks).

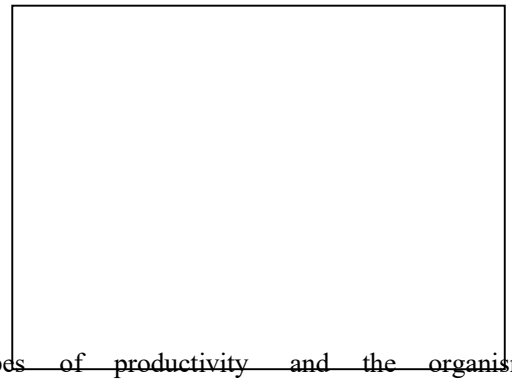
SECTION A (Attempt any Four questions) (5X4=20)

1.	a) **What**is a clade?(R) b) **Write the difference** between α-taxonomy & β-taxonomy?(U)	**U**	**CO5**
2.	a) **What** are the differences between habitat and niche?(U) b) Explain it with an example. How do you explain G.F. Gause's classical experiment with two different parameciumspecies, *Paramecium aurelia*&*Parameciumcaudatum*? (An)	**U,AN**	**CO1**
3.	**a) What are the factors that determine a species as threatened? (R)** **b)How can the loss of one species lead to the extinction of another?(U)**	**R,U**	**CO4**
4.	**Write** all the categories according to level of organization of tissues in a descending order. (An)	**AN**	**CO3**

SECTION B (Attempt any Two questions) (10X2=20)

5.	a) Suppose a metapopulationis consist of 2 population patches, A & B, in which A is occupied and B is unoccupied. If 150 individuals from population patch A (total population size 600) is migrated to patch B, then**evaluatewhat**will be the colonization/recolonization co-efficient (c) of that metapopulation? Consider growth rate of that metapopulation or dP/dtis equal to 0 & extinction co-efficient (e) is 0.25.(Eva) b) **Why** the pyramid of energy can never be inverted? Give a suitable explanation for it.(An)	**AN,CR**	**CO1** **CO2**
6.	**a) Explain how species diversity of an area is reduced by the invasion of an alien species.(An)** b) **What are** Biogeochemical Cycles of Biosphere?(R) c) **State** two advantages of in situ conservation.(U)	**AN, R, U**	**CO4**

<table>
<tr>
<td>7.</td>
<td>a)Name and describe the type of succession in the following picture.(An)
 
</td>
<td></td>
<td>CO2
CO1</td>
</tr>
<tr>
<td>8.</td>
<td>a)The following table shows the number of individuals of each species found in two communities. Using the table calculate the species diversity, species richness and species dominance of both the communities.(Ap)
b) Also you have to clearly mention in which community the species diversity & species richness is higher.(U)
COMMUNITY 1COMMUNITY 2
<table>
<tr><th>Species Name</th><th>Species Number</th><th></th><th>Species Name</th><th>Species Number</th></tr>
<tr><td>Orthoptera (Species 1)</td><td>6</td><td></td><td>Orthoptera (Species 1)</td><td>25</td></tr>
<tr><td>Orthoptera (Species 2)</td><td>5</td><td></td><td>Orthoptera (Species 2)</td><td>2</td></tr>
<tr><td>Lepidoptera</td><td>9</td><td></td><td>Lepidoptera</td><td>17</td></tr>
<tr><td>Hymenoptera</td><td>21</td><td></td><td>Hymenoptera</td><td>12</td></tr>
<tr><td>Coleoptera</td><td>12</td><td></td><td>Coleoptera</td><td>5</td></tr>
</table></td>
<td>AP,U</td>
<td>CO1
CO5</td>
</tr>
</table>

9.	a) **Explain** the following graph with respect to prey-predator relationship.(An)  b) **Mention** the basic requirementfor any ecosystem to function andsus tain. **Name** the types of productivity and the organism responsible? (U)	**AN,U**	**CO2** **CO1**

BIC21534	BIO-ETHICS AND INTELLECTUAL PROPERTY (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 90**	3	0	0	3
Pre-requisites/Exposure	Basic Knowledge of Biology, application of biotechnology and concept of innovation.				
Co-requisites	--				

Course Objectives

- To provide the students with understanding of components and process of obtaining protection using IPR.
- It will also discuss various aspects of bioethics
- To study the scope of entrepreneurship development using biotechnology and imbibe skills.

Course Outcomes

On completion of this course, Students will be able to

CO 1 Remembering: Recall various components of IPR and/or evaluate the feasibility of an invention/ innovation to be protected through IPR.
CO 2 Understanding: comprehend various ethical issues pertaining to biotechnological aspects.
CO 3 Applying: classify biosafety levels.
CO 4 Analyzing: Analyse skills for entrepreneurship through biotechnological innovation.
CO5 Evaluate: Evaluate different aspects of biosafety and IPR.

Catalog Description

The core-course of bioethics, IPR and biological patent is a core course that discusses various concepts of IPR along with its background, history and method of obtaining them. This is a fundamental course that would help students to be aware of the legal protection of innovation and innovative products. Several bio-ethical concepts are also discussed to provide critical appraisal on various biological processes. The scope of entrepreneurship utilizing biotechnological ideas are also dealt in this course.

Course Content

BIO-ETHICS, INTELLECTUAL PROPERTY RIGHTS & BIOLOGICAL PATENT

(SBC52102)

Unit I. Intellectual Property Right (IPR)

2. Concept and provisions ofIPR

Patents, Trademarks, Copyright, Conditional information, Breeder's right. Patent; importance, types, scope, criteria, applying for a patent.Protection of Biotechnological inventions. Patent infringement-meaning, scope, litigation, case studies and examples

3. Agreements and Treaties----History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty;PCT

Unit II. Safety in Biotechnology

Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines , Overview of Biotechnology Regulations and relevant International Agreements including Cartegana Protocol.

Unit III. Bioethics

Biotechnology information, communication and public perception, Future prospects of consumers and social acceptance .Case studies

Unit IV. Bio-entrepreneurship

Support mechanism for entrepreneurship in India; Leadership skills; Managerial skills; Team building; teamwork;. Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks. Information technology for business administration, E-business setup andmanagement.

Suggested Books:

1. The Ethics of Biotechnology by Jonathan Morris,2005
2. Understanding Bioethics and the Law: The Promises and Perils of the Brave New World of Biotechnology by Barry R. Schaller,2007
3. Nexus of Law and Biology: New Ethical Challenges by Barbara Ann Hocking,2009
4. Intellectual Property and Biotechnology: Biological Inventions by Matthew Rimmer,2008
5. An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology byPadma Nambisan,2017
6. Biotechnology Entrepreneurship by Craig Shimasaki,2014

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Mid Term	Attendance	Class Assessment	End Term
Weightage (%)	20	10	30	40

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	2	3	3	3	3	2	3	3	2
CO2	3	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3	2	3	3	2
CO4	3	3	3	2	3	3	3	3	2	3	3	2
CO5	3	3	3	2	3	3	3	3	2	3	3	2
Avg	3	3	3	2-	3	3	3	3	2	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: – BIC21534BIO-ETHICS and INTELLECTUAL PROPERTY RIGHTS (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt **any Four questions) (5X4=20)**			
1.	Define IPR and Mention its components	**U**	**CO1**
2.	Analyze the ethical issues of using GM crops	**R**	**CO2**
3.	Which category of Biosafety is required to work with COVID:19? Mention the facilities required in such lab.	**U**	**CO3**
4.	Identify and enlist the skill-sets required to become an Entrepreneur.	**U**	**CO4**
5	Write a short role on Infringement of Patent	**R**	**CO5**
SECTION B (Attempt any 3 questions) (10X3=30)			
6.	Discuss the origin of WIPO. Why an International organization like WIPO is required? Mention the administrative components of WIPO. The logo of a company is protected through IPR: Justify and mention the benefits.	**R,AP**	**CO1**
7.	A person has invented a new method of doing non-invasive treatment of removing kidney stone in human. He had applied for patent but his patent was rejected. Justify the decision of Controller of Patents for such decision. Mention any other criterion for an invention being non-patentable. Write a note on the types of patent application. Mention the validity of a patent in terms of duration.	**AP, CR**	**CO1,CO2**
8.	Name one convention related to Biosafety of biodiversity. Describe major amendments of that convention. Mention the source of finance for a start-up and the method to approach them.	**CR,AN**	**CO3, CO4**

Course Title	**Biophysical Chemistry and Bio-analytical Techniques Lab**	**L**	**T**	**P**	**C**
CourseCode	**BIC22542**	**0**	**0**	**4**	**2**
Contact Hours	**60**				
Pre-requisites/Exposure	**12thlevelEnglish +B.ScBiology discipline**				

Course Objectives

1. To gain a deeper understanding on analytical biochemistry techniques
2. To gain a deeper understanding on biophysical chemistry techniques

Course Outcomes

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

Catalogue Description

Familiarize students with the specific characteristics of a laboratory of analytical biochemistry& biophysical chemistry.
Toknowtheanalyticalmethodscommonlyusedintheclinicallaboratory.Knowhowcancontributetheclinicallaboratory toassessthehealthstatusofindividuals. At the end of the course the student will know the techniques and applications ofmolecularbiology and biochemistry.Emphasison currenttechniques andstructure/functionrelationshipsof biological macromolecules.This course covers the tools and techniquesbywhich biological molecules are isolated, separated, identified, and analyzed. Detailed discussionofexperimentalmethodsformacromoleculepurificationand characterization isincluded.
The Introductory Biochemistry course covers fundamental biochemical and molecular biologicallaboratorytechniques,supportingconcepts,anddataanalysis.Theaimsofthiscourseare1.To provide students with practical knowledge andhands-on experience with some of themostcommon experimental methods used in biochemical and molecular biological research, and 2. To introducestudentstothefundamentalsofscientificwriting.Methodsincludereagentpreparation,properuseofinstrumentation,biochemicalanalysis,

Course Outcomes

CO1.Remembering: Recall different aspects of biophysical chemistry and techniques.

CO2. Understanding: Comprehend different concepts of biophysical chemistry and techniques

CO3. Applying: Apply the knowledge of biophysical chemistry in different physical bioinstruments.

CO4. Analyzing: Analyze different experiments of biophysical chemistry and techniques.

CO5.Evaluate: Critically analyze data from different experiments.

Content Unit description

Topic	**Contacthours**
Demonstrationofanalyticalinstruments(principlesandapplications) availableintheDepartmentaswellasinUSICofVU.	4 hrs+ 4 hrs
Methodsofcellbreakage.	4 hrs
Estimationoftotalprotein,carbohydrateofa bacterialcell.	4 hrs
Estimationofcarbohydrateofa bacterialcell.	4 hrs
EstimationofDNAandRNAofabacterialcell.	4 hrs
Chromatography:Paper,TLCforsugar/lipid/aminoacid.	4 hrs
Determinationofactivityofamylase,protease.EffectofpH,temperature onenzymeactivity;Enzymekinetics.	4hrs+4hrs+ 4 hrs
DeterminationofMWofproteinbyPAGE.	4 hrs
Demonstrationof2D– gelelectrophoresisandGeldocumentationsystem.	4 hrs
TechniquesforpurifyingandcharacterizingProteinsandEnzymes	4 hrs
Idea of all analytical techniques like Electrophoresis, Liquid Chromatography,ColumnChromatographyforproteinanalysis.	4 hrs+ 4 hrs

Books& OtherResources

TextBook(s)	
T1	IntroductionToPracticalBiochemistrybyPlummerDT,2006
T2	Biochemistry(Lippincott IllustratedReviewsSeries)byR.Harvey
T3	PracticalPhysiologicalChemistry:ABookDesignedforUseinCoursesinPractical Physiological Chemistry inSchools of Medicineandof Science(ClassicReprint) byPhilipBovierHawk,2017

T=TextBook

ModesofExamination:

Assignment/Quiz/Project/Presentation/WrittenExamExaminationScheme:

Components	Internal	Attendance	MidTerm	End Term
Weightage(%)	30	10	20	40

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	2	3	3	3	3	2	3	3	2
CO2	3	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3	2	3	3	2
CO4	3	3	3	2	3	3	3	3	2	3	3	2
CO5	3	3	3	2	3	3	3	3	2	3	3	2
Avg	3	3	3	2-	3	3	3	3	2	3	3	3

1=weaklymapped
2=moderatelymapped
3=strongly mapped

ModelQuestionPaper **Name:Enrolm entNo:**			
Course:SBC 51202 –AnalyticalBiochemistryLab(PRACTICAL) **Program: M.Sc.Biotechnology** **Time:03Hrs.** **Semester:Odd2020-21** **Max.Marks: 50** **Instructions:** Attemptany**three**questionsfrom**SectionA**(eachcarrying10marks);**SectionB**isc ompulsory (carrying10marks)**.**			
Section A(Attempt**anyTwo)**			
1.	a) **Identify**theinstrumentshowninthe picture. b) **Write**theoperatingprinciple and uses of this instrument.(2+4+4)	**Ap/R**	**CO1**
2.	a) **Identify** sample A usingspecificreagentprovided. b) Write principle of thisprocedureand**interpret**there sult (2+4+4)	**Ap/U**	**CO3**
3.	a) **Identify** sample B usingspecificreagentprovided. b) Write principle of thisprocedureand**justify**theresul t (5+5)	**Ap/Ev**	**CO3**

4.	You want to purify two proteinswith identical molecular weights.**Design**suitablechromatography techniquetoexecutethisprocess. **Interpret**theresult.(5+5)	**Cr/Ap**	**CO2** **CO5**
	SECTIONB iscompulsory		
5.	**Viva-voce**(10)	**U/An/Ap/R/Ev**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practicalcopy**(10)	**U/Ap/Ev**	**CO1** **CO2** **CO3** **CO4**

R=Remember;U=understand;Ap=Application;Ev=Evaluation;Cr=Create;An=Analysi

BIC22557	**Enzymology and plant biochemistry Lab**	L	T	P	C
Version 1.0	**Contact Hours 60**	0	0	4	2
Pre-requisites/Exposure	BSc. level Biology knowledge				
Co-requisites	-				

Course Objectives

1. To provide students with hands-on training in the field of enzymology & plant biochemistry.
2. To provide in depth knowledge of enzymology.
3. Students willbecome more proficient with different practical applications of plant biochemistry (e.g. plant tissue culture).

Course Outcomes

CO1.Remembering-Recall different aspects of enzymology and plant biochemistry experiments
CO2. Understanding- Comprehend backgroungd knowledge of plant enzyme assay.
CO3. Application- Apply various techniques for separating plant pigments.
CO4. Analyzing-Analyze data from plant biochemistry experiments to draw conclusions.
CO5.Evaluate-Evaluatethe validity and reliability of experimental results in enzymology and plant biochemistry

Catalog Description

The discipline specific course “enzymology and plant biochemistry lab” is a practical paper which has been designed to provide the knowledge of different aspects of plant biochemistry.It will providebiochemical & molecular understanding of important physiological processes in plants.Students will be able to understand tissue culture and other techniques and will practice hands-on all of them. Students willcomprehend different assay systems of plant enzymes and estimation of secondary metabolites.All the lectures will be

devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement.. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

ENZYMOLOGY AND PLANT BIOCHEMISTRY LAB

1.Induction of hydrolytic enzymes proteinases /amylases/lipase during germination. (15 Lectures)

2.Extraction and assay of Urease from Jack bean. (10 Lectures)

3.Estimation of carotene/ascorbic acid/phenols/tannins in fruits and vegetables. (10 Lectures)

4.Temp & pH dependence of enzymes. (5 Lectures)

5Study of enzyme kinetics. (5 Lectures)

6.Culture of plants (explants). i)MS media preparation. ii)Callus culture. iii)Suspension culture. (15 Lectures)

SUGGESTED READINGS

1.Plant Biochemistry (2008), Caroline Bowsher, Martin steer, Alyson Tobin, Garland science ISBN 978-0-8153-4121-5

2.Biochemistry and molecular Biology of plant-Buchanan. (2005) 1 edition. Publisher: I

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: SBC52207 – PLANT BIOCHEMISTRY LAB (PRACTICAL)

Program: M.Sc. BiochemistryTime: 03 Hrs.
Semester: Even 2019-20

Instructions:
Attempt any **two** questions from **Section A** (each carrying 10 marks); **Section B** is Compulsory (carrying 10 marks)**.**

	Section A (Attempt **any Two)**		
1.	a) Write the principle of extraction of urease from jack bean.(U) b) Determine the effect of temperature on a membrane.(Ap)	**4** **6**	**CO1** **CO2**
2.	a) Explain the basic theory of tissue culture.(U) b)Determine the rate of oxygen evolution with respect to light intensity.(Ap)	**4** **6**	**CO3** **CO4**
3.	a) Write the principle behind column chromatography.(U) b)Demonstrate the presence of amylase in germinating seed with a simple experiment.(Ap)	**4** **6**	**CO3** **CO2**
	SECTION B is compulsory		
4.	**Viva-voce** (U/An/Ap/R/Ev)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
5.	**Practical copy**(U/Ap/Ev)	**10**	**CO1** **CO2** **CO3**

BIC22570	Professional Development Course-1 (Practical)	L	T	P	C
Version 1.0	**Contact Hours - 30**	0	0	1	1
Pre-requisites/Exposure	PLUS B.SC LEVEL SCIENCE				
Co-requisites	--				

Catalog Description: This professional development course aims to help you discover and achieve your goals by focusing on organization and action. You'll learn techniques to enhance goal-setting, communication, self-motivation, and a positive attitude, empowering you to maximize your performance both academically and professionally.

Course Syllabus:

The syllabus for Professional Development Course-I for senior students

(1st Semester- 3rd Semester for P.G students)

1. Introduction to Pre-Placement Training.
2. Resume Building & Cover Letter Writing.
3. Interview Skills.
4. Aptitude and Technical Skills.
5. Group Discussion and Communication Skills.
6. Personal Branding and Online Presence.
7. Professional Skills.
8. Industry Insights and Company Presentations.
9. Career Guidance for competitive entrance exams and Job Search Strategies
10. Mock Tests and Assessments.

Course learning outcomes:

CO1: Remembering-Students will be able to create professional resumes and cover letters tailored to specific job applications, demonstrating effective resume-building techniques.

CO2: Understanding-Students will analyze various interview scenarios to identify key strategies for successfully navigating different types of interview questions and formats.

CO3: Applying-Students will apply their aptitude and technical skills to solve real-world problems through mock tests and assessments, showcasing their problem-solving abilities.

CO4: Analysing-Students will evaluate their personal branding and online presence, making necessary adjustments to enhance their professional image on platforms like LinkedIn.

CO5: Evaluate-Students will demonstrate effective communication skills in group discussions, presentations, and professional interactions, ensuring clear and confident expression of ideas.

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	3	3	1	3	3	3	3	-	3	2	2
CO2	-	3	3	1	3	3	3	3	-	3	2	2
CO3	-	3	3	1	3	3	3	3	-	3	2	2
CO4	-	3	3	1	3	3	3	3	-	3	2	2
CO5	-	3	3	1	3	3	3	3	-	3	2	2
Avg	-	3	3	1	3	3	3	3	-	3	2	2

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	CA	End Term
Weightage (%)	**50**	**50**

BIC21511	**Molecular Biology (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	BSc. Level Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about organization of prokaryotic and eukaryotic genome.
- It will also provide in depth knowledge about DNA replication and repairmechanism.
- To deliver detail mechanism of RNA synthesis and different RNA processingevents.
- To provide students different methods of protein synthesis, protein transport mechanism.

Course Outcomes

On completion of this course, the students will be able to:

CO1: Remembering: Recall the fundamental principles, techniques, and terminology of molecular biology.

CO2: Understanding: Explain the key concepts and processes involved in molecular biology, such as gene expression, DNA replication, and genetic engineering.

CO3: Applying: Apply molecular biology techniques and methodologies to analyse genetic information, conduct experiments, and solve problems in the field.

CO4: Analysing: Analyse experimental data and scientific literature to draw conclusions and make informed decisions in molecular biology research.

CO5: Evaluating: Evaluate the significance and implications of molecular biology research findings, and assess the ethical considerations and potential applications of mole

Catalog Description

The core-course of 'Molecular Biology' will help to define fundamental difference between prokaryotic and eukaryotic genome organization. This course includes comprehensive approach through studying the DNA replication and repair mechanism and different RNA species and their mode of action. Furthermore, the implication of different protein modification and transport of proteins inside the cell will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with thecoordinator.

Course Content

MOLECULAR BIOLOGY

1. **Genome organization:** Organization of bacterial genome. Structure of eukaryotic chromosomes, Chromatin organization & packaging. Heterochromatin and Euchromatin; DNA reassociation kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions;DNAmethylation **[Lectu**
2. **DNA replication and repair:** Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms in prokaryotesandeukaryotes. **[Lecture hours6]**
3. **RNA synthesis and processing:** RNA world and RNA replication; Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA,RNAtransport. **[Lectu**
4. **Protein synthesis and processing:** Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyltRNAsynthetase, translational proof-reading, translational inhibitors, post- translational modification of proteins. **[Lectu**
5. **Protein localization**: Chaperones, SRP, translocons, protein transport,ubiquitination
6. **Molecular Evolution:** Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence. Speciation; allopatricity and sympatricity; convergent evolution; sexual selection;co-evolution. **[Lectu**
7. **Recombination:** Homologous and non-homologous; Site specific recombination; Chi sequences in prokaryotes; Gene targeting; Gene disruption; FLP/FRT and Cre/Lox recombination. **[Lectu**

Reference Books:

1. Molecular biology of gene by J. D.Watson
2. Biochemistry by L. Stryer 4thedition
3. Fundamentals of biochemistry by D. Voet, J. Voet and C.W.Prott
4. Molecular cell biology 4th ed. Lodish B., ZipurskyMatsudaira,Ball.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC21509 – Molecular Biology (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester: Even2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

	SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)		
1.	What is the difference between prokaryotic and eukaryotic genome? **Explain** DNA melting temperature	**U**	**CO1**
2.	**Define** Cot curve. **Describe** significance of satellite DNA.	**R**	**CO2**
3.	**Classify** different RNA species based on their i) structure and ii) function.	**R**	**CO3**
4.	**Define** genetic code. What are the start codon and stop codon?	**U**	**CO4**
5	**Define** natural evolution and co-evolution.	**U**	**CO5**
	SECTION B (Attempt any Three questions) (10X3=30)		
6.	Calculate the weight in grams of a double-helical DNA molecule stretching from the Earth to the moon (~320,000 km). The DNA double helix weighs about 1 $X10^{-18}$ g per 1,000 nucleotide pairs; each base pair extends 3.4 A. Explain why the absorption of UV light by double-stranded DNA increases (the hyperchromic effect) when the DNA is denatured.	**AN,AP**	**CO2**
7.	How is the helical structure of a long and fully base-paired (except at the end) hairpin in RNA different from that of a similar hairpin in DNA?	**AN,AP**	**CO1** **CO2**
8.	Protein A has a binding site for ligand X with a *K*d of 10^{-6} M. Protein B has a binding site for ligand X with a *K*d of 10^{-9} M. Which protein has a higher affinity for ligand X? **Explain** your reasoning. Convert the *K*d to *K*a for both proteins.	**AN,AP,R**	**CO4**
9	A team of biochemists uses genetic engineering to modify the interface region between hemoglobin subunits. The resulting hemoglobin variants exist in solution primarily as $\alpha\beta$ dimers (few, if any, $\alpha 2\beta 2$ tetramers form). Are these variants likely to bind oxygen more weakly or more tightly? **Explain** your answer.	**AN,R**	**CO4** **CO5**

BIC21512	**Recombinant DNA Technology**	L	T	P	C
Version 1.0	**Contact Hours: 45**	3	0	0	3
Pre-requisites/Exposure	Knowledge of Molecular Biology of B.Sc Level				
Co-requisites	-				

Course Objectives

- To conceptualize the characteristics of recombinant DNA.
- To acquire the knowledge about restriction and modification system and cloning vectors
- To acquire the knowledge about amplification of gene in *in vitro* system.
- To gain the knowledge about techniques for analysis of gene expression.
- To understand the transcriptomics, genomics and their application in recombinant DNA technology.

Course Outcomes

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

CO1. Remember the basic principles of Recombinant DNA Technology, including the methods used for DNA extraction, purification, and manipulation.
CO2. Understand the process of cloning DNA fragments and recombinant DNA technology.
CO3. Apply various techniques such as restriction enzyme digestion, gel electrophoresis, and polymerase chain reaction (PCR) in the laboratory to create recombinant DNA constructs.
CO4. Analyze and interpret the results of experiments conducted in the Recombinant DNA Technology lab, including the identification of recombinant DNA clones.
CO5. Evaluate the ethical considerations and potential applications of Recombinant DNA Technology in various fields such as healthcare, agriculture, and biotechnology.

Catalog Description

Recombinant DNA (rDNA) molecules are DNA molecules formed by laboratory methods of genetic recombination (such as molecular cloning) to bring together genetic material from multiple sources, creating sequences that would not otherwise be found in the genome.Recombinant DNA is the general name for a piece of DNA that has been created by combining at least two fragments from two different sources. Recombinant DNA is possible because DNA molecules from all organisms share the same chemical structure, and differ only in the nucleotide sequence within that identical overall structure. Recombinant DNA molecules are sometimes called chimeric DNA, because they can be made of material from two different species, like the mythical chimera. R-DNA technology uses palindromic sequences and leads to the production of sticky and blunt ends.The DNA sequences used in the construction of recombinant DNA molecules can originatefrom any species. For

example, plant DNA may be joined to bacterial DNA, or human DNA may be joined with fungal DNA. In addition, DNA sequences that do not occur anywhere in nature may be created by the chemical synthesis of DNA, and incorporated into recombinant molecules. Using recombinant DNA technology and synthetic DNA, literally any DNA sequence may be created and introduced into any of a very wide range of living organisms. Proteins that can result from the expression of recombinant DNA within living cells are termed recombinant proteins. When recombinant DNA encoding a protein is introduced into a host organism, the recombinant protein is not necessarily produced. Expression of foreign proteins requires the use of specialized expression vectors and often necessitates significant restructuring by foreign coding sequences. Recombinant DNA differs from genetic recombination in that the former results from artificial methods in the test tube, while the latter is a normal biological process that results in the remixing of existing DNA sequences in essentially all organisms.However, the goal of this paper to analyse the artificially created recombinant DNA and expression of their genes.

Course Content

Unit I: Basics ofDNAcloning **[9 Lecture Hours]** Simple cloning and cloning using linkers and adaptors.Cloning into various kinds of vectors – plasmids, phages lambda and M13, phagemids, cosmids, P1 phage, PACs, BACs and YACs.Selection and screening ofclones.

Unit II: Methods of DNA andproteinanalysis **[9 LectureHours]**
Agarose, polyacrylamide and pulsed field gel electrophoresis of DNA.
Southern and Northern Blotting.Radiolabellingprobes.Isolation and purification of DNA.RFLP analysis.DNA fingerprinting and its application in forensics, in disease diagnosis and in identification of strains.Native PAGE, SDS-PAGE and two-dimensional PAGE analysis of proteins.Western Blotting analysis.

Unit III: PolymeraseChainReaction **[9 Lecture Hours]** Concept of PCR and various thermophilic enzymes used in PCR.Gradient PCR versus Touchdown PCR.Designingprimers.Cloning PCR products. Long PCR, Inverse PRC, Vectorette PCR, RT-PCR, 5’ and 3’ RACE, qPCR, Real Time PCR using SYBR Green, Scorpion primers and TaqMan probes, MOPAC, Multiplex PCR, Differential Display PCR, RAPD fingerprinting of micro-organisms, Ligation Chain Reaction, Overlap PCR, Rolling Circle AmplificationTechnology.

Unit IV: Construction of cDNA and genomicDNAlibraries **[9 Lecture Hours]** Vectors used in the construction of cDNA versus genomic DNA libraries. Steps and enzymes involved in the construction of cDNA versus genomic DNA libraries. Screening libraries by colony hybridization and colony PCR.Screening expression libraries.Enriching for clones in cDNA libraries by positive selection and subtractive hybridization.Identifying genes in complex genomes by direct selection of cDNA and exontrapping.

UNIT V: Transcriptional analysis of gene expression and transcriptomics [9 Lecture Hours]

Gene expression analysis by Northern Blotting, RT-PCR, EST analysis and the use of reporter genes.Enzymatic and bioluminescent reporters. Reporters used in protein localization and trafficking studies. Promoter analysis – deletion analysis and linker scanning analysis coupled to reporter assays, mapping transcriptional start sites by S1 nuclease mapping, primer extension studies or 5' RACE. Transcriptome analysis by DD-PCR and EST analysis, DNA microarrays (cDNA arrays and oligo arrays), Serial Analysis of Gene Expression(SAGE).

Reference Books

1. Recombinant DNA: Genes and Genomes - a Short Course by James D. Watson,2006
2. Principles of Gene Manipulation and Genomics by Sandy Primrose and Twyman,2006
3. From genes to genomes concepts and applications of DNA technology by Jeremy Wdale and Malcolm von Scrantz, 2011
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard Glick2009
5. Genomes 3 by T.A. Brown,2006

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

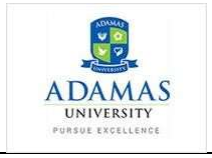
Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21510 –Recombinant DNA Technology
Program:M.ScBiochemistry **Time: 03 Hrs.**
Semester: Even2020-21 **Max. Marks: 50**

Instructions:
Attempt any three questions from Section A (each carrying 5 marks); any Two Questions from Section B (each carrying 10 marks).

SECTION A (Attempt any Four questions) (5X4=20)			
1.	**Discuss** Serial Analysis of Gene Expression.	**R**	**CO4**
2.	**Distinguish** cloning vector and expression vector.	**R**	**CO2**
3.	**Define** melting temperature (Tm)with respect to DNA. **Evaluate** the theoretical Tm of the primer sequence: 5́GGATTCAGAGAGGATCC3́	**U**	**CO3**
4.	**Distinguish** between Native-PAGE and SDS-PAGE.	**R**	**CO5**
SECTION B (Attempt any 3 questions) (10X3=30)			
5.	How can you use the AFLP-PCR analysis for paternity test? Briefly **describe**. A student researcher overexpresses an exogenous protein in cell culture and wants to **determine** if that protein is in fact, overexpressed. Which blotting technique would best demonstrate that this protein is expressed in these cells? Schematically represent the indirect detection of protein in western blot technique.	**AN,AP,U**	**CO1 CO4**
6.	**Describe** 5́RACE technique utility with suitable illustration. Which platform of DNA sequencing uses a 'sequence by synthesis' approach? **Describe** briefly with suitable diagram. Write two major advantages of SMRT sequencing over illumine sequencing. Which of the following technique can be used to detect DNA-protein interactionwithincell?a) ChIP and ChIP-	**AN,U,AP,R**	**CO3 CO4 CO5**

	seq b) Footprinting c) EMSA d) RACE		
7.	**Discuss** the steps of genomic DNA and cDNA library construction. **Describe** two advantage of creating a cDNA library compared to genomic library?	**4** **6**	**CO1**

BIC22543	**Bioinformatics, & Biostatistics (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	Contact hours = 45	3	0	0	3
Pre-requisites/Exposure	BSc. level Biology knowledge				
Co-requisites	-				

Course Objectives

- To providethose students with aptintroductorylevel knowledge to Biostatistics, Bioinformatics & Computer Applications .
- It will also provide in depth knowledge ofbiostatistics.
- Elaborating the database and biologicaldatabase
  Explore the knowledge of modern methods of Bioinformatics such as Microarray experiment, Clustering of microarray data, Principal component analysis.

Course Outcomes

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

CO1Remembering- Recall biostatistics techniques.
CO2 Understanding-Comprehend the biological database and their reole in bioinformatics.
CO3 Applying-Applythe knowledgeofCluster analysis; Phylogenetic clustering, Sequence Comparison.
CO4 Analysing-Analyse modern methodsof Bioinformatics such as Microarray experiment, Clustering of microarray data, Principal component analysis
CO5 Evaluate- demonstrate the structure based application in bioinformatics, protein structure prediction through homology modeling and current research activities in the field of bioinformatics

Catalog Description

The core-course will help to understand the introductory level knowledge to biostatistics, bioinformatics & computer applications. This course is an beginning to the biostatistics, the application of different bioinformatics methods to biological data analysis, biological database and some current research activities in the field of bioinformatics. Furthermore, the possible applications of this knowledge in biostatistics, bioinformatics & computer applications would also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge.
Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Bioinformatics [20 hrs]

1. IntroductiontoBioinformaticsandComputationalBiologywithhistoricalbackground, majordevelopments.
2. Biologicaldatabases, dataqueryanddatamining;Booleanoperators;Problemsand Applications to biologicalproblems.
3. Nucleic acid sequence analysis, alignment, similarity searches including remote similarity searches, secondary structure element,motifs.
4. Protein sequence analysis; alignment, similarly searches including remotesimilarity searches, secondary structure elements,motifs

Biostatistics [25 hrs]

1. Introduction: Applications of statistics in biology, definitions (populations,samples), Introduction to probability theory, Basic concepts, definitions to understand probability and sampling; Defining sample space, computing probability.
2. Random variables and probability distributions: Discrete random variables,Bernoulli random variable, binomial distribution, Poisson distribution withexamples
Continuous random variables, Normal random variable, other continuous distributions, Central limit theorem
3. Arithmetic and other means, median, mode; when touse each measure of location
Measures of spread: Variance and Standard Deviation, StandardError.
4. Framework for statistical analyses Framing hypothesis, The scientific method; deduction and induction; The Hypothetico-deductive method; Testinghypothesis, Significance andp-values;
5. Data Analyses: Computing sums of squares, standard error of differences between means, T-test, Regression, Fitting data to a linear model; Variances and co-variances; least-square parametric estimates; Hypothesis test with regression; Assumptions, Analyses of variance, ANOVA and Partitioning of Sum of Squares, Assumptions; Hypothesis tests with ANOVA; Constructing F-Ratios; ANOVA tables, Analyses of categorical data, Two-way contingency tables; Chisquaretest.

Text Books:

1. Bioinformatics: Sequence and Genome Analysis by David W. Mount,2004
2. Introduction to Bioinformatics by Arthur M.Lesk,2002
3. Biostatistics: A Foundation for Analysis in the Health Sciences by Wayne W. Daniel,2004
4. Computational Biology by David Fenyo,2010
5. Statistical Methods by Statistical Methods by William G. Cochran, George W. Snedecor1972.
6. Let us C –Kanetkar.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

1=weakly mapped
2= moderately mapped
3=strongly mapped

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC22525- Bioinformatics, Computational Biology & Biostatistics (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Even2019-20 **Max. Marks:50**

Instructions:
Attempt any four questions from Section A (each carrying 5 marks); any two questions from Section B (each carrying 10marks).

	SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)		
1.	What is Great mean ?**Explain**Scatter plot.	**R**	**CO1**
2.	D**emonstrate** the role of Database development in Bioinformatics	**U**	**CO2**
3.	**Explain** the process of X-ray crystallography for 3D structure determination of protein	**R**	**CO3**
4.	**Enlist 3** features of PDB and 2 features of NDB.	**U**	**CO4**
5	D**emonstrate** the Box Plot and Histogram with diagram.	**R**	**CO5**
	SECTION B (Attempt any 3 questions) (10X3=30)		
6.	**What** is Phylogenetic Tree? **Draw** a label diagram of a phylogenetic tree? **Explai**n different types of the Phylogenetic Tree.	**AN,U,R**	**CO3**
7.	**What** is microarray? Illustrate the microarray using flowchart and normalization of microarraydata	**U,AP**	**CO1** **CO2**
8.	Some trees are having the following heights: 150 cm, 200 cm, 250 cm, 300 cm, 350 cm, 400 cm, 450 cm, 500 cm Calculate the mean, variance and standard deviation	**AN**	**CO4** **CO5**
9	"Hidden Markov Model (HMM) is used in modelling of eukaryotic gene, two sequences analysis and multiple sequences analysis. Explain this statement	**AP**	**CO4** **CO5**

BIC21544	**Genomics and Proteomics (THEORY)**	**L**	**T**	**P**	**C**
Version1.0	**ContactHours -45**	3	0	0	3
Pre-requisites/Exposure	BasicknowledgeofGeneticsand ProteinBiochemistry				
Co-requisites	--				

CourseObjectives:

1. The course will provide an introduction to what genomics, proteomics andnanobiotechnologyisandwhyitisimportantinthecurrentcontextofbiologicalscience.
2. The course will give an overview about the application are asofgenomics and proteomics ,with a focus on the topics that will be taught in the course.
3. Thecoursewillbeabletodescribethebasicsofnanotechnologyandtheirapplicationsinnanobiotechnology

Courseoutcome:

Thestudentswillbeable

CO1. **Remembering-**To **recall** the importan tconcept of Omic stechnologies, with emphasis on genomics and proteomics.

CO2. **Understanding-**To **comprehend** the information and key technological developments that enabled modern genomics and proteomics studies.

CO3. **Applying-**To **assess** the advanced genomics and proteomics technologies and techniques innanobiosciences.

CO4. **Analysing-**To **explain** the different types of genome variation and their relationship to human diseases.

CO5. **Evaluate-**To **evaluate** the biological systems information relating to genes, proteins andcellular structures which can be used tomodel living cells, and even tocreate newsynthetic cells.

Course Description:

The main aim of this module is to provide an understanding about the genomics and proteomicstechniques and their applications in biological sciences. The subject deals with a rapidly evolving scientific are athat introduces students into genomes, proteomes, databases and nanobiotechnology that store various data about genes, proteins, genomes and proteomes. Students would learn about genomics , proteomics and nano biotechnology and offer basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications. Students would gain skills in comparative evolutionary, human genomics and functional genomics.The acquired knowledge during the course would be helpful to those students who want to work incorefacilitiesandcommercialbiologicalandmedicallaboratoriesaswellasintheirpostgraduate studies.

Course Content:

Genomics and Proteomics

Unit I.Introduction 15Lecturehours

StructuralorganizationofgenomeinProkaryotesandEukaryotes;OrganelleDNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects;Recognitionofcodingandnon-codingsequencesandgeneannotation;Toolsforgenomeanalysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical andgeneticmapping.

UnitII.Genomesequencingprojects 15Lecture hours Microbes,plantsandanimals;Accessingandretrievinggenomeprojectinformationfromweb;Comparativegenomics,Identificationandclassificationusingmolecularmarkers-16SrRNAtyping/sequencing,ESTs and SNPs.

UnitIII.Proteomics 10Lecturehours

Protein analysis (includes measurement of concentration, amino-acid composition, N-terminalsequencing); 2-D electrophoresis of proteins; Microscale solution isoelectric focusing; Peptidefingerprinting;

UnitIV Quantitative Proteomics

LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF;SAGEandDifferentialdisplayproteomics,Protein-proteininteractions,Yeasttwohybridsystem.

Unit V.Functionalgenomicsandproteomics 5 Lecture hours Analysisofmicroarraydata;Proteinandpeptidemicroarray-basedtechnology;PCR-directedprotein*insitu*arrays;Structuralproteomics

SuggestedBooks

1. Berg,J.M.,Tymoczko,J.L.andStryer,L.(2006).Biochemistry.VIEdition.W.HFreemanandCo.
2. Buchanan,B.,Gruissem,W.andJones,R.(2000)BiochemistryandMolecularBiologyofPlants.AmericanSocietyofPlantBiologists.
3. Nelson,D.L.,Cox,M.M.(2004)LehningerPrinciplesof Biochemistry,4thEdition,WHFreemanandCompany,NewYork,USA.
4. Hopkins,W.G.andHuner,P.A.(2008)IntroductiontoPlantPhysiology.JohnWileyandSons.

Modes of Examination: Assignment/Quiz/Project/Presentation/Written

ExamExaminationScheme:

Components	**Assessment**	**EndTerm**
Weightage(%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

BIC22545	**Molecular Biology &Recombinant DNA Technology Lab (Practical)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	0	0	4	2
Pre-requisites/Exposure	BSc. Level Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about how to isolate plasmid DNA from bacteria and genomic DNA from plant or livercells.
- It will also illustrate how to measure DNA concentration usingSpectrophotometer.
- To perform PCR amplification and analyze DNA by Agarose gelelectrophoresis.
- To provide students how to do restriction digestion, transformation and cloning of plasmidDNA.

Course Outcomes

On completion of this course, the students will be able to:
CO1. Remember the basic principles of Recombinant DNA Technology, including the methods used for DNA extraction, purification, and manipulation.
CO2. Understand the process of cloning DNA fragments and recombinant DNA technology.
CO3. Apply various techniques such as restriction enzyme digestion, gel electrophoresis, and polymerase chain reaction (PCR) in the laboratory to create recombinant DNA constructs.
CO4. Analyze and interpret the results of experiments conducted in the Recombinant DNA Technology lab, including the identification of recombinant DNA clones.
CO5. Evaluate the ethical considerations and potential applications of Recombinant DNA Technology in various fields such as healthcare, agriculture, and biotechnology.

The practical course of 'Molecular Biology Lab' will help to hands on experience on isolation of plasmid DNA from bacteria and genomic DNA from plant or liver cells. This course includes comprehensive approach to perform PCR amplification of desired gene and analysis by Agarose gel electrophoresis. Furthermore, recombinant biotechnology techniques like restriction digestion, transformation and cloning of plasmid DNA will also be illuminated. The hands-on experience will enable students to enrich in experimental protocol. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject viaexercise and discussions with thecoordinator.

Course Content

MOLECULAR BIOLOGY LAB

1. Isolation of DNA from E. coli/ liver/ plant/ plasmid **[8 Lecture Hours]**
2. Determinationofbasecomposition(spectrophotometry)**[8LectureHours]**

[8Lecture Hours]

3. Agarose gel electrophoresis of DNA**[8 LectureHours]**
4. PCR amplification of desired gene**[8 LectureHours]**
5. Restriction digestion and ligation of DNA, Endonuclease mapping of DNA**[8 Lecture Hours]**
6. Transduction**[6 LectureHours]**
7. Transformation**[7 LectureHours]**
8. Expression analysis**[7 LectureHours]**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Mid Term	Attendance	Class Assessment	End Term
Weightage (%)	20	10	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	

Course: BIC22513 – Molecular Biology Lab (Practical)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester: Even2020-21 **Max. Marks:40**

SECTION A (Compulsory**) (10X2=20)**			
1.	Isolate DNA from E. Coli. Measure DNA concentration.	**AN,AP**	**CO1**
2.	PCR amplify a desired DNA. Run on Agarose gel.	**AN,AP**	**CO2**
SECTION B (Compulsory**) (10X2=20)**			
3.	Lab Notebook	**AN,AP,U, R**	**CO1** **CO2**
4.	Viva voce	**AN,AP,U, R**	**CO1** **CO2** **CO3**

BIC21546	**Bioinformatics and Biostatistics Lab(PRACTICAL)**	**L**	**T**	**P**	**C**
Version1.0	**ContactHours-60**	0	0	4	2
Pre-requisites/Exposure	UGLEVELBIOLOGY				
Co-requisites	--				

Course Objectives

1. Toprovidestudents with hands-on activities designed toencourage interestin thefield of Bioinformatics, as well as promote greater understanding of the conceptspresentedinlecture.
2. Studentswillneedtobecomeproficientwithterms,techniques,andapplications.

CourseOutcomes

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

1. Knowledge:
- Identify different databases used in bioinformatics and computational biology for storing biological information

2. Comprehension:
- Compare and contrast different genome annotation tools and their capabilities

3. Application:
- Construct phylogenetic trees based on molecular data to infer evolutionary relationships

4. Analysis:
- Analyze RNA and protein structure prediction results to understand molecular structure-function relationships

5. Synthesis:
- Design and implement a bioinformatics and computational biology project using appropriate tools and methods

CatalogueDescription

Bioinformatics Lab (Practical) is the overall Learn and apply the knowledge of using differentmoderntoolsandtechniquesinthefieldofBioinformatics.Thiscoursecoverslaboratorytechniques describes different modern practical methods related to Bioinformatics such as genesand genomes, sequence alignment of DNA and proteins, basic programming using python, predictprotein structure-function and phylogenetic tree. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementatio n o fknowledge. Classes will be conducted by

lecture as well as powerpoint presentation, audio visual virtual session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led bythe course coordinator. Students will strongly grab the basic concepts of the subject via exercise anddiscussionswiththecoordinator.

CourseContent

Bioinformatics Lab(BIC21540)[12 hrs.eachexperiment]

1. Retrievinggenomes,identifyingofandannotatinggenes, databases.
2. SequenceAlignment ofDNAandProteins.
2. ApplyingUNIX, basicprogrammingusingpython:
3. Predictingproteinstructure-function
4. Buildingphylogenetictree
5. Proteinstructure-homologymodellinganddocking.

Suggestedreading:

1. EssentialsofBioinformatics,XinXiong,Cambridge
2. Bioinformatics:SequenceandGenomeAnalysis byDavidW.Mount,2004.

ModesofEvaluation:Quiz/Assignment/presentation/extempore/WrittenExaminationExaminationScheme:

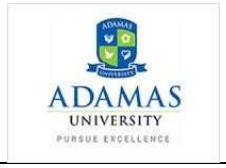
Components	ClassAssessment	EndTerm
Weightage(%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2=moderately
mapped3=str
ongly mapped

ModelQuestionPaper

Name:Enrolm **entNo:**			
Course:BIC21540–BioinformaticsLab(PRACTICAL) **Program: M.Sc.Biochemistry** **Time:03Hrs.** **Semester: Even2019-20** **Max.Marks: 50** **Instructions:** Attemptany**two**questionsfrom**SectionA**(eachcarrying10marks);**SectionB**isCompulsory (carrying10marks)**.**			
Section A(Attempt**any3)**			
1.	a)Retrievingonegenefromdifferent five b) Design a table using species name, gene accession no and gene length. (5+5)	**Ap/An**	**CO1** **CO5**
2.	a) Retrieving Five Proteins structure of SARS-CoV-2 from PDB with PDB ID as a basic step for homology modelling. Write aboutthemethod b) Design a table using Protein name, PDB ID and description structure. (2+4+4)	**Ap/An**	**CO4CO5**
3.	a)Perform Sequence Alignment of one Proteins from different five species .b) Write aboutthemethod anditsimportance.(4+3+3)	**Ap/R/An**	**CO2**
4.	a) Draw one phylogenetic tree of CRP protein from different six species. b) Explainitsmethodologyandresult.(4+3+3)	**Ap/U**	**CO4CO5**
	SECTIONB iscompulsory		

5.	**Viva-voce(10)**	**U/An/Ap/R/Ev**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practicalcopy(10)**	**U/Ap/Ev/Cr**	**CO1** **CO2** **CO3** **CO4**

BIC22547	**Genomics and Proteomics Lab (PRACTICAL)**	**L**	**T**	**P**	**C**
Version1.0	**ContactHours -45**	0	0	4	2
Pre-requisites/Exposure	BasicknowledgeofGeneticsand ProteinBiochemistry				
Co-requisites	--				

CourseObjectives:

1. Theobjectivesofthiscourseistoprovideintroductoryknowledgeconcerninggenomics,proteomics andtheirapplicationsinbioscience today.
2. The course will give an overview about the basic techniques and different softwaresused in areas of genomics and proteomics for their applications in current areas ofresearch.
3. The course will be providing some important insights about designing nanomaterialsandtheirapplicationinseveralareas ofbioscience.

Courseoutcome:

1. Remembering: Recall the basic concepts and terminology related to genomics and proteomics, including genome sequencing, genome-wide screening, and genome editing.

2. Understanding: Explain the principles and techniques used in genome analysis tools like CHIP-SEQ, RNA-SEQ etc., and proteome anlaysis tools such as 2D-gel electrophoresis and mass spectrometry for proteomics research.

3. Applying: Apply knowledge of genomics and proteomics to interpret and analyze data from genome sequencing and proteomics experiments (MS-data).

4. Analyzing: Analyze and compare different methods of genome analysis and proteomics techniques for differential proteomics studies.

5. Creating: Design and implement experiments using genome analysis tools and proteomics techniques to investigate biological processes and functions at the molecular level.

CourseDescription:

The main aim of this module is to provide an understanding about the genomics and proteomicstechniques and their applications in biological sciences. The subject deals with a rapidly evolvingscientificareathatintroducesstudentsintogenomes,proteomes,databasesandnanobiotechnologythats torevariousdataaboutgenes,proteins,genomesandproteomes.Studentswouldlearnaboutgenomics,proteomics andnanobiotechnologyandofferbasicknowledgeofgenomesequencing,majordifferencesbetweenprokaryotic andeukaryotic

genomes,basicproteomicsanditsapplications.Studentswouldgainskillsinappliednanoscience,comparative,evolutionary,humangenomicsandfunctionalgenomics.Theacquired knowledge during the course would be helpful to those students who want to work incorefacilitiesandcommercialbiologicalandmedicallaboratoriesaswellasintheirpostgraduate studies.

Course Content:

1. BacterialDNAextractionfromdifferentsources.4Lecture hour
2. PCRamplificationofDNAusing16srRNAprimers.6Lecture hour
3. Comparativeanalysisofsequencingresultforphylogeneticanalysisusingsuitablesoftware.6Lecturehour
4. SDS-PAGEofisozymes.8Lecturehour
5. SDS-PAGEanalysisofserumproteins8Lecture hour
6. Westernblotanalysisactinand tubulin8Lecturehour
7. BiosynthesisofFe/Agbasedbionanoparticles10Lecturehour
8. Detectionofantimicrobialproperties ofbionanoparticles.10Lecture hour

Text Books

1. Primrose,S.B., Twyman,R.M.,Primrose,S.B., &Primrose,S.B. (2006).Principles ofGene ManipulationandGenomics.
2. Malden,MA:BlackwellPub.2.Liebler,D.C.(2002).Introduction toProteomics:ToolsfortheNewBiology.
3. Totowa,NJ:HumanaPress.3.Campbell,A.M.,&Heyer,L.J.(2003).DiscoveringGenomics, Proteomics,andBioinformatics.SanFrancisco:BenjaminCummings.
4. BionanotechnologybyDavidS.Goodsell, 2004,WileyPublications.

ModesofExamination:Assignment/Quiz/Project/Presentation/WrittenExamExaminationScheme:

Components	**MidTerm**	**EndTerm**
Weightage(%)	**50**	**50**

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weaklymapped
2= moderatelymapped
3=stronglymapped

BIC22519	DSE-I CANCER BIOLOGY(THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	B.Sc. LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

- Students will **understand** the structures and purposes of basic carcinogenic components especially organic and inorganiccarcinogens
- Students will **understand** how cancer cells sabotage the normal metabolomics of a healthy cell and these cellular components are used to generate and utilize energy in cells
- Students will **understand** the cellular components underlying cell division and molecular basis ofcarcinogenesis
- Students will **apply** their knowledge of cancer biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about bymutation.

Course Outcomes

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

CO1. Remembering: Recall the fundamental principles of cancer genetics

CO2. Understanding: Demonstrate a thorough comprehension of the genetic mechanisms underlying cancer development and the role of developmental genetics in cancer progression.

CO3. Applying: Apply basic laboratory techniques and methodologies commonly used in cancer and developmental genetics research, such as polymerase chain reaction (PCR), DNA sequencing, and gene expression analysis.

CO4. Analyzing: Analyze experimental data obtained from laboratory experiments, interpret results, and draw conclusions regarding the genetic basis of cancer and developmental disorders.

CO5. Evaluating: Critically evaluate research articles and scientific literature related to cancer .

Catalog Description

The core-course of 'Cancer Biology' will help to understand the classification, structure and function of different carcinogenic compounds affecting animals. This course includes comprehensive approach through studying molecular mechanism of carcinogenesis, onsetand progression of cancer in humans. It also includes the role of virus as carcinogenic agents. Furthermore, the application of virus and other carcinogens in carcinogenesis, therapeutics and gene delivery would also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students withproblem-solving

ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Cancer Biology (BIC22517)

Unit I: Fundamentals of cancer biology (7 HOURS)

Regulation of Cell cycle, Apoptosis, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet andcancer.

Unit II: Mutations; Oncogenes and Tumor suppressor genes (7 HOURS)

Nonsense, missense and point mutations; Intragenic and Intergenic suppression; Frameshift mutations; Physical, chemical and biological mutagens; Transposition - Transposable genetic elements in prokaryotes and eukaryotes; Mechanisms of transposition; Role of transposons in mutation; Viral and cellular oncogenes; Tumor suppressor genes from humans; Structure, function and mechanism of action of pRB and p53 tumor suppressor proteins; Activation of oncogenes and dominant negative effect; Suppression of tumor suppressor genes; Oncogenes as transcriptional activators.

Unit III: Principles of carcinogenesis (7 HOURS)

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiationCarcinogenesis.

Unit IV: Principles of molecular cell biology of cancer (7 HOURS)

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity. Growth factors related to transformations.

Unit V: Principles of cancer metastasis (7 HOURS)

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

Unit VI: New molecules for cancer therapy (10 HOURS)

Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

Reference book:

1. Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics by Lauren Pecorino, 2016
2. The Biology of Cancer by Robert A. Weinberg,2006

3. Introduction to the Cellular and Molecular Biology of Cancer by Margaret A. Knowles,2005

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC22517 – DSE I CANCER BIOLOGY (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2020-21 **Max. Marks:50**

Instructions:
Attempt any four questions from Section A (each carrying 5 marks); any two questions from Section B (each carrying 10marks).

	SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)		
1.	What is Capsid? **Explain** various symmetry of viral particles.	**R, U**	**CO1**
2.	**Classify** virus based on their genetic material. What is the role of ICTV in viral classification?	**R**	**CO2**
3.	**Describe** four different stages of cancer and find the differences between them.	**U**	**CO3**
4.	**Enlist** 3 viruses that is associated with Cancer. Also mention the role of virus in etiology of cancer.	**U**	**CO4**
5	A person was suffering from Estrogen-induced breast cancer. **What** medicinal options do the doctor have to treat him to prevent cancer cell multiplication. Explain the mechanisms involved.	**R**	**CO5**
	SECTION B (Attempt any 3 questions) (10X3=30)		
6.	**Design** an experiment to locate p53 protein in a given sample from a cancer patient. **What** would be your preferred sample? **Illustrate** the headful mechanism. Add a note on mutated p53.	**AN,AP**	**CO3**
7.	**What** is the basis of EMT? Illustrate various stages of EMT. **What** is seed & Soil Hypothesis? How would you differentiate between EMT & MET?	**AN,AP**	**CO1** **CO2**
8.	**Mention** any three ways of dietary management of cancer. Which foods are most suitable if we want to prevent the onset of cancer in a given tissue? **What** all techniques can be employed to inoculate cancer cells in mice? Illustratethe role of tumor suppressor gene? **What** is a pappiloma virus?	**AN,AP,R**	**CO1** **CO2**
9	"A person was suffering from hepatocellular carcinoma and at that stage metastasis took place. Justify whether the patient is in preliminary or advanced stage of cancer. Which organ of his body is affected? Predict the viral infection that might be a etiological factor. Is the viral infection sole reason for cancer: comment. Mention the hallmarks of cancer.	**AN,AP,U, R**	**CO4** **CO5**

BIC22520	**DSE-I Nanobiotechnology (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	BSc. Level Chemistry and Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

1. To provide students basic idea about electron microscopy, Cryo-electron microscopy and scanning electron microscopy.
2. It will also provide in depth knowledge about biological nanomaterials and engineerednanomaterials.
3. To deliver detail mechanism microfabrication and nanofabrication.
4. To provide students recent advancement nano-biotechnology and its impact in society.

Course Outcomes

On completion of this course, the students will be able to:

CO **1 Remembering-Recall** the fundamental mechanism of electron microscopy, Cryo-electron microscopy and scanning electron microscopy.
CO **2 Understanding-Comprehend** different mode of action of biological nanomaterials and engineered nanomaterials.
CO **3 Applying-Apply** microfluidics and nano-fluidics and its importance in drug discovery.
CO **4 Analyzing-Analyze** detail mechanism microfabrication and nanofabrication.
CO **5 Evaluate-Interpret**recent advancement nano-biotechnology and its impact in society.

Catalog Description

The core-course of 'Nano-biotechnology' will help to define fundamental mechanism of electron microscopy, Cryo-electron microscopy and scanning electron microscopy.This course includes comprehensive approach through studying different mode of action of biological nanomaterials and engineered nanomaterials. Furthermore, the implication of recent advancement nano-biotechnology and its impact in society will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

DSE 2 NANOBIOTECHNOLOGY

1. Course overview. Nanoscale Properties (Electrical, Optical, Chemical), Nanoscale visualization techniques: Electron microscopy (TEM, SEM, Cryo-SEM), Scanning probe microscopy (AFM, STM), Diffraction techniques (XRD, synchrotron) **[8 LectureHours]**
2. Bionanomaterials, Biological building blocks, Bio nanostructures (nanofibers, nanotubes, nanocellulose). Biological nanomachines: Ribosomes, Photosynthesis systems, Bio nanomotors. **[7 LectureHours]**
3. Engineered Nanomaterials: Carbon nanomaterials (fullerenes, graphene, nanotubes, nanofibers), Metal nanoparticles (synthesis, properties and applications) , Magnetic nanoparticles (synthesis, properties and applications), Quantum dots, liquid crystals, Nano porous materials (metallic, zeolite, MOFs) **[8 LectureHours]**
4. Microfabrication methods (photolithography, soft lithography, replication). Nanofabrication methods (Top-Down approaches). Nanotechnology by self-assembly (Bottom-Up approach): Principles, thermodynamics, interactions, properties, Supramolecular self-assembly, Protein nanotechnology DNA nanotechnology**[7 Lecture Hours]**
5. Microfluidics: surface tension, capillarity, Reynolds number, diffusion, viscosity. Nanofluidic: nanopores and nanocapillaries. Debye length, Diffusion in solid phase and drug delivery. **[8 LectureHours]**
6. Biological and medical microdevices: lab on chips**,** organ-on chips, Biosensors (fabrication, functionalization, applications). Nanotechnology safety and the environment. Impact of nanotechnology on society and industry **[7 LectureHours]**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name:

Enrolment No:

Course: BIC22518 – DSE-I Nano-biotechnology (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester: Even2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20)			
1.	**Define** Nanotechnology. Write different modes of classification of Nanomaterials.	**2+3**	**CO1**
2.	**Explain** Chemical Vapor Deposition of Carbon Nanotubes.	**5**	**CO2**
3.	**Describe** the challenges faced by Nanotechnology.	**5**	**CO3**
4.	Write short note on (i) Carbon fullerenes (ii) Carbon Nanotubes.	**2+3**	**CO4**
5	**Analyze** the effect of recent advancement of nano-biotechnology in society.	**5**	**CO5**
	SECTION B (Attempt any 3 questions) (10X3=30)		
6.	Make short note on: (i) Atomic Force Microscopy (ii) Scanning Electron Microscopy	**5+5**	**CO2**
7.	**Explain** in detail Electrical, magnetic, optical, thermal, and mechanical properties of nanostructured materials.	**2+2+2+2+2**	**CO1 CO2**
8.	What is nanomedicine? How can nanomaterialsbe used for targeted drug delivery. **Explain** your answer.	**3+2+5**	**CO4**
9	**Describe** synthesis of Nanoparticles through Homogenous and Heterogenous nucleation.	**5+5**	**CO4 CO5**

BIC21509	**DSE-I Drug design and development (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	BSc. Level Chemistry and Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about classification of drugs, drug targets and drug action.
- It will also provide in depth knowledge about identification of drug targets; fundamentals of receptor-ligand interactions; concept of structure–activity relationship.
- To deliver detail information about pharmacophores, antagonist, agonist, prodrugs, pharmacokinetics andpharmacodynamics.
- To provide students recent advancement in drugmetabolism.

Course Outcomes

On completion of this course, the students will be able to:
CO1 Remembering-Identify different stages of drug development process.
CO2 Understanding-Explain the principles and techniques of drug design and development.
CO3 Applying-Utilize computational tools and software for drug design.
CO4 Analysing-Evaluate the efficacy and safety of potential drug candidates.
CO5 Evaluate-Assess strategies for optimizing drug design process and design a comprehensive drug development plan for a specific target.

Catalog Description

The core-course of 'Drug design and development' will help to define fundamental knowledge about classification of drugs, drug targets and drug action.This course includes comprehensive approach through studying different drug targets; fundamentals of receptor- ligand interactions; concept of structure–activity relationship. Furthermore, the implication of recent advancement in drug metabolism and its impact in society will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject viaexercise and discussions with the coordinator.

Course Content

DSE-I Drug design and Development

1. Introduction: classification of drugs, drug targets and drug action, concepts of drug dosing, half-life, tolerance, potency, physical dependence, and therapeutic index (LD-50 & CD-50). **[9 LectureHours]**
2. Definition of terminology: pharmacophores, lead, antagonist, agonist,prodrugs, pharmacokinetics and pharmacodynamics. **[9 LectureHours]**
3. Drug discovery: Identification of drug targets; Fundamentals of receptor-ligand interactions; Concept of structure –activity relationship (SAR & QSAR). Pharmacogenomics and pharmacogenetics, Toxicogenomic; Metagenomics and drug development**. [9 LectureHours]**
4. Drug metabolism (Biotransformation of drugs): Definition, classification and mechanism of action of common antibiotics, antivirals, antifungals, local anti-infective drugs, Sulfa drugs, aspirin, paracetamol**. [9 LectureHours]**
5. Logic of Drug design and drug action: Drugs based on targeting enzyme inhibition, nucleic acids (Alkylating agents and intercalating agents), metabolic diseases and Endocrine function and psychopharmacological agents. Definition, classification and mechanism of action of commonly used drugs: Analgesics, nonsteroidal anti- inflammatory drugs (NSAIDs) as pain killers, Antineoplastic agents, Antihistamines, hormone drugs, steroidal drug, Cardiovascular drugs, anaesthetic drugs, antidepressants, antipsychotics, prostaglandin synthesis. Drug resistance and mechanism**. [9 Lecture Hours]**

References Books:

1. Madsen U, Krogsgaard-Larsen P, Liljefors T (2002). Textbook of Drug Design and Discovery. Washington, DC: Taylor & Francis. ISBN978-0-415-28288-8.
2. Reynolds CH, Merz KM, Ringe D, eds. (2010). Drug Design: Structure- and Ligand-Based Approaches (1 ed.). Cambridge, UK: Cambridge University Press. ISBN978-0521887236.
3. Wu-Pong S, Rojanasakul Y (2008). Biopharmaceutical drug design and development (2nd ed.). Totowa, NJ Humana Press: Humana Press. ISBN978-1-59745-532-9.
4. R. B. Silverman & M. W. Holladay 'The Organic Chemistry of Drug Design and Drug Action', 3rdEdition; Burlington : Elsevier Science, 2014. ISBN:978-0-12-382030-3.
5. DenizEkinhi 'Medicinal Chemistry and Drug Design' Croatia, InTech, ISBN 978-953-51- 0513-8.
6. Madsen U, Krogsgaard-Larsen P, Liljefors T (2002). Textbook of Drug Design and Discovery. Washington, DC: Taylor & Francis. ISBN978-0-415-28288-8.
7. Reynolds CH, Merz KM, Ringe D, eds. (2010). Drug Design: Structure- and Ligand-Based Approaches (1 ed.). Cambridge, UK: Cambridge University Press. ISBN978-0521887236.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC22519 – DSE-I Drug design and development (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester: Even2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

	SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)		
1.	What is QSAR? **Discuss** how Hansch developed a correlation between numerical descriptor of physicochemical properties and biological activities in hiscorrelation analysis.	**U,AN**	**CO1**
2.	**Describe** receptor theories of drug action.	**U**	**CO2**
3.	What is the need for prodrug design? Which example **define** the benefits of prodrug over routine drugs?	**U**	**CO3**
4.	Give a brief overview of solid phase synthesis. **Explain** its utility in drug discovery.	**R**	**CO4**
5	What are the various drug receptor interaction involved for drug activity? **Explain** the effect of voltage gated and ion channels in drug receptor interaction.	**R**	**CO5**
	SECTION B (Attempt any 3 questions) (10X2=20) (10X2=20)		
6.	How will you approach to design an enzyme inhibitor based on understanding of binding pockets and active sites?	**AN**	**CO2**
7.	What are the statistical test used for the validation od QSAR equation? **Explain** all of them.	**R**	**CO1** **CO2**
8.	Discuss i) Computer in drug design, ii) 3Dpharmacophore, iii) Ab-initio methods.	**R,AN**	**CO4**
9	Write the generic, empirical force field equation and **explain** the significance of various terms in energy calculation.	**AP**	**CO4** **CO5**

BIC22510	**DSE-I Food and dairy: food safety and quality control (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	BSc. Level Chemistry and Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about Food as substrate for microorganisms and about the intrinsic and extrinsic factors affecting growth ofmicrobes.
- It will also provide in depth knowledge about sources of food contamination and spoilage and also the principles of foodspoilage.
- To deliver detail information about principles and methods of foodpreservation.
- To provide students Good Hygiene Practices, Sanitation in manufacture and retail trade.

Course Outcomes

On completion of this course, the students will be able to:

CO **1 Remembering-Define** the fundamental knowledge about Food as substrate for microorganisms and about the intrinsic and extrinsic factors affecting growth of microbes.
CO **2 Understanding-Identify** sources of food contamination and spoilage and also the principles of food spoilage.
CO **3 Applying-Explain** principles and methods of food reservation.
CO **4 Analysing-Analyze** Food-borne infections and intoxication.
CO **5 Evaluate-Describe** Good Hygiene Practices, Sanitation in manufacture and retail trade.

Catalog Description

The core-course of 'Food and dairy: food safety and quality control' will help to define fundamental knowledge about Food as substrate for microorganisms and about the intrinsic and extrinsic factors affecting growth of microbes.This course includes comprehensive approach through studying sources of food contamination and spoilage and also the principles of food spoilage. Furthermore, the implication of recent advancement in principles and methods of food preservation will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

DSE-I FOOD AND DAIRY: FOOD SAFETY AND QUALITY CONTROL

1. **Scope of food microbiology and biotechnology**. Food as substrate for microorganisms, intrinsic and extrinsic factors affecting the growth of microbes, important microorganisms in food (moulds, yeasts and bacteria) and their source (air, soil, water, plants and animals). **[7 LectureHours]**
2. **Proximate composition of food**. Sources of food contamination and spoilage. Principles of food spoilage; spoilage of cereals, sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish and sea food, poultry; spoilage of canned food; conventional and modern methods for detection of spoilageandcharacterization. **[7 Lecture Hours]**
3. **Importance of food Preservation**, Principles and methods of food preservation - Physical (temperature, irradiation, drying, canning, processing for heat treatment-D, Z and F values) Chemical (Organic acids, food additives. Class I and Class II preservatives), Bio preservation. **[6 LectureHours]**
4. **Food Packaging-** Types of packaging materials, properties and benefits. Other methods of preservation- curing, pickling, smoking, fermentation, addition of chemical preservatives, high pressure processing, hurdle technology. **[6 LectureHours]**
5. **Food-borne infections and intoxication:** Bacterial- Brucella, Bacillus, Clostridium, Campylobacter, Escherichia, Listeria, Vibrio; Food intoxication- Botulism, Staphylococcal. Mycotoxins& their types – aflatoxins, ochratoxins, fuminosins, trichothecenes, zealenone, ergot alkaloids. Laboratory testing procedures. Preventive measures. **6 LectureHours]**
6. **SCP-** Nutritional & therapeutic importance, Quorn and SCO and their Industrial production. Dairy food (cheese, srikhand). Production procedure of Kefir, Yogurt, Acidophilus milk; Probiotics, Prebiotics and Symbiotic. Nutraceuticals, functional food and their quality standards. Application of fungal pigments infoodindustry. **7 Lecture Hours]**
7. **Food and sanitation:** Good Hygiene Practices, Sanitation in manufacture and retail trade; food control agencies and their regulation, hazard analysis and critical control points (HACCP); GMP, quality control. Recent trends and development in food technologies in India.**6 LectureHours]**

References Books:

1. Introduction to food biotechnology / Perry Johnson-Green. Latestedition.
2. James, M. J. Martin, J. Loessner, and David, A.G. (2006) Modern food microbiology (7th ed.)
3. John S Norak, Gerald M Sapers, Vijaya Kumar Juneja, Daniel K Gay. (2002), .Microbial Safety of Minimally Processed Foods.1st Edition.CRCPress.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC22520 – DSE-I Food and dairy: Food safety and quality control (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester: Even2020-21 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)			
1.	Explain food sanitation. Define botulism.	**U**	**CO1**
2.	Discuss about different milk borne diseases.	**R**	**CO2**
3.	Describe food infection by Salmonella Typhimurium.	**U**	**CO3**
4.	Identify source of food spoilage microorganisms.	**R**	**CO4**
5	Define Brucella ring test and test for mastitis.	**U**	**CO5**
SECTION B (Attempt any 3 questions) (10X3=30)			
6.	Explain the spoilage of meat and poultry products. Describe food prevention by canning.	**R**	**CO2**
7.	Give the steps involved in commercial sterilization process in industrial canning.Which are the important spoilage organisms of acid foods in cans?	**R, AN**	**CO1** **CO2**
8.	Which organism spoils pasteurized milk, chicken, fish and bread?	**R**	**CO4**
9	How will you determine the microbial loading in a food sample? What are practical rules for good sanitation?	**U**	**CO4** **CO5**

BIC21522	**Immunology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	Graduate level degree in biology or relevant area				
Co-requisites	--				

Course Objectives:

1. To provide basic understanding of our immune system and its medicalimplication.
2. To provide basic understanding of the activation, mechanism and regulation of the immune system and Host pathogeninteraction.
3. To understand how an altered signaling pathways of the immune system lead to Immune disorder.

Course Outcomes

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

CO1
- Recognize the components and steps of the immune response

CO2
- Explain the interaction between antigens and antibodies

CO3
- Apply knowledge of antigens and antibodies in diagnosing and treating immunological disorders

CO4
- Evaluate the effectiveness of different antigens in eliciting immune responses

CO5
- Assess the effectiveness of immune responses in combating infections and diseases

Course Description:

Immunology and Medical Biotechnology course will provide an advanced understanding of the principles and mechanisms of the immune system and immune responses in the context of infection, malignancy and immunological disorders. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with

practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content:

IMMUNOLOGY (BIC21522)

UnitI 10 LectureHours

Immunology- fundamental concepts and anatomy of the immune system

Components of innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoiesis; Organs and cells of the immune system- primary and secondary lymphoid organs; Lymphatic system; Lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous associated Lymphoid tissue. (MALT&CALT); Mucosal Immunity; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing

UnitII 10 LectureHours

Immune responses generated by B and T lymphocytes

Immunoglobulins-basic structure, classes & subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; Principles of cell signalling; Basis of self –non-self-discrimination; Kinetics of immune response, memory; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC; Cytokines-properties, receptors and therapeutic uses; Antigen processing and presentation- endogenous antigens, exogenous antigens, non-peptide bacterial antigens and super-antigens; Cell-cell co-operation, Hapten-carrier system

UnitIII 10 LectureHours

Antigen-antibody interactions

Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy; Surface Plasmon resonance, Biosensor assays for assessing ligand – receptor interaction, CMI techniques- lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis, Microarrays, Transgenic mice, Gene knock outs

UnitIV 15 LectureHours

Clinical Immunology

1. Pathogenic infection: Normal human microflora. Recognition and entry processes of different pathogens like bacteria viruses into animal and plant host cells, Virulence factors and pathogenicity islands, alteration of host cell behaviour by pathogens. Immunity to Infection : Bacteria, viral, fungal and parasitic infections (with examples from each group) Hypersensitivity – Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy; Immunodeficiency-Primary immunodeficiency, Acquired or secondary immunodeficiency.

2. Vaccine technology: Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering-chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin genelibraries.

Reference Books

Suggested Books:

1. Kuby Immunology by Judy Owen, Jenni Punt, Sharon Stranford,2013
2. Roitt's Essential Immunology (Essentials) by Ivan M. Roitt,2016
3. Medical Microbiology & Immunology by Warren Levinson,2004
4. Basic and Clinical Immunology by MarkPeakman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

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2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC21522 – IMMUNOLOGY
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2020-2021 **Max. Marks:50**

Instructions:
Attempt all the questions from Section A (each carrying 4 marks); all the questions from Section B (each carrying 6 marks).

SECTION A (Attempt all the questions)

1.	(i) All of the following are true of antigen EXCEPT whichone of the following? (U)(R) A. They contain epitopes. B. They contain antigenic determinants. C. They can elicit an immune response. D. They contain paratopes	**U** **AN**	**CO1, CO2, CO3,CO5**
	(ii) A 27-year-old housewife presents to her family physician with a 3month history of fatigue, and a facial rash which is aggravated by sun exposure. Laboratory tests reveal anemia of 10-gm/dl (normal is 12-14) and immune testing reveals auto-antibodies against DNA. What is the most likely diagnosis? (An) (Ap)(R) A. Rheumatoid Arthritis B. Myasthenia Gravis C. Systemic Lupus Erythematous D. Graves' Disease	**U** **U**	
	(iii) A Type IV hypersensitivity reaction is characterized by: (U) (R) A. Neutrophil infiltrate B. Participation by complement C. T lymphocyte infiltration D. Cytotoxic antibody	AP	
	(iv)The major role of the complement system is to work in conjunction with (U) A. antibodies to lyse cells via the C8 and C9 components B. the major histocompatibility complex for cell recognition C. antibodies to opsonize cells D. the T-cell receptor for production of lymphokines		

<table>
<tr><td>2.</td><td>Explain, how does immune specificity fit with non-specific cytokines? List the functions of cytokine? (U) (R)</td><td>AP</td><td>CO2, CO3</td></tr>
<tr><td>3.</td><td>Demonstrate the underlying mechanism of Grave's disease. Use diagram to explain. Discuss about mechanism of hypersensitive reaction in ABO blood incompatibility. (U)(Ev)</td><td>U,R</td><td>CO1</td></tr>
<tr><td>4.</td><td>Definepolygenism and polymorphism in context of MHC. How is polymorphism beneficial for the population? (R) (U)</td><td>U</td><td>CO2, CO4</td></tr>
<tr><td></td><td>SECTION B (Attempt any 3 questions) (10X3=30)</td><td></td><td></td></tr>
<tr><td>5.</td><td>(a) Distinguish between attenuation and inactivation. (2)(An)
(b) Discuss the drawbacks of passive immunization. (3)(Cr)
(c) Why MMR vaccine is not given before 12 to 15 months of age? List the disadvantages of attenuated bacterial or viral vaccines. (2+3)(R)</td><td>R,U,</td><td>CO4</td></tr>
<tr><td>6.</td><td>You have prepared knockout mice with mutations in the genes that encode various complement components. Each knockout strain cannot express one of the complement components listed across the top of the table below. Predict the effect of each mutation on the steps in complement activation and on the complement effector functions indicated in the table using the following symbols: NE – no effect; D- process/function decreased but not abolished; A- process/function abolished.
Justify your answer for each. (Ev) (Cr)
<table>
<tr><td>Function</td><td colspan="5">Complement component knocked out</td></tr>
<tr><td rowspan="2">Formation of classical pathway C3 convertase</td><td>C1q</td><td>C4</td><td>C3</td><td>C5</td><td>Factor B</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>AP</td><td>CO3, CO4</td></tr>
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BIC 21536	MICROBIOLOGY	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	Graduate in any discipline of Biology				
Co-requisites	--				

Course Objectives:

1. To gain a deeper understanding of the scope, evolution, history and developments in the field of Microbiology
2. To be able to distinguish between cellular structures of prokaryotes and eukaryotes
3. To appreciate microbial diversity in the world
4. To be able to discern between applications of Microbiology in diverse areas

Course Outcomes

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

CO1.
Remembering-Recall and analysethe contributions of various microbiologists in shaping the field of Microbiology

CO2.
Understanding-Compare and contrast structures and functions between prokaryotic and eukaryotic cells

CO3.
Analysing-Explore the diversity of microbial world

CO4.
Applying-Enlist and describe the scope of microbiology

CO5.
Evaluate-Evaluate the different aspects of microorganisms.

Catalogue Description:

Introduction to Microbiology and Microbial Diversity introduces learners and students to the exciting world of Microbiology and covers history, scope, applications in the field of Microbiology.

Course Content:

Unit 1 Introduction to Microbiology (15 h)

Definition of Microbes; Categories of Microbes; Evolution and classification ofMicrobes; Overview of history of Microbiology: Biogenesis and abiogenesis.Contributions of Redi, Spallanzani, Needham, Pasteur, Lister, Koch, Jenner andFlemming. Scope of Microbiology. Notable contributions in the development ofMicrobiology: i) Spontaneous generation(abiogenesis). ii) Biogenesis. iii) GermTheory of Disease. iv) Koch's Postulates.Development of the field of soilmicrobiology: Contributions of Martinus W. Beijerinck, Sergei N. Winogradsky,SelmanA.Waksman. Establishment of fields of medical microbiology andimmunology through the work of Paul Ehrlich, Elie Metchnikoff, Edward Jenner.Technological Microbiology and contributions of AnandaChakrabortyand patenting.Role of Warner Arber, Hamilton Smith, Daniel Nathans in the discovery of restriction enzymes.Contributions ofKaryMulis and Carl Woese.

Unit 2 Prokaryotic cell structure and function (15 h)

Structure and function; Cell envelope: Plasma membranes; Cell Wall and types.Components external

to cell envelope: Capsule, Slime Layer, S Layer, Pili, Fimbriaeand Flagella. Components internal to the Cell envelope: Cytoplasmic matrix,Inclusion bodies, Ribosome; Bacterial chromosomes and plasmids; Bacterialendospores and their formation.

Unit 3 Diversity of Microbial World (25 h)

A. Systems of classification

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdomclassification systems and their utility. Difference between prokaryotic and eukaryoticmicroorganisms

B. General characteristics of different groups: Acellular microorganisms (Viruses,Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa)with emphasis on distribution and occurrence, morphology, mode of reproductionand economic importance.

• Algae

History of phycology with emphasis on contributions of Indian scientists; Generalcharacteristicsofalgae including occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespotfood reserves and vegetative, asexual andsexual reproduction. Different types of life cycles in algaewith suitable examples:Haplobiontic, Haplontic, Diplontic, Diplobiontic and Diplohaplonticlifecycles.Applications of algae in agriculture, industry, environment and food.

• Fungi

Historical developments in the field of Mycology including significant contributions ofeminentmycologists. General characteristics of fungi including habitat, distribution,nutritional requirements, fungal cell ultra- structure, thallus organization andaggregation, fungal wall structure and synthesis,asexual reproduction, sexualreproduction, heterokaryosis, heterothallism and parasexualmechanism.Economicimportance of fungi with examples in agriculture, environment, Industry, medicine,food,biodeterioration and mycotoxins.

• Protozoa

General characteristics with special reference to Amoeba, Paramecium,Plasmodium, Leishmania and Giardia

Unit 4 An overview of Scope of Microbiology (5h)

Different applications of microbiology in various industries related tofood, agriculture, chemical and fuels, environment, medical and materials. ,

Text Books

T1. Willey, J.M.; Sherwood, L.; Woolverton, C.J. *Prescott's microbiology*. McGraw-Hill: 2016

Reference Books

R1

R2

Modes of Examination: Assignment/Quiz/Project/Presentation/Written Exam

Examination Scheme:

Components	Internal	Mid Term	End Term
Weightage (%)	30	20	50

Course Outcomes for BIC 21528

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: BIC21528 -MICROBIOLOGY
Program: M.Sc. BIOCHEMISTRY **Time: 03 Hrs.**
Semester: Odd 2020-21

Instructions:
Attempt all questions from **Section A** (each carrying 4 marks) and all q**uestions** from **Section B** (each carrying 6 marks)**.**

Section A **(Attempt** all questions**)**			
1.	How do the components of bacterial envelope differ from the components of archaeal cell walls? (R, An)	**4**	**CO2**
2.	Contrast between differential and selective medium giving an example of each. (R, U)	**4**	**CO3**
3.	List down the Koch's postulates. (R, U)	**4**	**CO1**
4.	Discuss how the piece of equipment shown in the image below was used to disprove the theory of spontaneous generation. (E, An) 	**4**	**CO1**
5.	Why did agar offer an improvement over gelatin for the growth of microorganisms? (E)	**4**	**CO1**
	SECTION B (Attempt all questions**)**		
6.	Write names of two microbes that harbor multiple chromosomes. What are the major types of bacterial plasmids? Mention an example each type of plasmid. (R, U)	**6**	**CO2**
7.	Illustrate the scientific method (include observation, hypothesis, experimental design, results and interpretation of results) as applied to Jenner's experiment on vaccination. (An, C)	**6**	**CO1**
8	How would you visualize flagella in a compound microscope? Outline the different arrangements of flagella with an example of each. (E, R)	**6**	**CO6**
9	Schematically differentiate between flagella of gram positive and Gram negative bacteria. (R,	**6**	**CO3**

	An)		
10	Discuss the four major categories of medically relevant fungi using a table (R, U)	**6**	**CO4**

BIC 22549	Microbiology Lab	L	T	P	C
Version 1.0	Contact Hours - 60	0	0	4	2
Pre-requisites/Exposure	UG level Biology				
Co-requisites	--				

Course Objectives:

1. To provide hands on training on how to work safely in a Microbiology lab
2. To acquaint working principle of different instruments in a Microbiology lab
3. To make students learn on how to properly handle and care for lab microscope
4. To make students learn about growing and isolating microbes in the laboratory
5. Hands on training of various staining procedure including simple, negative and gram staining.

Course Outcomes

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

CO1: Remembering: To Identify different bacterial and viral species based on their unique characteristics.
-
CO2. Understanding: To Interpret the results of various laboratory tests used to identify bacteria and viruses.
-
CO3. Applying: To Perform aseptic techniques and handle microbial cultures safely in a laboratory setting. Apply molecular techniques such as PCR and gene cloning in the study of microbial genetics.

CO4. Analysing: To Critically evaluate the significance of microbial interactions in various environments.
-
CO5. Evaluate: Evaluate the reliability and validity of experimental results obtained in the laboratory. Design experiments to investigate specific research questions in bacteriology, virology, and microbial genetics.

Catalogue Description:

Introduction to Microbiology and Microbial Diversity Lab introduces learners and students to the exciting world of Microbiology lab and covers lab safety, instrumentation used in Microbiology lab, microscope handling and staining techniques to visualize microbes in the lab.

Course Content:

1. Lab safety

(5h)

2. To know the principles and mode of operation of various instruments in Microbiology lab including Microscope, Laminar air flow, autoclave, biological incubator, weighing balance, pH meter

(5h)

3. Microbiological media preparation

(3 h)

4. Aseptic techniques

(3 h)

5. Environmental sampling of microbes

(3 h)

6. Isolation of microbes using streak plate, and pour plates.

(3 h)

7. Enumeration of microbes using spread plate method.

(3h)

8. Simple staining

(3h)

9. Negative staining

(3h)

10. Fungal staining

(3h)

11. Use of temporary mounts to study *Spirogyra* and *Chlamydomonas*and *Volvox* (5h)

12. Demonstration of permanent mounts/photographs of *Amoeba*,*Entamoeba*, *Paramecium* and *Plasmodium*

(5h)

Text Books

T1. Cappucino J and Sherman N (2010). Microbiology: A Laboratory Manual, 9th edition, Pearson Education

Modes of Examination: Assignment/Quiz/Project/Presentation/Written Exam

Examination Scheme:

Components	Internal	End Term
Weightage (%)	50	50

Course Outcomes

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**			
CourseBIC 22548 –Microbiology Lab **Program: M.Sc. BIOCHEMISTRYTime: 03 Hrs.** **Semester: Odd 2020-21** **Instructions:** Attempt all questions from **Section**			
Section A **(Attempt** all questions**)**			
1.	State the principle and method of quadrant streaking. **Determine** if streaking has been proper in plate marked __? Identify whether the provided culture is pure? (R, An)	**15**	**CO3**
2.	State the principle and method of gram staining. Identify if the given microbial strain is gram positive or negative by performing gram staining. **Mention** the shape and arrangement of the given sample. (R, Ap)	**15**	**CO4**
3.	Lab Notebook and Viva (R, U, An, Ap, E. C)	**20**	**CO1, CO2, CO3, CO4**

BIC21550	FORENSIC BIOLOGY (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	UNDERSTANDING OF BASIC BIOLOGY				
Co-requisites	--				

Course Objectives

To provide students the basic understanding of forensic biology.
It will also provide in depth knowledge of forensic science.
Elaborating biophysical and biochemical techniques for forensics.
General overview of forensic genetics and advanced DNA forensics.

Course Outcomes

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

CO1.Remembering-Students will be able to **recall** various fundamental components of forensic biology.
CO2Understanding-.Students will be able to **summarise** tools and techniques of forensic biology.
CO3.Analysing-Students will be able to **analyse** different administration and organizational setup.
CO4.Applying-Students will be able to **outline** the forensic genetics.
CO5.Evaluate-Students will be able to **explore** advanced DNA forensics.

Catalog Description

The core-course of 'forensic biology' will help to understand the fundamental components of forensic biology. This course is a step by step journey from the basic to modern concepts of forensic biology. Furthermore, students will be able to summarise tools and techniques of forensic biology. They will be able to outline the forensic genetics and advanced DNA forensics.

Course Content

Forensic Biology (BIC 21550)

I) ELEMENTARY FORENSIC SCIENCE: Definition of Forensic Science, The Role of the Forensic Laboratory, History and Development of Forensic Science in India & Abroad, Pioneers in Forensic Science, Multidisciplinary nature, Forensic Technology solving crimes with advanced technology, Forensic intelligence and Interviews. Administration and Organizational Setup: DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR&D, Qualifications and duties of Forensic Scientists Academic centres of education and research: Indian and Academy of Forensic Science, American Board of Forensic Odontology, Interpol and FBI, Australian Academy of Forensic Sciences.

II) GENERAL FORENSIC TOOLS AND TECHNIQUES: Meaning and Terminology of Instrumentation; Definition, Need of Instrumentation in Forensic Science, Qualitative and quantitative methods of analysis, Destructive and Non-Destructive Methods. Centrifugation Techniques, Basic principles of sedimentation. Theory and basic principles, setup and Forensic applications of Compound, Comparison, Fluorescence, Polarized, Stereo-zoom microscope. Electron Microscopy- Theory and basic principles of Electron Microscopy. Introductory Chromatography: Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography. Forensic Toxicology, Serology & Microbiology.

III) FORENSIC GENETICS: Concepts of Human Genetics; DNA Profiling: Introduction, History of DNA Typing, molecular biology of DNA, variations, polymorphism, SNPs.

IV) ADVANCED DNA FORENSICS:

DNA Extraction-Organic and Inorganic extraction, Comparison of Extraction methods, Commercial kits DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, YSTR, Mitochondrial DNA, Ancient DNA typing, Evaluation of results. Forensic Significance of DNA profiling, New and future technologies: DNA chips, SNPs and limitations of DNA profiling.

Textbook:

Forensic Biology By Richard Li. 2nd Edition,CRC Press. Taylor & Francis Group.
Essential Forensic Biology, 3rd edition. Alan Gunn. ISBN: 978-1-119-14140-2.WILEY.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: BIC 21550 – FORENSIC BIOLOGY (THEORY)

Program: M.Sc. Biochemistry **Time: 03 Hrs.**
Semester: Odd

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10marks)**.**

SECTION A (Attempt **any Four questions)**

1.	What is forensic inelligence? **Explain** with a suitable example.	**2+3**	**CO1**
2.	**Classify** Administration and Organizational Setup.	**5**	**CO2**
3.	**Describe** non-descriptive method of forensics.	**5**	**CO3**
4.	**Enlist** 3 important organizational set up.	**5**	**CO3**
5	**Explain** forensics toxicology and serology .	**3+2**	**CO1**
	SECTION B (Attempt any **Two questions)**		

6.	**Illustrate** the technique of electron microscopy. **Describe** history of DNA forensics.	**4+2+3+1**	**CO3**
7.	Explain analysis of hair in forensic. Outline the methods of forensic sampling	**2+4+2+2**	**CO1** **CO2**
8.	**Illustrate** the role of Forensic applications of Compound?**Compare** between motifs and domain with example. Where do you find triple helix? Explain briefly.	**2+2+3+3**	**CO1** **CO2**
9	**Outline** the principles advanced DNA forensics. **Analyse** the roles of different chromatographic techniques by briefly describing their principle.	**2+3+3+2**	**CO4** **CO3**

BIC 21551	NUTRITION AND TOXICOLOGY (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 45**	3	1	0	4
Pre-requisites/Exposure	BASIC UNDERSTANDING OF BIOCHEMISTRY				
Co-requisites	--				

Course Objectives

To provide students the basic understanding of nutrition, energy metabolism and toxicology.

It will also provide in depth knowledge of functional aspects food and drug interactions with nutriceuticals.

Elaborating dietary components of health and diseases.

General overview of nutritional and toxicological assessment .

Course Outcomes

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

CO1.Students will be able to recall various aspects of nutrition, energy metabolism and toxicology.

CO2.Students will be able to **summarise** functional features of food and drugs.

CO3.Students will be able to **analyse** and **choose** between food, drug, nutraceuticals and toxins.

CO4.Students will be able to **apply** the role of different nutraceuticals.

CO5.Students will be able to **evaluate** major reasons for disease and toxicology.

Catalog Description

The core-course of 'Nutritional Biochemistry' will help to understand the classification, structure and properties of foods and nutraceuticals. Nutritional biochemistry has also helped to reveal facts about how nutrients influence the growth, development, and function of cells and tissues. Therefore, studying the biochemistry of nutrition has a significant real-world impact. It has the potential to greatly influence the future of preventative and therapeutic strategies for mental and physical illness.

Course Content

Nutritional Biochemistry **(BIC21551)**

Unit I Introduction to Nutrition and Energy Metabolism

Defining Nutrition, role of nutrients. Unit of energy, Biological oxidation of foodstuff. measurement of energy content of food, Physiological energy value of foods, SDA. Measurement of energy expenditure, estimating energy requirements, BMR factors Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups.

Unit II Dietary components and health

Review functions of carbohydrates, lipids, proteins and vitamins. Digestion, absorption. Their classification, sources, functions, digestion, absorption, utilization and storage. Deficiency diseases (Kwashiorkor, Scurvy, Rickets, Xeropthalmia etc.).Minerals (Ca,P,Fe etc.) absorption, importance and deficiency disease.

Unit III Assessment of Nutritional status

Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Biochemical assessment; Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment, GTT and glycosylated Hb, Differential diagnosis of B12 and folate.

Unit IV Food, Drug interactions, Nutriceuticals and Toxicology

Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Anti-depressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

Unit V Toxicology

Classification of Food Toxicants. Food, Law and Safety. Principles of Toxicology I: Exposure, the Dose-Response Curve. Absorption, Distribution and Elimination of Toxicants. Biotransformation Reactions (Phase I & Phase II).Carcinogenesis, Mutagenesis, Teratogenesis. Organ Toxicity.Natural Toxins in Foods of Plant Origin I. Risk Assessment. Pesticides in Foods. Marine,Toxinns Poisonous Mushrooms , Mycotoxins ,Toxicants Resulting from Food Processing I , Food Additives I , Food Adulteration Pesticides .

Textbook:

1. Nutriional Biochemistry 1st Edition, ISBN: 978-93-90699-76-6, Nitya Publication. Dr.Renu Verma.
2. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.

Reference books:

1. Physi
2. The T

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Name: **Enrolment No:**	

Course: Nutrition and toxicology (THEORY)

Program: M.Sc. Biochemistry **Time: 03 Hrs.**
Semester: Odd 2019-20

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10marks)**.**

SECTION A (Attempt **any Four questions)**			
1.	What are toxins? **Explain**with a suitable reaction.	**2+3**	**CO1**
2.	**Illustrate** the concept of BMR. Explain the significance.	**4+1**	**CO2**
3.	Explain Kwashiorkor and Scurvy with full biochemical explanation.	**4**	**CO3**
4.	**Enlist** 3 important techniques for food analysis. What is the importance of urine analysis.	**2+3**	**CO3**
5	**Explain** the biochemical cause behind the development of thalassemia and sickle cell anemia.	**3+2**	**CO1**
	SECTION B (Attempt any **Two questions)**		
6.	Explain dose-response curve. Name some marine toxicants and summarize their mode of action. Name one food additive extensively used in food industry.	**4+2+3+1**	**CO3**
7.	Summarize any four Anthropometric measurements which are useful for nutritional assessment.	**2.5 x 4**	**CO1** **CO2**
8.	**Illustrate** the role of ADME studies for the development of drugs in industry. Explain the nutritional basis of different minerals in food.	**5+5**	**CO1** **CO2**
9	**Outline** the principles of Edmann degradation and solid phase peptide synthesis. **Analyse** the roles of different chromatographic techniques by briefly describing their principle.	**2+3+3+2**	**CO4** **CO3**

BIC 22552	FORENSIC BIOLOGY LAB	L	T	P	C
Version 1.0	**Contact Hours - 45**	0	0	4	2
Pre-requisites/Exposure	UNDERSTANDING OF BASIC BIOLOGY				
Co-requisites	--				

Course Objectives

To provide students hands on understanding of forensic biology.

It will also provide in depth practical knowledge of forensic science.

Elaborating biophysical and biochemical techniques for forensics.

General overview of forensic serology and advanced DNA forensics.

Course Outcomes

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

CO1.Students will be able to **recall** various fundamental components of forensic biology.

CO2.Students will be able to **understand** tools and techniques of forensic biology.

CO3.Students will be able to apply different DNA techniques.

CO4.Students will be able to **analyse** the forensic serology techniques.

CO5.Students will be able to **explore** advanced DNA forensics.

Catalog Description

The core-course of 'forensic biology lab' will help to understand the fundamental components of forensic biology. This course is a hands on journey from the basic to modern concepts of forensic biology. Furthermore, students will be able to summarise tools and techniques of forensic biology. They will be able to outline the forensic genetics and advanced DNA forensics.

Course Content

Forensic Biology Lab

1. To prepare gel plates for electrophoresis.

2. Organic extraction of DNA from blood.
3. Extraction of DNA from other body fluids.
4. Quantification of DNA
5. PCR for DNA samples.
6. Serology Test.

Textbook:

1. F
orensic Biology By Richard Li. 2nd Edition, CRC Press. Taylor & Francis Group.
2. E
ssential Forensic Biology, 3rd edition. Alan Gunn. ISBN: 978-1-119-14140-2.WILEY.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	

Course: BIC22552 – FORENSIC BIOLOGY LAB (PRACTICAL)
Program: M.Sc. Biochemistry **Time: 03 Hrs.**
Semester: Odd

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10marks)**.**

SECTION A (Attempt **any Four questions)**			
1.	Perform PCR identification of human DNA	**10**	**CO1**
2.	Perform microscopic observation of human hair	**10**	**CO2**
3.	Describe the importance of DNA forensics.	**10**	**CO3**
	SECTION B (Attempt any **Two questions)**		
6.	Lab copy.	**10**	**CO3**
7.	Viva Voce.	**10**	**CO1** **CO2**

BIC 22553	NUTRITIONAL AND TOXICOLOGY LAB (PRACTICAL)	L	T	P	C
Version 1.0	**Contact Hours - 60**	0	0	4	2
Pre-requisites/Exposure	BASIC KNOWLEDGE OF BIOCHEMISTRY				
Co-requisites	--				

Course Objectives

To provide students with hands-on training in the field of nutritional biochemistry.
To provide in depth knowledge of modern research on nutrition and toxicology.
Students will become more proficient with different practical applications nutrition and toxicology.

Course Outcomes

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

CO1.Remembering-Recall the basic principles of nutritional biochemistry.
CO2.Understanding-Understand biochemical aspects of nutrition and toxicology.
CO3.Applying-Applydifferent assay systems of vitamins, minerals and food adulterant.
CO4.Analysing-Analyse food samples and microbes.
CO5. Evaluate-Evaluate the knowledge of nutritional biochemistry to understand different practical applications.

Catalog Description

The discipline specific course "nutritional biochemistry lab" is a practical paper which has been designed to provide the knowledge of different aspects of nutritional biochemistry. It will provide biochemical & molecular understanding of important processes in nutrition. Students will be able to understand biochemical aspects of nutrition and toxicology. Students will comprehend different assay systems of vitamins, minerals and food adulterant. Apply the knowledge of nutritional biochemistry to understand different practical applications.Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

NUTRITIONAL AND TOXICOLOGY LAB
1.Estimation of vitamins. (15 Lectures)
2.Estimation of minerals. (10 Lectures)
3.Estimation of adulterant in food stuffs. (10 Lectures)
4.Tests on Heavy Metal Toxicity. (15 Lectures)
5Tests for microbial toxicity. (10 Lectures)

SUGGESTED READINGS

1.A Practical Handbook of Food and Nutrition (2019): ISBN-9789387195660; Shivalik Prakashan. Jayashree Mishra and Pravabati Guru.

2.Practical Forensic Medicine and Toxicology: ISBN: 9789388178846, KK Banerjee. CBS Publishers & Distributors. (2019)

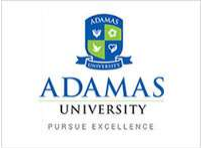
Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Name: **Enrolment No:**	

Course: BIC– NURITIONAL BIOCHEMISTRY LAB (PRACTICAL)

Program: M.Sc. Biochemistry **Time: 03 Hrs.**
Semester: Even 2019-20

Instructions:
Attempt any **two** questions from **Section A** (each carrying 10 marks); **Section B** is Compulsory (carrying 10 marks)**.**

	Section A (Attempt **any Two)**		
1.	Write the principle of estimation of ascorbic acid. Perform the experiment.	**10**	**CO1** **CO2**
2.	Determine different adulterant in food stuffs.	**10**	**CO3** **CO4**
3.	a) Write the principle behind column chromatography. b)Demonstrate the presence of amylase in germinating seed with a simple experiment.	**4** **6**	**CO3** **CO2**
	SECTION B is compulsory		
4.	**Viva-voce** (U/An/Ap/R/Ev)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
5.	**Practical copy**(U/Ap/Ev)	**10**	**CO1** **CO2** **CO3**

BIC21513	BIOENERGETICS AND METABOLISM (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	GRADUATION IN BIOCHEMISTRY				
Co-requisites	FUNDAMENTAL KNOWLEDGE IN BIOENERGETICS AND METABOLISM				

Course objectives

- To provide students the basic understanding of laws of thermodynamics in membrane metabolism.
- To provide in depth knowledge of carbohydratemetabolism.
- To outline details of lipidmetabolism.
- To discuss general overview of amino acidmetabolism.

Course Outcomes

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

1. Remembering: Recall the key concepts and principles of metabolism, including bioenergetics, photosynthesis, oxidative phosphorylation, carbohydrate metabolism, lipid metabolism, amino acid metabolism, and nucleic acid metabolism.

   2. Understanding: Demonstrate an understanding of the different metabolic pathways utilized to generate energy, synthesize macromolecules, and regulate metabolic processes.

   3. Applying: Apply knowledge of metabolism to analyze and interpret experimental data related to bioenergetics, photosynthesis, oxidative phosphorylation, carbohydrate metabolism, lipid metabolism, amino acid metabolism, and nucleic acid metabolism.

   4. Analyzing: Evaluate the impact of different environmental factors on metabolism and predict how changes in these conditions can affect metabolic pathways in microorganisms.

   5. Creating: Design experiments to investigate specific aspects of metabolism, formulate hypotheses, and propose innovative strategies for optimizing metabolic pathways for practical applications in the fields of biotechnology and medicine.
2.

Catalog Description

The core-course of 'bioenergetics and metabolism' deals with intrinsic laws of thermodynamics in the field of metabolism. The syllabus includes different types of anabolic and catabolic pathways as well

as their relation to our lives. Three main classes of biomolecules i.e. carbohydrates, lipids and protein metabolism have been included in the syllabus for a better understanding of life processes.All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Bioenergetics and Metabolism (BIC21511)

Carbohydrate Metabolism [20 Lecture Hours]

1. Survey of metabolism: Carbon, oxygen, nitrogen cycle catabolism, use of mutants and isotopes in the study of metabolism, compartmentation, food chain and energyflow.

2. Glycolysis: Anaerbic pathway of glucose metabolism, two phases of glycolysis. Detailed study of all the reactions, entry of other carbohydraesin Glycolytic pathway, energy balance sheet regulation of glycolytic sequence by enzymes and hormones, alcoholicfermentation.

3. Gluconeogenesis, Reciprocal regulation of glycolysis andgluconeogenesis

4. Glycogen metabolism: Biosynthesis and degradation of glycogen and it'sregulation. Starch and cellulosebiosynthesis.

5. Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway, glyoxalate cycle, glucuronic acid cycle, inter conversion of hexoses, Pasteur effect.

Lipid Metabolism [25 Lecture Hours]

. Biosynthesis of lipids: Requirements of carbon dioxide and citrate for biosynthesis, fatty acid synthase complex, regulation of biosynthesis. Biosynthesis of triglycerides, cholesterol and phospholipids.

7. Lipid metabolism: Fatty acid metabolism, Beta oxidation of saturated and unsaturated fatty acids, the phases of fatty acid oxidation, energetics of beta oxidation. Oxidation of fatty acids with odd number of carbon atoms, formation of ketone bodies, other types of fatty acid oxidation.Integration of carbohydrate and lipidmetabolism.

8. Citric acid cycle: Aerobic pathway of glucose metabolism, historical background, details of the cycle, use of isotope for the study of citric acid cycle, interconversionof hexoses, PasteurEffect.

Amino Acid Metabolism

9. Biosynthesis of amino acids: amino acid biosynthesis, precursor functions of amino acids, biosynthesis of aromatic amino acids, Histidine,glycine, serine, cysteine, methionine, threonine.Peptides, polyamines, Porphyrins, gamma glutamyl cycle, glutathione biosynthesis, nonribosomal proteinbiosynthesis.

10. Oxidative degradation of amino acids: Proteolysis, Transamination, oxidative deamination, acetyl CoA, Alpha ketogutarate, acetoacetyl CoA, succinate, fumarate and oxaloaccetate pathway, decarboxylation, urea cycle, ammoniaexcretion.

11. Biosynthesis of Purine and pyrimidine nucleotides, Regulation, Biosynthesis of nucleotide coenzymes.Purine pyrimidinedegradation.

Reference books:

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: Enrolment No:	

Course: BIC21511 -BIOENERGETICS AND METABOLISM (THEORY)

Program: M.Sc. Biochemistry **Time: 03Hrs.**

Semester: Even2019-20 **Max. Marks:50**

Instructions:

Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)			
1.	**What** is cori cycle? **Explain** the fates of pyruvate.	**U**	**CO2**
2.	**What** do you understand by transamination and oxidative decarboxylation? Explain with proper reaction.	**R**	**CO4**
3.	**Differentiate** between beta oxidation of saturated and unsaturated fatty acids.	**R**	**CO3**
4.	**Enlist** different types of isotopes used in the dissection of a metabolic pathway.	**U**	**CO3**
5	**Outline** themechanism gluconeogenesis briefly with its regulatory steps.	**AN**	**CO2**
SECTION B (Attempt any 3 questions) (10X3=30)			
6.	Citric acid cycle is anaplerotic in nature**-explain.** What is the main enzyme in glycogen degradation? State its regulation. **Explain** the role of PP pathway in metabolism.	**R**	**CO5,CO1**
7.	What are the main regulatory enzymes in the purine and pyrimidine biosynthesis pathways? **Explain** with reactions. How many ATPs are generated from palmitoyl Co A when it undergoes beta oxidation?	**R,AN**	**CO4** **CO3**
8.	**Illustrate** the role of HMGCoAreductase in cholesterol biosynthesis. Why statin group of drugs are used to treat hypercholesterolemia? Describe the glyoxalate cycle with its importance. Why it is a major target of drug development for patheogenicmicrorganisms.	**AN,U,AP**	**CO2** **CO5**

BIC22523	IMMUNOLOGY LAB (PRACTICAL)	L	T	P	C
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre- requisites/Exposure	Concept of immunology at UG level				
Co-requisites	--				

Course Objectives

1. to demonstrate and interpret different antigen-antibodyinteractions.
2. to acquaint with various components of the immune system and apply this knowledge in immunodiagnostics.
3. to apply various immunological techniques for clinical and researchpurpose.
4. to quantify antigen/ antibody in differentsamples.
5. to identify and demonstrate host pathogeninteraction.

Course Outcomes

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

CO1. Remembering-Recall different antigen-antibody interactions.
CO2. Understand-Understand different components of immune system in humansystem
CO3. Applying-Apply different immunological techniques for research and clinicalpurposes.
CO4. Analysing- Estimate amount of antigen/antibody present in different samples
CO5. Evaluate-Evaluate different host pathogeninteractions.

Course Description

The student will be able to use the knowledge obtained to perform and analyze different types of antigen-antibody interaction. Identification of different components of the immune system is possible with the concept obtained. Students will gain the ability to apply different immunological techniques for research and clinical purposes. All the experiments will be based on hands-on training in laboratory setup along with discussions of basic theories and advanced topics for practical implementation of knowledge. Classes will be conducted by hands-on lab training and/or audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject via exercise and discussions with thecoordinator.

Course Content

IMMUNOLOGY LAB (BIC22523)

1. To study morphological and staining characteristics of lymphocytes, neutrophils,monocytes, eosinophils, and basophils. **[8 Lecture Hours]**
2. To perform immunoelectrophoresis. **[8 LectureHours]**
2. To perform radial immunodiffusion assay. **[8 LectureHours]**
3. To perform rocket immunoelectrophoresis. **[8 LectureHours]**
4. To stain a tissue by immunohistochemical reaction **[8 LectureHours]**

5. To study quantitative precipitation assay. **[10 LectureHours]**
6. Gel Techniques; ELISA; SDS PAGE/Western blot**[8 LectureHours]**
7. To perform latex agglutination test **[10 LectureHours]**

Text Book(s)

2. Immunology Lab Manual by Wilmore Weberly,2015
3. Immunology methods manual - The comprehensive source book by Lefkovits. ,1996
4. Manual of clinical laboratory immunology by Rose NR,2002
5. Laboratory Immunology by BradshawLJ.1997

T1. Owen, J.A.; Punt, J.; Kuby, J.; Stranford, S.A. Kuby immunology. W.H. Freeman: 2013.

Reference books

R1. T1. Owen, J.A.; Punt, J.; Kuby, J.; Stranford, S.A. Kuby immunology. W.H. Freeman: 2013.

Modes of Examination: Assignment/Quiz/Project/Presentation/Written Exam

Examination Scheme:

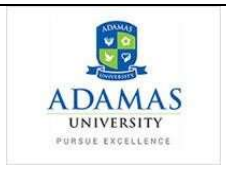
Components	Mid Term	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
Avg	3	3	2	3	3	3	3	3	1	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	

Course: BIC22525 – IMMUNOLOGY LAB

Program: M.Sc. Biochemistry **Time: 03Hrs.**

Semester:Odd 2020-21 **Max. Marks:50**

Instructions:
Answer the following questions"

SECTION A (Attempt **all questions) (10X2=20)**			
1.	Summarize the working principle of DOT-ELISA.	**Ap**	**CO1**
2.	Perform the procedure for latex agglutination test for the given sample/s and evaluate the results *(Practical skill- 5, Method accuracy -5)*	**AP**	**CO1, CO2**
SECTION B (Attempt all **questions) (10X2=20)**			
6.	Lab note book	**AP,AN,U,R**	**CO1, CO2, CO3, CO4. CO5**
7.	Viva	**AP,AN,U,R**	**CO1, CO2, CO3, CO4. CO5**

BIC21554	Applied Toxicology (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	UG level knowledge of Biochemistry and Cell Biology				
Co-requisites	--				

Course Objectives

The study on toxic substances have clinical and environmental significance. From this course the students will identify various approaches of toxicity analysis and therapeutics.

Course Outcomes

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

CO 1. Remembering-Recall the various types of clinical toxicity
CO 2. Understanding-Explain biochemical mechanisms of toxicity
CO 3. Analyzing-interpret toxic ingredients in food and cosmetics
CO 4. Applying-Apply various routs and mechanisms of environmental toxicity
CO 5. Evaluate-Develop the concept of toxicity analysis

Catalog Description

The elective course 'Appled toxicology' will help to understand the scope and domensions of toxicology. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject via exercise, case studies and discussions with the coordinator.

Course Content

Applied toxicology (BIC 21554)

UNIT-I Medical Toxicology: Mission of medical toxicology, Comparative toxicology, Human risk assessment, Toxicological database. Hepatic Toxicology Anatomy and physiology of the liver, Types of liver injury (acute and chronic), Hepatotoxic histological analysis of liver injury. Renal Toxicology Renal structure and functions, chemically induced renal, nephrotoxic potential of drugs and chemicals (with special reference to paraquat and amphotericin B) and their mechanism of action, histological analysis of renal injury. Pulmonary Toxicology, Lung toxicants (silica, asbestos, acid fumes) and their effects (acute and chronic) in occupational toxicology, pulmonary diseases and dysfunction (Asthma, COPD, and Lung cancer) by inhaled toxicants, in vitro and in vivo assessment of pulmonary injury, histological characterization of pulmonary injury. Reproductive Toxicology- heavy metals and genotoxicity. Neuro-toxiity: Pesticide and heavy metal induced. Neurotoxic chemicals found in food, drugs and environment.

UNIT-II: Biochemical Toxicology: Fundamentals of Toxicology and Dose- Response Relationships , Factors Affecting Toxic Responses: Disposition , Factors Affecting Toxic Responses, Biochemical Mechanisms of Toxicity, Toxicokinetics- Absorption, distribution, and storage of toxic chemicals. Metabolism of a toxicant. Biotransformation and detoxification reactions- Phase I and Phase II. Genotoxicity: Mechanisms and Methods Introduction and Importance of genotoxicity studies, classification of carcinogens, Mechanism of genotoxicity, Standard test battery for genotoxicity, In-Vitro testing methods, Ames teat, Mammalian chromosome aberration test, In-Vivo genotoxicity testing methods: Laddering and tunnels assay, comet assay, micronuclei test.

UNIT III: Food and cosmetic toxicology: Food adulterants, contaminants and Food additives toxicity Agricultural and industrial contaminants in foods (pesticides residues in fruits and vegetables, metal contaminants such as lead, arsenic and mercury in foods), Food additives and its mode of action in packed food, classification and mechanism of toxicity of food additives with special reference to BHT (Butylated hydroxyl toluene) and BHA (Butylated hydroxyl anisole), Toxicants in food Enzyme inhibitors, antivitamins, glycoalkaloids, saponins, goitrogens, teratogens. Mycotoxins -Aflatoxin B1 and its metabolism, toxicity and preventive measures Food borne bacterial illness with reference to Staphylococcus aureus and Bacillus cerus. Cause, Treatment and prevention of food allergies-marine foods. Cosmetic toxicity Cosmetic induced disorders. Defense mechanism of skin against UV radiation, Agencies role in launching a cosmetic finish product, Toxicity of shampoos, conditioners, bleachers and dyes, Toxicities evaluation of cosmetic products.

UNIT- IV: Environmental toxicology: Pesticide Toxicity Classification and use of and toxicity of major groups of pesticides, Herbicide toxicity and toxicity of major groups of herbicides. Biomagnification of pesticides. Method of analysis. Heavy Metal Toxicity: Acute and Chronic Toxicity of Metals, Lead, Mercury, Arsenic, Cadmium, Chromium, Mechanism of heavy metal toxicity, Heavy Metal Toxicity Pathway, Oxidative damage by heavy metals, Genotoxicity of heavy metals, Ecotoxicology of Metals. Toxicology of Chemical Warfare Agents Chemical weapons, management of chemical warfare agents.

UNIT-V: Analytical toxicology: Qualitative Descriptions of Toxicity Exposure Limits Determination of LD50 and ED50, Units in Toxicology. Analysis of pesticides by Chromatography Method. Analysis of heavy metals by Spectrophotometric Methods. Determination of heavy metals by Atomic Absorption Spectrophotometer. Determination of heavy metals by Atomic Emission Spectrophotometer, Inductively Coupled Plasma Spectrophotometers, Determination of drug of abuse. Estimating genotoxicity: Immunoassay Techniques: ELISA.

Textbook:

P.K. Gupta, Fundamentals of toxicology, ELSEVIER 2016

Reference books:

Text book of modern toxicology, Ernest Hodgson, WILEY, 2004

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

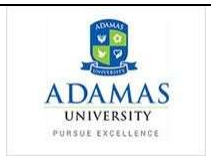
Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21554 – APPLIED TOXICITY (THEORY)

Program:M.Sc. (Biochemistry) **Time: 03Hrs.**

Semester: Odd **Max. Marks:50**

Instructions:

Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)

1.	**Analyze** arsenic toxicity.	**An**	**CO1**
2.	**Explain** why toxicological data base is required. .	**U**	**CO2**
3.	**Illustrate** why do proteins folding gets affected by heavy metals.	**R**	**CO3**
4.	**Describe** the use of Next Generation Sequencing (NGS) technology in determining genotoxicity	**U**	**CO4**
5	**Develop** a mass spectrometry-based toxin analysis protocol.	**AP**	**CO5**
	SECTION B (Attempt any Two questions) (10X2=20)		
6.	Elaborate majot groups of pesticides and explain their toxicity? How do herbicided recognize affect crop quality? Comprehend herbicide resistance as potential environmental hazard.	**U**	**CO3**
7.	Describe biomagnification and detoxification. Why amphotericin B) elicits nephrotoxicity? Elaborate laws for chemical decontamination. **2+4+4**	**U,AN**	**CO1** **CO2**
8	Define and classify poisons? How presence of a posison can be detected in a food sample? Elaborate heavy metal oxicity. **2+1+3+4+1+5+3**	**AN,AP, U**	**CO4** **CO5**

BIC21555	Environmental Toxicology (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	UG level knowledge of Biochemistry and Cell Biology				
Co-requisites	--				

Course Objectives

The study on toxic substances environmental significance. From this course the students will identify various approaches of toxicity analysis and therapeutics.

Course Outcomes

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

CO 1. Remembering- Recall different toxic substances affecting environment
CO 2. Understanding-Understanding toxicity inflicted by pesticide, herbicide, and heavy metals
CO 3. Analyzing-interpret toxic ingredients in food
CO 4. Applying-Describe a toxic substances present in and cosmetics
CO 5. Evaluate-Develop the concept of toxicity as an occupational hazard

Catalog Description

The elective course 'Environmental toxicology' will help to understand the scope and dimensions of toxicological aspects of environmental studies. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject via exercise, case studies and discussions with the coordinator.

Course Content

Environmantal toxicology (BIC 21555)

Unit-I Introduction to environmental toxicology, Hazardous substances in environment sources. Properties of toxic chemical influencing their distribution and accumulation. Bioaccumulation and biomagnifications. Toxicokinetics- Absorption, distribution, and storage of toxic chemicals. Metabolism of a toxicant. Biotransformation and detoxification reactions- Phase I and Phase II.
UNIT- II Pesticide Toxicity- Pesticide management, Toxic effects of pesticides: Pyrethroids, DDT, Organophosphate pesticides, Cyclodienes, Lindane, Carbamate, Method of analysis. Herbicide Toxicity- Herbicide Selectivity, mode of action, Benzoic acids (dicamba), Pyridines (picloram), Paraquat, Triazines (atrazine, cyanazine), Sulfonylureas (chlorsulfuron, tribenuron), Aryloxyphenoxypropionates (diclofop), Isoxamolidinones (clomazone). Heavy Metal Toxicity Acute and Chronic Toxicity of Metals, Lead, Mercury, Arsenic, Cadmium, Chromium, Mechanism of heavy

metal toxicity, Genotoxicity of heavy metals, Ecotoxicology of Metals . Heavy Metals in Medicine. Methods of analysis.
UNIT-III: Food toxicology: adulterants, contaminants and Food additives toxicity Agricultural and industrial contaminants in foods (pesticides residues in fruits and vegetables, metal contaminants such as lead, arsenic and mercury in foods), Food additives and its mode of action in packed food, classification and mechanism of toxicity of food additives with special reference to BHT (Butylated hydroxyl toluene) and BHA (Butylated hydroxyl anisole), Toxicants in food Enzyme inhibitors, antivitamins, glycoalkaloids, saponins, goitrogens, teratogens. Mycotoxins -Aflatoxin B1 and its metabolism, toxicity and preventive measures Food borne bacterial illness with reference to Staphylococcus aureus and Bacillus cerus.

UNIT-IV: Cosmetic toxicity: Cosmetic induced disorders such as acne, pruritis, nodules, papules etc. Defense mechanism of skin against UV radiation, Agencies role in launching a cosmetic finish product, Toxicity of shampoos, conditioners, bleachers and dyes, Toxicities evaluation of cosmetic products.
Unit- V Occupational toxicology: Occupational Hazards; Occupational Exposure, Occupational Disease; Occupational Dermatitis, Chloracne, Occupational Lung Diseases; COPD, Silicosis, Asbestosis, Asthama. Hazardous chemical substances and risk assessment of environmental chemical exposure. Rules and regulation governing release of hazardous chemicals into the environment.

Textbook:

P.K. Gupta, Fundamentals of toxicology, ELSEVIER 2016

Reference books:

Text book of modern toxicology, Ernest Hodgson, WILEY, 2004

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

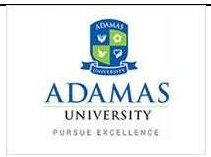
Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21555 – ENVIRONMENTAL TOXICITY (THEORY)
Program:M.Sc. (Biochemistry) **Time: 03Hrs.**
Semester: Odd **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)

1.	**Analyze** arsenic toxicity.	**An**	**CO1**
2.	**Explain** why toxicological data base is required. .	**U**	**CO2**
3.	**Illustrate** why do proteins folding gets affected by heavy metals.	**R**	**CO3**
4.	**Describe** the use of Next Generation Sequencing (NGS) technology in determining genotoxicity	**U**	**CO4**
5	**Develop** a mass spectrometry-based toxin analysis protocol.	**AP**	**CO5**
	SECTION B (Attempt any Two questions) (10X2=20)		
6.	Elaborate majot groups of pesticides and explain their toxicity? How do herbicided recognize affect crop quality? Comprehend herbicide resistance as potential environmental hazard.	**U**	**CO3**
7.	Describe biomagnification and detoxification. Why amphotericin B) elicits nephrotoxicity? Elaborate laws for chemical decontamination. **2+4+4**	**U,AN**	**CO1** **CO2**
8.	Define and classify poisons? How presence of a posison can be detected in a food sample? Elaborate heavy metal toxicity. Elaborate oxidative damage induced by heavy metals **2+1+3+4+1+5+3+1+3+4**	**AN,AP, U**	**CO3**

BIC21556	Advanced DNA forensics (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	UG level knowledge of Biochemistry and Cell Biology				
Co-requisites	--				

Course Objectives

The study on toxic substances environmental significance. From this course the students will identify various approaches of toxicity analysis and therapeutics.

Course Outcomes

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

CO 1. Remembering-Recall different genetic variation in population and its relevance in forensics
CO 2. Understanding-Explain fundamentals of DNA sequencing and its relevance in forensics
CO 3. Analysing-Interpret genomic variations at molecular level and its relevance in forensics
CO 4. Applying-Apply statistical approach for DNA typing and its relevance in forensics
CO 5. Evaluate-Evaluate the forensic significance of DNA profiling

Catalog Description

The elective course 'Advanced DNA forensics' will help to understand the scope and dimensions of state of the art DNA technologies in forensic science. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject via exercise, case studies and discussions with the coordinator.

Course Content

Advanced DNA forensics (BIC 21556)

Unit-I Human Genetics, Alleles, Mutations and Population Genetics, The concept of Genetics polymorphism, Hardy-Weinberg Law. Pedigree analysis.
Unit-II DNA sequencing. Sequencing of DNA- Sanger sequencing. Approaches for next gen sequencing. Long and short read sequencing. Genome assembly and annotation. Human genome project and variation data bases- SNPdb and OMIM.
Unit-III DNA Profiling: Introduction, History of DNA Typing, polymorphism, DNA Extraction-Organic and Inorganic extraction, Comparison of Extraction methods, RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, STR, Mitochondrial DNA, Ancient DNA typing, Evaluation of results. DNA figure printing.
Unit-IV DNA Statistics: frequency estimate calculations, interpretations, allele frequency determination, Paternity/Maternity index, Sibling index, Probability of match. Human Genome Project: Introduction, History, Goals, Benefits, Social, Ethical and Legal Issues DNA Forensic Databases
Unit-V Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife and agriculture cases, legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad. New and future technologies: DNA chips, SNPs and limitations of DNA profiling. Case studies.

Textbook:
P.K. Gupta, Fundamentals of toxicology, ELSEVIER 2016

Reference books:

Text book of modern toxicology, Ernest Hodgson, WILEY, 2004

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21554 – Advanced DNA forensics (THEORY)
Program:M.Sc. (Biochemistry) **Time: 03Hrs.**
Semester: Odd **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)			
1.	**Define: multiple allele**	**An**	**CO1**
2.	**Explain** gene pool and allele frequency	**U**	**CO2**
3.	**Illustrate** VNTR	**R**	**CO3**
4.	**Describe** the principle of Next Generation Sequencing (NGS) technology.	**U**	**CO4**
5	**Develop** an array based analysis protocol.	**AP**	**CO5**
	SECTION B (Attempt any Two questions) (10X2=20)		
6.	What is the role of dideoxyNTPs in Sanger sequencing? How do massively parallel sequencing is accomplished? **Illustrate** the steps of sequence assembly.	**U**	**CO3**
7.	Explain DNA fingure printing. Mention the features on mtDNA. How mtDNA anlaysis helps in forensics.- elaborate **2+4+4**	**U,AN**	**CO1** **CO2**
8.	Elaborate how DNA is extracted from forensic samples. Describe the use of PCR in forensics. If you need to determine paternal identity how can you implement DNA forensics? **2+1+3+4**	**AN,AP, U**	**CO3**

BIC21558	Advanced forensic chemistry (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	UG level knowledge of Biochemistry and Cell Biology				
Co-requisites	--				

Course Objectives

The study on forensic chemistry, i.e. chemical approaches in forensic science. From this course the students will identify various approaches of toxicity analysis and therapeutics.

Course Outcomes

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

CO1.Remembering: Students will be able to recall complex DNA extraction, quantification, and amplification techniques, including next-generation sequencing (NGS) and mitochondrial DNA analysis.

CO2. Understanding: Students will be proficient in interpreting genetic evidence, including understanding statistical methods used to assess the significance of DNA match results.

CO3. Analysing: Students will analyze real-world case studies to evaluate the role of DNA evidence in legal contexts, including its implications for justice and wrongful convictions.

CO4. Applying: Students will articulate the ethical issues surrounding DNA forensics, including privacy concerns, informed consent, and the potential for misuse of genetic information.

CO5: Evaluate: Students will demonstrate an understanding of the legal standards and guidelines governing the collection, analysis, and presentation of DNA evidence in court.

Catalog Description

The elective course 'Advanced forensic chemistry' will help to understand the scope and dimensions of state of the art DNA technologies in forensic science. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. Students will perceive the basic concepts of the subject via exercise, case studies and discussions with the coordinator.

Course Content

Advanced forensic chemistry (BIC 21558)

Unit I - Forensic Chemistry- Introduction. Trap cases, Preliminary analysis of evidence in trap cases. Alcoholic Beverages: Types of alcohols and analysis. Dyes: Scope & Significance of dyes in crime investigation, analysis of ink by TLC and UV visible spectrophotometry. Petroleum products and their adulterations. Analysis of petrol, kerosene, diesel.

Unit II- Forensic Toxicology Poisons- uses and origin. Types, routes of administration, toxicity, sign and symptoms of various poisons. Medico-legal aspects of poisoning cases. Pesticides: Different types and their formulations, identification of pesticides. Guidelines for collecting forensic evidences in poisoning cases at crime scene. Importance of Post mortem examination in poisoning cases. Sample preparation for the analysis of poisons in body tissues/fluids and analysis by various instrumental techniques.

Unit III- Narcotic Drugs and Psychotropic Substances. Scope and significance NDPS drugs in forensic science, NDPS Act, Classification and characterization of NDPS drugs, Sample preparation for analysis, Preliminary analysis of drugs, Drug laws and Reporting of drug cases, Drug abuse, Drug addiction and its problems.
Unit IV – Fire/Arson and Explosives Fire: Introduction to Fire & Arson, origin of fire, Chemistry of Fire, Firefighting operations, preservation of fire scene, collection of evidences, Analysis of fire debris, Case studies related to fire and Arson. Explosive and Explosion: Scope & significance of explosive analysis in forensic science, Types of explosives, deflagration and detonation, preliminary analysis of explosives.
Unit V: Case studies.

Textbook:

P.K. Gupta, Fundamentals of toxicology, ELSEVIER 2016

Reference books:

Text book of modern toxicology, Ernest Hodgson, WILEY, 2004Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

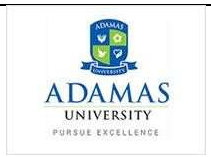
Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21558– Advanced forensic chemistry(THEORY)
Program:M.Sc. (Biochemistry) **Time: 03Hrs.**
Semester: Odd **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20) (5X4=20)			
1.	Define Trap cases. Mention analysis of evidence in trap cases.	**An**	**CO1**
2.	**Explain** how petroleum products are adulterated and how such adulteration might be detected.	**U**	**CO2**
3.	**Illustrate** why do proteins fold? What is peptide mass fingerprinting?	**R**	**CO3**
4.	**Describe** chemicaol anlaysis in postmortem for burn cases.	**U**	**CO4**
5	**Develop** a method to analyze fire debris	**AP**	**CO5**
	SECTION B (Attempt any Two questions) (10X2=20)		
6.	Define narcotics and psychodelics? **Illustrate** NDPS Act. How drug abuse can be confirmed? **3+2+5**	**U**	**CO3**
7.	Elaborate collection and forensic analysis of tissue fluids. Discuss the medico-legal aspects of poisoning cases.	**U,AN**	**CO1** **CO2**
8.	Elaborate how DNA is extracted from forensic samples. Describe the use of PCR in forensics. If you need to determine paternal identity how can you implement DNA forensics? **2+1+3+4**	**AN,AP, U**	**CO3**

BIC21532	Clinical Biochemistry (THEORY)	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	BSc. Level Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about instrumentation and automation in clinical biochemistry laboratories safety regulations.
- It will also provide in depth knowledge about different biochemical reactions that are used to determine different disease parameters.
- Outlining the types of specimen for biochemical analysis.
- To provide students different parameters like precision, accuracy, quality control, precautions and limitations that are used in clinical biochemistry.

Course Outcomes

On completion of this course, the students will be able to:
1. Remembering: Recall and describe the normal biochemical pathways in the human body
2. Understanding: Interpret the significance of abnormal biochemistry results in disease diagnosis and monitoring
3. Applying: Apply knowledge of biochemical pathways to analyze and interpret abnormal test results
4. Analyzing:Analyze and evaluate the correlations between biochemical changes and clinical manifestations of diseases
5. Evaluating: Critically evaluate the ethical implications of using biochemical tests in clinical practice

Catalog Description

The core-course of 'Clinical Biochemistry' will help to understand the basic idea about instrumentation and automation in clinical biochemistry. This course includes comprehensive approach through studying different biochemical reactions that are used to determine different disease parameters. Furthermore, the implication of precision, accuracy, quality control, precautions and limitations in different test results will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject viaexercise and discussions with the coordinator.

Course Content

DSE II: CLINICAL BIOCHEMISTRY

1. Disorders of Carbohydrate Metabolism – Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria,galactosemia.
2. Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides & phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies,Abetalipoproteinemia.
3. Inborn Errors of Metabolism – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia,Histidinemia.
4. Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea. Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney.Inulin and ureaclearance.
5. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption ofelectrolytes.
6. Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase,LDH.
7. Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogenbalance.
8. Blood Clotting – Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulatinganticoagulants.
9. Cancer – Cellular differentiation, carcinogens and cancertherapy

SUGGESTED READINGS

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata McGraw–Hill Publishing Company Limited (New Delhi). ISBN:9780070076594 /ISBN:9780070076631

2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests VoI. II (2010), Mukherjee, K.L., Tata McGraw – Hill Publishing Company Ltd. (New Delhi), ISBN:9780070076648.

3. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia),ISBN:0-7234-3341-0.
4. Experimental Biochemistry: A Student Companion (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi),ISBN:81-88237-41-8.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Question

Name:

Enrolment No:

Course: BIC21532 – Clinical Biochemistry (THEORY)
Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2019-20 **Max. Marks:50**

Instructions:
Attempt any **four** questions from **Section A** (each carrying 5 marks); any **two** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt any Four questions) (5X4=20)			
1.	Write short notes on galactosemia and glycogen storage disease.	**U,R**	**CO1**
2.	How can you measure blood glucose level? What is the normal range of blood sugar level?	**U,R**	**CO2**
3.	What is glycemic index? Describe various mechanisms for regulation of blood glucose.	**U,R**	**CO3**
4.	What is liver function test? Explain your answer.	**U,R**	**CO4**
5	Explain the formation, function and clinical significance of thyroid hormones.	**U,R**	**CO5**
	SECTION B (Attempt any 3 questions) (10X3=30)		
6.	Briefly demonstrate the importance of automation in a clinical laboratory.	**U,R**	**CO2**
7.	Do you think measuring blood sugar level in fasting condition is a true representation of sugar level for a diabetic patient? **Explain**. If not, what will be better technique to monitor blood sugar level for a diabetic patient? Why?	**U,CR**	**CO1** **CO2**
8.	Describe the laboratory investigation of kidney disease. Discuss the potential pitfalls and how can you overcome the pitfalls.	**AN**	**CO1** **CO2**
9.	What is Atherosclerosis? What are the risk factors for coronary artery disease? What is the link between smoking and heart disease? Explain your answer.	**AN,AP**	**CO4** **CO5**

BIC21529	DSE-II Research Methodologies and GLP (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 45**	3	0	0	3
Pre-requisites/Exposure	BSc. Level Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about how to understand and formulate a good researchplan.
- It will also provide in depth knowledge about plagiarism and how to follow research ethics.
- To illustrate good, automated laboratorypractice.
- To describe quality management system in a researchlab.

Course Outcomes

On completion of this course, the students will be able to:
CO1. Remember: Recall and explain the fundamental principles of research methodologies in biochemistry.
CO2. Understand: Analyze and compare different research paradigms in biochemistry.
CO3. Apply: Design and implement appropriate study designs for biochemistry research projects.
CO4. Analyze: Evaluate the importance of Good Laboratory Practices (GLP) and work standards in biochemistry research.
CO5. Evaluate: Critically assess the validity and reliability of research findings in biochemistry.

Catalog Description

The core-course of 'Research Methodology and GLP' will help to define fundamental knowledge about how to understand and formulate a good research plan.This course includes comprehensive approach to understand plagiarism and to follow research ethics. Furthermore, the implications of good, automated laboratory practice and quality management system will also be illuminated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

DSE-II Research Methodology and GLP

1. Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations. [**5 Lecture Hours]**
2. Effective literature studies approach, analysis Plagiarism, Research ethics. [**5 Lecture Hours]**
3. Effective technical writing, how to write report, Developing a Research Proposal, Format of research proposal, presentation and assessment by a review committee. [**5 Lecture Hours]**
4. Introduction to the WHO/TDR Handbook on GLP; Current Good Manufacturing Practices: [**5 LectureHours]**
5. Introduction, US Cgmp Part 210 and Part 211.EC Principles of GMP (Directive 91/356/EEC) Article 6 to Article 14 and WHO cGMP guidelines GAMP-5; Medical device and IVDs Global Harmonization Task Force (GHTF) Guidancedocs.
6. Introduction, USFDA GLP Regulations (Subpart A to Subpart K), Controlling the GLP inspection process, Documentation, Audit, goals of Laboratory Quality Audit, Audit tools, Future of GLP regulations, relevant ISO and Quality Council of India (QCI) Standards. [**5 LectureHours]**
7. Good Automated LaboratoryPractices:
8. Introduction to GALP, Principles of GALP, GALP Requirements, SOPs of GALP, Training Documentation,21 CFR Part 11, General check list of 21CFR Part 11, Software Evaluation checklist, relevant ISO and QCI Standards. [**5 LectureHours]**
9. Good DistributionPractices:
   Introduction to GDP, Legal GDP requirements put worldwide, Principles,
10. Personnel, Documentation, Premises and Equipment, Deliveries to Customers, Returns, Self-Inspection, Provision of information, Stability testing principles, WHO GDP, USP GDP (Supply chain integrity), relevant CDSCO guidance and ISO standards[**5 LectureHours]**
11. Quality management systems: [**5 LectureHours]**

    Concept of Quality, Total Quality Management, Quality by design, Six Sigma concept, Out of Specifications (OOS), Change control. Validation: Types of Validation, Types of Qualification, Validation master plan (VMP), Analytical Method Validation. Validation of utilities, [Compressed air, steam, water systems, Heat Ventilation and Air conditioning (HVAC)]and Cleaning Validation. The International Conference on Harmonization (ICH) process, ICH guidelines to establish quality, safety and efficacy of drug substances and products, ISO 13485, Sch MIII and other relevant CDSCO regulatory guidancedocuments.

References:

1. Montgomary, Douglas C. (2007) 5/e, Design and Analysis of Experiments(Wiley India).
2. Krishnswamy, K.N., Shivkumar, AppaIyer and Mathiranjan M. (2006) Management Research Methodology; Integration of Principles, Methods and Techniques(Pearson Education, NewDelhi)
3. Good Laboratory Practice Regulations, by Sandy Weinberg, Fourth Edition Drugsand the Pharmaceutical Sciences,Vol.168
4. Good Laboratory Practice Regulations, by Sandy Weinberg, Fourth Edition Drugsand the Pharmaceutical Sciences,Vol.16

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Avg	3	3	2	3	3	-	-	3	-	-	1	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	

Course: BIC21529 – DSE-II Research Methodology and GLP (THEORY)

Program: M.Sc. Biochemistry **Time: 03Hrs.**
Semester:Odd 2020-21 **Max. Marks:50**

Instructions:
Attempt all questions each carrying 20 marks

	Presentation of research in a seminar	**AN,AP, R**	**ALL POs**
	Question answer session	**AP, CR**	**ALL POs**

BIC24535	Industry Internship (Practical)	L	T	P	C
Version 1.0	Contact Hours	0	0	0	2
Pre-requisites/Exposure	BSc. Level Biochemistry Knowledge				
Co-requisites	--				

Course Objectives

- To provide students basic idea about work habits and attitudes necessary for job success.
- It will also illustrate the career alternatives prior tograduation.
- To develop communication, interpersonal and other critical skills in the job interview process.
- To provide students the ability to analyze interests and abilities in their field ofstudy.

Course Outcomes

On completion of this course, the students will be ableto:

CO 1 Remembering-Recall work habits and attitudes necessary for job success.

CO 2 Understanding-Understanding career alternatives prior to graduation.

CO 3 Apply-Develop communication, interpersonal and other critical skills in the job interview process.

CO 4 Analysing-Develop interests and abilities in their field of study.

CO 5 Evaluate-Evaluate employment contacts leading directly to a full-time job following graduation from college.

Catalog Description

The practical course of 'Industry Internship' will help to develop work habits and attitudes necessary for job success. This course includes comprehensive approach to develop communication, interpersonal and other critical skills in the job interview process. Furthermore, interests and abilities in their field of study will also be illuminated. The practical experience will enable students to enrich in real-life scenario. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject via exercise and discussions with the coordinator

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

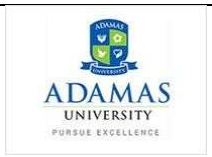
Components	Report submission	Presentation
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Avg	3	3	3	1	3	3	3	3	3	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

[redacted]

Name: **Enrolment No:**	

Course BIC21533– Industry Internship (Practical)

Program: M.Sc. Biochemistry **Time: 03Hrs.**

Semester:Odd 2020-21 **Max. Marks:50**

Presentation on the work

BIC21539	Comprehensive viva	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Knowledge about the biochemistry at M.Sc level and contemporary research in Biochemistry				
Co-requisites	-				

Course Objectives

1. Defining and outlining a research area with a clearquestion
2. Identifying the leadingissues
3. Sourcing the relevantinformation
4. Evaluating the evidence on all sides of adebate
5. Coming to a well-arguedconclusion

Course Outcomes

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

CO1. Remember-Recall their knowledge during their interview for biochemistry related jobs.
CO2. Understand-Explore their knowledge during their interview for biochemistry related research fields.
CO3. Apply- Develop the skill to conclude a scientific fact.
CO4. Analyse-Discuss about the biochemical data.
CO5. Evaluate-Establish himself/herself as a good biochemist in society.

Catalog Description

The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Biochemistry acquired over 2 years of study in the postgraduate program

Course Content

1. Reading of Biochemistry Text books,very recent research papers from highimpact journals containing biochemical research work and also performance of laboratory based research orientedexperiments.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

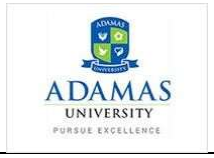
Components	Presentation
Weightage (%)	100

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Avg	3	3	3	1	3	3	3	3	3	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	

Course: BIC21538 –Comprehensive Viva
Program:M.ScBiochemistry **Time: 01 Hrs.**
Semester: Even 2020-21 **Max. Marks:100**

Instructions:
Attempt any two questions from Section A (each carrying 10 marks); Section B (each carrying 10 marks)isCompulsory.

Answer all asked questions

BIC25540	Dissertation	L	T	P	C
Version 1.0		0	0	0	12
Pre-requisites/Exposure	Knowledge about the basic knowledge and contemporary research in Biochemistry				
Co-requisites	-				

Course Objectives

6. Defining and outlining a research area with a clearquestion
7. Identifying the leadingissues
8. Sourcing the relevantinformation
9. Assessing its reliability andlegitimacy
10. Evaluating the evidence on all sides of adebate
11. Coming to a well-arguedconclusion

Course Outcomes

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

Upon completion of the Dissertation course, students will be able to:

1. **Conduct Independent Research**: Design and implement a research project that demonstrates the ability to identify, formulate, and address a significant problem using cutting-edge techniques.
2. **Apply Experimental Methods**: Utilize appropriate experimental methods to collect, analyze, and interpret data, ensuring methodological rigor and relevance to the field of study.
3. **Engage with Current Literature**: Critically review and synthesize existing literature to contextualize their research within the broader academic discourse, identifying gaps and potential contributions.
4. **Demonstrate Project Management Skills**: Effectively manage all phases of the dissertation project, from proposal development through to execution and final presentation, ensuring adherence to timelines and academic standards.
5. **Communicate Findings**: Present research findings clearly and effectively, utilizing appropriate formats (written, oral, and visual) to communicate complex ideas to diverse audiences.

Catalog Description

Dissertation allows students present their findings in response to a question or proposition that they choose themselves. The aim of the project is to test the independent research skills students have acquired during their time at university, with the assessment used to help determine their final grade. Although there is usually some guidance from your tutors, the dissertation project is largelyindependent.

Course Content

1. Reading of very recent research papers from high impact journals containing biochemical research work and also performance of laboratory based researchoriented experiments.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

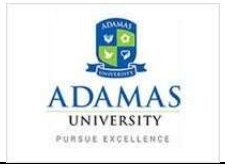
Components	Thesis	Presentation
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

CO Number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Avg	3	3	3	1	3	3	3	3	3	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	
Course: BIC25539 –Dissertation **Program:M.ScBiochemistry** **Time: 01 Hrs.** **Semester: Even 2020-21** **Max. Marks: 50**	
Presentation	

CO PO relationship

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BIC21501												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21503												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21507												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21528												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21541												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22542												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22527												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3

CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22570												
CO1	-	3	3	1	3	3	3	3	-	3	2	2
CO2	-	3	3	1	3	3	3	3	-	3	2	2
CO3	-	3	3	1	3	3	3	3	-	3	2	2
CO4	-	3	3	1	3	3	3	3	-	3	2	2
CO5	-	3	3	1	3	3	3	3	-	3	2	2
BIC21511												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21512												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22543												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21544												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22545												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC21546												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3

CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22547												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22519												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22520												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21509												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22510												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21522												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21536												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3

CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22549												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC21550												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21551												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC22552												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22553												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC21513												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3
CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC22523												
CO1	3	3	2	3	3	3	3	3	1	3	3	3
CO2	3	3	2	3	3	3	3	3	1	3	3	3

CO3	3	3	2	3	3	3	3	3	1	3	3	3
CO4	3	3	2	3	3	3	3	3	1	3	3	3
CO5	3	3	2	3	3	3	3	3	1	3	3	3
BIC21554												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21555												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21556												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21558												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21532												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC21529												
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
BIC24535												
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3

CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
BIC21534												
CO1	3	3	3	2	3	3	3	3	2	3	3	2
CO2	3	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3	2	3	3	2
CO4	3	3	3	2	3	3	3	3	2	3	3	2
CO5	3	3	3	2	3	3	3	3	2	3	3	2
BIC21539												
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
BIC25540												
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
BIC22570												
CO1	-	3	3	1	3	3	3	3	-	3	2	2
CO2	-	3	3	1	3	3	3	3	-	3	2	2
CO3	-	3	3	1	3	3	3	3	-	3	2	2
CO4	-	3	3	1	3	3	3	3	-	3	2	2
CO5	-	3	3	1	3	3	3	3	-	3	2	2
BIC22571												
CO1	-	3	3	1	3	3	3	3	-	3	2	2
CO2	-	3	3	1	3	3	3	3	-	3	2	2
CO3	-	3	3	1	3	3	3	3	-	3	2	2
CO4	-	3	3	1	3	3	3	3	-	3	2	2
CO5	-	3	3	1	3	3	3	3	-	3	2	2
BIC22572												
CO1	-	3	3	1	3	3	3	3	-	3	2	2
CO2	-	3	3	1	3	3	3	3	-	3	2	2
CO3	-	3	3	1	3	3	3	3	-	3	2	2
CO4	-	3	3	1	3	3	3	3	-	3	2	2
CO5	-	3	3	1	3	3	3	3	-	3	2	2
Total	555	615	450	540	615	270	270	615	105	225	320	591
Total Courses	48											
Average	2.3125	2.5625	1.875	2.25	2.5625	1.125	1.125	2.5625	0.4375	0.9375	1.333333	2.4625