ADAMAS
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PURSUE EXCELLENCE
KOLKATA

ADAMAS UNIVERSITY

SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY

Department of Microbiology

B.Sc. (Hons) in Microbiology

Program code: MIB 3302

(2022-25)

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ADAMAS UNIVERSITY, KOLKATA

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF MICROBIOLOGY

VISION OF THE UNIVERSITY

To be an internationally recognized university through excellence in inter-disciplinary education, research and innovation, preparing socially responsible well-grounded individuals 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 centres 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 MICROBIOLOGY

VISION OF THE SCHOOL

To achieve global standard and **excellence in research** on various **interdisciplinary and multidisciplinary 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 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.

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

DEAN / SCHOOL CONCERNED

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF MICROBIOLOGY

VISION OF THE DEPARTMENT

To achieve **excellence in microbiological education and research** for **societal development** through **innovation** and producing **technologically sound graduates** as **global citizen** fostering **life-long learning.**

MISSION STATEMENTS OF THE DEPARTMENT

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

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

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

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

Rudraprasad Saha

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF MICROBIOLOGY

Name of the Programme: B.Sc. Microbiology

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 01 : Acquire basic theoretical and practical domain knowledge.
PEO 02 : Acquainted with tools and technology related to the field of study.
PEO 03 : Ability to do identify research gaps, comprehend fundamentals and specialize in the domain.
PEO 04 : Develop as professional aspirants and sustainable learners.
PEO 05 : Global outlook with imbibed human values

Rudraprasad Saha

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF MICROBIOLOGY

Name of the Programme: B.Sc. in Microbiology

GRADUATE ATTRIBUTE / PROGRAMME OUTCOME (PO)

GA 01/ PO 01: Strong fundamental knowledge in basic and applied field of microbiology.
GA 02/ PO 02: Ability to correlate between courses and develop critical/logical thinking.
GA 03/ PO 03: Develop skill set related to microbiology and allied fields.
GA 04/ PO 04: Familiarized with classical as well as modern tools and techniques in microbiology.
GA 05/ PO 05: Ability to identify scientific research gaps and problems pertaining to microbiology and allied fields.
GA 06/ PO 06: Explore the acquired knowledge and skills of microbiology to identify approaches for suitable solution.
GA 07/ PO 07: Ability to retrieve biological data for a meaningful solution.
GA 08/ PO 08: Decide upon career path, force the challenges and develop professional aspirations.
GA 09/ PO 09: Uphold integrity and collaborative approach in workplace.
GA 10/ PO 10: To accept and implement learning towards sustainable development.
GA 11/ PO 11: Practice ethical philosophies and systems in creating and partnering a progressive society.
GA 12/ PO 12: Develop as global citizen to contribute in the greater benefits of humanity.

Rudraprasad Saha

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY

DEPARTMENT OF MICROBIOLOGY

B.Sc. in Microbiology Semester - I

Type of the Course	Revised course code	Course Name	Contact Hours Per Week	L	T	P	Credit
CORE Theory	**MIB11001**	**Introduction to Microbiology and Microbial Diversity**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12002**	**Introduction to Microbiology and Microbial Diversity Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11003**	**Biochemistry**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12004**	**Biochemistry Lab**	**3**	**0**	**0**	**3**	**2**
AECC I	**ENG11057**	**English Language and Literature**	**2**	**1**	**1**	**0**	**2**
FOUNDATION	**DGS11001**	**Design Thinking**	**2**	**2**	**0**	**0**	**2**
Generic Elective 1 (GE1) Theory	**BOT11001/ ZOL11001**	**Any one of the following: Elective Botany I / Elective Zoology I**	**4**	**3**	**1**	**0**	**4**
Generic Elective 1 (GE1) Practical	**BOT12002/ ZOL12002**	**Corresponding Practical (any one): Elective Botany I Lab / Elective Zoology I Lab**	**3**	**0**	**0**	**3**	**2**
Total			**25**	**12**	**4**	**9**	**22**

*6 credit course for non lab based subject

ADAMAS UNIVERSITY

DEPARTMENT OF MICROBIOLOGY

B.Sc. Microbiology Semester - II

Type of the Course	Revised course code	Course Name	Contact Hours Per Week	L	T	P	Credit
CORE Theory	**MIB11005**	**Bacteriology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12006**	**Bacteriology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11007**	**Virology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12008**	**Virology Lab**	**3**	**0**	**0**	**3**	**2**
AECC II Theory	**EVS11112**	**Environmental Science and Energy Resources**	**2**	**2**	**0**	**0**	**2**
FOUNDATION	**EIC11001**	**Venture Ideation**	**2**	**2**	**0**	**0**	**2**
Generic Elective 2# (GE2*) Theory	**BOT11003/ ZOL 11003**	**Any one of the following:** **Elective Botany II / Elective Zoology II /**	**4**	**3**	**1**	**0**	**4**
Generic Elective 2# (GE2*) Practical	**BOT12004/ ZOL12004**	**Corresponding Practical (any one):** **Elective Botany II Lab / Elective Zoology II Lab**	**3**	**0**	**0**	**3**	**2**
Total			**25**	**13**	**3**	**9**	**22**

*6 credit course for non lab based subject; # same subject to be continued as in semester I

ADAMAS UNIVERSITY
DEPARTMENT OF MICROBIOLOGY

B.Sc. Microbiology Semester - III

Type of the Course	**Revised course code**	**Course Name**	**Contact Hours Per Week**	**L**	**T**	**P**	**Credit**
CORE Theory	**MIB11009**	**Cell Biology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12010**	**Cell Biology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11011**	**Microbial Genetics**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12012**	**Microbial Genetics Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11013**	**Environmental Microbiology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12014**	**Environmental Microbiology Lab**	**3**	**0**	**0**	**3**	**2**
FOUNDATION Skill Enhancement Course I (SEC I) Theory	**MIB11015/ MIB11016**	**Microbial Quality Control in Food and Pharmaceutical Industries / Food Fermentation Techniques**	**2**	**0**	**0**	**0**	**2**
FOUNDATION	**SOC14100**	**Community Service**	**-**	**-**	**-**	**-**	**1**
FOUNDATION	**IDP14001**	**Interdisciplinary Project**	**3**	**0**	**0**	**3**	**3**
Generic Elective $3^{\#}$ (GE3*) Theory	**PHY11015/ CSE11641/ CHM11151/ SDS11506**	**Any one of the following: Elective Physics I / Elective Computer Science I / Elective Chemistry I/ Elective Statistics I* /**	**4**	**3**	**1**	**0**	**4**
Generic Elective $3^{\#}$ (GE3*) Practical	**PHY12016/ CSE12642/ CHM12152**	**Corresponding Practical (any one): Elective Physics ILab/ Elective Computer Science ILab/ Elective Chemistry ILab/**	**3**	**0**	**0**	**3**	**2**
Total			**33**	**12**	**4**	**15**	**30**

*6 credit course for non lab based subject

ADAMAS UNIVERSITY DEPARTMENT OF MICROBIOLOGY							
B.Sc. Microbiology Semester - IV							
	Revised course code	**Course Name**	**Contact Hours Per Week**	**L**	**T**	**P**	**Credit**
CORE Theory	**MIB11017**	**Molecular Biology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12018**	**Molecular Biology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11019**	**Immunology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12020**	**Immunology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11021**	**Microbial Physiology and Metabolism**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12022**	**Microbial Physiology and Metabolism Lab**	**3**	**0**	**0**	**3**	**2**
FOUNDATION Skill Enhancement Course II (SEC II) Theory	**MIB11023 / MIB11024**	**Any one of the following:** **Microbial Diagnosis in Health Clinics /** **Management of Human Microbial Diseases**	**2**	**2**	**0**	**0**	**2**
FOUNDATION	**PSG11021**	**Human Values and Professional Ethics**	**2**	**2**	**0**	**0**	**2**
Generic Elective 4# (GE4*) Theory	**PHY11024 /CSE11643/CHM11153/ SDS11507**	**Any one of the following:** **Elective Physics II /** **Elective Computer Science II /** **Elective Chemistry II /** **Elective Statistics II* /**	**4**	**3**	**1**	**0**	**4**
Generic Elective 4# (GE4*) Practical	**PHY12025 /CSE12644/CHM12154**	**Corresponding Practical (any one):** **Elective Physics II Lab/** **Elective Computer Science II Lab/** **Elective Chemistry II Lab/**	**3**	**0**	**0**	**3**	**2**
Total			**32**	**16**	**4**	**12**	**28**

*6 credit course for non lab based subject; # same subject to be continued as in semester III

ADAMAS UNIVERSITY **DEPARTMENT OF MICROBIOLOGY**							
B.Sc. Microbiology Semester - V							
Type of Course	**Revised course code**	**Course Name**	**Contact Hours Per Week**	**L**	**T**	**P**	**Credit**
CORE Theory	**MIB11025**	**Food and Diary Microbiology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12026**	**Food and Diary Microbiology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11027**	**Recombinant DNA Technology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12028**	**Recombinant DNA Technology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Discipline Specific Elective I (DSE I) Theory	**MIB11029/** **MIB11030/** **MIB11031**	**Any one of the following:** **Bioinformatics /** **Biomathematics and Biostatistics/** **Plant Pathology**	**4**	**3**	**1**	**0**	**4**
CORE Discipline Specific Elective I (DSE I) Practical	**MIB12032/** **MIB12033/** **MIB12034**	**Corresponding Practical (any one):** **Bioinformatics Lab /** **Biomathematics and Biostatistics Lab/** **Plant Pathology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Discipline Specific Elective II (DSE II) Theory	**MIB11035/** **MIB11036/** **MIB11037**	**Any one of the following:** **Microbial Biotechnology/** **Advances in Microbiology/** **Inheritance Biology**	**4**	**3**	**1**	**0**	**4**
CORE Discipline Specific Elective II (DSE II) Practical	**MIB12038/** **MIB12039/** **MIB12040**	**Corresponding Practical (any one):** **Microbial Biotechnology Lab/** **Advances in Microbiology Lab/Inheritance Biology Lab**	**3**	**0**	**0**	**3**	**2**
FOUNDATION	**MIB14041**	**Industry Internship**					**2**
Total			**28**	**12**	**4**	**12**	**26**

*6 credit course for non-lab based subject.
Note: Offer of DSE courses may vary from year to year based on availability of faculty

ADAMAS UNIVERSITY
DEPARTMENT OF MICROBIOLOGY

B.Sc. Microbiology Semester - VI

Type of the course	Revised course code	Course Name	Contact Hours Per Week	L	T	P	Credit
CORE Theory	**MIB11042**	**Medical Microbiology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12043**	**Medical Microbiology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Theory	**MIB11044**	**Industrial Microbiology**	**4**	**3**	**1**	**0**	**4**
CORE Practical	**MIB12045**	**Industrial Microbiology Lab**	**3**	**0**	**0**	**3**	**2**
CORE Discipline Specific Elective III (DSE III) Theory	**MIB11046/ MIB11047**	**Any one of the following:** **Microbial Physiology / Biosafety and Intellectual Property Rights* /**	**4**	**3**	**1**	**0**	**4**
CORE Discipline Specific Elective III (DSE III) Practical	**MIB12048**	**Corresponding Practical (any one):** **Microbial Physiology Lab**	**3**	**0**	**0**	**3**	**2**
	MIB15049	**Dissertation**	**6**	**0**	**0**	**6**	**6**
FOUNDATION (any one)	**MIB15050/ MIB14051**	**Seminar on Contemporary Research in Microbiology/ Educational tour**	**2**	**2**			**2**
Total			**29**	**11**	**3**	**15**	**26**

*Any one of two

Total credit distribution semester-wise:

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**Total**
Credits	22	22	30	28	26	26	154

NB: 1 credit ~ 15 contact hours

MIB11001	**Introduction to Microbiology and Microbial Diversity**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12th level 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. **Discuss** andanalysethe contributions of various microbiologists in shaping the field of Microbiology
CO2. **Compare**and contrast structures and functions between prokaryotic and eukaryotic cells
CO3. **Explore** the diversity of microbial world
CO4. List and **describe** the scope of microbiology

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 of Microbes; Overview of history of Microbiology: Biogenesis and abiogenesis. Contributions of Redi, Spallanzani, Needham, Pasteur, Lister, Koch, Jenner and Flemming. Scope of Microbiology. Notable contributions in the development of Microbiology: i) Spontaneous generation(abiogenesis). ii) Biogenesis. iii) Germ Theory of Disease. iv) Koch's Postulates. Development of the field of soil microbiology: Contributions of Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A. Waksman. Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Elie Metchnikoff, Edward Jenner. Technological Microbiology and contributions of Ananda Chakraborty and patenting. Role of Warner Arber, Hamilton Smith, Daniel Nathans in the discovery of restriction enzymes. Contributions of Kary Mulis 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, Fimbriae and Flagella.

Components internal to the Cell envelope: Cytoplasmic matrix, Inclusion bodies, Ribosome; Bacterial chromosomes and plasmids; Bacterial endospores 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 kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms

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 reproduction and economic importance.

• Algae

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

• Fungi

Historical developments in the field of Mycology including significant contributions of eminent mycologists. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic importance 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 to food, 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 Tortora, G.J.; Funke, B.R.; Case, C.L. Microbiology: An introduction. Pearson Education: 2015.

R2 Madigan MT, Martinko JM, Dunlap PV and Clark DP. Brock Biology of Microorganisms, 14th edition, Pearson International Edition, 2014

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

Examination Scheme:

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

Course Outcomes for MIB11001

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** and **analyse** the roles of various microbiologists and their contributions in shaping Microbiology	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8, PO12**
CO2	Students will be able to **compare** and **contrast** between cellular structures and function and distinguish between prokaryotic and eukaryotic cells	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8,**
CO3	Students will be able to **explore** the diversity of microbial world	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8, PO11**
CO4	Students will be able to **discuss** scope of microbiology	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8, PO9, PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11001	Introduction to Microbiology and Microbial Diversity	3	3	3	3	3	3	3	3	1	1	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB11001 –Introduction to Microbiology and Microbial Diversity
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

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 harbour multiple chromosomes. What are the major types of bacterial plasmids? Mention an example each	**6**	**CO2**

	type of plasmid. (R, U)		
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, An)	**6**	**CO3**
10	Discuss the four major categories of medically relevant fungi using a table (R, U)	**6**	**CO4**

MIB12002	**Introduction to Microbiology and Microbial Diversity Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	12th 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. Students will be able to explain and **demonstrate** safety measures in the Microbiology Lab

CO2. Students will be able to **demonstrate** various components of a compound microscope

CO3. Students will be able to **prepare** media, grow and isolate microbes in the laboratory

CO4. Students will be able to **summarize,** demonstrate and discuss procedure of simple staining, negative staining and Gram staining.

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**

<u>Course Outcomes for MIB12002</u>

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to explain and **demonstrate** safety measures in the Microbiology Lab	**PO1, PO2, PO3,PO4,PO5, PO6, PO7,PO10, PO11**
CO2	Students will be able to **demonstrate** various components of a compound microscope	**PO1, PO2, PO3,PO4,PO5, PO6, PO7,PO8**
CO3	Students will be able to **prepare** media, grow and isolate microbes in the laboratory	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8, PO11**
CO4	Students will be able to **summarize,** demonstrate and discuss procedure of simple staining, negative staining and Gram staining.	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
MIB12002	Introduction to Microbiology and Microbial Diversity Lab	3	3	3	3	2	3	3	-	-	-	-	-

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

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE		
Course: MIB12002 –Introduction to Microbiology and Microbial Diversity Lab **Program: B.Sc. Microbiology Time: 03 Hrs.** **Semester: Odd 2020-21 Max. Marks: 50** **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**

MIB11003	**Biochemistry (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Plus Two (12th) Level Biology				
Co-requisites	--				

Course Objectives

1. To provide students a thorough knowledge on bio-macromolecules like carbohydrates, proteins and lipids.
2. It will also provide in depth knowledge of structural and functional diversity of carbohydrates, proteins and lipid.
3. Elaborating properties of enzymes and vitamins along with their importance.
4. Comprehend laws of thermodynamics and ionic equilibrium in relation to biochemical pathways.

Course Outcomes

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

1. Students will be able to **explain** various structural aspects of biomolecules like carbohydrate, protein, lipid etc.
2. Students will be able to **interpret** the structure function relationship of biomolecules.
3. Students will be able to **identify** important aspects of biomolecules for their future utilization**.**
4. Students will be able to **analyze** the role biomolecules in the living world.
5. Students will be able to **relate** laws of thermodynamics and ionic equilibrium in biochemical pathways.

Catalogue Description

The core-course of 'Biochemistry' will help to understand the structure and function of bio-macromolecules like carbohydrates, proteins and lipids. The syllabus includes all the properties of enzymes and vitamins which provide ample scope for their future utilization. The course also relates laws of thermodynamics and ionic equilibrium in biochemical pathways.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

Biochemistry (MIB11003)

Unit 1 Carbohydrates (10 h)

Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Haworth projection formulae for glucose; chair and boat forms of glucose, Sugar derivatives, glucosamine, galactosamine, muramic acid, N- acetyl neuraminic acid, Disaccharides; concept of reducing and non-reducing sugars, occurrence and Haworth projections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch and glycogen. Structural Polysaccharides, cellulose, peptidoglycan and chitin

Unit 2 Proteins (15 h)

Structure and functions of proteins; Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitterion. Titration curve of amino acid and its Significance, Classification, biochemical structure and notation of standard protein amino acids Ninhydrin reaction. Natural modifications of amino acids in proteins hydroxyllysine, cystine and hydroxyproline, Structure and functions of naturally occurring glutathione and insulin and synthetic aspartame, Secondary structure of proteins: Peptide unit and its salient features. The alpha helix, the beta pleated sheet and their occurrence in proteins, Tertiary and quaternary structures of proteins. Forces holding the polypeptide together. Human haemoglobin structure, Quaternary structures of proteins, Ramachandran Plot

Unit 3 Lipids(10 h)

Definition and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions. Essential fatty acids. Triacylglycerols structure, functions and properties. Saponification Structural lipids. Phosphoglycerides: Building blocks, General structure, functions and properties. Structure of phosphatidylethanolamine and phosphatidylcholine, Sphingolipids: building blocks, structure of sphingosine, ceramide. Special mention of sphingomyelins, cerebrosides and gangliosides, Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers, structure of cholesterol and steroids

Unit 4 DNA and RNA (5 h)

Structures and chemistry of DNA and RNA, DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides.

Unit 5 Enzymes and vitamins (10h)

Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme
NAD, metal cofactors, Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis. Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanism, Definitions of terms – enzyme unit, specific activity and turnover number, Multienzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase, Effect of pH and temperature on enzyme activity. Enzyme inhibition: competitive- sulfa drugs; uncompetitive, non-competitive-heavy metal salts. Classification and characteristics with suitable examples, sources and importance of vitamins

Unit 6 Bioenergetics (5 h)

Concepts of systems and surroundings, Zeroth Law, First and second laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant Coupled reactions and additive nature of standard free energy change, Energy rich compounds: Phosphoenolpyruvate, 1,3- Bisphosphoglycerate, Thioesters, ATP, Numerical problems

Unit 7 Acid, Bases and Salts (5 h)

Arrhenius Concept of Acid and bases, Lewis concept of acids and bases, Concept of pH, Relation between pH and pOH, pH scale, Buffer solution, Types of buffers, Henderson-Hasselbalch equation, Concept of salts, Hydrolysis of salts, Solubility product, Ionic product of water, Numerical problems

Text Book:
T1. Nelson DL and Cox MM (2013) Lehninger principles of biochemistry, 6th edition, W.H. Freeman

Reference books
R1. Campbell, MK (2012). Biochemistry, 7th edition, Cengage Learning
R2. Berg JM, Tymoczko JL and Stryer L (2011). Biochemistry, 7th edition, WH Freeman
R3. Voet D and Voet JG (2004). Biochemistry, 3rd edition, John Wiley and Sons

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** various structural aspects of biomolecules like carbohydrate, protein, lipid, etc.	**PO1, PO2**
CO2	Students will be able to **interpret** the structure function relationship of biomolecules	**PO1, PO2, PO5**
CO3	Students will be able to **identify** important aspects of biomolecules for their future utilization	**PO2, PO3, PO5**
CO4	Students will be able to **analyze** the role biomolecules in the living world	**PO2, PO3, PO5, PO6**
CO5	Students will be able to **relate** laws of thermodynamics and ionic equilibrium in biochemical pathways	**PO1, PO2,**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
MIB11003	BIOCHEMISTRY (THEORY)	3	3	2	-	2	1	-	-	-	-	-	-

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

[redacted]

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course:MIB11003- BIOCHEMISTRY (THEORY)
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

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

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

1.	What is glycosidic linkage and peptide bond? **Explain** depicting their structure. (R, U)	**2+3**	**CO1**
2.	**What** are vitamins? Name fat soluble vitamins with their importance. (R, U)	**4+1**	**CO1**
3.	**Differentiate** between secondary and tertiary structure of protein. **What** is the role of cholesterol in biological membranes? (R, An)	**3+2**	**CO3,CO1**
4.	**Distinguish** between phospholipid and glycolipid. **What** are the monomers of lactose and sucrose? (R, An)	**2+3**	**CO4**
5	**What** are anomers? **Explain** the mechanisms of mutarotation. (U, An)	**2+3**	**CO5**
	SECTION B (Attempt any **Three questions)**		

6.	**Evaluate** the role of ATP in biological system. **Explain** its high phosphoryl transfer potential. **What** is standard Gibbs free energy? **Explain** its sign for different types of reaction. (R, U, An)	**3+2+2+3**	**CO3**
7.	**Why**BF3 is considered an acid? **Explain** buffering mechanism with an example. **What** do you mean by ionic product of water? What is pH? (R, An)	**2+4+2+2**	**CO1** **CO2**
8.	**Illustrate** the role of enzyme in a biochemical reaction with respect to activation energy. Define the following: Km, turnover number, allosteric mechanism. (R, U, An)	**3+2+2+3**	**CO1** **CO2**
9	State names of vitamins whose deficiency causes pellagra and pernicious anemia. **Write** down the Henderson equation for pH calculation of buffer solutions. State the name of three energy rich compound apart from ATP. Draw the structure of cholesterol and mention its importance. (R, U, An)	**2+1+1+3+3**	**CO4** **CO5**

MIB12004	**Biochemistry Lab**	L	T	P	C
Version 1.0	**Contact Hours: 45**	0	0	3	2
Pre-requisites/Exposure	Knowledge of Chemistry at 10+2 level				
Co-requisites	-				

Course Objectives

1. To understand the presence of different types of carbohydrates in different samples
2. To understand the presence of amino acids, proteins and enzymes in a solution
3. To characterize the lipids
4. To gain the knowledge about different types of nucleic acid
5. To understand the properties of water and buffer

Course Outcomes

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

CO1. Describe the chemical behaviour of different type of sugars and quantify their content from a solution.
CO2. Identify physical and chemical properties of amino acids and proteins and quantify their content from a solution.
CO3. Acquire the knowledge about characteristics of lipids.
CO4. Distinguish between an organic acid and amino acid by determining their pKa value.
CO5. Determine the velocity, substrate specificity and Km value of an enzyme.

Catalogue Description

Life is a condition through which living organisms can be differentiated from non-living matters. For example, growth, reproduction are the essential physiological phenomena of living organism. To support those physiological characteristics, some enzyme catalyzed are very much essential, which are considered as "biochemistry". The learning of the detailed structures of those molecules are necessary for understanding the key of the life. So the course consists of the identification of carbohydrates (energy source), amino acids (structural unit of protein), water (a major part of protoplasm of the cell), lipids (building block of the cell) and nucleotides(responsible for construction of energy currency and genetic material) by several qualitative and quantitative tests and analysis of different parameters of the activities of some enzymes.

Course Content

1. 1. General safety procedures in a laboratory. Use of auto pipettes. Making solutions and buffer preparation - acetate and tris buffers (3)
2. 2. Use of analytical balance and weighting; Calculation, preparation of normal, molar and percentage solutions (2)

3. Qualitative and quantitative analysis for sugars, non-reducing and reducing sugars (5h)
4. Qualitative and Quantitative tests for proteins and lipids (5h)
5. Estimation of Amino acid by Ninhydrin method. (5 h)
6. Estimation of Protein by Biuret method. (5 h)
7. Determination of DNA by Diphenylamine method. (5 h)
8. Determination of RNA by Orcinol method. (5 h)
9. Paper Chromatography- Isolation of the pigments from leaves of Radish 5 h)
10. Understanding of secondary and tertiary structures of proteins with models (5h)

Reference Books

1. Introduction to Practical Biochemistry: by Sawhney and Singh Biochemistry (2011) 4th ed.
2. Advanced Practical Chemistry; Subhas Chandra Das
3. Organic Chemistry, Vol 1 & 2., IL Finar.
4. Chemistry of Nucleic acids, Adams.
5. Organic Chemistry, Nasipuri.
6. Biochemical Calculations, Irwin Segel

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **describe** the chemical behaviour of different type of sugars and quantify their content from a solution.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO10**
CO2	Students will be able to **identify** physical and chemical properties of amino acids and proteins and quantify their content from a solution.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO10, PO12**
CO3	Students will be able to **develop** knowledge about characteristics of lipids	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO10, PO12**
CO4	Students will be able to **distinguish** between an organic acid and amino acid by determining their pKa value.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO10**
CO5	Students will be able to **determine** the velocity, substrate specificity and Km value of an enzyme.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO10, PO11**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
MIB12004	Biochemistry Lab	3	3	3	3	-	3	3	3	-	3	-	-

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

Model Question Paper

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

Course: MIB12004 –Biochemistry Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:
Attempt any two questions from **Section A** (each carrying 15 marks); Section **B** (each carrying 10 marks)isCompulsory.

Section A (Attempt **any Two)**

1.	**Identify** the molecules from the given sample A and B.(Ap) and Write the results along with the experimental procedure in detail.(An)	**15**	**CO1, CO2, CO3,CO4**
2.	**Estimate** the quantity of protein from the given sample(Ap) and detail the experimental procedure , observation and inference.(An)	**15**	**CO2**

3.	**Estimate** the Vmax and Km from the given enzyme sample, using the substrate concentration(0.1 mg/ml, 0.2 mg/ml, 0.3 mg/ml,0.4 mg/ml, 0.5 mg/ml)(Ap) and detail the experimental procedure , observation and inference.(An)	**15**	**CO5**
Section B (Compulsory**)**			
4.	**Viva-Voce** (U/An/Ap/R)	**10**	**CO1, CO2,CO3, CO4,CO5**
5.	**Laboratory Notebook** (U, An, Ap, E)	**10**	**CO1, CO2, CO3, CO4, CO5**

ENG11057	English Language & Literature	L	T	P	C
Version 1.0	**Contact Hours - 60**	1	1	0	2
Pre-requisites/Exposure	Basic Knowledge in English Language and Literature				
Co-requisites	--				

Course Objectives:

1. To introduce the students to applied knowledge of English as a language
2. To give basic idea regarding the day-to-day usage of the language
3. To facilitate the students in various required writing techniques and skills
4. To give them the confidence to express themselves using basic communication skills of English as a language

Course Outcomes

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

CO1. **Explain** the ethical use of language at the work space
CO2. **Recognizing** the importance of language as lifelong process of learning
CO3. **Developing** the capability to work as a team.
CO4. **Identifying** their individual language related skills
CO5. **Describe** and develop the communication skills through speaking, reading and writing
CO6. **Building** perceptions for accommodating all sorts of opinions

Course Description:

English Language and Literature, is a foundational course for the students to sharpen their reading, writing, and speaking skills, using the language English. It would give them the confidence to speak their mind at a public form using English as the common language of communication and also would help them to perform extravagantly during any job interview on both national and international level. It would also train them in the basic applications of English as a language in their day-to-day lives at both formal and informal front.

Course Content:

Module 1: (10 h)

Communication

a) Types of Communication
b) Verbal and Non-verbal Communication
c) Barriers and Strategies of Communication

Module 2: (10 h)

Grammar and Syntax

a) Subject-verb agreement
b) Conjunction

c) Articles
d) Prepositions
e) Editing
f) Idioms
g) One- Word Substitutions

Module 3: (10 h)
Listening Skills
a) Active Listening
b) Types of Listening
c) Listening Exercises

Module 4: (10 h)
Speaking Skills
a) Introduction
b) Extempore
c) Group Discussion
d) Mock Interview

Module 5: (10 h)
Writing Skills
a) Composition
b) Paragraph
c) Letter writing- CV and application letter
d) Report Writing
e) Notice writing
f) Business Communication

Module 6: (10 h)

Reading and Textual analysis
a) Reading Comprehension
b) Interpreting Graphics

Text Books
T1. Spoken English and Functional Grammar. P. C. Das.
T2. Essential Grammar in Use. Raymond Murphy

Reference Books
R1. Kaul Asha. *Effective Business Communication.* PHI Learning Pvt Ltd. 2014.
R2. Wren and Martin. *High School Grammar And Composition.* S. Chand, 1995.
R3. Lewis, Norman. *Word Power Made Easy*. Anchor: 2014.
R4. Riordan, Daniel G & Pauley Steven A. :*Technical Report Writing Today.* 2004.
R5. Hamp-Lyons and Heasely, B . *Study Writing; A Course in Written English. For Academic and Professional Purposes,* Cambridge Univ. Press, 2006.

R6. Quirk R., Greenbaum S., Leech G., and Svartik, J. *A Comprehensive Grammar of the English language*, Longman: London, 1985.
R7. Gupta, A. *English Reading Comprehension.* Ramesh Publishing House, 2009.
R8. Balasubramaniam, T. *A Textbook of English Phonetics for Indian Students.* Macmillan: 2012.
R9. A Practical Course in English Pronunciation. J Sethi, Kamlesh Sadanand and D.V. Jindal.
R10. English for Technical Communication. NP Sudarshana and C Savitha.

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

Examination Scheme:

Components	**Mid term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between Cos and POs

Course Outcomes (COs)		**Mapped POs**
CO-1	**Explain** the ethical use of language at the work space	PO1, PO11
CO-2	**Recognizing** the importance of language as lifelong process of learning	PO2
CO-3	**Developing** the capability to work as a team.	PO8, PO9
CO-4	**Identifying** their individual language related skills	PO3
CO-5	**Describe** and develop the communication skills through speaking, reading and writing	PO12
CO-6	**Building** perceptions for accommodating all sorts of opinions	PO12

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
ENG11057	English Language & Literature	1	1	1	-	-	-	-	2	1	-	1	3

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

Model Question Paper

Name:

Enrolment No:

Course: (ENG11057) English Language & Literature
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd Semester 2020-21 **Max. Marks: 50**

Instructions:
Attempt all questions from **Section A** (each carrying 5 marks); any **Two Questions** from **Section B** (each carrying 10 marks). **Section C** is Compulsory (carrying 10 marks).

Section A (Attempt all)

1.	Subject-verb agreement (An)	**5**	**CO1**
2.	Article (U, An)	**5**	**CO2**
3.	Preposition (U, An)	**5**	**CO3**

4.	Idioms and one word substitution (U, An)	**5**	**CO4**
SECTION B (Attempt any **Two Questions)**			
5.	Write a composition on… (C)	**10**	**CO2,CO5,CO4**
6.	Write an application letter and a paragraph on….(C)	**4** **6**	**CO1, CO2,CO5,CO4**
7.	Write a notice and a report (C)	**4** **6**	**CO3, CO1** **CO5, CO6**
	SECTION C is Compulsory		
8.	Comprehension Passage (Reading exercise) (An)	**10**	**CO5**

DGS11001	Design Thinking	L	T	P	C
Version 1.0	Contact hours-30	2	0	0	2
Pre-requisites/Exposure	Knowledge of analysing society problems and product usage problems and a zeal to improve the current situation, in addition to knowing to using laptop/computers, internet, social media interaction, file sharing and uploading, email and communication etiquettes.				
Co-requisites	-				

Course Objectives

1. To enable students to acquire knowledge, imagination and be more assertive on opinions on problems in society.
2. To enable students to learn basics of research, data collection, analysis, brainstorming to find solutions to issues.
3. To make them understand Design Thinking methodologies to problems in field of study and other areas as well.
4. To help students to understand future Engineering positions with scope of understanding dynamics of working between inter departments of a typical OEM.

Course Outcomes

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

CO1. **Examine** design thinking concepts and principles
CO2. **Practice** the methods, processes, and tools of design thinking
CO3. **Apply** the Design Thinking approach and model to real world scenarios
CO4. **Analyse** the role of primary and secondary research in the discovery stage of design thinking

Catalogue Description

Design thinking course is a completely online course offered to the first year UG programs across all streams. This course is designed to help understand the steps followed in the process of designing a solution to a problem.

Course Content

Unit I: **(4 h)**
WHAT IS DESIGN THINKING: Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on

the way to developing human-centered products and/or services. This approach is at the very heart of design thinking.

Unit II: (4 h)
THE DESIGN THINKING MODEL: A tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user's need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.

Unit III: (4 h)
PHASE 1: DISCOVER: Begin the design thinking process with the Discover phase, where you will identify the specific problem your design is intended to solve, as well as important usability aspects from those who will use your design. Discovery can be performed through a variety of different research methods which you will learn in this module.

Unit IV: (4 h)
PHASE 2: DEFINE: In the Define phase, you come to understand the problem. We often refer to this as framing the problem. You can do this by using a variety of tools, including storytelling, storyboarding, customer journey maps, personas, scenarios, and more.

Unit V: (4 h)
PHASE 3: DEVELOP: Turn your attention to solving the problem. In this phase you brainstorm custom creative solutions to the problems previously identified and framed. To do this, you conceptualize in any way that helps, putting ideas on paper, on a computer, or anywhere whereby they can be considered and discussed.

Unit VI: (4 h)
PHASE 4: DELIVER: This phase is all about testing and building concepts. Here you take all of the ideas that have been discussed to this point and bring them a little closer to reality by building a concept; something that makes it easier for a user to experience a design. This concept is referred to as a prototype.

Unit VII: (4 h)
PHASE 5: ITERATE: You will test the prototype of your design solution, collecting and acting on feedback received. These actions may mean minor or major revisions to your design, and are repeated as often as necessary until a solution is reached. Tools such as focus groups and questionnaires are used to help you collect feedback that can help with your final design.

Unit VIII: (2 h)
BEYOND DESIGN THINKING: The Design Thinking Model is a tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user's need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.

Reference Books

1. Brown, Tim. “What We Can Learn from Barn Raisers.” Design Thinking: Thoughts by Tim Brown. Design Thinking, 16 January 2015. Web. 9 July 2015.
2. Knapp, Jake. “The 8 Steps to Creating a Great Storyboard.” Co.Design. Fast Company & Inc., 21 Dec. 2013. Web. 9 July 2015.
3. Van der Lelie, Corrie. “The Value of Storyboards in the Product Design Process.” Journal of Personal and Ubiquitous Computing 10.203 (2006): 159–162. Web. 9 July 2015. [PDF].
4. Millenson, Alisson. “Design Research 101: Prototyping Your Service with a Storyboard.” Peer Insight. Peer Insight, 31 May 2013. Web. 9 July 2015.

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Examine** design thinking concepts and principles	**PO2, PO3, PO6, PO9, PO11, PO12**
CO2	**Practice** the methods, processes, and tools of design thinking	**PO2, PO3, PO6, PO9, PO11**
CO3	**Apply** the Design Thinking approach and model to real world scenarios.	**PO2, PO3, PO6, PO12**
CO4	**Analyse** the role of primary and secondary research in the discovery stage of design thinking	**PO5, PO8, PO9, PO10, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DGS11001	Design Thinking	-	3	2	-	1	3	-	2	3	3	2	-

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

Model Question Paper

Name of the Program: B.Sc. Stream: MICROBIOLOGY
PAPER TITLE: Design Thinking Semester: I
PAPER CODE: DGS11001
Maximum Marks: 50 Time duration: 3 hours
Total No of questions: 12 Total No of Pages: 01

Instruction for the Candidate:

1. At top sheet, clearly mention Name, Univ. Roll No., Enrolment No., Paper Name & Code, Date of Exam.
2. All parts of a Question should be answered consecutively. Each Answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

Section A (Answer All the Questions) (5 x 1 = 5)			
1.	List the steps involved in Design Thinking.	**U**	**CO1**
2.	Enumerate the basic elements of Design Thinking.	**U**	**CO2**
3.	Define Napkin Pitch.	**R**	**CO3**
4.	What is Assumption testing?	**R**	**CO4**
5.	Give the principles of Ethnography.	**U**	**CO2**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
6.	Briefly explain the importance of ethnography in design thinking?	**U**	**CO2**
7.	What are the successive steps for concept development?	**Ap**	**CO3**
8.	Elucidate the different types of concept development strategies.	**Ap**	**CO3**
9.	Explain with Example: surface keys for Assumption Testing.	**E**	**CO4**
	SECTION (Answer Any Two Questions) (2 x 15 = 30)		
10.	Explain in detail about importance of prototyping in Design Thinking.	**U**	**CO4**
11.	Write an importance of involving stakeholders in developing new concepts and Plan for conducting experiments within short time and inexpensively.	**C**	**CO3**
12.	Distinguish between design thinking and visualization of a problem.	**An**	**CO1**

BOT11001	ELECTIVE BOTANY I	L	T	P	C
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12thwith Biology as one subject				
Co-requisites	12th level English				

Course Objectives:

1. Students will be able to develop basic knowledge in plant science and also be able to explain various aspects of plant growth and development of lower group of plants;
2. Students will be able to understand intrinsic mechanism of plant growth and developments and their correlation with surrounding ecosphere as well biosphere;
3. Students will be able to develop fundamental knowledge and can be implemented agrotechniques practices of economic important plant.

Course Outcomes

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

1. Students will be able to develop basic knowledge in plant science and also be able to explain various aspects of plant growth and development of lower group of plants;
2. Students will be able to **explain** and Categorize in detail various divisions of Fungi and their commercial importance as well harmful effects;
3. Students will be able to develop basic knowledge and economic importance of Lichen;
4. Students will be able to develop basic knowledge in plant pathology and also be able to explain various genetic aspect of plant disease as well their impact plant diseases and their controlling measures;
5. Students will be able to **develop** basic knowledge in plant physiology and also be able to explain various physiological reactions as well their impact on plant growth and development.

6. Students will be able to **develop** fundamental knowledge and can be implemented this skill for cultivation practices and commercial uses of economic important plant.

Catalogue Description

Elective Botany I course covers a vast range of basic plant science including various branches of Botanical subjects. The course takes a broader approach and covers many aspects of lower group of plants as well physiological phenomena of all the plants community. Moreover, this curriculum covers cultivation practices of economic importance plants. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies using digital platforms, such as analysis of video scenes and debates. Students will be encouraged to actively take part in all group activities and to give an oral group presentation. Students will be expected to interact with media resources, such as, web sites, videos, DVDs, and newspapers etc.

Course Content:

UNITI (8 h)

Algae: Introduction; habitat and range of thallus structure in algae; Principles of classification and outline classification of Lee (2009) up to divisions, Diagnostic characters of important algal family's examples, Algal genetics, Economic importance of algae, Bioreactor. cultivation of algae and its prospects.

UNITII (7 h)

Fungi: Introduction; habitat, Basic classifications, Diagnostic characters of important families with examples, Fungal genetics, Economic importance of fungi, Pathogenic and poisonous fungi.

UNITIII (5 h)

Lichen: Habitat and thallus structures; economic importance.

UNIT IV (20 h)

Plant Pathology: Plant Diseases: Introduction and Definition; concepts of parasitism and saprophytism, Koch's postulates, Classification of plant diseases based on symptoms; Factors influencing infection, colonization and development of symptoms, Genetic basis of disease resistance and pathogenicity: gene for gene hypothesis; breeding for disease resistance, Brief idea about symptoms; disease cycles and control measures of: Loose smut of wheat, Citrus canker, Late blight of potato, Rust of wheat , Brown spot of Rice& Alternaria blight of Brassica.

UNIT V (10 h)

Plant physiology: Transport in plants water and mineral uptake, Transpiration- Mechanism of stomatal movement, significance; Photosynthesis-types of photosystem, significance, cycles; Plant Growth regulators**.**

UNIT VI (10 h)

Economic Botany: Introduction, Method of cultivation, processing and utilities of the products of the following: Rice, Tea, Jute and Brassica.

Text Books

1. Phycology by Robert Edward Lee
2. Introduction to Fungi by John Webster
3. Plant Pathology by G.N. Agrios
4. Plant Physiology by Lincoln Taiz, Eduardo Zeiger

Reference Books

1. College Botany Vol. II By Gangulee and Kar
2. Studies in Botany Vol I & II by J.N. Mitra, D. Mitra, S.K. Chaudhuri

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **develop** basic knowledge in plant science and also be able to explain various aspects of plant growth and development of lower group of plants	**PO1, PO4, PO8**
CO2	Students will be able to **explain** and Categorize in detail various divisions of Fungi and their commercial	**PO1, PO4**

	importance as well harmful effects.	
CO3	Students will be able to **develop** basic knowledge and economic importance of Lichen	**PO1**
CO4	Students will be able to **develop** basic knowledge in plant pathology and also be able to explain various genetic aspect of plant disease as well their impact plant diseases and their controlling measures.	**PO1, PO3, PO5**
CO5	Students will be able to **develop** basic knowledge in plant physiology and also be able to explain various physiological reactions as well their impact on plant growth and development	**PO1, PO3, PO5**
CO6	Students will be able to **develop** fundamental knowledge and can be implemented this skill for cultivation practices and commercial uses of economic important plant	**PO1, PO3, PO6, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BOT11001	Elective Botany I (Theory)	3	-	1	2	2	1	-	1	-	-	-	-

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

[redacted]

Name: **Enrolment No:**	

Course: **BOT11001**-ELECTIVE BOTANY I(THEORY)
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

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

SECTION A (Attempt any Four questions)

1.	Member of Cyanophyceaean algae shows much resemblances with photosynthesizing bacteria (cyanobacteria)- **justify** under the light of evolution. (E)	5	CO4
2.	**Differentiate** Heterothallism and Homothallism in Fungi.(An)	5	CO2
3.	Write a short note on economic importance of Lichen. (R)	5	CO3
4.	State the most important reactor use for commercial algal production.(R)	5	CO1
5	**Mention** the key differences between Transpiration and Evaporation. (R, U)	5	CO5

SECTION B (Attempt any **Three questions)**

6.	**Differentiate** plant and animal growth regulators. Mention the role of Ethylene on fruit ripening. Why ABA called as stress hormone? (R, U)	3+5+2	CO5
7.	**Explain** in brief oil extraction process from Brassica. Mention the cultivation practices of summer rice in India. (R, U)	4+6	CO6
8.	Elaborately **discuss** the prospect of using algae in nutraceutical industry. (R, U)	10	CO1
9	(a) Define Koch's postulates. (b) Briefly explain the disease cycles and control measures of Loose smut of wheat (R, U)	3+4+3	CO4

BOT12002	**Elective Botany I Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives:

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

1. Demonstrate a basic understanding of developmental terms and mechanisms of different plants.
2. Utilize laboratory techniques to design and carry-out experimental studies related to botany.
3. Convey and discuss experimental results via written assignments.

Course Outcome

CO1: Students will be able to learn the handling of laboratory instruments – Microscope, Autoclave, Incubator, centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant, Laminar Air Flow operation etc.

CO 2: Students will be able to compare between monocot and dicot plants.
CO3: Students will be able to separate plant pigments.
CO4: Students will be able to determine amount of water absorption, retention and transpiration
CO5: Students will be able to prepare percent, normal, molal and molar solutions of any compound.

Catalogue Description:

Botany is a rapidly expanding field of biology integrating concepts from plant science, genetics, molecular biology, cell biology, physiology, ecology and evolution. This course investigates the cellular and molecular processes involved in regulating plant development. Topics to be covered include experimental approaches to understand the principle of laboratory instruments involved in botanical studies with their mechanism, study the anatomy and developmental stages of different plants with a comparative understanding. Laboratory work will include a demonstration-based learning of plant water relationship and phenomenon like guttation and also the separation of photosynthetic pigments by paper chromatography.

Course Content:

1.	Acquaintance with laboratory instruments –Microscope, Autoclave, Incubator, centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant, Laminar Air Flow operation etc.	**6 h**
2.	Study of the following genera and their identification: *Oscillatoria, Scytonema, Oedogonium, Chara, Ectocarpus, Polysiphonia.* (vegetative and reproductive structures).	**6 h**

3.	Study of the following genera and their identification: *Rhizopus, Penicillium*, *Ascobolus, Agaricus, Polyporus.*	**6 h**
4.	Identification of specimens with diseases prescribed in the theoretical syllabus: Loose smut of wheat, Citrus canker, Late blight of potato, Rust of wheat & Brown spot of Rice.	**6 h**
5.	Chemical separation of photosynthetic pigments by paper chromatography.	**4 h**
6.	Preparation of percent, normal, molal and molar solutions of any compound.	**4 h**
7.	Comparison of imbibitions of starchy, proteinaceous and fatty seeds.	**4 h**
8.	Determination of amount of water absorption, retention and transpiration.	**4 h**
9.	Demonstration of Guttation.	**2 h**
10.	Study of Monocot root.	**1 h**
11.	Study of Dicot root.	**1 h**
12.	Study of leaves anatomy of different plants.	**1 h**

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **learn** the handling of laboratory instruments –Microscope, Autoclave, Incubator, centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant, Laminar Air Flow operation etc.	**PO1, PO2, PO3**
CO2	Students will be able to **compare** between monocot and dicot plants.	**PO1, PO10, PO11**
CO3	Students will be able to **separate** plant pigments.	**PO1, PO2, PO3, PO4, PO8**

CO4	Students will be able to **determine** amount of water absorption, retention and transpiration	**PO1, PO3. PO6, PO9**
CO5	Students will be able to **prepare** percent, normal, molal and molar solutions of any compound.	**PO1, PO4, PO8, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
BOT12002	Elective Botany I Lab	3	2	3	2	-	1	-	1	1	1	1	1

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: MIB12002 - Elective Botany ILab
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

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

Section A (Attempt any Three)

1.	a) **Identify** specimen A under microscope and write your conclusion. (Ap) b)**Classify** simple tissue in plants.	**6** **4**	**CO2**

	(An)		
2.	a) **Identify** specimen B under microscope and write your conclusion. (Ap) b) **Classify** different type of plants. (An)	**6** **4**	**CO1**
3.	a) **Identify** specimen C. (Ap) b) **Write** about guttation. (U)	**5** **5**	**CO4**
4.	a) **Identify** the model of dissection of cockroach D. (Ap) b)**Draw** the monocot root. (Ap)	**6** **4**	**CO3** **CO5**
Section B is compulsory			
5.	**Viva-voce** (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practical copy** (U/Ap/E)	**10**	**CO1** **CO2** **CO3**

ZOL11001	**Elective Zoology I**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide those students with some biology background with an introduction to zoology and the study of animals. This course is designed for students of any major, but will especially benefit biology majors, as well as secondary science education majors.
2. It will also provide an informative elective for 5-8 math/science education majors.
3. Gathering information about other organisms' structure and function, and how that compares to human beings, enables us to live a more knowledgeable, involved, and environmentally aware life in a science-conscious age.

Course Outcomes

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

1. Students will **know** about the fundamentals of animal sciences, which helps them to **understand** the complex relations among various living organisms.
2. Students will be able to **understand** and **analyze** the course of evolution: i.e. how complex multicellular organisms develop from unicellular cells and correlate with other fields of biology.
3. Students will **understand** and **compare** the basis of life processes in the non-chordates and chordates which helps them to identify the economically important organisms.
4. Students will able to **know** and **compare** between acoelomate, pseudo-coelomate and coelomate.
5. Students will **develop** as lifelong learner about vertebrate and invertebrate organisms which contribute in greater benefit of humanity.

Catalogue Description

Elective zoology I course will help to understand the behavior structure and evolution of animals. This course includes diverse approaches by studying animals and develop a better understanding of how we, ourselves, function and interact with the world around us. 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

Unit 1: Protista (3 h)

General characters of Protozoa; Life cycle of *Plasmodium*; Conjugation in *Paramoecium*.

Unit 2: Porifera (3 h)
General characters and canal system in Porifera.
Unit 3: Radiata (3 h)
General characters of Cnidarians and polymorphism.
Unit 4: Acoelomates (3 h)
General characters of Helminthes; Life cycle of *Taenia solium*.
Unit 5: Pseudocoelomates (3 h)
General characters of Nemathehelminthes; Parasitic adaptations.
Unit 6: Coelomate Protostomes (4 h)
General characters of Annelida; Metamerism.
Unit 7: Arthopoda (4 h)
General characters; Social life in insects; Communication in Honey Bees.
Unit 8: Mollusca (4 h)
General characters of mollusca; Torsion in gastropoda.
Unit 9: Coelomate Deuterostome (4 h)
General characters of Echinodermata; Water Vascular system in Starfish.
Unit 10. Protochordata (4 h)
Salient features
Unit 11. Pisces (5h)
Outline of classification; Parental care in Fish.
Unit 12. Amphibia (5 h)
General characters; Outline of classification; Paedogenesis.
Unit 13. Reptilia (5 h)
Amniotes; Origin of reptiles; Outline of classification in reptiles.
Unit 14. Aves (5 h)
General characters; Flight adaptations
Unit 15. Mammalia (5 h)
Outline of classification; Dentition in mammals.

Reference Books

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
3. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
4. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will **know** about the fundamentals of animal sciences, which helps them to understand the complex relations among various living organisms.	**PO1,PO2, PO6**
CO2	Students will be able to understand and **analyze** the course of evolution: i.e. how complex multicellular organisms develop from unicellular cells and correlate with other fields of biology.	**PO1, PO2, PO6, PO9, PO3**
CO3	Students will understand and **compare** the basis of life processes in the non-chordates and chordates which helps them to identify the economically important organisms.	**PO1, PO2, PO5, PO8**
CO4	Students will able to know and **compare** between acoelomate, psuedocoelomate and coemate.	**PO1, PO2, PO6**
CO5	Students will **develop** as life-long learner about vertebrate and invertebrate organisms which contribute in greater benefit of humanity.	**PO1, PO10, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ZOL11001	ELECTIVE ZOOLOGY I (THEORY)	3	3	1	-	1	2	-	1	1	1	-	1

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

Model Question Paper

Name:

Enrolment No:

Course: ZOL11001–Elective Zoology I
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**
Instructions:
Attempt **all** questions from **Section A** (each carrying 5 marks); any **three** questions from **Section B** (each carrying 10 marks)**.**

SECTION A (Attempt **all** questions)

1.	**Describe** the social structure of a termite colony.(U)	**5**	**CO5**
2.	**What** are the adaptations acquired by the round worms to maintain their parasitic nature in their habitat inside human host? (R)	**5**	**CO2**
3.	Maternal care is more often provided in mammals' – **Why?** (An)	**5**	**CO4**
4.	Will it be possible to propose that annelids evolve from *platyhelminthes* according to corn or fission theory? **Give justification** against your answer. (An)	**2** **3**	**CO3**
	SECTION B (Attempt any **three questions)**		
5.	a) **How** do Gastropods loss their symmetry? **Explain** the process with diagram. (Ap) b) **What** do understand by chiastoneury? (U)	**2** **6** **2**	**CO2**
6.	a) **What** is the difference between monogenetic and digenetic life cycle? (U) b)**Discuss** the process of sexual reproduction of malarial parasite. (U)	**4** **6**	**CO1** **CO2** **CO4**
7.	a)**Discuss** the process of sexual reproduction in Paramecium with proper diagram. (Cr) b)**Why** pinacocyte and choanocyte cells are there in the canal system of *Scypha*? (An)	**6** **4**	**CO1** **CO2**
8.	a)'Parental care is defined as "any form of parental behavior that appears likely to increase the fitness of the parent's offspring"'-**Explain** this phrase in your own words. (Ev) b)**What** do you mean by parental care? Give example. (U)	**6** **4**	**CO5** **CO2**
9.	a) **List** anatomical modification in bird's that enhances flight. (R) b)**Write** down two characteristic features of order chelonia. **What** is notochord? **Name** one agnathan chordate. (U)	**4** **3** **2** **1**	**CO4**

ZOL12002	**Elective Zoology I Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide students with hands-on activities designed to encourage interest in the field of zoology, as well as promote greater understanding of the concepts presented in lecture.
2. Students will need to become proficient with terms, techniques, and applications.

Course Outcomes

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

CO1. **Identify**, classify and compare between non chordate and chordate specimens.

CO2. **Understand** the ecological importance of these both chordate and non-chordate specimens.

CO3. Learn, draw and **compare** between the digestive, reproductive and nervous system of cockroach.

CO4. **Understand** and analyze the course of evolution: i.e. how complex multicellular organisms develop from unicellular cells and correlate with other fields of biology.

CO5. **Learn** and apply the knowledge of using different modern tools and techniques in the field of biology which will help in their further academics.

Catalogue Description

Elective zoology I Practical (LAB) is the overall about diversity of life forms which include identification, classification and ecological importance of unicellular organisms to multicellular organisms, non-chordate to chordate, in the course of evolution. This course covers laboratory techniques and study of animal phyla. The very nature of zoology lab requires students to view animals in different settings and to identify and describe many of the animal phyla. 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 the coordinator.

Course Content

1. Identification and Classification of Any these of the following:

   a. **Non-chordate specimens: (12 h)** Scypha, *Obelia,* Sea-anaemone, *Ascaris, Hirudinaria,* Scorpion, *Bombyxmori, Achatina, Loligo,* Starfish, *Balanoglossus.*

   b. **Chordate specimens**:**(12 h)***Branchiostoma, Petromyzon, Scolidon, Lates,* Axolotl larva, *Tylototriton, Gekko; Hemidactylus,* Turtle, *Naja,* Chiroptera.

2. Ecological Note**(12 h)** – On any of the specimens in Exercise No 1.
3. Models of dissection of Cockroach**(9 h)** - Cockroach: Digestive, Reproductive, Nervous System.

Reference Books

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
3. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
4. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Identify**, classify and compare between non chordate and chordate specimens.	**PO1, PO2, PO3**
CO2	**Understand** the ecological importance of these both chordate and non-chordate specimens.	**PO1, PO10, PO11**
CO3	Learn, draw and **compare** between the digestive, reproductive and nervous system of cockroach.	**PO1, PO2, PO3, PO4, PO8**
CO4	**Understand** and analyze the course of evolution: i.e. how complex multicellular organisms develop from unicellular cells and correlate with other fields of biology.	**PO1, PO3. PO6, PO9**
CO5	**Learn** and apply the knowledge of using different modern tools and techniques in the field of biology which will help in their further academics.	**PO1, PO4, PO8, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ZOL12002	ELECTIVE ZOOLOGY I LAB (PRACTICAL)	3	2	3	2	-	1	-	1	1	1	1	1

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

Model Question Paper

Name:

Enrolment No:

Course: ZOL12002 – Elective Zoology I Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:
Attempt any **two** questions from **Section A** (each carrying 15 marks); **Section B** is Compulsory (carrying 10 marks).

Section A (Attempt **any Two)**

1.	a) **Identify** specimen A. (Ap) b)**Classify** its taxonomical position and **write** about its identifying characters. (An)	**4** **5** **6**	**CO1** **CO4**
2.	a) **Identify** specimen B. (Ap) b) **Classify** its taxonomical position and **write** about its identifying characters. (An)	**4** **5** **6**	**CO1** **CO4**
3.	a) **Identify** specimen C. (Ap) b) **Write** about its ecological	**5** **10**	**CO2**

	importance. (U)		
4.	a) **Identify** the model of dissection of cockroach D. (Ap) b)**Draw** the model and **write** about the functions of the endocrine gland in this model. (Ap)	**4** **5** **6**	**CO3** **CO5**
SECTION B is compulsory			
5.	**Viva-voce** (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practical copy** (U/Ap/E)	**10**	**CO1** **CO2** **CO3**

MIB11005	**Bacteriology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12th level Biology				
Co-requisites	--				

Course Objectives:

1. To provide an overview of structure and function of various components within a bacterial cell
2. To introduce to students that various tools and techniques available for study of bacteria including microscopic and biochemical approaches
3. To give an overview of nutritional requirements of bacteria and ways to control them
4. To provide a basis for classification of bacteria and archaea and study selected bacteria and archaea based on classification

Course Outcomes

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

CO1. To **describe**, compare and contrast the structure and function of various cell components in bacteria

CO2. **Classify** and list isolation and preservation techniques of microbes

CO3. Students will be able to **categorize** microscopy techniques and choose appropriate techniques for visualization.

CO4. **List** and select appropriate growth conditions and requirements of the microbes as well as propose appropriate control strategy of microbes

CO5. Students will be able to **solve** calculations on growth kinetics and list taxonomical basis of classification of microbes

CO6. **Classify** and list examples of archaea and eubacteria

Catalogue Description:

Bacteriology is the study of bacteria. This course covers various aspects of structure and functions of bacterial cells, methods of growing and studying bacteria and focusing on certain bacteria and archaea based on classification.

Course Content:

Unit 1 Microscopy (3 h)

Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluoresence Microscope, Confocal microscopy, Scanning and Transmission Electron Microscope

Unit 2: Bacteriological techniques (5 h)

Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-culturable bacteria.

Unit 3:Growth, nutrition and control of microbes (20 h)

Nutritional requirements in bacteria and nutritional categories; Culture media: components of media, natural and synthetic media, defined media, complex media, selective, differential, enriched and enrichment media. Control of microbes: Definition, application and examples of frequently used terms; Sterilization, disinfection, antiseptic, sanitizer, germicide, antimicrobial agent, bacteriostatic and bactericidal agents; Pattern / Rate of Microbial Death; Concept of sterilization, Conditions influencing the effectiveness of Antimicrobial Agents. Physical methods of microbial control: heat, temperature, pressure, filtration, desiccation, osmotic pressure, radiation. Chemical methods of microbial control: disinfectants, types and mode of action

Unit 4:Reproduction in Bacteria (7 h)

Asexual methods of reproduction, logarithmic representation of bacterial populations, phases of growth, calculation of generation time, doubling time and specific growth rate, genetic exchange, F plasmid, Hfr

Unit 5: Bacterial Systematics (8 h)

Aim and principles of classification, systematics and taxonomy, concept of species, taxa, strain; conventional, molecular and recent approaches to polyphasic bacterial taxonomy, evolutionary chronometers, rRNA oligonucleotide sequencing, signature sequences, and protein sequences. Differences between eubacteria, proteobacteria and archae

Unit 6: Important bacterial groups (15 h)

Eubacteria: Morphology, metabolism, ecological significance and economic importance of selected groups such as
Gram Negative:
Non proteobacteria: General characteristics with suitable examples
Alpha proteobacteria: General characteristics with suitable examples
Beta proteobacteria: General characteristics with suitable examples
Gamma proteobacteria: General characteristics with suitable examples
Delta proteobacteria: General characteristics with suitable examples
Epsilon proteobacteria: General characteristics with suitable examples
Zeta proteobacteria: General characteristics with suitable examples
Gram Positive:
Low G+ C (Firmicutes): General characteristics with suitable examples
High G+C (Actinobacteria): General characteristics with suitable examples
Cyanobacteria: An Introduction
Actinomycetes
Mollicutes

Textbooks

T1. Willey JM, Sherwood LM, and Woolverton CJ (2013). Prescott's Microbiology, 9th edition, McGraw Hill

T2. Madigan MT, and Martinko JM.(2014). Brock Biology of Micro-organisms, 14th edition, Parker J, Prentice Hall International, Inc

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

Examination Scheme:

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

<u>Course Outcomes for MIB11005</u>

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **describe**, compare and contrast the structure and function of various cell components in bacteria	**PO1, PO2, PO3,PO4,PO5, PO6, PO7**
CO2	Students will be able to **classify** and list isolation and preservation techniques of microbes	**PO1, PO2, PO3,PO4,PO5, PO6, PO7**
CO3	Students will be able to **categorize** microscopy techniques and choose appropriate techniques for visualization.	**PO1, PO2, PO3,PO4,PO5, PO6, PO7**
CO4	Students will be able to **list** and select appropriate growth conditions and requirements of the microbes as well as propose appropriate control strategy of microbes	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO8**
CO5	Students will be able to **solve** calculations on growth kinetics and list taxonomical basis of classification of microbes	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO10, PO11**
CO6	Students will be able to **classify** and **list** examples of archaea and eubacteria	**PO1, PO2, PO3,PO4,PO5, PO6, PO7, PO10, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11005	Bacteriology	3	3	2	2	2	2	2	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: MIB11005– Bacteriology
Program:B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt all questions from **Section A** (each carrying 5 marks) and any three questions from **Section B** (each carrying 10 marks)**.**

Section A
(Attempt **all** questions)

1.	A researcher unexpectedly identified mutant bacteria deficient in the FtsZ protein. Their growth appeared filamentous, and displayed incomplete cell division. **Explain** the role of the FtsZ protein and how a deficiency would account for this altered growth. (An)	**5**	**CO1**
2.	**Why** is water activity important to microbial growth? What changes water activity? (U)	**5**	**CO1, CO2**
3.	**How** is it possible for a strict anaerobic bacterium to cause a disease in humans? (E)	**5**	**CO6**
4.	**What** is a batch culture? Describe how it can illustrate bacterial growth curve. (R)	**5**	**CO4**

	SECTION B (Attempt **any three** questions**)**		
5.	**Compare** and contrast defined media and complex media with examples. Under what circumstances would you use a selective medium and or a differential medium? (R, U)	**10**	**CO4**
6.	Suppose 1,000 bacteria are inoculated in a tube containing a minimal salts medium, where they double once an hour; and 10 bacteria are inoculated into rich medium, where they double in 20 minutes. Which tube will have more bacteria after 2 hours? After 4 hours? (An)	**10**	**CO5**
7.	**Why** microbial preservation is required? Outline the short- and long-term preservation techniques of microbial cultures in the laboratory. (R, U)	**10**	**CO2**
8.	**Compare** and contrast between scanning and transmission electron microscopy. (An, U)	**10**	**CO3**

MIB12006	**Bacteriology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	12th level Biology				
Co-requisites	--				

Course Objectives:

1. To choose right lab tools and techniques for study of bacterial cells
2. To prepare different types of media such as differential, selective and enrichment.
3. To be able to visualize bacteria such as *Mycobacterium* by using acid staining
4. To isolate pure cultures and estimate viable number of bacteria
5. To preserve bacterial cultures by various method
6. To determine motility of a given bacteria

Course Outcomes

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

CO1. **Utilize** laboratory skills to enhance understanding of bacterial structure and function
CO2. **Choose** and prepare appropriate media for growing different bacteria
CO3. **Demonstrate** acid fast staining techniques to identify an acid-fast bacterium
CO4. **Calculate** viable number of bacteria by spread plate techniques
CO5. **Interpret** the difference between motile and non-motile cells by motility test
CO6. **Differentiate** between pure and mixed culture of bacteria
CO7. **Demonstrate** different type of preservation techniques

Catalogue Description:

Bacteriology lab focuses on tools and techniques to study bacteria and covers microscopy, staining, preservation techniques, viable count, pure culture determination and motility assessments.

Course content

1.Gram staining (2h)
2.Endospore staining (2h)
3. Acid-fast staining (2h)
4. Preparation of differential and selective media: MacConkey, Eosin Methylene Blue Agar, Mannitol Salt Agar and Hektoen enteric agar (18h)
5. Bacterial culture preservation techniques (6h)
6. Determination of motility by hanging drop method (3h)
7. Biochemical tests for bacterial identification: IMVIC, TSI, and Use of SIM media. (6h)
8. Determination of antibiotic sensitivity by Kirby Bauer disk-diffusion method (6h).

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**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **utilize** laboratory skills to enhance understanding of bacterial structure and function	**PO1, PO2, PO3, PO4, PO5, PO6, PO7**
CO2	Students will be able to **choose** and prepareappropriate media for growing different bacteria	**PO1, PO2, PO3, PO4, PO5, PO6, PO7**
CO3	Students will be able to **demonstrate** acid fast staining techniques to identify an acid-fast bacterium	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO10**
CO4	Students will be able to **calculate** viable number of bacteria by spread plate techniques	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO10**
CO5	Students will be able to **interpret** the difference between motile and non-motile cells by motility test	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8**
CO6	Students will be able to **differentiate** between pure and mixed culture of bacteria	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO11**
CO7	Students will be able to d**emonstrate** different type of preservation techniques	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12006	Bacteriology lab	3	3	2	2	2	2	2	-	-	-	-	-

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

Model Question Paper

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

Course: MIB12006 – Bacteriology Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt all questions

Section A
(Attempt all questions**)**

1.	**Perform** and determine if the sample A is acid fast or not. What kind of control you would you like to have in your experiment? (An, E)	**15**	**CO1 CO3**
2.	**Calculate** the colony forming units of sample B based on the petridish A to G. Do you think this culture is pure? Explain. (An. E)	**15**	**CO1 CO4 CO6**
3.	Lab notebook and viva (R, U, An, Ap, E, C)	**20**	**CO1 CO2 CO3 CO4 CO5 CO6 CO7**

MIB11007	**Virology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide those students with apt understanding of identification and characterization of virus as an obligatory intracellular entity.
2. It will also provide in depth knowledge of virus classification, evolution, structural and functional diversity.
3. Elaborating virus infection cycle which would include bacteriophage, RNA, DNA and retrovirus alongside possible application of virus and virus like particles.
4. Outlining the relation between virus infection and cancer/ oncogenesis.

Course Outcomes

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

1. Students will be able to **explain** various structural components of virus.
2. Students will be able to **classify** viruses and compare their taxonomic position.
3. Students will be able to **compare** and contrast between lytic and lysogenic cycles andsummarise the events.
4. Students will be able to **analyse** the role of virus in causing cancer.
5. Students will be able to **choose** or **identify** the preferred antiviral drug for a few viral infection based on the mode of action

Catalogue Description

The core-course of 'virology' will help to understand the classification, structure and evolution of animals. This course includes comprehensive approach through studying bacteriophage, plant and animal virus as infective agents. Furthermore, the application of virus 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 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

Virology (MIB11007)

Unit 1 Nature and Properties of Viruses (15 h)

Introduction: Discovery of viruses, nature and definition of viruses, general properties, concept of viroids, virusoids, satellite viruses and Prions. Theories of viral origin. Structure of Viruses: Capsid symmetry, enveloped and non-enveloped viruses

Isolation, purification and cultivation of viruses; Viral taxonomy: Classification and nomenclature of different groups of viruses

Unit 2 Bacteriophages (5 h)
Diversity, classification, one step multiplication curve, lytic and lysogenic phages (lambda phage) concept of early and late proteins, regulation of transcription in lambda phage

Unit 3 Viral Transmission, Salient features of viral nucleic acids and Replication (25 h)
Modes of viral transmission, lytic and lysogenic cycles, vertical and horizontal, Salient features of viral Nucleic acid : Unusual bases (TMV,T4 phage), overlapping genes (ϕX174, Hepatitis B virus), alternate splicing (HIV), terminal redundancy (T4 phage), terminal cohesive ends (lambda phage), partial double stranded genomes (Hepatitis B), long terminal repeats (retrovirus), segmented (Influenza virus), and non-segmented genomes (picornavirus), capping and tailing (TMV), Viral multiplication and replication strategies: Interaction of viruses with cellular receptors and entry of viruses. Replication strategies of viruses as per Baltimore classification (phi X 174, Retroviridae, Vaccinia, Picorna) , Assembly, maturation and release of virions

Unit 4 Viruses and Cancer (5 h)
Introduction to oncogenic viruses
Types of DNA and RNA viruses: Concepts of oncogenes and proto-oncogenes

Unit 5 Prevention & control of viral diseases (5 h)
Antiviral compounds and their mode of action
Interferon and their mode of action
General principles of viral vaccination

Unit 6 Applications of Virology (5 h)
Use of viral vectors in cloning and expression, Gene therapy and Phage display

Textbook:

1. Carter JB, Saunders VA (2013).Virology: Principles and applications,2nd edition, Wiley

Reference books:

1. Dimmock NJ, Easton AL, Leppard KN (2007). Introduction to Modern Virology, 6th edition, Blackwell Publishing
2. Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM (2004). Principles of Virology, Molecular biology, Pathogenesis and Control, 2nd edition, ASM press
3. Levy JA, Conrat HF, Owens RA. (2000). Virology, 3rd edition, Prentice Hall
4. Wagner EK, Hewlett MJ. (2004). Basic Virology, 2nd edition, Blackwell
5. Hall R (2002). Mathew's Plant Virology, 4th edition, Elsevier
6. Nayudu MV (2008). Plant Viruses, McGraw Hill
6. Bos L (1999). Plant viruses-A text book of plant virology, Backhuys Publishers
7. Versteeg J (1985). A Color Atlas of Virology, Wolfe Medical

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** various structural components of virus	**PO1, PO2**
CO2	Students will be able to **classify** viruses and **compare** their taxonomic position	**PO1, PO2, PO3**
CO3	Students will be able to **compare** and contrast between lytic and lysogenic cycles and summarise the events	**PO1, PO2, PO3**
CO4	Students will be able to **analyse** the role of virus in causing cancer	**PO1, PO2, PO5, PO6**
CO5	Students will be able to choose or **identify** the preferred antiviral drug for a few viral infection based on the mode of action	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11007	VIROLOGY	3	3	1	-	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: MIB11007 - VIROLOGY (THEORY)
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even2020-21 **Max. Marks: 50**

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

	SECTION A (Attempt **any four questions)**		
1.	What is Capsid? **Explain** various symmetry of viral particles. (R, U)	**2+3**	**CO1**
2.	**Classify** virus based on their genetic material. What is the role of ICTV in viral classification? (R, U)	**4+1**	**CO2**
3.	**Differentiate** between Temperate and Virulent Phage. (An)	**5**	**CO3**
4.	**Enlist** 3 virus that is associated with Cancer. Also mention the role of virus in etiology of cancer. (R, An)	**2+3**	**CO4**
5	A person was suffering from HIV. What medicinal options do the doctor have to treat him to prevent virus multiplication. **Explain** the mechanisms involved. (An)	**1+2+2**	**CO5**
	SECTION B (Attempt any **three questions)**		
6.	**Design** an experiment to isolate lytic phage. What would be your preferred sample? **Illustrate** the headful mechanism. Add a note on concatemer. (R, U)	**4+1+3+2**	**CO3**
7.	**What** is the basis of Baltimore Classification? Illustrate various classes of virus as per Baltimore Classification. Categorize TMV and HIV according to Baltimore **Classification**. Enlist any two alternative ways of viral classification. (R, U)	**2+4+2+2**	**CO1** **CO2**
8.	**Mention** any three methods of viral cultivation. **Which** method is most suitable if we want to study the pathophysiological changes or symptoms? What all routes can be employed to inoculate virus in a mice? **Illustrate** the role of candling? What is a cryptic virus? (R, An)	**2+1+3+2+2**	**CO1** **CO2**
9	"A person was suffering from hepatocellular carcinoma and at that stage metastasis took place. The patient was also diagnosed with a persistent viral disease." **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 an etiological factor. Is the viral infection sole reason for cancer: comment? Mention the hallmarks of cancer. (R, An)	**2+1+1+3+3**	**CO4** **CO5**

MIB12008	**Virology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide the students with apt understanding of identification and characterization of virus.
2. It will also provide in depth knowledge of virus classification,structural and functional diversity.
3. To study the life cycle of virus through experimental data analysis.

Course Outcomes

On completion of this course,

1. Students will be able to **explain** various structural components of virus
2. Students will be able to **identify** and classify viruses and compare their properties by electron micrograph.
3. Students will be able to **isolate** and analyze the results of plaque formation by bacteriophage.

Catalogue Description

The core-course of ‘virology lab’ will help to understand the classification, structure and differentiate between various viruses based on electron microscopic micrographs. This course also deals with the study of life cycle of bacteriophage through various assays. Classes will include discussion session, virtual observation of viral micrographs and hands-on experiments on bacteriophage. Students will perceive the basic concepts of the subject and attain skill-sets via exercise and analytical-discussions with the coordinator.

Course Content

Virology Lab (MIB12008)

1. Study of the structure of important animal viruses (rhabdo, influenza, paramyxo hepatitis B and retroviruses) using electron micrographs (6h)

2. Study of the structure of important plant viruses (caulimo, Gemini, tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using electron micrographs (9h)

3. Study of the structure of important bacterial viruses (ϕX 174, T4, λ) using electron micrograph. (6h)

4. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique (9h)

5. Perform local lesion technique for assaying plant viruses. (3h)

Textbook:

Carter JB, Saunders VA (2013).Virology: Principles and applications,2nd edition, Wiley

Reference books:

1. Dimmock NJ, Easton AL, Leppard KN (2007). Introduction to Modern Virology, 6th edition, Blackwell Publishing
2. Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM (2004). Principles of Virology, Molecular biology, Pathogenesis and Control, 2nd edition, ASM press
3. Levy JA, Conrat HF, Owens RA. (2000). Virology, 3rd edition, Prentice Hall

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** various structural components of virus	**PO1, PO2**
CO2	Students will be able to **identify** and classify viruses and compare their properties by electron micrograph.	**PO1, PO2, PO3**
CO3	Students will be able to **isolate** and analyze the results of plaque formation by bacteriophage.	**PO1, PO2, PO3, PO4, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12008	Virology Lab	3	3	3	2	1	-	-	-	-	-	-	-

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

Model Question Paper

Name: **Enrolment No:**			
Course: MIB12008– VIROLOGY LAB **Program: B.Sc. Microbiology Time: 03 Hrs.** **Semester: Even 2020-21**			**Max. Marks: 50**
Instructions: Attempt question from all the sections:			
SECTION A: Major Experiment (Performance)			
1.	**Perform** plaque assay using the given sample and estimate the viral load as pfu/mL (R, Ap, An)	**15**	**CO3**
SECTION B Analysis			
2.	**Identify** the virus and mention its general characteristics from the provided electron micrograph. (R, An)	**15**	**CO2**
SECTION C Viva-voce (R, U, E, C)		**10**	
SECTION D Lab manual		**10**	

EVS11105	**Environmental Science and Energy Resources**	**L**	**T**	**P**	**C**
Version 1.1	**Contact Hours – 60**	2	0	0	2
Pre-requisites/Exposure	Basic physics, chemistry, biology and mathematics				
Co-requisites	--				
Academic year	2020-21				

Course Objectives

1. To understand the intrinsic relation between humans and environment, our position in the ecosystem around us
2. To comprehend the significance of the biodiversity surrounding us.
3. To figure out the importance and need for energy resources, various sources of energy, renewable and non-renewable sources, conventional and unconventional sources.
4. To have basic concepts about sustainability, our dependence on nature and the consequences of overexploitation.
5. To enable students to appreciate the importance and how much we owe to the earth systems for our survival.
6. To have a basic concept about the types of pollution and mitigation procedures.
7. To have an overall idea about the environmental legal framework in our country and about the EIA and environmental audit procedures.

Course Outcomes

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

CO 1: **Understanding** multidimensional complex nature of environmental problems, various types of ecosystems, ecosystem dynamics, perceive and appreciate the surrounding nature.

CO 2: **Feel** connected with the intrinsic relation between humans and environment, our position in the ecosystem around us, and importance of biodiversity.

CO 3: **Comprehend** the presence of various pollutants, their significance, and impacts, and develop the underlying concepts involved in various air pollution prevention and mitigation measures.

CO 4: **Understand** the routes of generation, classification, management, and environmental significance of solid waste.

CO 5: **Understand** water chemistry, deduce the relationship between various water pollutants, and understand the principles of various water and wastewater treatment procedures.

CO 6: **Create** awareness and concern about importance of environmental resources and their damage and protection.

CO 7: **Understand** the different approaches and practices of biodiversity conservation and management.

CO 8: **Understand** the legal framework in our country for safeguarding the environment including pollution prevention, control, management, and wildlife management.

CO 9: **Standup** as responsible citizens for various global environmental issues and motivate others for active participation in minimizing the environmental damage already caused.

Catalogue Description

To distinguish between various types of ecosystems, ecosystem dynamics, perceive and appreciate the surrounding nature and feel connected, develop the concept of innate relationship of humans and biodiversity, need for conservation and different conservation strategies. The students will be developed in a way so that they can spontaneously comprehend the importance of studying about the various air pollutants, their significance and impacts, and develop the underlying concepts involved in various air pollution prevention and mitigation measures, understand fundamental water chemistry, deduce the relationship between various water pollutants, and understand the principles of various water and wastewater treatment procedures. They will understand the routes of generation, classification, management and environmental significance of solid waste, apply the basic concepts of waste management in their daily lives, understand the need of the 5Rs of waste management, importance of waste minimization.

Course content

Unit I: (20h)

Multidisciplinary nature of environmental sciences; scope and importance; need for public awareness; concept of sustainability and sustainable development

Forest resources: Function of forests, cause and effects of deforestation, case studies.

Water resources: distribution of water, hydrological cycle, use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies

Food Resources: World food problems and environmental concern, Food security, case studies

Energy resources: Concept of energy, SI Units of Work, Heat and Power, World energy use, Energy consumption pattern in India and U.S., Environmental aspects of energy utilization Renewable and non-renewable sources; Fossil fuel: types, use and environmental impacts, Solar energy: Solar Radiation – Passive and active solar systems – Flat Plate and Concentrating Collectors – Solar direct Thermal Application– Fundamentals of Solar Photo Voltaic Conversion- advantages and disadvantages of Solar Power generation, Solar energy status in India; Wind Energy: site selection, Wind turbine: basic working principle and types, Wind energy status in India, advantages and disadvantages of Wind Power generation; Hydroelectric power : How is it generated, advantages and disadvantages; Biomass energy: various types, generations of biofuel, Biogas plants, Bio diesel; Geothermal Energy: source, advantages and disadvantages, Nuclear Power: nuclear fission, moderation of reaction, nuclear reactor: pressurized water reactor, advantages and disadvantages

Unit II: Ecosystems (5h)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Food chains, food webs and ecological pyramids, energy flow, ecological succession

Unit III: Biodiversity and its conservation (10h)

Levels of Biodiversity: genetic, species and ecosystem diversity. Biogeographical classification of India, Values of biodiversity, Biodiversity at global, National and local levels, India as a mega-diversity nation, Biodiversity hotspots, Threats to Biodiversity, In-situ and Ex-situ conservation of Biodiversity

Unit – IV: Environmental Pollution and Waste Management(15h)
Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, marine pollution; case studies. Nuclear hazards and human health risks.
Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital Wastes and Hazardous Wastes) Recycling of waste material. Waste minimization technologies. Hazardous Wastes Management and Handling Rules, 1989

Unit – V: Global Issues and Environmental Acts(10h)
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents.
Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).

Text Books:

1. Principles of Environmental Science, 4th edition by Cunningham, W.P. and Cunningham, M.A. (2002), Tata McGraw-Hill Publishing Company, New Delhi

2. Basic Environmental Engineering & Elementary Biology by Monidranath Patra and Rahul Kumar Singha, Aryan Publishing house

3. Introduction to Environmental Engineering and Science, by Masters, G.M., Prentice Hall of India, Second Indian Reprint.

Reference Books:

1. Wastewater Engineering: Treatment and Reuse, 4th Edition, Metcalf and Eddy, Inc. McGraw-Hill, Inc., New York, 2002

2. Environmental Engineering", Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, McGraw-Hill Education (India) Private Limited, New Delhi

3. Introduction to Environmental Engineering, 2nd Ed. by Davis, M. L. and Cornwell D. A. McGraw Hill, Singapore.

4. Environmental Sciences: The Environment and Human Impact by Jackson, A.R.W. and Jackson, J.M., , Longman Publishers

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Understanding** multidimensional complex nature of environmental problems, various types of ecosystems, ecosystem dynamics, perceive and appreciate the surrounding nature.	**PO1, PO2, PO10, PO12**
CO2	**Feel** connected with the intrinsic relation between humans and environment, our position in the ecosystem around us, and importance of biodiversity.	**PO1, PO2, PO10, PO11, PO12**
CO3	**Comprehend** the presence of various air pollutants, their significance, and impacts, and develop the underlying concepts involved in various air pollution prevention and mitigation measures.	**PO9, PO10**
CO4	**Understand** the routes of generation, classification, management, and environmental significance of solid waste.	**PO6, PO9, PO10**
CO5	**Understand** water chemistry, deduce the relationship between various water pollutants, and understand the principles of various water and wastewater treatment procedures.	**PO5, PO6, PO9, PO10**
CO6	**Create** awareness and concern about importance of environmental resources and their damage and protection.	**PO10, PO11, PO12**
CO7	**Understand** the different approaches and practices of biodiversity conservation and management.	**PO10, PO11**
CO8	**Understand** the legal framework in our country for safeguarding the environment including pollution prevention, control, management, and wildlife management.	**PO8, PO10, PO11**
CO9	Stand up as responsible citizens for various global environmental issues and motivate others for active participation in minimizing the environmental damage already caused.	**PO9, PO10, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EVS11105	Environmental Science and Energy Resources	1	1	-	-	1	2	-	1	2	3	3	2

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

Model Question Paper

Name:
Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: EVS11105– Environmental Science and Energy Resources
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 Max. Marks: 50
Instructions:

Attempt any **five questions** from **Section A** (Each Carrying 2 Marks); any **four questions** from **Section B** (Each Carrying 5 Marks)**. All question** from **Section C** (Each Carrying 10 Marks)**.**

SECTION A (Answer any five questions) (5 x 2 = 10)

1.	**What** information about any ecosystem are conveyed by ecological pyramids?	An	**CO1**
2.	Give one **example** for each. a. Inverted pyramid of number b. Inverted pyramid of biomass	U	**CO2**
3.	A sample of sewage water has 4-day 20°C BOD value of 60% of the final. Find the rate constant per day.	Ap	**CO5**
4.	**Mention** few problems associated with large dams?	An	**CO6**
5.	**What** are the different types of wind turbine?	R	**CO6**

6.	**What** is PV cell? What are the diverse applications of solar energy unlike other renewable energy resources?	R	**CO3**
SECTION B (Attempt any **four questions) (4 x 5 =20)**			
1.	**What** is electrostatic precipitator? What are the advantages of electrostatic precipitator? (1+2+2)	U	**CO3**
2	**What** is "Dobson unit"? What is ozone hole? How does it happen chemically in the stratosphere? (1+1+3)	R	**CO9**
3.	**What** are the adverse effects of open dumping of municipal solid wastes on environment? How does sanitary landfill differ from open dumping? (3+2)	An	**CO4**
4.	**Describe** the distribution of water resources. (5)	R	**CO6**
5.	**What** are the fundamental steps involved in an EIA? Draw a simple flowchart describing the steps that are followed in an EIA process in India. (2+3)	R	**CO8**
SECTION C (Attempt **all question**) **(2 x 10 = 20)**			
1.	**What** are the various methods for water resources management? What is integrated solid waste management? How does it **differ** from the age-old conventional system of solid waste management in India? (5+3+2)	Ap	**CO6**
2.	**How** is photochemical smog formed? **What** are effects of photochemical smog? Discuss the factors affecting photochemical smog? (4+3+3)	U	**CO3**

EIC11001	**Venture Ideation**	**L**	**T**	**P**	**C**
Version 2.0	**Contact Hours:30**	2	0	0	2
Pre-requisites/Exposure	Basic knowledge of English and computer applications such as Internet Explorer and MS Office				
Co-requisites	--				

Course Objectives

1. To help the students understand the way to be an Entrepreneur
2. To identify the right business opportunity
3. To empower students to perform a technical feasibility study and thereby developing a prototype
4. To help students in identifying their customers using primary and secondary research methods.
5. Expose students to various factors of market and competition with the help of market feasibility study, forecasting techniques, business model canvass and insights about financial statements.
6. To prepare students with finalizing their entrepreneurial Portfolio

Course Outcomes

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

CO1. **Assess** personal capacity in the context of the entrepreneurial process

CO2. **Assess** characteristics of successful entrepreneurs and entrepreneurial forms and processes

CO3. **Apply** resources, research and tools for Entrepreneurial ventures

CO4. **Analyse** and apply opportunity identification techniques, feasibility terminology, processes and models

CO5. **Develop** Ideation and planning documents for entrepreneurial venture

Catalogue Description

Over the last decade, the core of our economy has been transitioning from one of industrial might, large monolithic corporations and mass production towards one of networks, flexible enterprises comprising many smaller units and unique value. This new economy is based on innovation originating in creativity and design; it is also disrupting long-standing and established employment patterns and bringing to the fore the importance of entrepreneurship. This core unit will bring together creativity, design and entrepreneurship at the conceptual and more practical level. It aims to explore the nature, determinants and consequences of creativity, design and entrepreneurship as well as the interaction between them.

Course Content

Unit 1. Introduction (8 h)

Preview of the Course, Introduction to the Course, Guest Lecture with U.S. Secretary of Commerce Penny Pritzker – Meaning of Innovation, Entrepreneurial opportunities, Factors influencing the feasibility of an innovation, Innovation strategy: technology-push or market-pull, Product-market fit, how to develop a business model, Walkthrough of the business model canvas, Welcome to Innovation for Entrepreneurs: From Idea to Marketplace.

Unit 2. Customer Discovery and Validation (8 h)

Customer types, Customer archetypes, Customer segments and business models, Customer segments, value propositions, product features, value mapping, interviewing customer, insights of your customers.

Unit 3: Product Understanding and Marketing. (8 h)

Customer value, The DNA of customer-centricity, Crossing the chasm, Qualitative and quantitative marketing research, importance and methods of market segmentation, Focusing on the target market, Beyond the chasm, Strategic implications of beyond the chasm, E-commerce: The internet as a selling platform.

Unit 4. Prototyping and Testing. (6 h)

Planning for prototyping, Rapid prototyping and development, Lean start-up MVPs, choosing a wire framing/UX prototyping tool, Anatomy of an experience map, what you'll learn from user testing, Analytics and insight, Troubleshooting your customer discovery, Levels of a product/service.

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

Components	**Internal Assessment (Discussion+ Initiating Internship Template) MTE**	**ETE (Detailed Report Submission + Testimonials Photographs / Student Experience Sharing Video)**
Weightage (%)	**40**	**60**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Assess** personal capacity in the context of the entrepreneurial process	**PO8, PO11, PO2, PO3,**

		PO12
CO2	**Assess** characteristics of successful entrepreneurs and entrepreneurial forms and processes	**PO5, PO8, PO11**
CO3	**Apply** resources, research and tools for Entrepreneurial ventures	**PO8, PO9, PO11**
CO4	**Analyse** and apply opportunity identification techniques, feasibility terminology, processes and models	**PO6, PO8, PO9, PO11**
CO5	**Develop** Ideation and planning documents for entrepreneurial venture	**PO8, PO10, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EIC11001	Venture Ideation	-	2	2	-	2	2	-	3	3	2	3	2

1=Weakly mapped
2= Moderately mapped
3=Strongly mapped

Model Question Paper

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

Course: EIC11001- Venture Ideation
Program: B.Sc. Microbiology 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 10 marks)**.**

Group A **Answer Any Four** **Questions (5 x 4 = 20)**			
		Knowledge Level	**CO**
1	Problem Identification is an important stage for Ideation: Explain with suitable example.	**Analyze**	**CO1**
2	What are the characteristics of a creative person? How can creativity solve problems in clay is day life	**Analyze**	**CO2**
3	Compare market driven innovation with product driven innovation	**Understand**	**CO3**
4	Illustrate the stages of TRL	**Remember/ Understand**	**CO4**
5	How does IPR help in the creation of start-ups	**Analyze**	**CO3**
Group B **Answer Any Three** **Questions (10 x 3 = 30)**			
6	Explain the role of the following in creation of new enterprise: a) MVP b) Product Market Fit	**Understand**	**CO1**
7	Name your favourite entrepreneur. Enlist the personal traits orqualities that have brought success to his venture. Mention the USPs of his business.	**Remember/ Understand**	**CO2**
8	Create a roadmap of any industry that was badly hit due to COVID-19. You may take a Design Thinking approach.	**Analyze**	**CO3**
9	Suppose you are pitching a business plan to a venture capitalist to seek funding. Prepare the content within 5 slides.	**Apply**	**CO4**

BOT11003	**ELECTIVE BOTANY II**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12thwith Biology as one subject				
Co-requisites	12th level English				

Course Objectives:

1. Students will be able to develop basic knowledge in higher groups of plants and also be able to understand various branches of Botany for understanding in details;
2. Students will learn practical implementations of various branches of plant science and their and commercial exploitations;
3. Students will be able to develop fundamental knowledge about surrounding ecosphere and biosphere and their corelations.

Course Outcomes

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

CO1. Students will be able to **illustrate** in detail about *Moses and Ferns* in various aspects and also their implementation for commercial purposes;

CO 2. Students will be able to **explain** and categorize in detail various divisions of *Gymnosperms* and their commercial importance as well harmful effects;

CO 3. Students will be able to **develop** basic knowledge in Angiospermic plants and also be able to understand various divisions for understanding in details;

CO4. Students will be able to **develop** fundamental knowledge about surrounding ecosphere and biosphere and their corelations;

CO 5. Students will be able to **explain** and summarize the basic concept of pharmacognosy and also can be able implement this knowledge in applied fields;

CO 6. Students will be able to **develop** fundamental knowledge in plant biotechnology and can be implemented this skill for cultivation practices and commercial uses.

Catalogue Description

Elective Botany II lecture course covers a vast range of basic plant science. The course takes a broader approach and covers many aspects of higher group of plants as well fundamental knowledge of surrounding environments and their corelations. Moreover, this curriculum covers an practical approach for understanding implementation of gaining knowledge in industrial field. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies using digital platforms, such as analysis of video scenes and debates. Students will be encouraged to actively take part in all group activities and to give an oral group presentation. Students will be expected to interact with media resources, such as, web sites, videos, DVDs, and newspapers etc.

Course Content:

UNIT I(10h)

Moses and Ferns:

Bryophytes: Introduction, Basic classifications, Diagnostic characters of important families with examples, Economic importance.

Pteridophytes: Introduction, Basic classifications, Diagnostic characters of important families with examples, Economic importance.

UNIT II(10 h)

Gymnosperms: Introduction, Basic classifications, Diagnostic characters of important families with examples, Economic importance.

UNIT III(10 h)

Angiosperm: Brief ultra-structure of plant cell and tissues, Brief description of Plant Architecture (vegetative and reproductive parts); Taxonomic Definitions, principles, Outline of the system of classification with examples, Herbarium, ICBN(ICN), Diagnostic features of important angiospermic families.

UNIT IV(10 h)

Plant Ecology: Population and community ecology, Ecological Succession, Major Ecosystems and ecological adaptations, Environmental Pollution and its effects on plants, Biodiversity and conservation, Bio/Phytoremediation and their environmental significance.

UNIT V(10 h)

Pharmacognosy: A brief idea about pharmacognosy, discuss about- active principles; Pharmacopeia and adulteration; Study of the following drug plants (Diagnostic features, active principles and uses): *Rauwolfia serpentina* (root), *Adhatoda vasica* (leaf), *Strychnos nuxvomica* (seed), *Cinchona succirubra* (bark), Business review of herbal industry.

UNIT VI(10 h)

Plant Biotechnology: Plant Tissue Culture: Introduction, Composition of media; Nutrient and hormone requirements, Types, Applications, In vitro germplasm conservation;

Methods of gene transfer: Agrobacterium-mediated, Direct gene transfer methods;

Applications of Biotechnology: Problems and prospects of transgenic crops and their commercial utilizations

Text Books

1. Bhojwani S S & Dantu P K Plant Tissue Culture: An introductory text
2. Odum, E. P. 1971. Fundamentals of Ecology. W.B Sounders Co., Philadelphia
3. TrigianoR N & Gray D J Plant Tissue Culture, Development and Biotechnology
4. Trease & Evans: Pharmacognosy

Reference Books

1. College Botany Vol. II By Gangulee and Kar
2. Studies in Botany Vol I & II by J.N. Mitra, D. Mitra, S.K. Chaudhuri

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

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **illustrate** in detail about *Moses and Ferns* in various aspects and also their implementation for commercial purposes	**PO1 & PO5**
CO2	Students will be able to **explain** and Categorize in detail various divisions of *Gymnosperms* and their commercial importance as well harmful effects	**PO1 & PO4**
CO3	Students will be able to **develop** basic knowledge in Angiospermic plants and also be able to understand various divisions for understanding in details	**PO1, PO4& PO6**
CO4	Students will be able to **develop** fundamental knowledge about surrounding ecosphere and biosphere and their corelations	**PO1, PO3, PO5**
CO5	Students will be able to **explain** and summarize the basic concept of pharmacognosy and also can be able implement this knowledge in applied fields	**PO1, PO3, PO8**
CO6	Students will be able to **develop** fundamental knowledge in plant biotechnology and can be implemented this skill for cultivation practices and commercial uses	**PO1, PO3, PO6 &PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BOT11003	Elective Botany II	3	-	1	-	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: BOT11003-ELECTIVE BOTANY II(THEORY)
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

SECTION A (Attempt any **Four questions)**			
1.	**Why ‘**Pteridophytes are claimed as the first true land plants not Bryophytes’ explain in details under the light of their morphological and anatomical structure. (R, U)	5	CO1
2.	**Mention** the steps of Production of natural drug products. (R)	5	CO5
3.	**Write** down the subsequent steps of making herbarium sheet. (R)	5	CO3
4.	Briefly **discuss** about the Population and community ecology. (R, U)	5	CO4
5	**Mention** the key differences between plant tissue culture and open field culture. (An)	5	CO6
	SECTION B (Attempt any **Three questions)**		
6.	(a)Bryophytes and other plants have a common ancestor, but neither is ancestral to the other- justify with suitable comparison. (b) Mention the Medicinal use of Bryophytes. (An, U)	6+4	CO1
7.	(a)**Define** Plant Tissue Culture. (b) **Discuss** their achievements, advantages and limitations. (R, U)	3+7	CO6
8.	(a) Elaborately **discuss** the characteristic features of Solanaceae family. (b) Draw and label the ultra-structure of a typical plant cell. (R, U)	5+5	CO3
9	Briefly **explain** the Basic classifications of Gymnosperm with suitable examples. **Mention** the key differences between Gymnosperms and Angiosperms. (R, U)	7+3	CO2

BOT12004	**Elective Botany II Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	12th with Biology as one subject				
Co-requisites	12th level English				

Course Objectives:

1. Students will be able to demonstrate and design with hands-on activities for applied plant science experiments in laboratory;
2. Students will be able to implement acquired knowledge in commercial field in crop improvement.

Course Outcomes

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

1. Students **develop** their skill by hands on training in laboratory Experiments on Imbibition in Plants
2. Students will be able to **design** and demonstrate Root Pressure in Plants;
3. Students will be able to **explain** by performing Demonstration of opening & closing of stomata;
4. Students will be able to **develop** fundamental knowledge and can be implemented this skill for demonstrating Transpiration in Plants;
5. Students will be able to **design** and explain Demonstration of respiration;
6. Students will be able to **demonstrate** and design experiments for Osmosis in Plants;
7. Students **develop** their skill by hands on training in laboratory Experiments on performing Plasmolysis in Plants
8. Students **develop** their skill by hands on training in laboratory for Photosynthesis in Plants;
9. **Understand** the importance of plant growth and development by demonstration and hands on training;
10. Students **develop** their skill by demonstration and hands on training in laboratory basic techniques use for plant tissue culture;
11. Learn and **apply** the knowledge of using different modern tools and techniques in the field of biology which will help in their further academics.

Catalogue Description

Elective Botany practical is a skill enhancement course covers a vast range of basic as well applied implementation of knowledge in inherent metabolism of plants as well technical application for betterment for mankind. The course takes a broader approach and covers many spectra of plant physiological phenomena as well fundamental techniques in plant tissue culture using various technical parameters in laboratory scale which broadly covered by demonstration and hands on trainings. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies using digital platforms, such as analysis of video scenes and debates. Students will be encouraged to actively take part in all group activities and to give an oral group presentation. Students will be expected to interact with media resources, such as, web sites, videos, DVDs, and newspapers etc.

Course Content:

UNITI (3 h)
Experiments on Imbibition in Plants

UNITII(3 h)
Experiment on Root Pressure in Plants

UNITIII(3 h)
Demonstration of opening & closing of stomata

UNIT IV(3h)
Experiments on Respiration in Plants

UNIT V(3 h)
Experiments on Osmosis in Plants

UNIT VI (3 h)
Experiments on Ascent of Sap in Plants

UNIT VII(3 h)
Experiments on Plasmolysis in Plants

UNIT VIII (3 h)
Experiments on Photosynthesis in Plants

UNIT IX(3 h)
Experiments on Plant growth

UNIT X(10 h)
Basic plant tissue culture techniques: Media composition and Preparation of media Sterilization and contamination, Initiation of aseptic cultures from seed, isolated embryos and other explants

UNIT XI (8 h)

Local Excursions and Field records

Text Books

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
2. Plant cell culture – A practical approach by Dixion RA. 1995

Reference Books

1. Practical Botany, Volume II, S C Samanta

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students **develop** their skill by hands on training in laboratory Experiments on Imbibition in Plants	**PO1, PO3, PO4**
CO2	Students will be able to **design** and demonstrate Root Pressure in Plants	**PO1, PO4, PO5**
CO3	Students will be able to **explain** by performing Demonstration of opening & closing of stomata	**PO1, PO3, PO4, PO5**
CO 4	Students will be able to **design** and explain Demonstration of respiration	**PO1, PO3, PO5**
CO 5	Students will be able to **demonstrate** and design experiments for Osmosis in Plants	**PO1, PO3, PO4**
CO 6	Students will be able to **demonstrate** and design experiments on Ascent of Sap in Plants	**PO1, PO3, PO4**
CO7	Students **develop** their skill by hands on training in laboratory Experiments on performing Plasmolysis in Plants	**PO1, PO3, PO4**
CO8	**Understand** the importance of plant growth and development by demonstration and hands on training	**PO1, PO3, PO5**
CO9	Students **develop** their skill by hands on training in laboratory for Photosynthesis in Plants	**PO1, PO3, PO4**
CO10	Students develop their skill by demonstration and hands on training in laboratory basic techniques use for plant tissue culture	**PO1, PO3, PO4&PO8**
CO11	Learn and **apply** the knowledge of using different modern tools and techniques in the field of biology which will help in their further academics	**PO2, PO3, PO5&PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BOT12004	Elective Botany II Lab	3	1	3	3	2	-	-	1	-	1	-	-

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

Model Question Paper

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

Course:**BOT12004- Elective Botany II Lab**
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**
Instructions:
Attempt any **three** questions from **Section A** (each carrying 10 marks); **Section B** is compulsory (carrying 10 marks).

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

1.	a) **Work out with** specimen A. b) **Write** about the protocol and observations (R, Ap)	**6** **4**	**CO1, C9, C7**
2.	**Design and analysis** with specimen B. (R, Ap)	**10**	**CO2, CO3& CO4**
3.	**Estimate** the final outcome with specimen C. (R, Ap)	**10**	**CO3, CO4, CO5**
4.	a) **Demonstration** the preparation of provided samples with specimen D. b) **Write** the procedure in details. (R, Ap)	**4** **6**	**C8, CO10**

	SECTION B is compulsory		
5.	**Viva-voce**(R, An, Ap, E, C)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6** **CO7** **CO8** **CO9** **CO10**
6.	**Practical copy**	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6** **CO7** **CO8** **CO9** **CO10**

ZOL11003	**Elective Zoology II**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide those students with some biology background with an introduction to ecology and the study of evolution. This course is designed for students of any major, but will especially benefit biology majors, as well as secondary science education majors.
2. It will also provide an informative elective for 5-8 math/science education majors.
3. Gathering information about ecological community, biodiversity and its structure and function, and how evolutionary concepts and animal behavior enables us to live a more knowledgeable, involved, and environmentally aware life in a science-conscious age.

Course Outcomes

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

CO1. **Know** about habitat and niche, ecotone, edge effect, ecological succession.

CO2. **Understand** the significance of energy flow in ecosystem and ecological succession, variation and ecological process which implement changes in learning towards a sustainable development.

CO3. **Compare** and analyze between population growth curves, life strategies.

CO4. **Understand** and correlate between different animal behaviour, bee dancing which follows future practice of ethical philosophies.

CO5. **Solve** the analytical problems on density, mortality, natality from fecundity tables and life tables and population genetics.

Catalogue 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, animal behavior 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 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

Unit 1: Introduction to Ecology (4 h)

History of ecology, Autecology and synecology, Levels of organization.

Unit 2: Population (9 h)

Unitary and Modular populations. Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion. Exponential and logistic growth, equation and patterns, r and K strategies. Population regulation - density-dependent and independent factors.

Unit 3: Community (9 h)

Community characteristics: species richness, dominance, diversity, Ecotone and edge effect. Ecological succession with one example.

Unit 4: Ecosystem (8 h)

Types of ecosystems with one example in detail, definition, components, energy flow, food chain, food web, and ecological pyramids.

Unit 5: Historical review of evolutionary concept (5 h)

Lamarckism, Darwinism, Neo-Darwinism, Geological time scale.

Unit 6: Sources of variations and Population genetics (10 h)

Heritable variations and their role in evolution, Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies), Speciation.

Unit 7: Animal Behavior (7 h)

Instinctive and learning behaviour, Fixed action pattern, Communication in honeybees (dance Language), Elements of Sociobiology: Altruism and selfishness.

Unit 8: Biodiversity (8 h)

Basic concept of Biodiversity, Biodiversity hotspots, Conservation of wild life- purpose & methods, concept of Biosphere Reserve, importance & strategies of wildlife conservation; conservation act and application. National park & Wildlife Sanctuary, Animal cruelty and prevention act.

Reference Books

1. Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publishers
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press
6. Ridley,M (2004) Evolution III Edition Blackwell publishing
7. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.

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

Examination Scheme:

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	**Know** about habitat and niche, ecotone, edge effect, ecological succession.	**PO1, PO8, PO10**
CO2	**Understand** the significance of energy flow in ecosystem and ecological succession, variation and evolutionary process which implement changes in learning towards a sustainable development.	**PO1,PO2, PO10**
CO3	**Compare** and analyze between population growth curves, life strategies.	**PO1, PO2, PO5, PO6, PO7**
CO4	**Understand** and correlate between different animal behaviour, bee dancing which follows future practice of ethical philosophies.	**PO1, PO3, PO11, PO12**
CO5	**Solve** the analytical problems on density, mortality, natality from fecundity tables and life tables and population genetics.	**PO1, PO2, PO5, PO6, PO7**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ZOL11003	Elective Zoology II	3	2	1	-	2	2	2	2	-	2	-	-

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

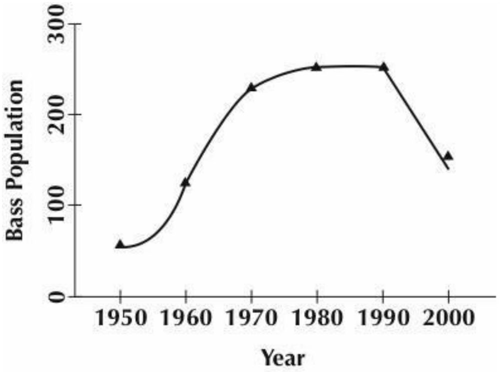
Model Question Paper

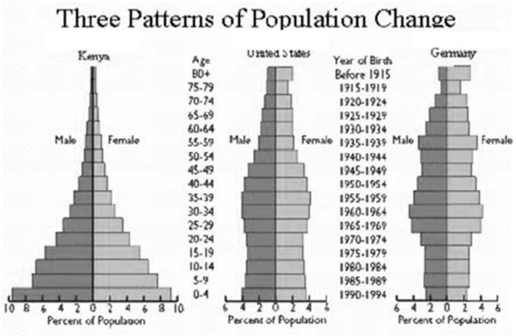
Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: ZOL11003 - ELECTIVE ZOOLOGY II (THEORY)
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

SECTION A (Attempt **all questions)**

1.	a) **What** is ecotone? Write two general features of ecotone? (R) b) **What** do you understand about the term 'Edge Species'? (U)	**3** **2**	**CO1**
2.	A community in a wood log depends on the neighbouring community, but a forest community doesn't. **Explain** this statement by clearly mentioning all the factors involved. (An)	**5**	**CO2**
3.	The graph shows the changes in population of bass fish in a lake  a)**Describe** the trend in population growth from 1950 to 1990. Give an example of something that may have happened in 1990 that affected the bass population. (Ap) b)**Explain** your reasoning. (An)	**3** **2**	**CO3**
4.	The mule, which is the offspring of a male donkey and a mare, is a vigorous animal, well suited for hard work. However, it is sterile. **Why? Explain** your answer with a proper scientific reason. (An)	**5**	**CO4**
	SECTION B (Attempt any **three questions)**		
5.	a)**Utilize** a proper illustration to explain how a worker bee can inform other fellow worker bees that the food source may be found by flying 30^0 to the right of the sun when they will leave the hive. (Ap) b) Does the genetic drift play a more important role in large or a small population? **Explain** with proper reasons. (U)	**6** **4**	**CO4** **CO5**
6.	a) Two populations were sampled for distribution of the MN blood group. **Evaluate** each of these two populations is in equilibrium or not? (Eva) (i) 2% M, 96% MN, 2 % N (ii) 9% M, 42% MN, 49% N b)If you analysed a population for a trait known to be due to a single pair of genes and your analysis revealed that the population was not	**5** **5**	**CO5**

<table>
<tr><td></td><td>in equilibrium for that trait, **what possible reasons** could you offer for the lack of equilibrium? (An)</td><td></td><td></td></tr>
<tr><td>7.</td><td>a) **What** is mimicry? How does it **differ** from crypsis? Give examples of both. (U)
b) **Describe** the following equation with respect to the regulation of the population size. (U)
$N_{t+1}=N_t+B+I-D-E$
Clearly **write** the name of all the symbols used in the equation.(R)</td><td>**6**
4</td><td>**CO4**
CO1</td></tr>
<tr><td>8.</td><td>a)On a particular island, a population suddenly becomes split into two parts by a mountain range. After very many generations the two parts of the original population come together again. **What** do you think the nature of this reformed population might be? **Indicate** the evolutionary processes involved in your answer.
(An)
b) **What** do you mean by Batesian mimicry? Give example. (R)</td><td>**7**
3</td><td>**CO2**
CO4</td></tr>
<tr><td>9.</td><td>a)**Which** country below has the most rapid population growth? Will the pyramids above tell you total population of a country? (An)

 </td><td>**3**</td><td>**CO1**</td></tr>
<tr><td></td><td>b) Using the table **calculate** the species diversity and species dominance of the community. Also, you have to clearly mention in which species is dominant in the community. (Ap)
<table>
<tr><th>Species Name</th><th>Species Number</th></tr>
<tr><td>A</td><td>54</td></tr>
<tr><td>B</td><td>11</td></tr>
<tr><td>C</td><td>28</td></tr>
<tr><td>D</td><td>1</td></tr>
<tr><td>E</td><td>3</td></tr>
</table></td><td>**7**</td><td></td></tr>
</table>

ZOL12004	**Elective Zoology II Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide students with hands-on activities designed to encourage interest in the field of ecology and evolution, as well as promote greater understanding of the concepts presented in lecture.
2. Students will need to become proficient with calculations, analysis and applications of different types from the hypothetical / data provided.

Course Outcomes

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

CO1. **Identify** and compare between fossil specimens and also learn how to construct phylogenetic tree and draw them.
CO2. **Understand** the importance of field trip and they will get more interest on the subject as they learn how to work in the field trip effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
CO3. Learn, calculate and **analyse** Shanon-Weiner diversity index for the same community.
CO4. **Solve** the analytical problems on Hardy-Weinberg Law by chi square analysis.
CO5. **Compare** and analyze between survivorship curves of different types from the hypothetical/real data provided.

Catalogue Description

This course covers laboratory and on field hands on techniques and study of ecology and evolution. The very nature of ecology and evolution lab requires students to learn, calculate and analyze of real different types from the hypothetical / data provided for the community and also learn to construct phylogenetic tree and draw them. 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, on field excursion 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 coordination.

Course Content

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided. (9 h)

2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community. (9 h)

3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary. (9 h)

4. Study of fossils from models/ pictures.(6 h)

5. Study and verification of Hardy-Weinberg Law by chi square analysis. (6 h)

6. Construction of phylogenetic trees and its interpretation.(6 h)

Reference Books

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
3. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
4. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Identify** and compare between fossil specimens and also learn how to construct phylogenetic tree and draw them.	**PO1, PO2, PO3, PO10**
CO2	**Understand** the importance of field trip and they will get more interest on the subject as they learn how to work in the field trip effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**PO1, PO3, PO8, PO11**
CO3	Learn, calculate and **analyse** Shanon-Weiner diversity index for the same community.	**PO1, PO3, PO4, PO5, PO11, PO12**
CO4	**Solve** the analytical problems on Hardy-Weinberg Law by chi square analysis.	**PO1, PO5, PO6**
CO5	**Compare** and analyze between survivorship curves of different types from the hypothetical/real data provided.	**PO1, PO5, PO6, PO7**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ZOL12004	Elective Zoology II Lab	3	1	3	1	3	3	1	1	-	1	1	1

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

Model Question Paper

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

Course: ZOL12004 – ELECTIVE ZOOLOGY II LAB (PRACTICAL)
Program: B.Sc.   MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

Section A (Attempt **any three**)

<table>
<tr>
<td>1.</td>
<td>
<table>
<tr><td>Species</td><td colspan="7">Characters</td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>A</td><td>+</td><td>-</td><td>-</td><td>+</td><td>-</td><td>-</td><td>+</td></tr>
<tr><td>B</td><td>+</td><td>+</td><td>+</td><td>-</td><td>-</td><td>-</td><td>+</td></tr>
<tr><td>C</td><td>+</td><td>+</td><td>+</td><td>-</td><td>-</td><td>-</td><td>+</td></tr>
<tr><td>D</td><td>+</td><td>-</td><td>-</td><td>+</td><td>+</td><td>-</td><td>-</td></tr>
<tr><td>E</td><td>+</td><td>-</td><td>-</td><td>+</td><td>+</td><td>+</td><td>-</td></tr>
<tr><td>F</td><td>-</td><td>+</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>
a)Draw the phenogram and cladogram using the above data table. (An/Ap)
b) Find out which species is the outgroup for both the cases. (U)
</td>
<td>4
4
2</td>
<td>CO1</td>
</tr>
</table>

<table>
<tr><td>2.</td><td>a)Estimate the pH of the given water sample. You have to calculate 3 times and write the average value in the answer sheet. (E)
b)Interpret the nature of the sample. (An)</td><td>8
2</td><td>CO2</td></tr>
<tr><td>3.</td><td>a) Identify specimen A. (Ap)
b)What is the evolutionary significance of the specimen. (R)</td><td>4
6</td><td>CO1</td></tr>
<tr><td>4.</td><td>a)Construct the survivorship graph using the following life table data for <i>Zootoca vivipera</i> in the Netherlands. (Cr)
b) Interpret which type of survivorship curve this population is following. (U)
<table>
<tr><td>Age interval</td><td>Number alive at the start of the year</td></tr>
<tr><td>0</td><td>1000</td></tr>
<tr><td>1</td><td>763</td></tr>
<tr><td>2</td><td>308</td></tr>
<tr><td>3</td><td>158</td></tr>
<tr><td>4</td><td>57</td></tr>
<tr><td>5</td><td>10</td></tr>
<tr><td>6</td><td>7</td></tr>
<tr><td>7</td><td>2</td></tr>
<tr><td>8</td><td>0</td></tr>
</table>
</td><td>7
3</td><td>CO5</td></tr>
<tr><td></td><td>SECTION B is compulsory</td><td colspan="2"></td></tr>
<tr><td>5.</td><td>Viva-voce (U/An/Ap/R/Ev)</td><td>10</td><td>CO1
CO2
CO3
CO4
CO5</td></tr>
<tr><td>6.</td><td>Practical copy (U/Ap/Ev)
Field trip diary (Ap/Ev/An)</td><td>5
5</td><td>CO1
CO2
CO3</td></tr>
</table>

MIB11009	**Cell Biology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12th level Biology				
Co-requisites	--				

Course Objectives:

1. To correlate between the cellular organization and function
2. To categorize different ways of protein sorting and transport across membranes
3. To describe and illustrate cell signalling mechanisms
4. To investigate cell cycle, cell death, and cell renewal

Course Outcomes

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

CO1. **Connect** between the structures and function of cell organelles, cytoskeleton and extracellular matrix

CO2. **Illustrate** different outline protein sorting and transport across membranes

CO3. **Analyse** different ways of transport across membranes and protein trafficking

CO4. Discuss and **illustrate** different types of cell signaling mechanisms

Catalogue Description:

Cell biology is the study of eukaryotic cells. This course covers various aspects of structure and functions of cells and cellular processes such as cell division, cell transport, signalling, cell senescence among others.

Course Content:

Unit 1 Basics of Cell Biology (structure & function) (20 h)

Discovery of cell and Cell theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and microbodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells Cell-Cell Interactions - adhesion junctions, tight junctions, gap junctions, and

plasmodesmata (only structural aspects) Structure and organization of actin filaments, association of actin filaments with plasma membrane, cell surface protrusions, intermediate filaments, microtubules; Cell motility; Amoeboid, ciliary, flagellar movement

Unit 2 Nucleus (4h)

Nuclear envelope, nuclear pore complex and nuclear lamin; Chromatin – Molecular organization Nucleolus

Unit 3 Protein Sorting and Transport (12h)

Ribosomes, Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing and quality control in ER, smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – Organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Unit 4 Cell Signaling (12h)

Signaling molecules and their receptors; Function of cell surface receptors; Pathways of intra-cellular receptors – Cyclic AMP pathway, cyclic GMP and MAP kinase pathway

Unit 5Cell cycle - An overview of cell cycle; Components of cell cycle control system (12h)

Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant. Mitosis and Meiosis;
Development of cancer, causes and types Stem cells, embryonic stem cells, induced pluripotent stem cells

Text Books

T1. Alberts B. Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K, Walter P (2013). Essential cell biology, 4th edition, Taylor & Francis

Reference Books

R1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's world of the cell, 8th edition, Pearson
R2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley

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

Examination Scheme:

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

Course Outcomes for MIB11009

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	Students will be able to **correlate** the structure and function of cellular organelles, cytoskeleton and extracellular matrix	**PO1, PO2, PO3, PO4, PO5, PO6, PO10, PO11**
CO2	Students will be able to **outline** protein sorting and transport across membranes	**PO1, PO2, PO3, PO4, PO5, PO6, PO10, PO11**
CO3	Students will be able to **illustrate** cell signaling mechanisms	**PO1, PO2, PO3, PO4, PO5, PO6, PO10, PO11**
CO4	Students will be able to **describe** cell cycle, cell death, and cell renewal	**PO1, PO2, PO3, PO4, PO5, PO6, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11009	Cell Biology	3	3	2	2	2	2	-	-	-	-	1	-

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

Model Question Paper

Name:
Enrolment No:

Course: MIB11009– Cell Biology
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**
Instructions:

Section A
(Answer **all** questions)

1.	A scientist observes the motion of a certain type of vesicle around the cell. She notices that vesicle movement ceases when colchicine is added to the culture medium. **What** conclusion can she draw? (**U**)	**5**	**CO2**
2.	You are exploring a rather inhospitable planet, which has seas that are somewhat hydrophobic in nature. Surprisingly, there are living organisms in the seas whose cytoplasm is hydrophobic to a similar degree. These organisms have membranes made primarily of phospholipids arranged in a bilayer. **What** is the most probable orientation of these phospholipids? (**An**)	**5**	**CO1**
3.	You have just found a dead deep-sea creature in your fishing nets. It appears to be a new species. During the post-mortem attempt to classify the organism, a jelly-like, extracellular mass is found in the abdomen. It is found to contain proteins, carbohydrates and lots of water. What kind of molecule would you expect to find in the jelly-like mass? (**E**)	**5**	**CO1**
4.	**Contrast** between primary and secondary plant cell wall. What is thought to orient the movement of the rosettes that appear to synthesize each cellulose microfibril? (**U**)	**5**	**CO1**
5.	What recently developed technique allows scientists to follow with their own eyes the dynamic movements of specific proteins as they occur within the living cell? (**Ap**)	**5**	**CO2**
6.	**Contrast** between uniport, antiport and symport	**5**	**CO2**
	SECTION B (Answer any two questions**)**		

7.	Schematically **describe** the major cell cycle checkpoints. (**R**)	**10**	**CO4**
8.	Schematically **discuss** the mode of action of intracellular second messenger, cAMP and IP3. (**U**)	**10**	**CO3**
9.	What are the two major types of microtubules? **List** their functions. **Contrast** between dynamic instability and treadmilling of microtubules. (**E**)	**10**	**CO1**
10.	Outline the major types of cell-cell and Cell-ECM attachments and **list** their associated structures and functions. (**U**)	**10**	**C03**

MIB12010	**Cell Biology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	12th level Biology				
Co-requisites	--				

Course Objectives:

1. To choose right lab tools and techniques for study of eukaryotic cells
2. To identify and detect cellular components and organelles
3. To study cellular processes such as cell division using eukaryotic cells and photomicrographs
4. To differentiate between healthy and cancer cells using photomicrographs

Course Outcomes

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

CO1. **Utilize** laboratory skills to enhance understanding of cell structure and function

CO2. **Demonstrate** appropriate technique for study of eukaryotic cells

CO3. **Analyse** different stages of cell division from eukaryotic cells and photomicrographs

CO4. **Interpret** the differences between healthy and cancer cells

Catalogue Description:

Cell biology lab focuses on introducing tools and techniques to study eukaryotic cells. This course covers microscopy, staining, structure and other techniques to study eukaryotic cells.

Course content

1. Microscopic Observation of Plant and Animal Cells (**10h**)

2.. Overview of cellular organelles through Electron micrographs (5**h**)

3. Cytochemical staining of DNA – Feulgen. (5**h**)

4. Identification and observation of mitochondria in human cheek epithelial cells using vital stain Jenus Green B and Methylene Blue (5**h**)

5. Study of polyploidy in Onion root tip by colchicine treatment. (5**h**)

6. Identification and study of cancer cells by photomicrographs. (5**h**)

7.. Observation and Identification of different stages of Mitosis and Meiosis using root tip and flower bud of onion (5**h**)

8. Use of Micrometre and calibration, measurement of onion epidermal cells. (5**h**)

Text Books

T1. Alberts B. Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K, Walter P (2013). Essential cell biology, 4th edition, Taylor & Francis

Reference Books

R1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's world of the cell, 8th edition, Pearson

R2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **utilize** laboratory skills to enhance understanding of cell structure and function	**PO1, PO2, PO3, PO4, PO5, PO6**
CO2	Students will be able to **demonstrate** appropriate technique for study of eukaryotic cells	**PO1, PO2, PO3, PO4, PO5, PO6**
CO3	Students will be able to **analyse** different stages of cell division from eukaryotic cells and also from photomicrographs	**PO1, PO2, PO3, PO4, PO5, PO6, PO7**
CO4	Students will be able to **interpret** the differences between healthy and cancer cells	**PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12010	Cell biology lab	3	3	2	2	2	2	-	1	-	1	-	-

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

Model Question Paper

Name:
Enrolment No:

Course: MIB12010 – Cell Biology Lab
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:
Answer all questions

Section A

(**Answer** all questions)

1.	**Identify** the structures labelled A-F given in the photomicrographs. Mention the function of these structures. (**Ap**)	**15**	**CO3**
2.	From the microscope slides, **identify** and label all the stages of mitosis. **Determine** the mitotic index. (**An**)	**15**	**CO1**
3.	Lab notebook and viva	**20**	**CO1, CO2, CO3, CO4**

MIB11011	**Microbial Genetics**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12thlevel Biology				
Co-requisites	--				

Course Objectives

1. To provide the students with understanding of gene organization mutation and repair.
2. It will also provide in depth knowledge of plasmids and their properties.
3. To study the methods of genetic exchange in microorganisms.
4. To study the concept and application of transposons.

Course Outcomes

On completion of this course,

1. Students will be able to **explain** the basic concepts of gene, genome, genetics, genomics.
2. Students will be able to classify plasmid and **compare** their properties and applications
3. Students will be able to classify mutation, **distinguish** between various types of mutagens, and **illustrate** the DNA repair mechanisms.
4. Students will be able to explain mechanisms of genetic exchange and **contrast** between various methods of horizontal gene transfer.
5. Students will be able to **summarize** transposable element

Catalogue Description

The core-course of ‘microbial genetics is a fundamental course to develop knowledge about the genetic aspect of microorganisms. It discusses the aspects of gene organization, plasmids, genetic exchanges and transposons. The process of mutation and horizontal gene transfer are the major focus of this course. The repair mechanism is also dealt.

Course Content

Unit 1 Genome Organization, Mutations and repair (18 h)

Genome organization: EBacteria and Yeast

Spontaneous (Spontaneous mutation Luria - Delbruck's Fluctuation Test) and induced mutations, Mutagenic agents - Physical, Chemical and Biological (Phage-mu). Genetic Techniques to detect mutations in bacteria and fungi (isolation and characterization of nutritional auxotrophic mutation); Different forms of mutations and how they arise (tautomeric shift, base analog, alkylating agent, apurinic lesions, UV radiation and thymine dimers, replicational error); Repair: reversal of UV damage in prokaryotes: photoreactivation, base excision and nucleotide excision repair, post replicational repair, mismatch repair, SOS repair, error prone repair.

Unit 2 Plasmids (12 h)

Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, yeast- 2 μ plasmid, Plasmid replication and partitioning, Host range, plasmid-incompatibility, plasmid amplification, Regulation of copy number, curing of plasmids

Unit 3 Mechanisms of Genetic Exchange (15 h)

Transformation - Discovery, mechanism of natural competence; Conjugation - Discovery, mechanism, Hfr and F' strains, Interrupted mating technique and time of entry mapping; Transduction - Generalized transduction, specialized transduction, LFT & HFT lysates, Mapping by recombination and co-transduction of markers

Unit 4 Transposable elements (15 h)

Discovery of transposition. Classes of bacterial transposons. Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Mu transposon

Eukaryotic transposable elements - Yeast (Ty retrotransposon), Drosophila (P elements), Maize(Ac/Ds) Uses of transposons and transposition.

Textbook:

Russell PJ. (2009). Genetics: A Molecular Approach, 3rd edition, Benjamin Cummings

Reference books:

1. Klug WS, Cummings MR, Spencer C, Palladino M (2011). Concepts of Genetics, 10th edition, Benjamin Cummings
2. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd edition, Jones and Bartlett Learning
3. Pierce BA (2011) Genetics: A Conceptual Approach, 4th edition, WH Freeman
4. Watson JD, Baker TA, Bell SP (2008). Molecular Biology of the Gene, 6th edition, Benjamin Cummings

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

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Students will be able to **explain** the basic concepts of gene, genome, genetics, genomics	PO1, PO2

CO2	Students will be able to classify plasmid and **compare** their properties and applications.	**PO1, PO2, PO4**
CO3	Students will be able to classify mutation, distinguish between various types of mutagens, and illustrate the DNA repair mechanisms.	**PO1, PO2, PO3, PO4, PO6**
CO4	Students will be able to **explain** mechanisms of genetic exchange and contrast between various methods of horizontal gene transfer	**PO1, PO2, PO4, PO5**
CO5	Students will be able to **summarize** transposable element	**PO1, PO2**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11011	Microbial Genetics	3	3	2	3	1	1	-	-	-	-	-	-

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

Model Question Paper

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

Course: MIB11011 – Microbial Genetics
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Answer **all questions)**			
1.	**Define** Gene. Compare and contrast gene with genome. (**U**)	**2+3**	**CO1**
2.	Write a short note on F-plasmid. (**R**)	**5**	**CO2**
3.	**Differentiate** between Temperate and Virulent Phage. (**E**)	**5**	**CO3**
4.	**What** is base analogue? Mention its role in mutation. (**An**)	**2+3**	**CO4**
5.	Write a short role on Transposons. (**Ap**)	**5**	**CO5**
6.	How is Hfr strain **different** from F+ strain?	**5**	**CO4**
	SECTION B (Answer **all questions)**		
7.	**Compare** and contrast Generalized vs Specialized Transduction. Add a note on Episome. (**E**)	**8+2**	**CO2** **CO4**
8.	A template DNA: 5’ TTTTACAAT 3’ while replication has undergone mutation in the newly synthesized strand. The First nucleotide has been replaced with ‘G’ and the fourth nucleotide has been replaced with ‘T’. This mutated strand was used as template for the synthesis of mRNA and subsequent Protein. Find out which type of mutation has occurred. (Refer the list of genetic code provided at the end of the question paper) (**An**)	**10**	**CO3**

MIB12012	**Microbial genetics Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	**0**	**0**	**3**	**2**
Pre-requisites/Exposure	**12th level Biology discipline**				
Co-requisites	**--**				

Course Objectives

1. To understand the genetic constituents of bacteria with special emphasis on mutations.
2. To understand the mechanism of genetic transfers in microbes.
3. To understand different techniques used to study the microbial genetics and utilizing the microbial phenomenon in different biotechnological applications.

Course Outcomes

On completion of this course,

No.	**Course Outcomes**
CO1	Students will be able to **discuss** the importance of preparation of master and replica plates.
CO2	Students will be able to **explain** the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells.
CO3	Students will be able to **illustrate** the protocol of isolation of plasmid DNA from *E. coli* and study different conformations of plasmid DNA through Agarose gel.
CO4	Students will be able to **demonstrate** bacterial conjugation, transformation and transduction.
CO5	Students will be able to **design** AMES test.

Catalogue Description

Throughout the course, we will discuss the role of microbial genetics and molecular biology in the advancement of science and society. The student will become familiar with methods of transfer of genetic material in bacteria and will understand the effect of chemical and physical mutagens on bacterial growth. This course explains the processes and techniques used for extraction and purification of genomic and plasmid DNA.

Course Content

1. Development of Replica and Master plate.	**5h**)
2. Understanding the effect of mutagens (UV and HNO_2) on bacterial cells	(**5h**)
3. Observation of the survival curve of bacteria post UV exposure	(**5h**)

4. Plasmid DNA isolation from *E.coli* (**10h**)
5. Plasmid DNA observation through Agarose Gel Electrophoresis (**5h**)
6. Study of Bacterial transformation, conjugation and transduction (**10h**)
7. AMES test. (**5h**)

Text Books

T1. Russell PJ. (2009). iGenetics: A Molecular Approach, 3rd edition, BenjaminCummings.

Reference Books

R1. Klug WS, Cummings MR, Spencer C, Palladino M (2011). Concepts of Genetics,10th edition, Benjamin Cummings.

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

Examination Scheme:

Components	Internal Assessment	End Term
Weightage (%)	50	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **discuss** the importance of preparation of master and replica plates.	**PO1, PO2, PO3**
CO2	Students will be able to **explain** the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells.	**PO1, PO2, PO3, PO4, PO5**
CO3	Students will be able to **illustrate** the protocol of isolation of plasmid DNA from *E. coli* and study different conformations of plasmid DNA through Agarose gel.	**PO1, PO2, PO3, PO4, PO5, PO7**
CO4	Students will be able to **demonstrate** bacterial conjugation, transformation and transduction.	**PO1, PO2, PO3, PO4, PO5**
CO5	Students will be able to **design** AMES test.	**PO1, PO2, PO3, PO4**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12012	Microbial Genetics Lab	3	3	3	3	3	-	1	-	-	-	-	-

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

Model Question Paper

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

Course: MIB12012 – Microbial Genetics Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:

Section A (Answer **any THREE)**

1.	a)**State** the significance of Lederberg experiment. (**Ap**) b) Write down the principle and procedure of Replica Plating technique. (**An**)	**2** **4** **4**	**CO1**
2.	a)**Explain** the effect of chemical mutagens. (**Ap**) b) Write down the principle and procedure for **study** of survival curve of bacteria after exposure to ultraviolet light.(**An**)	**2** **4** **4**	**CO2**
3.	a)**Identify** the buffers used in plasmid DNA isolation. (**Ap)** b) Write down the protocol of isolation of plasmid DNA from *E. coli*. **(An**)	**2** **5** **3**	**CO3**
4.	**Describe** the steps in bacterial conjugation.	**5**	**CO4**

	Write down the principle of Ames test.	**5**	**CO5**
	SECTION B is compulsory		
5.	**Viva-voce** (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practical copy** (U/Ap/E)	**10**	**CO1** **CO2** **CO3** **CO5**

MIB11013	**Environmental Microbiology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12th level Biology				
Co-requisites	--				

Course Objectives:

1. Students will be able to summarize the different microbial ecosystems and identify the various phenomena of microbial worlds.
2. Students will be able to demonstrate and categorize the interactions of microbes present in different ecosystems.
3. Students will be able to illustrate the different microbial biogeochemical cycles of macro and micro elements in different ecosystems.
4. Students will be able to illustrate and appraise the regulations associated with waste management, and apply the knowledge to judge the potability of water samples.
5. Students will be able to comprehend microbial bioremediation.

Course Outcomes

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

1. The students will **develop** basic concept of environment management
2. This conception will enable them to understand and if required to **apply** biotechnological techniques for remediation of damage caused to the environment caused by pollution and accumulation of toxic chemicals and heavy metals
3. The knowledge of the subject will encourage students to **formulate** proposal for environmental remodelling.
4. The knowledge of the subject will enable students to **appraise** the regulations associated with waste management, and **apply** the knowledge to judge the potability of water samples
5. **comprehend** microbial bioremediation

Catalogue Description

The student will be able to use the knowledge obtained from the core course “Environmental Microbiology” to understand different components of the ecosystem and the interrelationship between them along with the significance of ecological balance for existence of life. Also, the awareness about different forms of pollutions and environmental deterioration attributed to man-made as well as natural causes will be enhanced. The knowledge gained will be helpful in implementing different preventive strategies to protect the environment from the harmful effect of pollutions. Information regarding historical and contemporary laws and regulations will help the students to use application of biotechnology for environmental protection and also to reprimand the harmful effects of pollutions. 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

Unit I: Microbial Ecology (30h)

1. History, significance and developments in the field of microbial ecology
2. Succession of microbial communities in the decomposition of plant organic matter
3 Biological Interactions: i). Microbe–Microbe Interactions; Mutualism, Synergism, Commensalism, Competition, Ammensalism, Parasitism, Predation, Biocontrol agents
ii). Microbe–Plant Interactions; Roots, Aerial Plant surfaces, Biological Nitrogen fixation, Defence response, Pathogenicity in plants, Tools for infectious Phytotoxin. iii) . Microbe–Animal Interactions; Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as Symbiont iv) Compost and Biofertilizers

Unit II:Air Soil and Water Microbiology (30h)

1. Diversity of microorganisms & their natural habitats
i). Terrestrial Environment: Soil characteristics, Soil profile, Soil formation, Soil as a natural habitat of microbes, Soil microflora
ii). Aquatic Environment: Stratification & Microflora of Freshwater & Marine habitats
iii). Atmosphere: Stratification of the Atmosphere, Aeromicroflora, Dispersal of Microbes
iv). Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.
v). Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.
2. Techniques of studying Air and Soil Microflora.
3. Marine & fresh water environments. Water as a microbial habitat. Nutrient cycling, Fresh Water environments, Glaciers & permanently frozen lakes, Streams & rivers, Lakes, Marine environments, Estuaries & Salts marshes, The Photic zone, The Benthic zone.
4. Water purification & sanitary analysis. Waste water Microbiology, Measurement of waste water quality, Waste water treatment.

Text Books

T1. Fundamentals of Ecology (2010), 5th edition, Eugene. P. Odum, Gary W. Barrett, Saunders,
T2. Ecology and environment, (2017), 13th edition, P.D. Sharma, Rastogi Publications, ISBN: 9789350781227, 9350781220
T3. Environmental Microbiology (2015), 3rd Edition, Ian L. Pepper, Charles P. Gerba, Terry J. Gentry. Elsevier
T4. Pepper IL, Gerba CP, Gentry TJ (2014). Environmental Microbiology, 3rdedition, AcademicPress

Reference Books

R1. Prescott's Microbiology, 10 edition (2017) McGraw-Hill Education;
Christopher J. Woolverton, Joanne Willey, and Linda Sherwood, ISBN-10: 9813151269
ISBN-13: 978-9813151260

R2. Brock Biology of Microorganisms, 14th edition, (2014) Pearson, Madigan MT, Martinko JM and Parker J.

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **summarize** the different microbial ecosystems and **identify** the various phenomena of microbial worlds	**PO1, PO2, PO3**
CO2	Students will be able to demonstrateand **categorize** the interactions of microbes present in different ecosystems	**PO1, PO2, PO6, PO10, PO12**
CO3	Students will be able to **illustrate** the different microbial biogeochemical cycles of macro and micro elements in different ecosystems	**PO1, PO2, PO3, PO12**
CO4	Students will be able to illustrate and **appraise** the regulations associated with waste management, and **apply** the knowledge to **judge** the potability of water samples	**PO2, PO3, PO5, PO6, PO7, PO10**
CO5	Students will be able to **comprehend** microbial bioremediation	**PO1, PO2, PO3, PO5, PO7, PO8, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11013	Environmental Microbiology	3	2	1	2	3	1	-	2	-	2	-	3

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

Model Question Paper

Name: **Enrolment No:**			
Course: MIB11013- Environmental Microbiology **Program:B.Sc. MicrobiologyTime: 03 Hrs.** **Semester: Odd 2020-21** **Max. Marks: 50** **Instructions:**			
SECTION A (Answer **all questions)**			
1.	Give the diagrammatic representation of zonation in marine ecosystem. (U) What do you **mean** by denitrification? (R)	**3+2**	**CO1**
2.	**Why** do the halophiles require high salinity for their survival? (An) What is the compatible solute in halophiles? (U)	**4+1**	**CO4**
3.	**Write** a note on the working principle of anaerobic sludge digester. (U)	**5**	**CO1, CO4**
4.	**What** are faecal and non-faecal coliform bacteria? (R) What is the significance of adding bromothymol blue in Simmon's citrate agar media? (U)	**2+3**	**CO2, CO4**
5	What are psychrotolerant microorganisms? (U) Name an acidophile and an alkaliphile.(R) What is the role of these nodules in nitrogen fixation? (U)	**1+2+2**	**CO2, CO3**
6.	**What** are barophiles? (R) Why is halorhodopsin important for the halophiles? (U)	**1+4**	**CO4**
	SECTION B (Attempt **all questions)**		
6.	**Illustrate** the mutualistic relationship between microbes in ore leaching. (An) **Explain** antagonism among microorganisms with suitable example. (U)What is synergism?(U)	**4+4+2**	**CO1, CO5**
7.	**Discuss** the working principle of trickling filter and activated sludge system of secondary water treatment. (U) What is meant by BOD_5? (U) Write a note on enumeration of air microbiota by method of impaction on solid media. (R)	**3+3+2+2**	**CO1** **CO2**

MIB12014	**Environmental Microbiology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Concept of Environmental science and basic microbiology				
Co-requisites	--				

Course Objectives

1. Students will learn to assess physical parameters that characterize the natural resources wherefrom microorganisms may be obtained.
2. Students will be able to identify, and estimate the microbial populations in different natural resources
3. Students will be able to illustrate the different microbial interactions with other microbes and plants and requirement of oxygen by the microbes.
4. Students will be able to assess the potability of water samples.
5. Students will be able to comprehend microbial bioremediation.

Course Outcomes

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

1. Students will be able to **analyse** the different parameters of soil samples and identify, and estimate the soil microbial populations
2. Students will be able to **identify** and categorize the microbes present in rhizospheres and root nodules
3. Students will be able to **assess** the microbial quality of water samples
4. Students will be able to **determine** the BOD and judge the potability of water samples
5. Students will be able to conclude on the microbial metabolic processes by determining their enzyme activities

Catalogue Description

The student will be able to characterize the physical parameters defining the natural resources inhabited by microorganisms followed by estimation of type and quantity of microorganisms present there. Students will be able to appraise the nutritional requirement of different microorganisms. Microbial interactions will also be clarified. The knowledge acquired will also help to assess potability of water samples. 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 the coordinator.

Course Content

1**. Analysis of soil** **(6h)**

Determination of capillary action, water holding capacity, pH, moisture content and percolation of soil

2. **Enumeration of microbes** **(6h)**

Isolation of soil microorganisms by spread/pour plate method using serial dilution 3. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane. (**6h**)

4. Microbiological quality assessment of water (a) Presumptive test b) Confirmatory test c) Completed test for coliform d) IMViC reactions. (**6 h**)

5. Determination of BOD of waste water sample. (**6h**)

6. Qualitative analysis and detection of dehydrogenase, amylase and urease from soil microorganisms (**6h**)

7. Isolation of Rhizobium from root nodules. (**9h**)

Text Book(s)

T1. Pepper IL, Gerba CP, Gentry TJ (2014). Environmental Microbiology, 3rdedition, Academic Press

Reference books

R1. Atlas RM and Bartha R (2000). Microbial Ecology: Fundamentals & Applications. 4th edition, Benjamin Cummings

R2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms, 14th edition, Pearson

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **analyze** the different parameters of soil samples and identify, and estimate the soil microbial populations	**PO1, PO3, PO5**
CO2	Students will be able to **identify** and categorize the microbes present in rhizospheres and root nodules	**PO3, PO4, PO5**
CO3	Students will be able to **assess** the microbial quality of water samples	**PO3, PO4, PO5**
CO4	Students will be able to **determine** the BOD and judge the potability of water samples	**PO2, PO5, PO6**
CO5	Students will be able to **conclude** on the microbial metabolic processes by determining their enzyme activities	**PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12014	Environmental Microbiology Lab	2	3	3	2	3	1	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: MIB12014 –Environmental Microbiology Lab
Program:B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**
Instructions:
Answer the following questions

SECTION A

1.	**Elaborate** your observations obtained from sample A with emphasis on following points: a) Description of microbial growth, type of media (R An,) b) Probable conclusion from the observation. (An)	**5+10**	**CO1**
2.	You have been provided with mother stock of a soil sample (1gm soil dissolved in 10ml sterile 0.9(N) NaCl solution). a) How will you prepare serial dilutions 10-1 to 10-6? (U) b) Which dilution is best for determining the microbial load? Justify with reference to the picture provided. (An) c) 200ul of each dilution was used for plating by spread plate method. **Determine** the microbial load in 20gm of this soil sample. (U)	**4+4+7**	**CO1, CO2**

	SECTION B		
6.	Lab note book (U, An)	**10**	**CO1, CO2, CO3, CO4. CO5**
7.	Viva (R, An)	**10**	**CO1, CO2, CO3, CO4. CO5**

MIB11015	**MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	0	2	5
Pre-requisites/Exposure	PLUS TWO (12^{th}) LEVEL BIOLOGY AND BASIC INTRODUCTION TO MICROBIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide the students with understanding of industrial process especially in context to quality control
2. It will also develop skill-set required for working as microbiologists in an industry
3. To understand the quality standards as per regulatory authorities.

Course Outcomes

On completion of this course,

1. Students will be able to explain and **analyze** the basic concepts of GLP along with GMP, GDP.
2. Students will be able to **determine** and enumerate microorganisms from food and pharmaceutical samples.
3. Students will be able to **compare**QA and QC
4. Students will be able to **summarize** various pathogenic microorganisms and their detection method.
5. Students will be able to design HACCP audit and **illustrate** the safety measures in terms of QC.

Catalogue Description

The core-course of ‘microbial quality control in food and pharmaceutical industries is a skill enhancement course to develop knowledge and skill sets required by a microbiologist working in the quality control department of pharmaceutical or food industry. This course covers several aspect of Quality Management System and standards to be followed. The course is delivered through power point presentations, interactive discussion and supplemented with visit to industries in gaining practical and real-time exposure.

Course Content

Microbial Quality Control in Food and Pharmaceutical Industries (MIB11015)

Unit 1 Microbiological Laboratory and Safe Practices (12h)

Good laboratory practices - Good microbiological practices; Biosafety cabinets - Working of biosafety cabinets, use of protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste - Methodology of Disinfection, Autoclaving &Incineration

Unit 2 Determining Microbes in Food and Pharmaceutical Samples (20h)
Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products; Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

Unit 3 Pathogenic Microorganisms of Importance in Food & Water (20h)
Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Mannitol salt agar, EMB agar, McConkey Agar, Saboraud Agar; Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay)

Unit 4 HACCP for Food Safety and Microbial Standards (8h)
Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations; Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water

Textbook:
Doyle MP, Buchanan RL (2012). Food Microbiology: Fundamentals and Frontiers, 4th edition, ASM

Reference Book:
1. Harrigan WF (1998). Laboratory Methods in Food Microbiology, 3rd edition, Academic Press
2. Jay JM, Loessner MJ, Golden DA (2005). Modern Food Microbiology, 7th edition, Springer
4. Baird RM, Hodges NA and Denyer SP (2005). Handbook of Microbiological Quality control inPharmaceutical and Medical Devices, Taylor and Francis

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** and **analyze** the basic concepts of GLP along with GMP, GDP.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO11**

CO2	Students will be able to **determine** and enumerate microorganisms from food and pharmaceutical samples.	**PO1, PO3, PO4, PO5,PO6,PO7,PO9**
CO3	Students will be able to **compare** QA and QC	**PO1, PO2, PO3, PO7,PO8**
CO4	Students will be able to **summarize** various pathogenic microorganisms and their detection method.	**PO1, PO3, PO4, PO5,PO6,PO7**
CO5	Students will be able to design HACCP audit and **illustrate** the safety measures in terms of QC.	**PO1, PO2, PO3, PO4,PO6,PO7,PO8, PO9, PO11**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
MIB11015	MICROBIAL QC IN FOOD AND PHARMA INDUSTRIES	3	3	3	3	1	3	3	3	1	-	1	-

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

Model Question Paper

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

Course: MIB11015–MICROBIAL QUALITY CONTROL IN FOOD AND PHARMA INDUSTRIES (THEORY)
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: III (Odd 2021-22) Max. Marks: 50

Instructions:

SECTION A (Attempt **all questions)**			
1.	**Illustrate** the utility of PDCA in QC (An)	**5**	**CO1**
2.	Blood Agar can be called Enriched media as well as Differential media: **Justify** (U)	**5**	**CO2**
3.	**Compare** QA and QC (U)	**5**	**CO3**
4.	**Explain** the process of MBRT. Comment on the endpoint of the experiment. (U,R)	**4+1**	**CO4**
5	Write a short note on Biomedical Waste Management	**5**	**CO1, CO5**
6.	**Mention** the steps of PCR.	**5**	**CO2**
	SECTION B (Attempt **all questions)**		
7.	**Why** do a Pharmaceutical company need to follow GLP? Briefly explain the role of GDP in an industry. Explain the role of validation as a part of QC. (An/R/U)	**4+3+3**	**CO1,CO3**
8.	As a research supervisor, you would like to establish a lab and work on *Mycobacterium tuberculosis.* Which grade of laboratory (BSL) would you build? How will you upgrade the laboratory of academic institution to attain such facility? Create a SOP for any instrument used in your microbiology lab. (An/U/Cr)	**2+6+2**	**CO1, CO5**

MIB11016	Food Fermentation Techniques	L	T	P	C
Version 1.0	**Contact Hours - 60**	3	0	2	4
Pre-requisites/Exposure	Basic Knowledge of Microbiology, Biochemistry				
Co-requisites	--				

Course Objectives

1. Understand the types of fermented food and health benefit.
2. Understand the basic method of fermentation.
3. Know the basic physiology of a microorganism and how their structure dictates their function in Process Industries.
4. Outlining the production of different fermented food products.

Course Outcomes

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

1. Students will be able to **explain** the production methods of industrially important substances
2. Students will be able to **design** the process of industrial production of biologically important products
3. Students will be able to **design** formulation of different probiotic products
4. Students will be able to compare and **classify** different types of fermented food

Catalogue Description

A fair knowledge of principles of fermentation, downstream processing will be acquired. The focus of the course is on design of innovative microbial fermentations, for bio-products such as amino acids and monomers for microbiologically important products.

Course Content

Unit 1 Fermented Foods **(10 h)**

Definition, types, advantages and health benefits

Unit 2 Milk Based Fermented Foods **(10 h)**

Dahi, Yogurt, Buttermilk and cheese: Preparation of inoculums, types of microorganisms and production process

Unit 3 Grain Based Fermented Foods **(10 h)**

Soy sauce, Bread, Idli and Dosa: Microorganisms and production process

Unit 4 Vegetable Based Fermented Foods **(10 h)**

Pickles, Sauerkraut: Microorganisms and production process

Unit 5 Fermented Meat and Fish **(10 h)**

Types, microorganisms involved, fermentation process

Unit 6 Probiotic Foods **(10 h)**

Definition, types, microorganisms and health benefits

Textbooks:

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

Reference books:

1. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
2. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

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

Examination Scheme:

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** the production methods of industrially important substances.	**PO1, PO2**
CO2	Students will be able to **illustrate** and classify the process of industrial production of biologically important products.	**PO1, PO2, PO3**
CO3	Students will be able to **compare** and contrast different fermented food.	**PO1, PO2, PO3**
CO4	Students will be able to **design** the different probiotic products.	**PO1, PO2, PO4, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11016	Food Fermentation Techniques	3	3	2	2	1	1	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: MIB11016- Food Fermentation Techniques
Program:B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt all questions)

1.	What is fermentation? **Explain** homo- and heterolactic fermentation. (U)	**2+3**	**CO1**
2.	**Classify** different types of cheeses and mention producer organisms. (E)	**4+1**	**CO2**
3.	**Differentiate** between Conventional fermentation and biotransformation. (An)	**5**	**CO3**
4.	**Enlist** 3 type of modification method involved in strain improvement. Also mention the role of precursor in media formulation. (U)	**2+3**	**CO4**
5.	A batch system with nitrogen enriched media was working for long hours, does it really require any antifoaming agent? **Explain** the mechanisms involved. (E)	**1+2+2**	**CO5**

6.	With a proper labelled diagram **explain** the basic design of a fermenter?	**5**	**CO1**
	SECTION B (Attempt **all questions)**		
7.	What is the basic biochemistry behind alcohol fermentation? Illustrate various process involved in Microbial production of amylase. **Enlist** the by-products and their utilization of alcohol industries. (Ap)	**3+4+3**	**CO1** **CO2**
8.	**Mention** three forms of fungal spoilage of fruits and fruit products. What are the dietary benefits of probiotics? **Elaborate** the production of Sauerkraut? (E)	**3+4+3**	**CO1** **CO2**

IDP14001	**Interdisciplinary Project**	**L**	**T**	**P**	**C**
Version 1.0		**0**	**0**	**3**	**3**
Pre-requisites/Exposure	**Knowledge of Basic English**				
Co-requisites	**Knowledge of Basic Computer Skills**				

Course Objectives

This course will develop a student's knowledge of and appreciation for the

- interdisciplinary nature of knowledge and learning
- importance and value of integrating knowledge and perspectives from multiple disciplines as a means to evaluating and understanding complex topics, problems, issues, phenomena, and events
- competencies learned during the educational process and to apply these competencies in a real-world application

Course Outcomes

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

CO1. recognize the unique advantages of integrative research and learning
CO2. understand the fundamentals of research methods and practices of various academic disciplines
CO3. demonstrate an understanding of current issues and concerns
CO4. realize the importance of ethics in research process
CO5. understand the inter-disciplinary systems of research documentation

Typical Progress Roadmap

- After discussion with the Project Advisor(s), each student shall prepare an initial outline of their assigned project indicating the major sections of discussion, list the principal research sources for each section, and explain the overall objective of the project, including a justification of the interdisciplinary nature of the work.
- Each student shall meet with the Project Advisor(s) regularly as per the weekly Time-Table. Other meetings may be scheduled at the discretion of the Project Advisor(s) at mutually agreed upon timings.
- Typically, the progress will include a combination of industrial and academic mentoring, self study sessions, case studies, trend studies, presentation by students, interactive sessions, industrial visits etc.
- Regular submission of progress reports shall be required of each student-group as notified through the Project Advisor(s) from time to time.

Mode of Evaluation

Students will be evaluated by team participation and a team presentation at the end of the project. Interactive & continuous, task/assignment- based evaluation methodology will be applied for the course.

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**recognize** the unique advantages of integrative research and learning	**PO1, PO2, PO3, PO5,**
CO2	**understand** the fundamentals of research methods and practices of various academic disciplines	**PO1, PO3, PO4**
CO3	**demonstrate** an understanding of current issues and concerns	**PO1, PO2, PO3**
CO4	**realize** the importance of ethics in research process	**PO1, PO5, PO11**
CO5	**understand** the inter-disciplinary systems of research documentation	**PO3, PO4, PO7, PO5, PO8, PO9**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IDP14001	Inter disciplinary project	2	3	3	3	3	-	1	1	3	-	1	-

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

SOC14100	**Community Service**	**L**	**T**	**P**	**C**
Version 1.0		-	-	-	1
Pre-requisites/Exposure	Knowledge of Basic English				
Co-requisites	Knowledge of Basic Computer Skills				

Course Objectives

1. To familiarise the students on the concept ‘giving back to the society’.
2. To familiarize the students on the issues faced by marginalized communities.
3. To provide an experiential platform to the students on any one or two issues as an internship.

Course Outcomes

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

CO1: **Understand** the concept of social responsibility through an internship.
CO2: **Acquire** hands on experience in ‘giving back to the society’ through the concept of social responsibility through an internship.

Catalogue Description

Along with Intelligent Quotient, it is important for students to enhance their Emotional Quotient as well. The Social Internship offers opportunity to the student to be empathetic towards social issues facing our society. To help and support the affected community / cause through a field internship is the essence of the course in ‘giving back to the society’.

Course Content

Unit I:
Introduction to the course. A brief on social issues facing the society with both global and Indian examples.

Unit II:
Minimum 24 hours of field work on a social issue and helping the marginalized / affected community / cause with photographs and testimonies.

Unit III:
Submission of individual reflection on the social service rendered.

The benefits that accrue to the students are

A.) Subjective

1. Psychosomatic benefits: Volunteering increases overall life satisfaction and also helps to relive stress and acts as an anti-depressant.
2. Intellectual benefits: Enhances knowledge through new experiences, and develops communication skills.
3. Career benefits: Enhances career prospects by acquisition of work-related skills, builds good references for employers and provides a forum to network with future potential employers. It also the experience allows gained helps students to take up leadership positions. Letters of recommendation can also be easily sought. Research shows that students who indulge in volunteer word perform better in studies as it invigorates their passion for learning
4. Personal benefits : Real world skills like leadership, problem-solving, collaboration with others, time management and communication skills, learn patience and empathy.
5. Connect learning to real world and enables deeper and lifelong learning.

B.) **Community**

1. Collective benefits: Strong interpersonal bonds are created, and leads to increased civic and social awareness and responsibility.

Further Reading:

1. Tadevosyan, Gohar & Schoenhuth, Michael. Participatory Research Approach: Principles, Challenges and Perspectives.
   http://ysu.am/files/01G_Tadevosyan_M_Schoenhuth.pdf

2. Bergold, Jarg & Thomas Stefan. Participatory Research Methods: A Methodological Approach in Motion
   http://www.qualitative-research.net/index.php/fqs/article/view/1801/3334

Plan of Work

1. Reading on social issues facing the society with both global and Indian examples.
2. Selecting an issue where the student wishes to contribute and wants to make a difference.
3. Areas - The internship may be broadly completed by getting in touch with NGO in your city / town / Police / Municipal Corporation / Local Gram Panchayat / Hospital / State Health Department / Women & Child Development Centre / CSR departments of Corporates /school / Old Age Home / Orphanage / Literacy Drive / Aanganwadi Centers / etc.
4. **Online Discussion –** Through discussion, students elaborate their preferred area of work with reference to the Global Scenario and India. Reason for choosing that area also needs and resources of the people in their area of Social Internship and also submit the

testimonials, which include signature of the authority where students initiated their work, or the signature of the authority in whose area students are currently working or photographs of work (photographs must include students working).

5. **Final Report Submission** - Submission of theTestimonials include signatures of the authorities you have worked with, or the signature of the authority in whose area you have worked or photographs of your work (photographs must include you working). Students' accomplishment in their area of operation along with the major successes student experienced and major challenges faced.
6. Students will submit the complete elaborated report along with testimonials and completion certificate in the form of signed Template

- The registration for all students will open twice, during winter and summer breaks. They may enroll for the internship in either of the two breaks.
- The student will have to submit a continuous record of their 10 to 15 days internship in the form of photographs and testimonies (wherever required).

Mode and Scheme of Online Evaluation:

Modes of Evaluation: Online – Quiz / Assignment / Discussions / Case StudiesExamination Scheme:

Components	**Internal Assessment (Discussion+ Initiating Internship Template) MTE**	**ETE (Detailed Report Submission + Testimonials Photographs / Student Experience Sharing Video)**
Weightage (%)	**40**	**60**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Understand** the concept of social responsibility through an internship.	**PO8, PO9, PO10, PO11, PO12**
CO2	**Acquire** hands on experience in 'giving back to the society' through the concept of social responsibility through an internship.	**PO8, PO9, PO10, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
SOC14100	Community Service	-	-	-	-	-	-	-	3	3	3	3	3

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

PHY11015	**Elective Physics I**	**L**	**T**	**P**	**C**
Version 1.2	**Contact Hour: 60**	4	0	0	4
Pre-requisites/Exposure	12th level Physics				
Co-requisites	Basic concept of Differential and Integral Calculus				

Course Objectives

1. To develop the capability of the students for understanding fundamental aspects of physics.
2. To give students theoretical background, the key prerequisite for performing laboratory experiments.
3. To build up idea on basic Newtonian mechanics, general properties of matters, electromagnetic theory and optics. These ideas can upgrade student's understanding in proper channel, so that they can flourish their career path.
4. To explore every day phenomena of the macroscopic world from a scientific point of view.

Course Outcomes

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

CO1: **Develop** knowledge of vector differentiation, integration, essential theorems and apply it in further study of physics.
CO2: **Relate** and illustrate the fundamental principles of dynamics of a single particle and system of particles and apply it in real life problems.
CO3: **Define** and develop the concepts of work and energy, Conservative and non-conservative forces and Central forces.
CO4: **Define** and analyse the fundamentals of rotational dynamics of a rigid body, and estimate the Moment of Inertia of different objects, explain Coriolis and Centrifugal forces.
CO5: **Define** and explain the basic concepts of Elasticity, viscosity, surface tension and apply it in different relevant areas.
CO6: **Develop** the basic concepts of electromagnetic theory and apply it in practical situation.
CO7: Define, **explain** and estimate different phenomenon of wave and optics.

Catalogue Description

In Elective Physics I course different aspects of Mathematical Physics is enlisted to explain phenomena in the natural world. This information is then can be used for practical endeavours through a controlled Laboratory environment. In this course the focus will be on improving the logical learning moved into a physical environment. Newtonian mechanics, general properties of matter, electromagnetic theory, these basic field will be covered. We will combine traditional lectures with other active teaching methodologies like digital platform, group discussions, cooperative group solving problems, Course will be concluded with basic understanding of Optics which will make a background to perform optical experiments

Course Content

Unit I: Vector Analysis (8 h)
Axial and polar vectors, dot product and cross product, scalar triple product and vector triple product. Scalar and vector fields -gradient, divergence and curl, statement of divergence theorem, statement of Stokes' theorem.

Unit II: Newtonian Mechanics (10 h)
(a) Newton's laws of motion, principle of conservation of linear momentum, time and path integral of force, conservative force field, concept of potential, conservation of total energy, equation of motion of a system with variable mass.
(b) Rotational motion, angular velocity, angular acceleration, angular momentum, torque, fundamental equation of rotational motion, principle of conservation of angular momentum, radial and cross-radial acceleration.
(c)Central force and Gravitation**:** Central force and its properties, Differential equation of orbits under central force field, Gravitational potential and intensity due to thin uniform spherical shell and solid sphere of uniform density, escape velocity.

Unit III: Elasticity (6h)
Elastic moduli and their interrelations, bending of a beam, cantilever, simply supported beam with concentrated load at the center.

Unit IV: Viscosity and Fluid Motion (6 h)
Streamline and turbulent motion, Poiseuille's formula, critical velocity, Reynolds number, Bernoulli's theorem, Stokes' law (statement only).

Unit V: Surface Tension (6 h)
Surface tension and surface energy, molecular theory, angle of contact, elevation and depression of liquid columns in a capillary tube, excess pressure in a spherical bubble and spherical drop.

Unit VI: **E M Theory (12 h)**
Gauss's Law in Electrostatics (in vacuum and in presence of dielectric), Laplace's Equation and Poisson's Equation, Lorentz Force, Motion of Charged Particles in crossed Electric & Magnetic fields, Velocity Selector & Magnetic focussing, Biot-Savart Law and Ampere's Law and their applications, Vector and Scalar potential, Electromagnetic induction, Faraday's Law, Maxwell's equations (differential and integral forms), Poynting vector, Poynting

Theorem (Statement only), propagation of plane electromagnetic waves in vacuum, dielectric and conducting media.

Unit VII: Wave and Optics **(12 h)**

Differential equation and its solution, analytical treatment, Lissajous figures, natural, damped and forced vibration, resonance, sharpness of resonance. Light as an electromagnetic wave, full electromagnetic spectrum, properties of electromagnetic waves, Huygens' principle, Interference of light, Young's experiment, intensity distribution, conditions of interference, Diffraction of light, Fresnel and Fraunhofer class, Fresnel's half-period zones, zone plate. Fraunhofer diffraction due to a single slit and plane transmission grating (elementary theory). Polarization of light Different states of polarization, Brewster's law.

Text books:

T1. Vector Analysis by Murray R Spiegel.

T2. Theoretical mechanics by Spiegel.

Reference Books

R1. An Introduction To Mechanics, by Robert J. Kolenkow and Daniel Kleppner.

R2. A Treatise on General Properties of Matter, Sengupta Chatterjee.

R3. Electromagnetic Fields (Theory and Problems), TVS Arun Murthy.

R4. Principles of Optics, B.K. Mathur, 1995, Gopal Printing

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

Examination Scheme:

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Develop**, define knowledge of vector differentiation, integration, essential theorems and apply it in further study of physics.	**PO1, PO2, PO3, PO5**
CO2	**Relate** and illustrate the fundamental principles of dynamics of a single particle and system of particles and apply it in real life problems.	**PO1, PO2, PO4, PO5**

CO3	**Define** and develop the concepts of work and energy, Conservative and non-conservative forces and Central forces.	**PO1, PO2, PO3, P012**
CO4	**Define** and analyse the fundamentals of rotational dynamics of a rigid body, and estimate the Moment of Inertia of different objects, explain Coriolis and Centrifugal forces.	**PO1, PO2, PO3, PO4, PO5, PO12**
CO5	**Define** and explain the basic concepts of Elasticity, viscosity, surface tension and apply it in different relevant areas.	**PO1, PO2, PO3, PO5, PO12**
CO6	**Develop** the basic concepts of electromagnetic theory and apply it in practical situation.	**PO1, PO2, PO10**
CO7	Define, **explain** and estimate different phenomenon of wave and optics	**PO1, PO2, PO4, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY11015	Elective Physics I	3	3	3	1	1	3	-	-	-	1	-	1

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

Model Question Paper

Name:

Enrolment No:

Course: PHY11015- Elective Physics I
Program:B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:

Answer all **(10 × 5) = 50**

Q. No. 1			
(a)	**Show** that for small vibrations of the compound pendulum has time period $T = 2\pi\sqrt{\frac{I_0}{Mga}}$. (**An**)	**2.5**	**CO4**
(b)	In the case of rocket motion, **determine** the height attained by the rocket at time t. (**R**)	**2.5**	**CO2**
(c)	Considering non-inertial frame determine Coriolis force due to rotational motion of the particle. Give some phenomena in nature arising due to the Coriolis force. (**E**)	**2.5 +0.5**	**CO4**
(d)	**What** are axial and polar vector? Give example of these vectors. (**R**)	**2**	**CO1**
Q. No. 2			
(a)	**Show** that, the moment of inertia of a solid sphere about a diameter is $2/5Ma^2$, where M is mass of solid sphere, *a* is diameter of sphere. (**E**)	**2.5**	**CO4**
(b)	Find the projection of the vector $\overrightarrow{A} = 2\hat{\imath} - 4\hat{\jmath} + 2\hat{k}$ on the vector$\overrightarrow{B} = 8\hat{\imath} - 8\hat{\jmath} + 14\hat{k}$.(**Ap**)	**1.5**	**CO1**
(c)	Prove that, $(\vec{X} \times \vec{Y}).(\vec{Y} \times \vec{Z}) \times (\vec{Z} \times \vec{X}) = (\vec{X}.\vec{Y} \times \vec{Z})^2$ (**Ap**)	**2**	**CO1**
(d)	**Express** the Stokes' theorem. Write down physical significance of curl of a vector. Verify Stokes' theorem for $\overrightarrow{A} = (2x - y)\hat{\imath} - yz^2\hat{\jmath} - y^2z\hat{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary. (**Ap**)	**1.5 +2.5**	**CO1**
Q. No. 3			
(a)	'Coefficient of viscosity of glycerine is 8.4 Poise', **explain**. (**R**)	**1.5**	**CO5**
(b)	A liquid of coefficient of viscosity η flows steadily through a cylindrical tube of radius r and length l under a pressure P. Show that its velocity at a point inside the tube situated at a distance x from the axis is given by $v = \frac{P}{4\eta l}(r^2 - x^2)$. (**Ap**)	**3**	**CO5**
(c)	**Distinguish** between streamline and turbulent motion. (**R**)	**1.5**	**CO5**
(d)	**What** is meant by torsional oscillation? Discuss how the modulus of	**0.5+**	**CO5**

	rigidity of the material of a long wire can be determined, using torsional oscillation. (**R**+**U**)	**2.5**	
(e)	A cylinder of radius r and length is being elongated under the action of a tensile force. If volume remains constant during this process then show that the Poisson's ratio of the material of the cylinder is $\frac{1}{2}$. (**Ap**)	**1**	**CO5**
Q. No. 4		**[1+3+2+4=10]**	
(a)	**Explain** Huygens' wave theory of light. What is wave front? (**R**)	**1**	**CO7**
(b)	Monochromatic light from a narrow-slit fall on two parallel slits and the interference fringes are obtained on a screen. Calculate the spacing between the consecutive maxima and minima. (**U**)	**3**	**CO7**
(c)	Show that the kinetic energy of a rigid body rotating about an axis with angular velocity $\vec{\alpha}$and angular momentum $\vec{L}$is $\frac{1}{2}\vec{\omega}.\vec{L}$. (**E**)	**2**	**CO1,** **CO7**
(d)	Show that intensity distribution for diffraction in a single slit is given by, $$I = I_0\frac{(\sin^2 \alpha)}{\alpha^2}$$ Where $= \frac{\pi a}{\lambda}\sin\theta$, $a$is the width of the slit, λ is the wavelength of light and θ is the angle**. (E)**	**4**	**CO7**
Q. No. 5			
(a)	Write down Ampere's circuital law. A straight long condenser of radius R, carrying current i. Using Ampere's law discuss the magnetic field produced by the current along its length. (**U**)	**1+3**	**CO1,** **CO6**
(b)	A potential difference of 300 V is applied between two horizontal parallel plates and the separation between the plates is 2 cm. A magnetic field $B = 1.5\,T$ is applied in the space between the plates perpendicular to the electric field. An electron goes through between the plates without any deflection. **What** is the velocity of the electron? (**Ap**)	**3**	**CO1,** **CO6**
(c)	**Prove** that, for a particle moving under the action of a central force field $\left(\vec{F} = f(r)\hat{r}\right)$ (i) $\vec{\nabla}\times\vec{F}=0$ (ii) Total angular momentum is conserved. (**U**)	**1+2**	**CO3**

PHY12016	**Elective Physics I Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours – 45 Hours**	0	0	3	2
Pre-requisites/Exposure	Basic knowledge on physics experiment (12th level Physics)				
Co-requisites	--				

Course Objectives:

1. To develop the capability of the students for practical understanding of fundamental aspects of physics.
2. To give students experimental/laboratory-based background, the key prerequisite for performing research near future.
3. To build up real-time idea on basic Newtonian mechanics, general properties of matters, electromagnetic theory and optics. These ideas can upgrade student's understanding in proper channel, so that they can flourish their career path.

Course Outcomes

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

CO1: **Estimate**, demonstrate realistic understanding of measurement of general properties of matter and experiment of light
CO2: **Experiment**, relate with measurement of Young's modulus by Flexure method
CO3: **Estimate**, demonstrate the fundamental idea of experiment with some basic measurement instruments, such as slide callipers, screw gauge etc.
CO4: **Experiment**, relate with measurement Rigidity modulus by Dynamic method
CO5: **Experiment**, relate with measurement of coefficient of viscosity by Poiseuille's capillary flow method, develop idea on conduct experiment with capillary tube
CO6: **Develop** the practical understanding on measurement of surface tension by Jurin's law
CO7: **Develop** skill enhancement on experiment of light and estimate the Brewster's angle and refractive index of glass Hands-on knowledge on spectrometer (Schuster's focussing), estimate the idea of polarized and un-polarized light by using polaroid
CO8: **Develop** the visualization of interference pattern of monochromatic light by Newton's ring method and concept of wavelength measurement

Catalogue Description:

In Elective Physics I Lab course different aspects of Physics lab is enlisted to explain phenomena in the natural world. This information is then can be used for practical endeavours through a controlled Laboratory environment. In this course the focus will be on improving the logical learning moved into a physical environment. Newtonian mechanics, general properties of matter, optics, these basic field-based laboratories will be covered. We will combine traditional lab classes with other active teaching methodologies like digital platform, group discussions, cooperative group solving problems, weekly viva.

Course Content:

Experiment 1: (3h)
Determination of Rigidity modulus by Dynamic method.
Experiment2: (6h)
Determination of Young's Modulus by Flexure method.
Experiment3: (6h)
Determination of coefficient of viscosity by Poiseuille's capillary flow method.
Experiment4: (6h)
Determination of Surface Tension of a given liquid by Jurin's Law.
Experiment5: (6h)
To determine the value of 'g' using Compound Pendulum.
Experiment6: (6h)
To determine the wavelength of a monochromatic light by Newton's ring method.
Experiment7: (3h)
Dispersive power of the material of the prism using spectrometer and Na light source.
Experiment8: (6h)
Determination Brewster's Angle and Refractive Index of Glass by using spectrometer and Polaroid.
Experiment9: (3h)
Determination of wavelength of a light by LASER diffraction method.

Text books:

T1. Vector Analysis by Murray R Spiegel.

Reference Books

R1. An Introduction to Mechanics, by Robert J. Kolenkow and Daniel Kleppner.

R2. A Treatise on General Properties of Matter, Sengupta Chatterjee.

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)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes

CO1	Estimate, demonstrate realistic understanding of measurement of general properties of matter and experiment of light	**PO1, PO2, PO3, PO5**
CO2	Experiment, relate with measurement of Young's modulus by Flexure method	**PO1, PO2, PO4, PO5**
CO3	Estimate, demonstrate the fundamental idea of experiment with some basic measurement instruments, such as slide callipers, screw gauge etc.	**PO1, PO2, PO3, P012**
CO4	Experiment, relate with measurement Rigidity modulus by Dynamic method	**PO1, PO2, PO3, PO4, PO5, PO12**
CO5	Experiment, relate with measurement of coefficient of viscosity by Poiseuille's capillary flow method, develop idea on conduct experiment with capillary tube	**PO1, PO2, PO3, PO5, PO12**
CO6	Develop the practical understanding on measurement of surface tension by Jurin's law	**PO1, PO2**
CO7	Develop skill enhancement on experiment of light and estimate the Brewster's angle and refractive index of glass Hands-on knowledge on spectrometer (Schuster's focussing), estimate the idea of polarized and un-polarized light by using polaroid	**PO1, PO2, PO4, PO6**
CO8	Develop the visualization of interference pattern of monochromatic light by Newton's ring method and concept of wavelength measurement	**PO1, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY12016	Elective Physics I Lab	3	3	2	3	1	2	-	1	-	-	-	1

1=weakly mapped

2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**			
Course:PHY12016-Elective Physics ILab **Program: B.Sc. Microbiology Time: 03 Hrs.** **Semester: Odd 2019-20** **Max. Marks: 50** **Instructions:** Read the questions carefully. Determine the values of nuclear g factor of the samples and compare the results for different samples.			
Q 1:	**Determine** Brewster's Angle and Refractive Index of Glass by using spectrometer and Polaroid. a. Demonstration of the Theory **(U)** b. Illustrate the working formula, ray diagram to determine the values **(U)** c. Demonstrate Schuster's focussing **(Ap)** d. Demonstrate of results in Tabular form **(U)** e. Estimate the values Brewester's angle and refractive index of glass **(E)** f. **Discus** the precautionary measurements **(C)** g. Viva voce	15+5+5+5+2+3+15	**CO 7**

Course Objectives

CSE11641	**Elective Computer Science I**	L	T	P	C
Version 1.0	**Contact Hours=60**	4	0	0	4
Pre-requisites/Exposure	Basics of Computer knowledge				
Co-requisites	--				

5. To understand the usage of computers in daily life applications.
6. To apply the Office productivity software applications in performing different tasks.
7. To understand about operating system about how it works.
8. To study about the different types of networks and their applications.

Course Outcomes

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

CO1: **Describe** the usage of computers and why computers are essential components in business and society.

CO2: Work effectively with a range of current, standard, **apply** Office Productivity software applications.

CO3: **Evaluate**, select and use office productivity software appropriate to a given situation

CO4: **Utilize** the Internet Web resources and evaluate on-line e-business system.

CO5: **Solve** common business problems using appropriate Information Technology applications and systems.

Catalogue Description

This course introduces the student to the world of computers and their basics. It helps them to grasp knowledge about the different Office productivity software applications and their practical application scenarios. They become familiar with the basics of Operating System and its different types and also get knowledge about computer networks and their principal network components.

Course Content

Unit I: Knowing computer: (8 h)

What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information; Applications of IECT; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.

Unit II: Operating Computer using GUI Based Operating System: (8 h)

What is an Operating System; Basics of Popular Operating Systems; The User Interface, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows; Using help; Creating Short cuts, Basics of O.S Setup; Common utilities.

Unit III: Understanding Word Processing: (10 h)

Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Mail merge, Printing of word document.

Unit IV: Using Spread Sheet: (9h)

Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet, Macro.

Making Small Presentation: Basics of presentation software; Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handouts.

Unit V: Communications and collaboration: (15h)

Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.

Unit VI: Introduction to Internet, WWW and Web Browsers: (10h)

Basic of Computer networks; LAN, WAN; Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet; Basics of internet connectivity related troubleshooting, World Wide Web; Web Browsing software, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website

Text Books

T1.Introduction to Computers with MS-Office, Leon, TMH
T2. Personal Computer Software, EXCEL BOOKS

Reference Books

R1. A First Course in Computers 2003, Saxena, VIKAS
R2. Windows & MS-Office 2000, Krishnan, SCITECH

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Describe** the usage of computers and why computers are essential components in business and society.	**PO1, PO3**
CO2	Work effectively with a range of current, standard, Office Productivity software applications.	**PO1, PO2, PO3, PO4**
CO3	**Evaluate**, select and use office productivity software appropriate to a given situation	**PO5, PO3, PO1**
CO4	**Utilize** the Internet Web resources and evaluate on-line e-business system.	**PO8, PO3, PO1**
CO5	**Solve** common business problems using appropriate Information Technology applications and systems.	**PO5, PO12, PO3, PO1**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE11641	Elective Computer Science I	3	1	3	1	2	-	-	2	-	-	-	1

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: CSE11641- Elective Computer Science I

Program: B.Sc. Microbiology Time: 3 Hrs.
Semester: Odd 2020-21 Max. Marks: 50

SECTION A (Answer all questions)

1.	Write down the **difference** between Random Access Memory and Read Only Memory. (**E**)	**5**	**CO1**
2.	Write short notes on: Keyboard. (**U**)	**5**	**CO1**
3.	**Define** utility software and its significance. (**Ap**)	**5**	**CO2**
4.	What is a function in Ms Excel? What function is used for counting the number? (**Ap**)	**4** **1**	**CO3**
5.	**What** are the uses of Header and Footer in MS Word? (**Ap**)	**5**	**CO2**
6.	**How** can you correct the spelling and grammatical mistakes in MS Word? (**U**)	**5**	**CO3**

SECTION B (Answer any two questions)

7.	(a) **What** is the slide show View in MS power point? (**U**) (b) **What** are Web sites & URL(s)? Define their usage in practical scenarios. (**An**) (c) What is the **difference** between "operating system" & "Application software"? (**E**)	**2** **3** **5**	**CO2** **CO3**
8.	(a) **Describe** the significance of E-mail. (**Ap**) (b) **What** are the productivity tools in an Email account? Define them. (**E**) (c) **Discuss** about Mail Merge in MS Word? (**E**)	**2** **5** **3**	**CO4**
7.	Write down the keyboard shortcuts for the following functions: - a)Making fonts bold: b)Making fonts underlines: c)Making fonts italic: d)Increasing font size: e) Making a paragraph right –aligned: What is the procedure of inserting Symbols in an MS Word document? (**U**) **What** is chart in MS Excel? Name three types of charts? (**U**)	**5** **2** **3**	**CO3,** **CO2**

CSE12642	**Elective Computer Science I Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours = 45**	0	0	3	2
Pre-requisites/Exposure	Basics of Computer knowledge				
Co-requisites	__--				

Course Objectives

1. To understand the usage of computers in daily life applications.
2. To apply formatting features in Word application to create documents.
3. To apply different formula in Excel to calculate and process information.
4. To apply slide transitions, themes and formatting features to create a power point presentation.

Course Outcomes

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

CO1: **Familiarization** with word and its different features.
CO2: **Designing** different documents using Word.
CO3: **Using** mail merge to create template using word.
CO4: **Familiarization** with excel and its different formulas.
CO5: **Creating** presentation with animation and effects.

Catalogue Description

This course introduces the student to the world of computers and their basics. It helps them to grasp knowledge about the different Office productivity software applications and their practical application scenarios. They become familiar with the basics of Operating System and its different types and also get knowledge about computer networks and their principal network components.

Course Content

List of experiments:

1. Introduction and familiarization with word with different type of stylings. (**3 h**)
2. Table creation in and basic formatting. (**3 h**)
3. Inclusion of image and editing image using Word and some basic designing features. (**3 h**)

4. Example of Mail-merge. **(3 h)**
5. Create spreadsheet with some basic calculation. **(3 h)**
6. Creating Spreadsheet with some advance level formula and conditions. **(3 h)**
7. Creating Macro in spreadsheet. **(3 h)**
8. Creating colour conditioning in spreadsheet. **(3 h)**
9. Creating different kinds of charts in spreadsheet. **(3 h)**
10. Creating basic presentation. **(3 h)**
11. Inclusion of different levels of animations in the presentation. **(3 h)**
12. Project on Word. **(6 h)**
13. Project on Excel. **(3 h)**
14. Project on power-point. **(3 h)**

Text Books

T1.Introduction to Computers with MS-Office, Leon, TMH
T2. Personal Computer Software, EXCEL BOOKS

Reference Books

R1. A First Course in Computers 2003, Saxena, VIKAS
R2. Windows & MS-Office 2000, Krishnan, SCITECH

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Familiarization** with word and its different features.	**PO1, PO3**
CO2	**Designing** different documents using Word.	**PO1, PO3, PO5, PO8**
CO3	**Using** mail merge to create template using word.	**PO1, PO3, PO5**
CO4	**Familiarization** with excel and its different formulas.	**PO3, PO5, PO6**
CO5	**Creating** presentation with animation and effects.	**PO3, PO5, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE12642	Elective Computer Science I Lab	3	-	3	-	3	1	-	2	-	-	-	1

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: CSE12642- Elective Computer Science I Lab

Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Odd 2020-21 **Max. Marks: 50**

Instructions:

Section A (Answer any Two)

1	a) **Create** your bio-data in Word document. (**Ap**)	5	**CO1**
	b) **Create** a table with basic formatting. (**Ap**)	3	**CO2**
	c) Insert image using Word and apply border effects. (**Ap**)	2	**CO3**
2	a) **Illustrate** Mail-merge in Word. (**E**)	5	**CO1**

	b) **Create** spreadsheet with some basic calculation. (**Ap**) c) **Create** a basic presentation and apply a suitable theme. (**Ap**)	3 2	**CO4** **CO5**
3	a) **Create** Spreadsheet with some advance level formula and conditions. (**Ap**) b) **Create** Macro in spreadsheet. (**Ap**) c) **Create** color conditioning in spreadsheet. (**Ap**)	4 3 3	**CO4**
4	a) **Create** different kinds of charts in spreadsheet. (**Ap**) b) Include of different levels of animations in the presentation. (**An**) c) Create Word document and insert hierarchical smart art. (**Ap**)	4 3 3	**CO1** **CO4** **CO5**
	SECTION B is compulsory		
5	Viva-voce (U/An/Ap/R/E)	20	**CO1** **CO2** **CO3** **CO4** **CO5**
6	Practical copy (U/Ap/E)	10	**CO1** **CO2** **CO3** **CO4** **CO5**

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

CHM11151	**Elective Chemistry I**	**L**	**T**	**P**	**C**
Version 1.0	**Contact hours:60**	3	1	0	4
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

1. To introduce important concepts required in the field of the course elective chemistry. This course gives students a thorough understanding regarding the prerequisites of basic chemistry knowledges in their course curriculums.
2. To introduce clear understanding of energy conditions necessary to execute a feasible chemical reaction.
3. To impart the basic notions of different properties of liquid states of chemical compounds and their effects with atmosphere.
4. To impart the concepts required for kinetics of a reaction mechanism and deeper understanding of the molecular interactions which can influence chemical reactivity. Students can understand the various kinds of reaction mechanisms occurring in their daily life cycle.
5. To learn the basic understanding of atomic structure of molecules important in our daily life and how nuclear reactions are pertinent to their structure.
6. To conceptualize the essence of molecular bonding of necessary molecules.

Course Outcomes

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

CO1	**Learn** to recognize the exclusive terminologies associated with thermodynamics and explain the basic concepts of thermodynamics i.e. heat transfer and its consequences with the thermodynamic system.
CO2	**Understand** to explain the difference between what the molecules are doing in a solid, liquid, and gas, including movement, spacing, and organization, and how this explains the physical characteristics of these states.
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.
CO4	**Learn** the concept of reaction rates and be able to use to predict products, yields etc.
CO5	**Understand** the concept of using the symbols for protons, neutrons, electrons, positrons, alpha particles, beta particles, and gamma rays.
CO6	**Recognize** the periodic properties of elements, principles in molecular theory and bonding models to the study of inorganic compound.

Catalogue Description:

This course gives a detailed understanding of the basics of physical and inorganic chemistry required in other disciplines. This course will include expert instructors who will introduce thermodynamics of chemical reaction, colligative properties of liquid states, the structures of nucleus and subatomic particles and their relations with the chemical properties and especially molecular bonding of important molecules of our daily life. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct theory classes by taking lecture as well as power point presentations, audio visual virtual lab sessions as per requirement of the course. The tutorials and required assignments will acquaint the students with practical problem-solving techniques led by the course coordinator. After finishing this course, students from different disciplines will strongly grasp the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content:

Physical Chemistry-I

Unit- 1-Thermodynamics (10h)

Thermodynamics: Definition of thermodynamic terms; Concept of heat and work; First law of thermodynamics; Concept of enthalpy (H); Expansion of ideal gas under isothermal and adiabatic conditions for reversible and irreversible processes; Concept of standard state, Standard enthalpy changes of physical and chemical transformations: fusion, sublimation, vaporization, ..-- solution, dilution, neutralization, ionization.; Hess's law of constant heat summation, Second law

of thermodynamics; Heat engine; Carnot cycle and its efficiency; Entropy (S) as a state function. Spontaneous processes; Concept of Free Energy (G and A).

Unit-2-Liquid state:
(4h)

Liquid States and Viscosity of Fluids: Nature of the liquid state (short range order and long range disorder); Physical properties of liquids; Vapor pressure, Surface tension; Surface energy, General features of fluid flow (streamline flow and turbulent flow); Coefficient of viscosity and their determination.

Unit-3-Colligative properties
(6h)

Colligative Properties: What are colligative properties? Dependence of colligative properties; Freezing point depression; boiling point elevation, Raoult's Law and Vapor Pressure Lowering; osmotic pressure.

Unit-4: Chemical kinetics
(10h)

Chemical kinetics and catalysis: Order and molecularity of reactions; Rate laws and rate equations for first order and second order reactions (differential and integrated forms); Zero order reactions; Determination of order of reactions; Temperature dependence of reaction rate, energy of activation; Catalytic reactions: homogeneous and heterogeneous catalytic reactions. Enzyme catalysis

Inorganic Chemistry-I

Unit-I: Atomic structure (10h)

Extra-nuclear Structure of atoms, Bohr's model. quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many¬, electron atoms, Aufbau principle.

Unit-II: Chemical Periodicity (5h)

Classification of elements on the basis of electronic configuration; Positions of hydrogen and noble gases; Atomic and ionic radii; ionization potential; electron affinity; and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.

Unit-III: Radioactivity and Nuclear Structure of Atoms (5h)

Natural radioactivity, group displacement law, law of radioactive decay, half-life of radio elements. Atomic Nucleus: Stability of 'atomic nucleus, nuclear binding energy, Nuclear reactions: fission, fusion, transmutation of elements.

Unit-IV: Chemical Bonding (10h)

Ionic Bonding: General characteristics of ionic compounds; Lattice energy; Born Haber cycle. Covalent bonding: General characteristics of covalent compounds; valence-bond approach, directional character of covalent bond; hybridization involving s-, p-, d orbitals; multiple bonding; Valence Shell Electron Pair Repulsion (VSEPR) concept; Partial ionic character of covalent bonds; Fajan's rules. Hydrogen bonding and its effect on physical and chemical properties.

Text Books

T1. D. A. McQuarrie and J. D. Simon: Physical Chemistry — A Molecular Approach
T2. G. W. Castellan: Physical Chemistry

Reference Books:

R1. P. W. Atkins: Physical Chemistry
R2. J. E Huheey, E. A. Keiter, R. L. Keiter: Inorganic Chemistry (Principle and structure and reactivity).
R3. N. N. Greenwood, A. Earnshaw: Chemistry of the Elements
R4. D. F. Shriver, P. W. Atkins, C. H. Langford: Inorganic Chemistry

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

Examination Scheme:

Components	Mid term	Class Assessment	End Term
Weightage (%)	20	30	50

Relationship between the Course Outcomes (COs) with Program Outcomes (POs) and Program Educational Outcomes (PEOs)

Mapping between COs, POs and PEOs

CO1	**Learn** torecognize the exclusive terminologies associated with thermodynamics and explain the basic concepts of thermodynamics i.e. heat transfer and its consequences with the thermodynamic system.	**PO3, PO4**
CO2	**Understand** to explain the difference between what the molecules are doing in a solid, liquid, and gas, including movement, spacing, and organization, and how this explains the physical characteristics of these states.	**PO5, PO4, PO7**
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.	**PO6, PO7, PO4**
CO4	**Learn** the concept of reaction rates and be able to use to predict products, yields etc.	**PO8, PO9, PO7**
CO5	**Understand** the concept of using the symbols for protons, neutrons, electrons, positrons, alpha particles, beta particles, and gamma rays.	**PO3, PO10, PO7**
CO6	**Recognize** periodic properties of elements, principles in molecular theory and bonding models to the study of inorganic compound.	**PO3, PO4, PO5, PO7**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM11151	Elective Chemistry I	-	-	3	1	1	-	2	2	1	1	-	-

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

Model Question Paper

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

urse: CHM11151- Elective Chemistry I
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Odd 2020-21 Max. Marks: 50

	Section A (Answer any six)		
1	Show the radial probability distribution function diagram of the orbitals of 3s, 3p and 3d in a Hydrogen atom. Explain number of radial nodes of 3s and 4p orbitals. (**Ap, R**)	5	**CO5**
2	Define Hund's rule of maximum spin multiplicity and using this write down the electronic configurations of the elements having atomic no 14 and 22? What are the possible values of ml (magnetic quantum number) for l=1? (**R,An**)	5	**CO5**
3	Account for the difference in electronegativity of carbon atom in C2H6, C2H4 and C_2H_2. Explain the hybridisation of CH4. (**R,Ap**)	5	**CO6**
4	State Pauli's Exclusion Principle and apply this to predict the maximum capacity of s-subshell for accommodating e-. Write down the relation between momentum of a particle & the wavelength associated with its wave. (**An, U**)	5	**CO6**
5	Explain the shapes of SOF4, IF2- and XeF2 according to VSEPR principle. b) Why F2O has smaller <FOF angle than H2O? (**Ap**)	5	**CO5** **CO6**
6	Draw the d orbital wave the d orbital wave functions of dxz, dyz and dz2 orbitals. Explain the hybridizations of H2O and NH3 molecules. (**Ap**)	5	**CO6**
7	Electron affinity of carbon is greater than boron-Explain? Why does atomic radii increase down the group and decrease across a period? (**Ap, U**)	5	**CO5** **CO6**
	SECTION B is compulsory		
8	Describe Carnot cycle. What is the prerequisite of a spontaneous reaction? (**Ap/R**) Explain the entropy and enthalpy of a chemical reaction. What is the difference between molecularity and order of a chemical reaction? (**U**)	5 5	**CO1**
9	Define the relation between half-life and rate constant between a secondorder reaction. Explain the reason for the depression of freezing point.**(R)**	10	**CO3** **CO4**

CHM12152	**Elective Chemistry I Lab**	L	T	P	C
Version 1.0	**Contact hours: 45**	0	0	3	2
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

1. To introduce important concepts required in the field of the practical field of elective chemistry. This course gives students a detailed understanding of lab-based chemistry knowledges in their course curriculums.
2. To introduce hands on training of standard solutions essential in every practical courses.
3. To impart the elementary ideas of physical methods of determination of surface tension, viscosity of organic solvents and acid catalysed hydrolysis of ester.
4. To learn the basic quantitative methods of titration of alkaline mixtures using various indicators.
5. To learn the determination methods of ionization constant of a weak acid by conductometric method.
6. To introduce the pH metric determination procedure of neutralization of acid-base titration.
7. To impart the determination method for rate constant of decomposition of H2O2 by acidified KI solution using clock reactions.

Course Outcomes

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

CO1	**Learn** skills in the proper handling of apparatus and chemicals.
CO2	**Learn** experimental skill of quantitative volumetric analysis and determination of physical properties of substances.
CO3	**Learn** to determine the "overall reaction order" for a chemical reaction using the (differential) rate law
CO4	**Understanding** monitoring a titration with a pH electrode and determining the equivalence point.

Catalogue Description:

This course gives a detailed understanding of the basics of chemistry lab techniques required in other disciplines. This course will include expert instructors who will introduce a detailed description of lab-based chemistry knowledges in their course curriculums, methods of determination of surface tension and viscosity of common liquids, correlation of theories of kinetics in the light of acid catalysed hydrolysis of ester, different quantitative methods of acid-base titrations using direct and pH mediated methods, determination of ionization constants of weak acids by conductometric titration and clock reaction mediated rate constant determinations. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct demonstration classes by taking lecture followed by practical hands on training per requirement of the course. The tutorials and required assignments will acquaint the students with practical problem-solving techniques led by the course coordinator. After finishing this course, students from different disciplines will strongly acquire the hands-on training via experiencing practical lab sessions with the coordinator.

Course Content:

General Chemistry Lab: **(25 h)**

1. Preparation of Solution: Normal Solution; Molar Solution
2. Determination of surface tension of a given solution by drop weight method using a stalagmometer, considering aqueous solutions of NaCl, acetic acid, ethanol etc, as systems.
3. Determination of viscosity of organic solvents with Ostwald Viscometer at room temperature.
4. To determine the rate constant for the acid catalysed hydrolysis of an ester.

Inorganic Chemistry Lab: **(20h)**

1. Titration of Na_4CO_3 + $NaHCO_3$ mixture vs HCl using phenolphthalein and methyl orange indicators.
2. Determination of ionization constant of a weak acid by conductometric method
3. Determination of neutralization point of the reaction between HC1 and NaOH with the help of pH meter .
4. Determination of rate constant of decomposition of H_2O_2 by acidified KI solution using clock reactions.

Text Books:

T1. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency
T2. Handbook of Inorganic Analysis (First Edition): U.N Dhur & Sons Private Ltd.

Reference Books:
R1. Das, S.C. Advanced Practical Chemistry:

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

Examination Scheme:

Components	**Class Assessment**	**End Term**

Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) with Program Outcomes (POs) and Program Educational Outcomes (PEOs)

Mapping between COs, POs and PEOs

CO1	**Learn** skills in the proper handling of apparatus and chemicals.	**PO3, PO4**
CO2	**Learn** experimental skill of quantitative volumetric analysis and determination of physical properties of substances.	**PO4,PO3, PO8**
CO3	**Learn** to determine the "overall reaction order" for a chemical reaction using the (differential) rate law	**PO1, PO7, PO3, PO4**
CO4	**Understanding** monitoring a titration with a pH electrode and determining the equivalence point.	**PO1, PO2, PO9, PO4**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM12152	Elective Chemistry I Lab	-	-	2	3	1	-	2	2	1	1	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: CHM12152- Elective Chemistry I Lab

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

Instructions:

	Section A (Answer any three:)		
1	**Determine** the surface tension of toluene and acetone at room temperature. (**An**)	10	**CO1** **CO2**
2	**Determine** the amount of Na_2CO_3 and $NaHCO_3$ in an unknown mixture by acid-base titration. (**An**)	10	**CO1** **CO2**
3	Find out the strength of unknown HCl using 0.01 N NaOH solution via conductometric titration.(**An**)	10	**CO3**
4	HNO_3 and H_2SO_4 have the same molarity. Why did H_2SO_4 require about twice the volume of NaOH solution for the titration? (**U**)	10	**CO4**
	SECTION B is compulsory		
5	Viva-voce (U/An/Ap/R/E)	10	**CO1** **CO2** **CO3** **CO4** **CO5**
6	Practical copy (U/Ap/E)	10	**CO1** **CO2** **CO3** **CO4** **CO5**

SDS11506	**Elective Statistics I**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours – 90 hrs.**	5	1	0	6
Pre-requisites/Exposure	12th level Mathematics				
Co-requisites	--				

Course Objectives:

The objective of this course for the graduate student is:

1. To provide a basic understanding of statistical data with preparation and presentation of data.
2. To develop the statistical concepts of the discrete and continuous variables or data and its various central and dispersion measures, regression, and correlation analysis with applications in simple real-life examples.

Course Outcomes:

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

CO1: **Define** different types of statistical data, attributes, and variables (discrete and continuous) with frequency distribution.

CO2: **Find** various measures of central tendency and dispersion for grouped and ungrouped data, regression lines and correlation coefficients.

CO3: **Summarize**, collect**,** and present the different types of data graphically and numerically.

CO4: **Compare** the results obtain from various central and dispersion measures, regression, and correlation Analysis.

CO5: **Utilize** the concept of correlation and regression and its properties to obtain the solution of simple statistical/business/economics problems.

Catalogue Description:

Knowledge of basic statistics and methods is necessary to work on statistical data for the beginners of graduate students. This course gives an idea and understanding about the several statistical methods and measures are used to extract the information from various types of data comes from statistical problems. This course deals with data collection, preparation and presentation with frequency distribution, various measures of central tendency and dispersion, correlation, regression analysis, and its application in statistical problems. Classes will be conducted by lecture as well as power point presentation, audio visual session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques guided by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Unit-I **(10h)**

Collection and Scrutiny of Data

Statistical data: Primary Data and Secondary Data, Collection of Data, Presentation of data, tabular representation of data, Scrutiny of Data.

Unit-II **(14h)**

Frequency Distribution

Attribute and variable, Discrete variable and continuous variable, Frequency Distribution of an Attribute, Frequency Distribution of a variable, Case of a discrete variable, Case of a continuous variable, Graphical Representation of a frequency Distribution, Frequency curve.

Unit-III **(8h)**

Presentation of Data

Frequency data and non-frequency data, Textual presentation of Data, Tabulation of Data, Diagrammatic presentation of Data (Bar chart, pie diagram, Histogram, Ogives).

Unit-IV **(17h)**

Measures of Central Tendency:

Meaning of Central Tendency, Common measure of Central Tendency, Requirements of an ideal Average, Comparison of Mean, Median and Mode, Geometric Mean and Harmonic Mean, weighted Means.

Unit-V **(15h)**

Measures of Dispersion:

Range, Mean Deviation, Standard Deviation, Quantiles and Percentiles, Quantile Deviation, Comparison of the Measures of Dispersion, Some important relations, Measures of relative Dispersion.

Unit-VI **(13h)**

Moments and Measures of Skewness and Kurtosis:

Moments, Relationship between central and ordinary moments, Skewness, Kurtosis, Some important relations.

Unit-VII **(13h)**

Correlation and Regression:

Correlation: Scatter diagram, Karl-Pearson's correlation, concurrent deviation method, rank correlation, uses of correlation in business regression, regression lines, regression coefficients, properties of regression coefficients, Use of regression in business problems.

Text book:

T1. A.M. Goon, M.K. Gupta and B. Dasgupta (2005): *Fundamentals of Statistics*, Vol. I, 8th Ed., World Press, Kolkata

T2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.

Reference book:

R1. N. G. Das (2009): Statistical Methods, combined edition (vol I & II), McGraw Hill Education (India).

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Define** different types of statistical data, attributes, and variables (discrete and continuous) with frequency distribution.	**PO1, PO2, PO7**
CO2	**Find** various measures of central tendency and dispersion for grouped and ungrouped data, regression lines and correlation coefficients.	**PO1, PO2, PO6**
CO3	**Summarize**, collect, and present the different types of data graphically and numerically.	**PO1, PO2, PO7**
CO4	**Compare** the results obtain from various central and dispersion measures, regression, and correlation Analysis.	**PO2, PO7**
CO5	**Utilize** the concept of correlation and regression and its properties to obtain the solution of simple statistical/business/economics problems.	**PO1, PO2, PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
SDS11506	Elective Statistics I	3	3	-	-	1	2	3	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: SDS11506-Elective Statistics I

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

Instructions:

Section A (Attempt all)

<table>
<tr><td>1.</td><td>a) Define primary and secondary data. (R)
b) Explain with illustration the distinction between an attribute and a variable. (U)</td><td>2
3</td><td>CO1
CO3</td></tr>
<tr><td>2.</td><td>Draw the histogram and frequency polygon to illustrate the following frequency distribution:
<table>
<tr><td>Wages(Rs.)</td><td>50-59</td><td>60-69</td><td>70-79</td><td>80-89</td><td>90-99</td><td>100-109</td><td>110-119</td></tr>
<tr><td>No. of employees</td><td>8</td><td>10</td><td>16</td><td>14</td><td>10</td><td>5</td><td>2</td></tr>
</table>
. (U)</td><td>5</td><td>CO3</td></tr>
<tr><td>3.</td><td>a) What is moment of distribution? What are the raw and the central moment? (R)
b) From the data given below, find the coefficient of variance: Pearson’s measure of skewness = 0.42, AM = 86; median = 80. (R)</td><td>2
3</td><td>CO2
CO2</td></tr>
<tr><td>4.</td><td>Ten hand-writing were ranked by two judges in a competition. The ranking are given below. Make use of rank correlation coefficient method, what conclusion do you draw from the result?
<table>
<tr><td></td><td colspan="10">Hand- writing</td></tr>
<tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td></tr>
<tr><td>Judge 1</td><td>3</td><td>8</td><td>5</td><td>4</td><td>7</td><td>10</td><td>1</td><td>2</td><td>6</td><td>9</td></tr>
<tr><td>Judge 2</td><td>6</td><td>4</td><td>7</td><td>5</td><td>10</td><td>3</td><td>2</td><td>1</td><td>9</td><td>8</td></tr>
</table>
</td><td>5</td><td>CO5</td></tr>
</table>

(**Ap**)

SECTION B (Attempt any **Two Questions)**

5\. The score of two batsmen, A and B, in ten innings during a certain season, are as under:

A	32	28	47	63	71	39	10	60	96	14
B	19	31	48	53	67	90	10	62	40	80

Compare the batsmen to identify who is better score getter and who is more consistent. (**U**)

10 **CO4**

6\. a) The arithmetic mean of two observations is 25 and their geometric mean is 15. **Find** (i) their harmonic mean and (ii) the two observations. (**R**)

4 **CO2**

b) The number of telephone calls received in 245 successive one-minute intervals at an exchange are shown in the following frequency distribution:

No. of calls	0	1	2	3	4	5	6	7	Total
Frequency	14	21	25	43	51	40	39	12	245

Find the mean, median, and mode. (**R**)

6 **CO2**

7\. While calculating the coefficient of correlation between two variables x and y, the following results were obtained: n=25, $\sum x = 125$, $\sum y = 100$, $\sum x^2 = 650$, $\sum y^2 = 460$, $\sum xy = 508$. It was however later discovered at the time of checking that two pair of observations (x, y) were copied (6,14) and (8,6), while the correct values were (8,12) and (6,8) respectively. **Find** the correct value of the coefficient of correlation. (**R**)

10 **CO2**

SECTION C is Compulsory

8\. From the following results, **find** the two regression equations and **utilize** these two equations to estimate the yield of crops when the rainfall is 22 cms, and the rainfall when the yield is 600 kg:

5 **CO2**

	y (Yield in kg.)	x (Rainfall in cm.)
Mean	508.4	26.7
S.D.	36.8	4.6

5 **CO5**

Coefficient of correlation between yield and rainfall = 0.52. (**R, Ap**)

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

MIB11017	MOLECULAR BIOLOGY (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic knowledge of Biology				
Co-requisites	--				

Course Objectives

1. Understand the basic concepts of central dogma of molecular biology and the structural aspects of DNA, RNA and Protein.
2. Study the process of replication transcription and translation.
3. Compare between the processes w.r.t. prokaryotes and eukaryotes

Course Outcomes

On completion of this course,

1. Students will be able to **explain** structures of DNA and RNA / genetic material
2. Students will be able to outline the molecular structures and events in Replication of DNA, **compare** and contrast between the processes involved in Prokaryotes and Eukaryotes.
3. Students will be able to **summarize** the events during Transcription in Prokaryotes and Eukaryotes
4. Students will be able to **analyze** the molecules and reactions of Post-Transcriptional Processing
5. Students will be able to **illustrate** Translation, compare and contrast between the process in Prokaryotes and Eukaryotes.

Catalogue Description

The core-course of molecular biology is a fundamental course that deals with the major molecules of life form i.e. DNA, RNA and protein. It also deals with the process of regulation of gene expression.

Course Content

Unit 1 Structures of DNA and RNA / Genetic Material (10h)

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation of DNA, cot curves. DNA topology - linking number, topoisomerases; Organization of DNA in Prokaryotes, Viruses, Eukaryotes; RNA Structure, Organelle DNA -- mitochondria and chloroplast DNA.

Unit 2 Replication of DNA (Prokaryotes and Eukaryotes) (10h)

Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication; Meselson-Stahl experiment, Mechanism of DNA replication:Enzymes and proteins involved in DNA replication –DNA polymerases, Helicase, SSB protein, DNA ligase, primase, telomerase, RNA primers – for replication of linear ends, Okazaki fragments, Leading and Lagging strands, Various models of DNA replication including rolling circle, D-loop (mitochondrial), Ө(theta) mode of replication and other accessory protein, Mismatch and excision repairs, Photoreactivation

Unit 3 Transcription in Prokaryotes and Eukaryotes (10h)

Transcription: Definition, difference from replication, promoter - concepts. Sigma factor, RNA Polymerase and the transcription unit. Transcription in Eukaryotes: RNA polymerases, general Transcription factors

Unit 4 Post-Transcriptional Processing (10h)

Split genes, concept of introns and exons, RNA splicing, spliceosome machinery, concept of alternative splicing, Polyadenylation and capping, Processing of rRNA, RNA interference: siRNA, miRNA and its significance, transposons

Unit 5 Translation (Prokaryotes and Eukaryotes) (10h)

Translational machinery, Charging of tRNA, aminoacyltRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes and eukaryote, clover leaf structure of tRNA, Genetic Code – Concept and Characteristics, Wobble hypothesis, Post-translational modifications

Unit 6 Regulation of gene Expression in Prokaryotes and Eukaryotes (10h)

Principles of transcriptional regulation, regulation at initiation with examples from *lac* and *trp*operons, *ara* operons, Inducible and repressible operons, Sporulation in *Bacillus,* Yeast mating type switching, Changes in Chromatin Structure –DNA methylation and Histone Acetylation mechanisms.

Text books:

T1. Weaver R. (2011). Molecular biology.4th edition, McGraw-Hill

Reference books:

R1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008).
R2. Molecular Biology of theGene, 6th edition, Pearson
R3. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009). The World of the Cell, 7th edition, Pearson.

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

Components	Mid Term	Class Assessment	End Term

Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** structures of DNA and RNA / genetic material	**PO1, PO2**
CO2	Students will be able to outline the molecular structures and events in Replication of DNA, **compare** and contrast between the processes involved in Prokaryotes and Eukaryotes	**PO1, PO2, PO5**
CO3	Students will be able to **summarize** the events during Transcription in Prokaryotes and Eukaryotes	**PO1, PO2, PO5**
CO4	Students will be able to **analyze** the molecules and reactions of Post-Transcriptional Processing	**PO1, PO2, PO5**
CO5	Students will be able to **illustrate** Translation, compare and contrast between the process in Prokaryotes and Eukaryotes	**PO1, PO2, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11017	Molecular Biology	3	3	-	-	2	-	-	-	-	-	-	-

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

Model Question Paper

Name: **Enrolment No:**		ADAMAS UNIVERSITY PURSUE EXCELLENCE	
Course: MIB11017 –Molecular Biology **Program: B.Sc. Microbiology** **Time: 03 Hrs.** **Semester: Even 2020-21** **Max. Marks: 50** **Instructions:**			
SECTION A (Attempt **all questions)**			
1.	**Show** the formation of Hydrogen bond (Chemical Structure) between Adenine and Thymine in a DNA molecule. (**An**)	**5**	**CO1**
2.	DNA does not replicate by dispersive mode: Justify with experimental evidence. (**U**)	**5**	**CO2**
3.	**Enlist** the enzymes necessary during DNA replication in prokaryotes. Mention their function. (**An**)	**5**	**CO3**
4.	Give an account of post translational modification. (**U**)	**5**	**CO4**
5	**Mention** the direction of movement of ribosome on RNA. Add a note on role of Prokaryotic ribosome in translation. (**E**)	**5**	**CO5**
6.	Explain the regulation of *lac* operon during: a) Presence of only Glucose, b) Presence of Glucose and Lactose.	**5**	**CO1**
	SECTION B (Attempt all **questions)**		
7.	**Mention** the post transcriptional modifications. Write a short note on 5'capping. **Define** open reading frame. State the role of polyadenylation in post transcriptional modification. (**An**)	**2+4+2+2**	**CO2, CO3**
8.	**Define** pseudo genes. **Explain** the occurrence overlapping genes in an organism with example. Split genes are property of eukaryotic or prokaryotic genome: Justify. (**U**)	**2+5+3**	**CO1, CO2, CO5**

MIB12018	**Molecular Biology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Plus two (12th) level Biology				
Co-requisites	--				

Course Objectives

1. To provide basic concepts of buffer preparation to be used for different practical.
2. To provide advanced concepts of Molecular biology techniques.
3. Elaborating protein and nucleic acids isolation and quantification.

Course Outcomes

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

CO1	Students can gather **knowledge** about how to isolate genomic DNA from various sources.
CO2	Students can **demonstrate**/illustrate the process of RNA estimation.
CO3	Students can **sketch**/illustrate and perform plasmid DNA isolation.
CO4	Students can perform Agarose gel electrophoresis and **interpret** the data. Students will be able to **develop** skills for establish themselves in the field like pharmaceutical and biotechnology industries.
CO5	Students can perform Polyacrylamide Gel Electrophoresis and interpret the data. Students will be able to **develop** skills for establish themselves in the field like pharmaceutical and biotechnology industries.

Catalogue Description:

In classroom sessions students will study the theoretical and applied aspects of basic biotechnology techniques for the study of DNA and proteins. In the laboratory students will apply theory and practical skills from this and previous courses to perform standard molecular biology techniques for the isolation, manipulation and analysis of DNA as well as the expression and purification of protein. Students will be assisted in career development through instruction and practice in resume-writing and interview skills, and will be exposed to different biotechnology job possibilities via a number of special interest seminars and/or company tours. The students will gain an in depth understanding of these important techniques in order to design an analytical work-flow to acquire data and achieve the research objectives of their project.

Course Content

1. Isolation of plasmid DNA (**9h**)
2. Isolation of genomic DNA from E. coli (**9h**)
3. Estimation of salmon sperm / calf thymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260 measurement) (**6h**)
4. Estimation of RNA using colorimeter (orcinol reagent) or UV spectrophotometer (A260 measurement) (**3h**)
5. Observation of DNA by Agarose Gel Electrophoresis. (**6h**)
6. Separation and determination of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE). (**3h**)
7. Demonstration of various types of DNA and RNA using micrographs and model / schematic representations (**6h**)
8. Study of semi-conservative replication of DNA through micrographs / schematic representations (3h)

Textbooks:

T1. Weaver R. (2011). Molecular biology.4th edition, McGraw-Hill.
T2. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbour Laboratory

Reference books:
R1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008). Molecular Biology of the Gene, 6th edition, Pearson
R2. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009). The World of the Cell, 7th edition, Pearson
R3. De Robertis EDP and De Robertis EMF (2006). Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins
R4. Karp G (2010). Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons 5.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students can gather **knowledge** about how to isolate genomic DNA from various sources.	**PO1, PO2**
CO2	Students can **demonstrate**/illustrate the process of RNA estimation.	**PO1, PO2, PO3**
CO3	Students can **sketch**/illustrate and perform plasmid DNA isolation.	**PO1, PO2, PO3, PO4**
CO4	Students can perform Agarose gel electrophoresis and interpret the data. Students will be able to **develop skills** for establish themselves in the field like pharmaceutical and biotechnology industries.	**PO1, PO2, PO5, PO6, PO7, PO8**
CO5	Students can perform Polyacrylamide Gel Electrophoresis and **interpret** the data. Students will be able to develop **skills** for establish themselves in the field like pharmaceutical and biotechnology industries.	**PO1, PO2, PO3, PO5, PO8, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12018	Molecular Biology Lab	3	2	2	2	1	1	1	2	-	-	1	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB12018 - Molecular Biology Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt any **Two** questions from **Section A** (each carrying 10 marks)

	SECTION A (Attempt **any Two questions)**		
1.	**Perform** the given experiment A and write down its principle and interpret the result. (**Ap**)	**15**	**CO1**
2.	**Perform** the given experiment B and write down its principle and interpret the result. (**Ap**)	**15**	**CO2**
3.	**Perform** the given experiment C and write down its principle and interpret the result. (**Ap**)	**15**	**CO3**
4.	Digest the sample "X" with reagent "Y" following the protocol given. Separate digested and undigested samples by agarose gel electrophoresis. Document and **interpret** the result. (**Ap**)	**15**	**CO5**
	SECTION B is compulsory		
5.	**Viva-voce** (U/An/Ap/R/Ev)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practical copy** (U/Ap/Ev)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5**

MIB11019	**Immunology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide those students with apt understanding of identification and characterization of virus as an obligatory intracellular entity.
2. It will also provide in depth knowledge about antigen-antibody interaction and their effects.
3. Students will be able to elaborate organization and expression pattern of components of immune system and the medical conditions that may arise due to anomaly in expression of components of immune system.
4. Students will be proficient in application of various immunologic techniques in the field of research and medical science.

Course Outcomes

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

1. Students will be able to **explain** and compare different components of the immune system.
2. Students will learn to **explain** and analyze different antigen-antibody interactions and elucidate their effects
3. Students will be able to **assess** expression and organization of components of immune system
4. Students will **appraise** and elaborate different types of medical conditions that occur due to anomaly in functioning of immune system
5. Students will learn to **apply** different immunological techniques for research and clinical purposes.

Catalogue Description

The core-course of ‘immunology’ will help to understand the classification, components and organization of components of immune system. This course comprehends the function of all components of immune system and effect of different form of interactions of antibodies, complement components, cytokines in response to invasion of antigen. Furthermore, the application of immune system in carcinogenesis, therapeutics and gene delivery would also be illuminated. Medical conditions arising from malfunctioning of one or more component of immune system would also be illustrated. 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

Unit 1 Introduction (4 h)

Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter, Louis Pasteur and Susumu Tonegawa

Unit 2 Immune Cells and Organs (4 h)

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT, hematopoietic stem cells

Unit 3 Antigens (6 h)

Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants – complete and incomplete

Unit 4 Antibodies (8 h)

Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies

Unit 5 Major Histocompatibility Complex (6 h)

Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways), isotype switching, affinity maturation

Unit 6 Complement System (6 h)

Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation

Unit 7 Generation of Immune Response (8 h)

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells, Immune to tolerance, graft rejection

Unit 8 Immunological Disorders and Tumor Immunity (10 h)

Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiencies - Animal models (Nude and SCID mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Types of tumors, tumor Antigens, causes and therapy for cancers.

Unit 9 Immunological Techniques (8 h)

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence, Flow cytometry, Immunoelectron microscopy.

Text Book:
Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology.6th edition W.H. Freeman and Company, New York.

Reference books:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology.6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology.7th edition Garland Science Publishers, New York.
4. Peakman M, and Vergani D. (2009).Basic and Clinical Immunology.2nd edition Churchill Livingstone Publishers, Edinberg.
5. Richard C and Geiffrey S. (2009). Immunology.6th edition. Wiley Blackwell Publication.
6. Owen, J.A.; Punt, J.; Kuby, J.; Stranford, S.A. Kuby immunology. W.H. Freeman: 2013.

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain and** compare different components of the immune system.	**PO1, PO2**
CO2	Students will learn to **explain** and analyze different antigen-antibody interactions and elucidate their effects	**PO1, PO2, PO5, PO6**
CO3	Students will be able to **assess** expression and organization of components of immune system	**PO2, PO5**
CO4	Students will **appraise** and elaborate different types of medical conditions that occur due to anomaly in functioning of immune system	**PO1, PO2, PO3, PO5**
CO5	Students will learn to **apply** different immunological techniques for research and clinical purposes.	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11019	Immunology	3	3	3	3	3	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB11019- IMMUNOLOGY (THEORY)
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt**all questions)**

1.	**How** is the secondary immune response different from the primary immune response? (**U**) Give a **comparative** statement on innate and adaptive immunity. (**An**)	**2+3**	**CO1**
2.	Draw the precipitation curve and **explain** different zones of it. (**An**)	**5**	**CO2**
3.	Schematically **illustrate** the structure of T-cell receptor. (**R**) “Diversity of TCR genes is significantly greater than Immunoglobulin genes”- Why? (**U**)	**2+3**	**CO3**
4.	Write a note on application of agglutination reaction in	**5**	**CO4**

	diagnostic tests. (**U**)		
5	**What** is meant by anaphylaxis? (**R**) What is hay fever? (**R**)	**3+2**	**CO5**
6.	**What** is the mode of action of the home pregnancy kit? (**U**)	**5**	**CO2**
	SECTION B (Attempt **all questions)**		
7.	Write a note on the pros and cons of Sabin polio virus vaccine. (**U**) How do we overcome the drawbacks of this vaccine in order to eradicate Polio completely from the world? (**An**) **Explain** how autoimmune diseases can be mediated by stimulating auto-antibodies taking the example of Grave's disease (**An**).	**4+2+4**	**CO4** **CO2**
8.	**Which** antibody is known as maternal antibody and why? (**R**) How secretory IgA is generated- Show schematically. (**U**) Give the schematic diagram of Class II MHC molecule. (**R**) Which region of human genome encodes for Class II MHC molecule? (**R**)	**2+3+3+2**	**CO1** **CO3**

MIB12020	**Immunology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours -45**	0	0	3	2
Pre-requisites/Exposure	Concept of microbiology from first year of UG level				
Co-requisites	--				

Course Objectives

1. Students will be able to demonstrate and interpret different antigen-antibody interactions.
2. It will make the students well acquainted with various components of the immune system.
3. The concept will enable the students to apply various immunological techniques for clinical and research purpose.
4. Students will learn to quantify antigen/ antibody in different samples.
5. Students will be adept to identify the virulence factors in pathogens.

Course Outcomes

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

1. Students will be able to **analyse** different antigen-antibody interactions.
2. Students will learn to **identify** different components of immune system in human system
3. Students will learn to **apply** different immunological techniques for research and clinical purposes.
4. Students will be able to **estimate** and compare amount of antigen/antibody present in different samples
5. Students will be able to **identify** the virulence factors of microorganisms that act as antigens in infectious diseases

Catalogue Description

The student will be able to use the knowledge obtained to perform and analyse 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 the coordinator.

Course Content

1. Staining of components of blood
2. Radial immunodiffusion assay.
3. Identification of human blood groups. (3 h)
4. Serum separation from the blood sample (demonstration). (8 h)
4. Study of immunodiffusion by Ouchterlony's double diffusion method. (8 h)
5. DOT ELISA. (8 h)

6. Illustration of phagocytic activity (4hrs)
7. Study of immunoelectrophoresis (8 h)

Text Book(s)

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

Reference books

R1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology.6th edition Saunders Publication, Philadelphia.

R2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.

R3. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology.7th edition Garland Science Publishers, New York.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **analyze** different antigen-antibody interactions.	**PO1, PO2, PO3, PO5**
CO2	Students will learn to **identify** different components of immune system in human system	**PO1, PO2, PO3, PO5**
CO3	Students will learn to **apply** different immunological techniques for research and clinical purposes.	**PO2, PO4, PO5, PO8**
CO4	Students will be able to **estimate** and compare amount of antigen/antibody present in different samples	**PO2, PO5, PO6, PO8**
CO5	Students will be able to **identify** the virulence factors of microorganisms that act as antigens in infectious diseases	**PO2, PO4, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12020	Immunology Lab	2	3	3	3	3	2	-	2	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB12020–Immunology Lab

Program: B.Sc. Microbiology Time: 03 Hrs.

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

Instructions:

Answer the following questions”

SECTION A

1.	**Summarise** the working principle of Ouchterloney double diffusion technique mentioning the different types of Ag-Ab interaction that can be elucidated using this technique. (**U**)	**15**	**CO1**
2.	**Perform** the procedure for radial immunodiffusion with two dilutions (10x, 20x) of an antigen discussing the expected result. *(Practical skill- 5, Method accuracy -5)* (**An**)	**15**	**CO1, CO2**

SECTION B

6.	Lab note book	**10**	**CO1, CO2, CO3, CO4. CO5**
7.	Viva	**10**	**CO1, CO2, CO3, CO4. CO5**

MIB11021	**Microbial Physiology and Metabolism**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. Developing knowledge of microbial growth
2. To have general perception of microbial metabolism
3. To analyse roles of nutrients as carbon and nitrogen source and utilization
4. To identify photosynthesis and ETC as basis of energy metabolism

Course Outcomes

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

1. Students will be able to **distinguish** and compare microorganism based on growth requirement demonstrate the evolutionary trends.
2. Students will be able to **model**, analyse and explain uptake of nutrients
3. Students will be able to **interpret** the basis of bacterial aerobic and anaerobic respiration
4. Students will be able to **discuss** and interpret chemolithotrophy and phototrophy
5. Students will be able to **explain** the mechanism of Nitrogen fixation evaluate its importance and application

Catalogue Description

The core-course of 'Microbial Physiology and Metabolism' will help to understand the basic concept and application of microbial growth and metabolism. This course includes comprehensive approach through studying impact of conditions on growth and metabolism. Furthermore, students will be able to classify based on nutritional parameters and elaborate energy metabolism. 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

Unit 1 Microbial Growth and Effect of Environment on Microbial Growth (15h)

Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, fed-batch culture, generation time and specific growth rate, synchronous growth, diauxic growth curve. Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe),barophilic. Microbial growth in response to nutrition and energy – Autotroph/Phototroph, heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photoorganoheterotroph, photoorganotrophs.

Unit 2 Nutrient uptake and Transport (5h)

Passive and facilitated diffusion; Primary and secondary active transport, concept of uniport, symport and antiport, osmosis, reverse osmosis, Plasmolysis, Group translocation, Iron uptake, Na^+-K^+ exchange pump, porin proteins, Ca^{2+} pump.

Unit 3 Aerobic Respiration (10h)

Concept of aerobic respiration, Sugar degradation pathways i.e. Glycolysis, EMP, ED, Pentose phosphate pathway, TCA cycle Electron transport chain: components of ETC, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation, uncouplers and inhibitors

Unit 4 Anaerobic respiration and fermentation (10h)

Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate/ammonia respiration; fermentative nitrate reduction); Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways

Unit 5 Chemo lithotrophic and Phototrophic Metabolism (10h)

Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction)

Introduction to phototrophic metabolism - groups of phototrophic microorganisms, anoxygenic, oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria

Unit 6 Nitrogen Metabolism - an overview (10h)

Introduction to biological nitrogen fixation, nod gene, role of Rhizobium sp. in biological nitrogen fixation, Ammonia assimilation, Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification

Text Books:

T1. Madigan MT and Martinko JM (2014). Brock Biology of Microorganisms.14th edition. Prentice Hall International Inc.

Reference books:

R1. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition. John Wiley & Sons

R2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
R3. Gottschalk G. (1986). Bacterial Metabolism.2nd edition. Springer Verlag
R4. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
R5. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9th edition. McGraw Hill Higher Education.
6. Albert G. Moat, John W. Foster, Michael P. Spector. Microbial Physiology.4th edition. John Wiley & Sons, 2003.

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **distinguish** and compare microorganism based on growth requirement demonstrate the evolutionary trends.	**PO1, PO3**
CO2	Students will be able to **model,** analyze and explain uptake of nutrients	**PO1, PO2, PO4**
CO3	Students will be able to **interpret** the basis of bacterial aerobic and anaerobic respiration	**PO1, PO2, PO4**
CO4	Students will be able to **discuss** and interpret chemolithotrophy and phototrophy	**PO1, PO2, PO5, PO8**
CO5	Students will be able to **explain** the mechanism of Nitrogen fixation evaluate its importance and application	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11021	Microbial Physiology and Metabolism	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB11021-Microbial Physiology and Metabolism
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt **all questions)**

1.	What are the possible sources for energy for bacteria? How bacteria are **classified** according to their energy requirement? Define “auxotroph”. (**U**)	**2+3**	**CO1**
2.	2.**Justify** the following statements: a. Substrate level phosphorylation always occurs during fermentation. (**An**) b. All the enzymes of TCA cycle are localized in mitochondrial matrix. (**E**)	**5**	**CO2**
3.	**Name** two metabolic pathways where transketolase reaction takes place. **Mention** a reaction catalysed by transketolases. What are the two enzymes which shunt TCA cycle to glyoxalate cycle? (**E**)	**5**	**CO3**
4.	**What** is the rate limiting reactions of ED pathway? In which organism ED path ways are found and why is it preferred despite being energy inefficient? (**E, An**)	**3+2**	**CO4**
5	Why molecular Oxygen is toxic for nitrogenases? Briefly **discuss** various strategies adopted by different groups of N_2-fixers to overcome this impediment? (**E**)	**2.5+2.5**	**CO5**
6.	**Design** experiments to study Cryptic growth in S-phase bacterial population (E)	**5**	**CO2**
	SECTION B (Attempt all **questions)**		

7.	**Cite** an example of a protein which forms beta helix and why it does form. Where porin proteins do localize? If you are assessing C^{14} tagged Lactose transport in presence of increasing concentrations of 2,4 DNP (uncoupler) graphically represent the rate of lactose transport vs. conc. of DNP. **(E, An**)	**4+2+4**	**CO3**
8.	**What** is the significance of mitochondrial outer membrane in light of chemiosmotic theory? Which chemical feature of ubiquinone do you consider crucial for ETC? **Explain** the basis of cyanide toxicity. Name a copper containing component of ETC. (**E, An**)	**5+5**	**CO1** **CO2**

MIB12022	**Microbial Physiology and Metabolism Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours: 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. Developing knowledge of microbial culture methods
2. To have general perception of physical and chemical effects on growth
3. To analyse roles of nutrients as carbon and nitrogen source
4. To demonstrate alcohol fermentation as model metabolic reaction

Course Outcomes

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

1. Students will be able to **assess** microbial growth parameters and will compare various strategies for measuring growth
2. Students will be able to **design** strategies to determine physical parameters of microbial growth
3. Students will be able to **identify** nutritional requirement, formulate media composition for microbial growth
4. Students will be able to **examine** and apply microbial fermentation.
5. Students will be able to **identify** and categorize mutants linked to growth requirements.

Catalogue Description

The core-course of 'Microbial Physiology and metabolism' will help to understand the basic concept and application of Microbial Growth. Furthermore, the application of microbial fermentation will also be elaborated. All the lab sessions will be both demonstrative and performing. The classes will aim maximal individual skill enhancement.

Course Content

1. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data **(6h)**
2. .Analysis of temperature and pH changes on growth of *E. coli* (9h)
3. Analysis of carbon and nitrogen sources on growth of *E. coli* **(6h)**
4. Effect of salt on growth of *E. coli* (6h)
5. Study and plot the growth curve of *E. coli* by turbidometric and standard plate count methods. **(9h)**
6. Illustration of microbial alcohol production **(3h)**
7. Assessment of kill curve of *E. coli* **(6h)**

Text Books:

T1. Madigan MT and Martinko JM (2014). Brock Biology of Microorganisms.14thedition.PrenticeHall International Inc.

Reference books:

R1. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition. John Wiley &Sons
R2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific PublishersIndia
R3. Gottschalk G. (1986). Bacterial Metabolism.2nd edition. Springer Verlag
R4. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). GeneralMicrobiology. 5th edition,McMillan Press.
R5. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9thedition.McGraw Hill Higher Education.
R6. Albert G. Moat, John W. Foster, Michael P. Spector. Microbial Physiology.4thedition.John Wiley & Sons, 2003.

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

Components	Internal Assessment	End Term
Weightage (%)	**50**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **assess** microbial growth parameters and will **compare** various strategies for measuring growth	**PO1, PO3**
CO2	Students will be able to **design** strategies to determine physical parameters of microbial growth	**PO1, PO2, PO4**
CO3	Students will be able to **identify** nutritional requirement, formulate media composition for microbial growth	**PO1, PO2, PO5**
CO4	Students will be able to **examine** and apply microbial fermentation.	**PO1, PO2, PO5, PO8**
CO5	Students will be able to **identify** and categorize mutants linked to growth requirements.	**PO1, PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12022	Microbial Physiology and metabolism Lab	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: MIB12022- Microbial Physiology and Metabolism Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt**all questions)**

1.	**Perform** experiment to determine DRT *for Pseudomonas aeruginosa* at 70ºC. (**An**)	**15**	**CO1**
2.	**Elaborate** the principle and observation for the experiment. (**U**)	**15**	**CO2**
3.	Lab note book. (**U/An/Ap/E**)	**10**	**CO1, CO2, CO3, CO4, CO5**
4.	Viva-voce. (**U/An/Ap/E**)	**10**	**CO1,**

			CO2, CO3, CO4, CO5

MIB11023	Microbial Diagnosis in Health Clinics	L	T	P	C
Version 1.0	Contact Hours: 60	3	0	2	4
Pre-requisites/Exposure	12th with Biology as one subject				
Co-requisites					

Course Objectives

The major objective of this course is to introduce the students to the importance of diagnosis of pathogens in controlling diseases. The student will become familiar with various approaches used for diagnosis along with their advantages and limitations. The importance of antimicrobial resistance and methods to determine it are also covered in this course.

Course Outcomes

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

1. **develop** a very good understanding of practical aspects of collection of different clinical samples, their transport and culture
2. **describe** standard microbiological staining techniques and examination by molecular and immunological diagnostic methods for diagnosis of microbial diseases
3. **develop** a very good understanding of practical aspects of antibiotic sensitivity testing skills using kits available in the market
4. **explain** the principles behind standard laboratory kits used for the detection or identification of pathogens
5. **evaluate** mechanisms underlying resistance of bacteria to antibiotics

Catalogue Description

A comprehensive study of microorganisms of importance in human health and disease. Topics include the preanalytical collection and processing of clinical specimens as well as the analytical morphology, isolation, and identification of pathogens, with a focus on colonial, microscopic, biochemical and molecular characteristics and additionally the postanalytical interrelationships of microorganisms and human hosts and the correlation, prevention and control of infectious diseases. Bacteriology is emphasized but the course includes a survey of mycology, parasitology, and virology. 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

Unit 1 Importance of Diagnosis of Diseases (10h)

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

Unit 2 Collection of Clinical Samples (10h)

How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Methods of transport of clinical samples to laboratory and storage.

Unit 3 Direct Microscopic (10h)
Examination and Culture Examination of sample by staining - Gram stain, Ziehl-Neelsen staining for tuberculosis, Giemsa stained thin blood film for malaria Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

Unit 4: Serological and Molecular Methods (10h)
Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid-based methods - PCR, Nucleic acid probes

Unit 5: Kits for Rapid Detection of Pathogens (10h)
Typhoid, Dengue and HIV, Swine flu

Unit 6: Testing for Antibiotic Sensitivity in Bacteria (10h)
Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

Text Books:
T1. Ananthanarayan R and Paniker CKJ (2009). Textbook of Microbiology, 8th edition, Universities Press Private Ltd.

Reference books:
R1. Brooks GF., Carroll KC., Butel JS., Morse SA. and Mietzner, TA. (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
R2. Randhawa, VS, Mehta G and Sharma KB (2009). Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
R3. Tille P (2013). Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
R4. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007). Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier.

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Students will be able to **develop** a very good understanding of practical aspects of collection of different clinical samples, their transport and culture	PO1, PO3

CO2	Students will be able to **describe** standard microbiological staining techniques and examination by molecular and immunological diagnostic methods for diagnosis of microbial diseases	**PO1, PO2, PO4**
CO3	Students will be able to **develop** a very good understanding of practical aspects of antibiotic sensitivity testing skills using kits available in the market	**PO1, PO2, PO4**
CO4	Students will be able to **explain** the principles behind standard laboratory kits used for the detection or identification of pathogens	**PO1, PO2, PO5**
CO5	Students will be able to **evaluate** mechanisms underlying resistance of bacteria to antibiotics	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11023	Microbial Diagnosis in Health Clinics	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: MIB11023- Microbial Diagnosis in Health Clinics

Program: B.Sc. Microbiology **Time: 03 Hrs.**

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

Instructions:

SECTION A (Attempt **all questions)**			
1.	**Describe** the collection and processing of Urine sample. (**U**)	**5**	**CO1**
2.	**Differentiate** Between ELISA and RIA. (**E**)	**5**	**CO2**
3.	**Explain** in detail the general safety guidelines for handling human clinical specimen (**E**)	**5**	**CO1**
4.	**State** the systematic approach of Ziehl-Neelsen staining and its uses. (**An**)	**3+2**	**CO2**
5	**Explain** the Antibiotic Susceptibility Assay and its applications. (**E**)	**5**	**CO5**
6	**Describe** the application in disease diagnosis (**E, U**)	**5**	**CO2**
	SECTION B (Attempt all **questions)**		
7.	Give detail of methods used in diagnosis of viral infections/diseases (**E, An**)	**10**	**CO3**
8.	**Discuss** the routine diagnosis method of Enteric fever and its limitations. (**E, An**)	**7+3**	**CO4**

MIB11024	**Management of Human Microbial Diseases**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours: 60**	3	0	2	4
Pre-requisites/Exposure	12thwith Biology as one subject				
Co-requisites	12th level English				

Course Objectives

The objective of this course is to make the students understand various attributes which make the microbes pathogenic or disease-causing. The students would also learn the mechanisms of resistance of bacteria to antibiotics and role of newer vaccines in controlling infectious diseases.

Course Outcomes

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

1. **understand** classical and molecular determinants of disease-causing microbes
2. **describe** the characteristics of newer disease-causing bacteria and viruses
3. **evaluate** mechanisms underlying resistance of bacteria to antibiotics and spread of resistance
4. **understand** of preventive measures for human infections by the use of antiviral drugs and vaccines

Catalogue Description

The course will provide the conceptual basis for understanding pathogenic microorganisms and particularly address the fundamental mechanisms of their pathogenicity. It will also provide opportunities for a student to develop diagnostic skills in microbiology, including the practical application and interpretation of laboratory tests for the treatment of infectious diseases. 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

Unit 1 Human Diseases (10h)

Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections

Unit 2 Microbial diseases (15h)

Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, digestive tract diseases, skin diseases, eye diseases, urinary tract diseases, sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (AIDS/SARS/Swine flu/Ebola/Dengue) – causes, spread and control, Mosquito borne disease – Types and prevention.

Unit 3 Therapeutics of Microbial diseases (20h)

Treatment using antibiotics: beta-lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides. Judicious use of antibiotics, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART.

Unit 4 Prevention of Microbial Diseases (15h)

General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the diseases transmitted by direct contact, food, water and insect vectors. Vaccines: Importance, types, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.

Text Books:

T1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.

Reference books:

R1. Ananthanarayan R. and Paniker C.K.J. (2009). Textbook of Microbiology. 8th edition, University Press Publication.

R2. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007). Mims' Medical Microbiology. 4thedition.Elsevier.

R3. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein's Microbiology.9th edition. McGraw Hill Higher Education.

R4. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition.

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

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **understand** classical and molecular determinants of disease-causing microbes	**PO1**
CO2	Students will be able to **describe** the characteristics of newer disease-causing bacteria and viruses	**PO1, PO2, PO4**
CO3	Students will be able to **evaluate** mechanisms underlying resistance of bacteria to antibiotics and spread of resistance	**PO1, PO2**

CO4	Students will be able to **understand** of preventive measures for human infections by the use of antiviral drugs and vaccines	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11024	Management of Human Microbial Diseases	3	2	2	1	1	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: MIB11024- Management of Human Microbial Diseases
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt**all questions)**

1.	Why physicians do not prescribe the antimicrobial agent with the largest zone of inhibition? Give two **examples** of	**2+3**	**CO3**

	side effects of antimicrobial agents. (**U**)		
2.	Schematically **discuss** the principle of disk diffusion method. (**E**)	**5**	**CO4**
3.	**Contrast** between antigenic shift and antigenic drift. Briefly discuss how they might lead to outbreak of infectious diseases? (**E**)	**5**	**CO2**
4.	**Illustrate** and define the five stages of infectious diseases. (**E**)	**5**	**CO1**
5	**What** are nosocomial infections and how are they spread? (**E**)	**5**	**CO1** **CO2**
6.	**Outline** the mechanisms of Sulphonamides and penicillin. (**E**)	**5**	**CO3**
	SECTION B (Attempt **all questions)**		
7.	**Discuss** the transmission, diagnosis, treatment and prevention of Salmonellosis and Tuberculosis. (**E**)	**5+5**	**CO1** **CO4**
8.	**Contrast** between Endemic, Epidemic and Pandemic with an example of each. Discuss the major reasons for a global pandemic in the 21st century. (**E, U**)	**6+4**	**CO2**

PSG11021	**Human Values and Professional Ethics**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours: 30**	2	0	0	2
Pre-requisites/Exposure	12thwith Biology as one subject				
Co-requisites	12th level English				

C

Course Objectives

- To inculcate human values and professional ethics in students.
- To enhance the understanding of students towards personal, professional & societal relationships and achieve harmony in life.
- To develop moral responsibilities and ethical vision.

Course Outcomes

At the completion of the course, the student should be able to:

CO1.**Understand**theimportanceofvalues, ethics, harmony and lifelong learning in personal and professional life

CO2.**Apply**theknowledgetoperformself-exploration and transformation augmenting harmony, peace and positivity in the surroundings

CO3.**Appreciate** the core values that shape the ethical behavior of professional

Catalogue Description

This course aims to develop an understanding for a movement from rule based society to a relationship based society. Apart from teaching values, this course encourages students to discover what values are for them and for society. Self-explorationalsoenablesthemtocriticallyevaluatetheirpre-conditioningsandpresentbeliefs. It is designed in a way where students get familiar with the Ethical Code of Conduct, Ethical Dilemma, Conflict of Interest and all this will help them eventually in their professional life.

Course Content

UnitI: Introduction to Human Values: (8h)

Character, Integrity, Credibility, Mutual Respect, Dedication, Perseverance, Humility and Perception. Self-Assessment & Analysis, Setting Life Goals, Consciousness and Self-Transformation. Team Work, Conflict Resolution, Influencing and Winning People, Anger Management, Forgiveness and Peace, Morality, Conscience. Yoga and Spirituality

Unit II: Harmony and Life Long Learning: **(8h)**

Harmony in human being, Nature and Existence. Harmony in family and society– Responsibilities towards society, Respecting teachers. Transition from School to College- Freedom & Responsibilities, Respecting Cultural Diversity, Learning beyond the Classrooms, Independent study and research

Unit III: Introduction to Professional Ethics: **(6h)**

Work Ethics, Engineering Ethics, Moral Dilemma, Moral Development Theories, Ethical Theories- Kantinism, Utilitarianism, etc , Case Studies for Choice of the theory, Code of Ethics

Unit IV: Individual to Global Issues: **(8h)**

Industrial Standards, A Balanced Outlook on Law, Safety, Responsibility, Rights, Confidentiality, Conflict of Interest, Occupational Crime, Whistle Blowing, Environmental Ethics, Business Conduct in MNC, E-Professionalism (IPR, Internet Ethics & Privacy issues)

Text Books

T1. Shetty, Foundation Course in Human Values and Professional Ethics[R.R. Gaur, R. Sangal, G.P. Bagaria]

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination Scheme:

Components	**Internal Assessment (Discussion+ Initiating Internship Template) MTE**	**ETE (Detailed Report Submission + Testimonials Photographs / Student Experience Sharing Video)**
Weightage (%)	**40**	**60**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Programme Outcomes**

CO1	**Understand** the importance of values, ethics, harmony and life long learning in personal and professional life	**PO8, PO11**
CO2	**Apply** the knowledge to perform self-exploration and transformation augmenting harmony, peace and positivity in the surroundings	**PO11**
CO3	**Appreciate** the core values that shape the ethical behavior of a professional	**PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
PSG11021	Human Values and Professional Ethics	-	-	-	-	-	-	-	2	-	-	3	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: - Human Values and Professional Ethics
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 Max. Marks: 50

Instructions:

	SECTION A (Attempt**all questions)**		
1.	What do you **mean** by happiness and Prosperity? Critically examine the prevailing notions of happiness in the society and their consequences. (**Ap**)	**5**	**CO1**
2.	How do the current world views lead to contradictions and dilemmas in professional life? – Explain. (**An**)	**5**	**CO2**
3.	What do you **mean** by 'Universal Human Order'? (**U**)	**5**	**CO3**
4.	"Physical facilities are necessary and complete for animals, while they are necessary but not complete for humans." **Comment**. (**An**)	**5**	**CO2**
5	Why do you think that there should be emphasis on Life Long Learning in the current academic setting? (**Ap**)	**5**	**CO3**
	SECTION B (Attempt any **One questions)**		
6.	Critically **examine** the issues in professional ethics in the current scenario. List any five unethical practices in profession today and the methods being tried to curb them. (**Ap**)	**10**	**CO3**
7.	What are the implications of value based living at all four levels of living? **Explain**. (**Ap**)	**10**	**CO1** **CO2**
8.	**Discuss** the Basic Aspects and Characteristic Features of Kohlberg's Theory and Gilligan'sTheory. (**U**)	**10**	**CO1** **CO2**
	SECTION C is Compulsory		
9.	**Case Study** Anhydrous ammonia is used to fertilize the crops. The anhydrous ammonia reacts violently with water. Pressurized tanks provided with wheels carry this fertilizer, and tanks are pulled by tractors. Farmers take these tanks on rent. They take on rent or purchase the hose to carry this ammonia from the tank to perforated blades that dig into		**CO3**

	the soil and spread ammonia. Leaks from the hose are very dangerous. After a few years of use of the product in the market, several accidents occurred where the hoses ruptured during use and severely injured and blinded the farmers. Legal action followed and the company argued in defense that the farmers had misused the hoses and not heeded the replacement warnings. But they have to make substantial out-of-court settlements. The company then dropped the product line and advertised in the press asking the farmers to turn-in their hoses for full refunds. The advertisement stated that the hoses are ‘obsolete’, and not that are unsafe. (*a*) **What** are the factual, conceptual and normative issues? (An) (*b*) **What** are the methods suggested for resolving these issues? (Ap)	**15**	

PHY11024	**Elective Physics II**	L	T	P	C
Version 1.0	Contact Hours: 60	3	1	0	4
Pre-requisites/Exposure	Knowledge of Class12 level Physics				
Co-requisites	Basic concept of Differential and Integral Calculus				

Course Objectives

1. To understand the principles of kinetic theory of gasses.
2. To apply basic postulates of thermodynamics and to understand the first and second law of thermodynamics.
3. To analyse different experimental evidence related to the concept of Quantum theory and discuss the development of the subject.
4. To apply the knowledge of quantum mechanics to different systems.
5. To explore the elementary idea about different theories of statistical mechanics.
6. To understand the basic working principle of LASER.
7. To understand the structural configuration of different materials.

Course Outcomes

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

CO1: Acquire the basic concepts of kinetic theory of gasses.

CO2: Develop the preliminary concepts of thermodynamics.

CO3: Build up the fundamental knowledge of quantum mechanics and apply it to few simple quantum mechanical systems.

CO4: Develop the elementary idea about the distribution functions of statistical mechanics.

CO5: Develop the basic knowledge of different topics of modern physics like LASER and fibre optics, solid state physics, band theory of solids and magnetism.

Catalogue Description

Elective Physics II gives an advance overview of modern physics. It deals with the fundamental area of physics in which one can explore a large domain starting from the collective behavior of gas particles, fundamentals of quantum mechanics, solid state physics and many more.

Course Content

1. Kinetic Theory of Gases (10h)

Maxwell's distribution of molecular velocities (statement only). Calculation of r.m.s, mean and most probable velocities.

2. Thermodynamics (15h)

Basic concepts: (Thermodynamic system, Surroundings and boundary, Thermodynamic coordinates, State, State function Thermodynamic equilibrium), First law of thermodynamics and its application. Isothermal and adiabatic changes and their relations, indicator diagrams. Reversible and irreversible processes, second law of thermodynamics, Carnot cycle and its efficiency calculation, entropy and its physical interpretation.

3. Quantum Physics (15h)

Planck's concept of blackbody radiation and radiation formula (statement only), qualitative discussion of photo-electric effect and Compton effect in support of quantum theory, wave-particle duality, Heisenberg uncertainty principle, and Schrödinger equation, particle in a one-dimensional infinite well, energy eigenvalues, wave function and its probabilistic interpretation. Bohr's theory of hydrogen spectra, concept of quantum number, Pauli Exclusion Principle.

4. Statistical Physics: (10h)

Elementary idea about three distribution functions (Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics), Concepts of Bosons and Fermions.

5. Modern Physics: (10h)

LASER and Fibre Optics, Einstein's A, B coefficient, Population Inversion, He-Ne LASER, Ruby LASER.

Concept of Lattice structure, Bravais Lattice, Free electron theory, Electrical and Thermal conductivity, Band Theory, Elementary idea about Magnetism and Superconductivity.

Test Books:

T1. Arthur Beiser, S RaiChoudhury, Shobhit Mahajan, (2009), Concept of Modern Physics, 6th Edition, Tata-McGraw Hill.
T2. A J Dekker, Solid State Physics, Mcmillan India Ltd, 1st Ed. 2009

Reference Books:

R1. Thermal Physics, Roy and Gupta
R2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Acquire** the basic concepts of kinetic theory of gasses.	**PO1, PO2, PO4**
CO2	**Develop** the preliminary concepts of thermodynamics.	**PO1, PO2, PO3, PO4**
CO3	**Build** up the fundamental knowledge of quantum mechanics and apply it to few simple quantum mechanical systems.	**PO1, PO2, PO4, PO5**
CO4	**Develop** the elementary idea about the distribution functions of statistical mechanics.	**PO1, PO2, PO4**
CO5	**Develop** the basic knowledge of different topics of modern physics like LASER and fiber optics, solid state physics, band theory of solids and magnetism.	**PO1,PO3, PO4**

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY11024	Elective Physics II	3	3	2	3	2	-	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: PHY11024- Elective Physics II
Program: B.Sc. Microbiology **Time: 03 Hrs.**
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

Section A (Answer any five)

Q. No. 1

(a)	Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and a critical field of 0.064 MAm^{-1}at 0 K. **Find** the critical field at 4K. (**Ap**)	**4**	**CO5**
(b)	**Show** that for a simple cubic lattice, $d_{100}:d_{110}:d_{111} = \sqrt{6}:\sqrt{3}:\sqrt{2}$, where d is interplanar spacing. (**B**)	**4**	**CO5**
(c)	**Compute** the line energy of dislocations in Aluminium. Aluminium exists in FCC crystalline form with lattice parameter *a* = 4.05 Å. The Burgers vector in Aluminium is of the 1/2<110> type. The shear modulus of Aluminium is 26 GNm^{-2}. (**R**)	**4**	**CO5**
(d)	**Define** operator. Prove that the position operator and its conjugate momentum operator don't commute. (**R**)	**4**	**CO3**
(e)	In developing the kinetic theory of gasses several idealized assumptions are made about the behavior of ideal gas, **mention** at least four of them. (**R**)	**4**	**CO1**
(f)	**Define** thermodynamics. What do you mean by thermodynamic system, boundary of the system and surroundings? (**R**)	**4**	**CO2**
(g)	Write down distribution function for Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics. Explain the	**4**	**CO3**

	requirement of statistical distribution function, mentioning different kinds of particles. (**R**)		
Section B(Answer all questions)			
Q. No. 2			
(a)	**Determine** the interplanar spacing between the two parallel planes with Miller indices (*h, k, l*) in a cubic crystal. (**U**)	**5**	**CO5**
(b)	**Show** that, NA of optical fiber could be expressed as $sini_m$, i_m is acceptance angle. (**R**)	**2**	**CO5**
(c)	**Show** mathematically that population inversion is necessary for the amplification of light intensity (laser action). (**R**)	**3**	**CO5**
(d)	Write down distribution function for Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics. Explain the requirement of statistical distribution function, mentioning different kinds of particles. (**R**)	**5**	**CO4**
Q. No. 3			
(a)	**Explain** the hysteresis loop formation according to domain model of ferromagnetism. Explain the B-H loop of soft and hard magnetic material? (**E**)	**5**	**CO5**
(b)	**Explain** Meissner effect of the superconductive materials. Which type of semiconductor does not follow the Meissner effect strictly? (**An**)	**5**	**CO5**
(c)	**Describe** Josephson effect underlying a SQUID. Discuss application od SQUID. (**R**)	**5**	**CO5**

PHY12025	**Elective Physics II Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours -45**	0	0	3	2
Pre-requisites/Exposure	Knowledge about basic higher secondary physics.				
Co-requisites	--				

Course Objectives:

To provide the knowledge about the thermal properties of a bad conductor. To give a basic idea about the behaviour of different non ohmic elements in the electrical circuits and to explore the behaviour of different electronic devices.

Course Outcome:

CO1: Students shall be able to **estimate** the thermal conductivity of a bad conductor.

CO2: Students shall be able to **verify** different laws of network theorems of electrical circuits.

CO3: Students shall be able to **study** of the response of various non-ohmic devices like inductance, capacitance in the electrical circuits.

CO4: Students shall be able to **study** the characteristic curves of junction diodes and bipolar junction transistors.

Catalogue Description

This course introduces basic concepts about the experiments related to different domains of physics starting from thermal physics to electrical and electronic devices.

Course Content:

List of Experiments:

1. Determination of thermal conductivity of a bad conductor of heat by Lee's and Charlton's method. (**9h**)

2. To verify the Thevenin and Norton theorem, Superposition theorem, and Maximum Power Transfer theorems. (**6h**)

3. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width. (**9h**)
4. To study V-I characteristics of PN junction diode, and Light emitting diode. (**6h**)
5. To study the V-I characteristics of a Zener diode and its use as voltage regulator. (**9h**)
6. To study the characteristics of a Bipolar Junction Transistor in CE configuration.(**6h**)

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

Examination Scheme:

Components	**Class Assessment**	**End Term**
Weightage (%)	**50**	**50**

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

Mapping between COs and POs

Course Outcomes (COs)		**Mapped POs**
CO1	Students shall be able to **estimate** the thermal conductivity of a bad conductor.	**PO2, PO3, PO1, PO5**
CO2	Students shall be able to **verify** different laws of network theorems of electrical circuits.	**PO1, PO2, PO3, PO5**
CO3	Students shall be able to **study** of the response of various non-ohmic devices like inductance, capacitance in the electrical circuits.	**PO1, PO2, PO3, PO5**
CO4	Students shall be able to **study** the characteristic curves of junction diodes and bipolar junction transistors.	**PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY12025	Elective Physics IILab	2	3	2	-	1	-	-	-	-	-	-	-

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

Name:

Enrolment No:

Course: PHY12025- Elective Physics II Lab

Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 Max. Marks: 50

Instructions:

Read the question carefully. Determine the values of nuclear g factor of the samples and compare the results for different samples.

Q 1 :	**Study** response curve of the given Series LCR circuit. Determine the following: (**U**) (i) Resonant frequency (ii) Impedance at resonance (iii) Quality factor Q (iv) Band width a. Demonstration of the Theory (**U**) b. Illustrate the working formula to determine the values (**U**) c. Design of circuit &Experiment to study response curve (**Ap**) d. Demonstrate of results in Tabular form(**U**) e. Graphical representation of response curve **(U)** f. Estimate the values resonance frequency, impedance at resonance, quality factor, band width(**E**) g. Discus the precautionary measurements (**C**) h. Viva voce	15+ 5+5 +3+ 2+2 +3+ 15	**CO2**

CSE11643	**Elective Computer Science II**	L	T	P	C
Version 1.0	**Contact Hours: 60**	4	0	0	4
Pre-requisites/Exposure	Basics of computer knowledge				
Co-requisites	--				

Course Objectives

1. To understand the basic procedural programming skills.
2. To apply the conditional constructs to solution of different problems.
3. To understand the iterative way of programming.
4. To design solution to different problem scenarios using the programming constructs.

Course Outcomes

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

CO1: **Understanding** a functional hierarchical code organization.
CO2: **Ability** to define and manage data structures based on problem subject domain.
CO3: **Ability** to work with textual information, characters and strings.
CO4: **Design** algorithms to solve simple problems.
CO5: **Demonstrate** the ability to correct, test and debug Processing programs.

Catalogue Description

This course introduces the students to the basics of programming skills. It familiarizes them with the procedural programming approach and design solutions to problems using conditional constructs, iterative programming and functions. They learn to create user-defined functions to solve different problem scenarios and grasp knowledge about string handling functions.

Course Content

Unit I: (8 h)

Basics of C Programming: Characters used in C, Identifiers, Keywords, Data type & sizes, Constants &Variables, Different types of Operators, Standard Input/output functions.

Unit II: (8 h)

Control Flow: Control Flow, if-else, switch-case, Loop Control Statements, for loop, while loop, do-while loop, nested loop, break, continue, goto label and exit( ) function.

Unit III: (15 h)

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays - Row Major Order, and Column Major Order, Application of arrays – searching and sorting, Sparse Matrices and their representations.

Unit IV: (9 h)

String: Definition of a String, Declaration of a String, Initialization of a String, Various String Handling Functions with example.

Unit V: (10 h)

Pointers: Definition of Pointer, Declaration of Pointer, Operators used in Pointer, Pointer Arithmetic, Functions with Pointer.

Unit VI: (10 h)

Functions: Basic Concept of Function, Declaration or Prototype of Function, Types of Functions, Call by Value, Call by Reference, Recursion, Tail Recursion.

Text Books

T1. “The C Programming Language”, 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI

Reference Books

R1. “Schaum's Outline of Programming with C”, 2nd Edition, Byron S. Gottfried, Mcgraw Hill Education
R2. “The Complete Reference”, 4th Edition by Herbert Schildt, Tata Mcgraw Hill Education

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Understanding** a functional hierarchical code organization.	**PO1, PO5**
CO2	Ability to **define** and manage data structures based on problem subject domain.	**PO8, PO2**
CO3	Ability to **work** with textual information, characters and strings.	**PO3, PO8, PO5**
CO4	**Design** algorithms to solve simple problems.	**PO5, PO8**
CO5	**Demonstrate** the ability to correct, test and debug Processing programs.	**PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE11643	Elective Computer Science II	1	-	1	-	2	-	-	3	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: CSE11643- Elective Computer Science II
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt any Three questions)

1	What is a data type? **Explain** about any two data types. (**An**)	**2** **3**	**CO1**
2	**Explain** nested if else statement with example. (**An**)	**5**	**CO2**
3	Write a C program to display the reverse of a number. **What** is ternary operator? (**U**)	**3** **2**	**CO4**
4	What is the **use** of break statement? **Explain** with a suitable example. (**An**)	**2** **3**	**CO2**

SECTION B (Attempt all questions)

5	a) Write a C program to find the largest among three numbers. (**Ap**) b) **What** is string? What is the use of strlen function? (**An**)	**3** **2** **2**	**CO3**
6	a)**What** is a pointer? Explain with suitable example. (**An**) b)Write short notes on Pointer arithmetic. (**U**)	**3** **2** **2**	**CO3**
7	a) **Differentiate** between row major and column major array representation. (**Ap**) b)Write a C program to swap two variables without using third variable. (**U**) c)Write a C program to print the elements of a one-dimensional array. (**U**)	**2** **3** **2**	**CO3, CO5**
8	a) Write a C program to search for an element in a given array. (**U**) b) What is a two-dimensional array? **Cite** an example. (**An**) c) What is a function? (**U**)	**3** **2** **2**	**CO4, CO5**
9	a) **Differentiate** between call by value and call by reference method of passing the parameters. (**Ap**) b)Write a C program to **examine** whether a number is palindrome by using user-defined function. (**U**)	**3** **4**	**CO1, CO2, CO5**

CSE12644	**Elective Computer Science II Lab**	L	T	P	C
Version 1.0	**Contact Hours: 45**	0	0	3	2
Pre-requisites/Exposure	Basics of computer skills				
Co-requisites	--				

Course Objectives

1. To understand the basic procedural programming skills.
2. To apply the conditional constructs to solution of different problems.
3. To understand the iterative way of programming.
4. To design solution to different problem scenarios using the programming constructs.

Course Outcomes

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

CO1: **Identify** situations where computational methods and computers would be useful.
CO2: Given a computational problem, identify and **abstract**the programming task involved.
CO3: **Approach** the programming tasks using techniques learned and write pseudo-code.
CO4: **Choose** the right data representation formats based on the requirements of the problem.
CO5: **Write** the program on a computer, edit, compile, debug, correct, recompile and run it.
CO6: **Identify** tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

Catalogue Description

This course introduces the students to the basics of programming skills. It familiarizes them with the procedural programming approach and design solutions to problems using conditional constructs, iterative programming and functions. They learn to create user-defined functions to solve different problem scenarios and grasp knowledge about string handling functions.

Course Content

List of experiments:

1. Introduction to C Programming	(**9h**)
2. C program to implement different aspects of Control Flow	(**6h**)
3. C program to implement different aspects ofArrays	(**9h**)
4. C program to implement different aspects of String	(**6h**)
5. C program to implement different aspects of Pointers	(**9h**)
6. C program to implement different aspects of Functions	(**6h**)

Text Books

T1. “The C Programming Language”, 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI

Reference Books

R1. “Schaum's Outline of Programming with C”, 2nd Edition, Byron S. Gottfried, Mcgraw Hill Education

R2. “The Complete Reference”, 4th Edition by Herbert Schildt, Tata Mcgraw Hill Education

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Identify** situations where computational methods and computers would be useful.	**PO1,PO3,PO6**
CO2	Given a computational problem, identify and **abstract** the programming task involved.	**PO5,PO3**
CO3	**Approach** the programming tasks using techniques learned and write pseudo-code.	**PO3,PO6,PO1**
CO4	**Choose** the right data representation formats based on the requirements of the problem.	**PO3,PO6,PO1**
CO5	**Write** the program on a computer, edit, compile, debug, correct, recompile and run it.	**PO3,PO6,PO1**
CO6	**Identify** tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.	**PO3,PO6,PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE12644	Elective Computer Science II Lab	3	-	3	-	-	3	-	2	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: CSE12644- Elective Computer Science II Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

Section A (Attempt any Three)

1	a. To convert the temperature from Celsius to Fahrenheit. (**Ap**) b. To **check** whether a number is odd or even. (**An**) **c.** To display the elements of an 1D array. (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1, CO2**

2	a. To print the reverse of a number. (**Ap**) b. To **evaluate** whether a string is palindrome or not. (**An**) c. To swap two variables using third variable (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1,CO2**
3	a. To print the largest among three numbers. (**Ap**) b. To search for a given element in an array. (**An**) c. To print the sum of first n natural numbers (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1,CO2**
4	a. To **apply** user defined function to find the Fibonacci series upto n terms. (**Ap**) b. To display the factorial of a given number. (**An**) c. To **find** the average of an array of integers. (**Ap**)	**4** **3** **3**	**CO3,CO5,CO6,CO1,CO2,CO4**
	SECTION B is compulsory		
5	Viva-voce (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**
6	Practical copy (U/Ap/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**

R=Remember; U=understand; Ap= Application; E=Evaluation; C=Create; An=Analysis

CHM11153	**Elective Chemistry II**	L	T	P	C
Version 1.0	**Contact Hours: 60**	3	1	0	4
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

1. To introduce important concepts required in the field of the course advanced elective chemistry. This course gives students a thorough understanding regarding fundamental knowledge of various branches of chemistry.
2. To introduce clear understanding of regarding the stabilization of colloidal systems and how solution properties are affected with different dissolutions.
3. To impart the basic notions of chemical equilibrium.
4. To impart detailed descriptions of basic properties of organic molecules and their related reaction mechanism which play major roles in everyday life cycle.
5. To learn the elementary concepts of acid-base chemistry required for daily life chemistry.
6. To understand the major role of inorganic complexes in living organisms which are very essential concepts in the course curriculum of some disciplines.
7. To introduce important tools of different spectroscopic methods required in structure analysis of molecules.

Course Outcomes

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

CO1	**Describe** fundamental principles and theories for stabilisation/destabilisation of colloidal systems.
CO2	**Learn** using LeChâtelier's Principle, how the equilibrium quantities of reactants and products are shifted by changes in the parameters of the chemical reactions.
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.
CO4	**Understand** reasonable mechanism for a chemical reaction.
CO5	**Learn** the acid-base concept in aqueous and non-aqueous media and reactions in non-aqueous media.
CO6	**Understand** the fundamental tasks performed by inorganic elements in living organisms as well as the related methods.
CO7	**Identify** the structure of unknown/new compounds with the help of different spectroscopic methods like UV-Visible, IR and NMR spectroscopic Technique.

Catalogue Description:

This course gives a detailed understanding of the basics of physical, organic, bioinorganic and spectroscopic knowledge required in other disciplines. This course will include expert instructors who will introduce the importance of chemical equilibrium, property of colloidal states, preliminary concepts of organic chemistry, stereochemistry and some and their various mechanisms, basic bioinorganic chemistry and spectroscopic methods required in analysing chemical structures. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct theory classes by taking lecture as well as power point presentations, audio visual virtual lab sessions as per requirement of the course. After finishing this course, students from different disciplines will strongly grasp the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content:

Physical Chemistry-II

Unit-I: Colloids (5 h)

Colloids and crystalloids; classification of colloids; Preparation and purification of colloids; Properties of colloids: Brownian motion, peptization, dialysis, Tyndal effect and its applications. Protecting colloids, Gold number, Isoelectric points, Coagulation of colloids by electrolytes, Schulze-Hardy rule

Unit II: Chemical and Ionic equilibrium (10 h)

Concept of Gibbs Free Energy; Criteria for thermodynamic equilibrium and spontaneity of a process; Chemical equilibria of homogeneous and heterogeneous systems, Derivation of expression of equilibrium constants; Temperature, pressure and concentration dependence of equilibrium constants (Kp, K. Kx); Le Chatelier's principle of dynamic equilibrium. Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).Concept of salt hydrolysis; Buffer solution and buffer capacity.

Organic Chemistry I

Unit-I:

Fundamentals of Organic Chemistry and Stereochemistry: (5 h)

Functional group-based classification and nomenclature; Sources I origin of different compounds; Concept of hybridization; resonance (including hyperconjugation); inductive effect; steric effect; steric inhibition of resonance. Orbital pictures of bonding (spa, sp^2, sp: C-C, C-N & C-O system).

Stereochemistry: Symmetry elements, Molecular chirality, Concept of Stereo Centre, Representation of molecules in Fischer projection, Concept of E/Z and Cis-Trans stereo-isomers.

Unit-II: (3 h)

Mechanistic classification: ionic, radical and pericyclic; heterolytic and homolytic bond cleavage and bond formation; representation of mechanistic steps using formalism. Reactive intermediates: carbocations (cabenium and carbonium ions), Carbanions, Carbon radicals, Carbenes-structure using orbital picture, Electrophilic/nucleophilic behaviour, Stability, generation and fate (elementary idea); Nucleophilic and electrophilic substitution reaction (only sp centre); Introduction to Elimination reaction and its types.

Unit-III: **(7 h)**

Basic Organic Reactions: (Addition, Substitution, Elimination, Rearrangement Reactions) Addition Reactions: Halogenations, Hydration, Hydrogenation, Epoxidation, Hydroxylation, Ozonolysis, electrophilic addition to diene; Hydroboration-oxidation reaction; Radical addition: HBr addition, Birch Reduction. Nucleophilic addition to carbonyl group.

Substitution Reactions: SN 1 , SN2, NGP, Elimination Reactions: El, E2, Elimination vs. Substitution, Rearrangement Reactions: Rearrangement to electron-deficient carbon: Wagner-Meerwein rearrangement, pinacol-pinacolon and related rearrangements, dienone-phenol.

Inorganic Chemistry-II:15L

Unit-I: **(7 h)**

Acids-Bases and Redox: Bronsted- Lowry concept of acid-base reaction, solvated proton, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle. Theory of acid-base titration and significance of Acid-base indicators. Common ion effect ;Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials with sign conventions; Nernst equation (without derivation); redox indicators

Unit-II: **(8 h)**

Bioinorganic Chemistry:

Elements of life: essential major, trace and ultra-trace elements; Basic chemical reactions in the biological systems and the role of metal ions (specially Na+, K+, Mg2+, Ca2+, Fe3+, 12+ , Cu2+, R- ,and Zn2+);Biological functions of haemoglobin and myoglobin.

Spectroscopy: **(15 h)**

Unit-I:

UV-Vis Spectra: Electronic transition, relative positions of k-max, Woodward's empirical rule; Labert-Beers Law.

Unit-II:

IR Spectra: Modes of molecular vibrations, application of Hooke's law, characteristic stretching frequencies and factors effecting stretching frequencies.

Unit-III:

NMR Spectra: Preliminary idea of NMR, Nuclear spin, NMR active nuclei, Equivalent and non-equivalent carbons and protons; Chemical shift 6; Shielding deshielding, Upfield and Downfield shifts.

Unit-IV:

Photochemistry: Fluorescence and phosphorescence; Quantum Yield; Jablonsky diagram

Text Books:

T1.D. A. Mcquarrie and J. D. Simon: Physical Chemistry — A Molecular Approach
T2. D. Nasipuri: Stereochemistry of organic compounds: Principles and Applications
T3. Bioinorganic Chemistry. Asim K. Das.
T4.Organic Spectroscopy. William Kemp.

Reference Books:

Physical Chemistry:
R1. G. W. Castellan: Physical Chemistry
R2. P. W. Atkins: Physical Chemistry
Organic Chemistry:
R1. P. Sykes: A Guide to Mechanism in Organic Chemistry
R2. R. T. Morrison and R. N. Boyd: Organic Chemistry

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

Examination Scheme:

Components	**Mid term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs, POs and PEOs

CO1	**Describe** fundamental principles and theories for stabilisation/destabilisation of colloidal systems.	**PO1, PO3, PO4**
CO2	**Learn** using LeChâtelier's Principle, how the equilibrium quantities of reactants and products are shifted by changes in the parameters of the chemical reactions.	**PO5, PO4**
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.	**PO6, PO4**
CO4	**Understand** reasonable mechanism for a chemical reaction.	**PO1, PO8, PO9**
CO5	**Learn** the acid-base concept in aqueous and non-aqueous media and reactions in non-aqueous media.	**PO3, PO10**
CO6	**Understand** the fundamental tasks performed by inorganic elements in living organisms as well as the related methods.	**PO1, PO3, PO4, PO5**
CO7	**Identify** the structure of unknown/new compounds with the help of different spectroscopic methods like UV-Visible, IR and NMR spectroscopic Technique.	**PO3, PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM11153	Elective Chemistry II	3	-	3	1	1	-	-	2	1	1	-	-

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

Model Question Paper

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

Course: CHM11153- Elective Chemistry II
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt **all** questions (each carrying **five** marks).

SECTION A (Attempt all questions)

1	a) Convert 1-propene to 1-propanol and 2-propanol. b) **Write** the mechanism and the rate law of E2reaction. (**E**)	**2** **3**	**CO3**
2	**Distinguish** between SN1 and SN2 reactions showing the mechanism of both. b) What are enantiomersand diastereoisomers? Explain with examples. (**An**)	**5**	**CO3, CO4**
3	a) What is configuration and conformation? **Explain** with examples. b) **Write** the mechanism offormation of nitrobenzene from benzene.	**3** **2**	**CO3**

	(**Ap**)		
4	**Describe** the properties of a stable colloidal solution. Is soap a colloid? (**An**)	**2** **3**	**CO1**
5	**Describe** the effects of temperature and pressure on a chemical equilibrium. (**E**)	**5**	**CO2**
6	**Why** is aniline a weaker base compared to methyl amine? What is optical rotation? (**Ap**)	**2** **3**	**CO3,** **CO4**
7	**State** the structural differences between haemoglobin and myoglobin. (**An**)	**5**	**CO5**
8	**Describe** Bohr effect. State the functional differences of haemoglobin and cytochrome C. (**An**)	**5**	**CO6**
9	**Describe** Lambert-Beers law. State the required characteristics of a molecule to execute UV-Vis spectra. (**E**)	**5**	**CO7**
10	**Why** pyridine is more basic than aniline? State the required characteristics of a molecule to show chirality.(**R**)	**5**	**CO4**

CHM12154	**Elective Chemistry II Lab**	L	T	P	C
Version 1.0	**Contact Hours: 45**	0	0	3	2
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

1. To introduce important concepts required in the field of the practical field of elective chemistry. This course gives students a detailed understanding of lab-based chemistry knowledge in their course curriculums.
2. To introduce hands on training of small instruments required for quantitative elemental determination.
3. To impart hand on training on qualitative determination of various acid and base radicals in inorganic complexes.
4. To introduce practical training on qualitative determination of functional groups present in an organic molecule.

Course Outcomes

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

CO-1	**Learn**quantitative determination of pH, conductivity, redox potential using Potentiometer, pH meter, conductometer etc.
CO-2	**Detect** qualitative determination of various acid and basic radicals in a given inorganic sample.
CO-3	**Establish** optical activity of sucrose/ glucose with polarimeter
CO-4	**Estimate** various functional groups in the given organic samples.

Course Description:

This course gives a detailed understanding of the basics of chemistry lab techniques required in other disciplines. This course will include expert instructors who will introduce a detailed description of lab-based chemistry knowledge in their course curriculums, methods of using small instruments like potentiometer, conductometer for quantitative titration, determination of acid and basic radicals in inorganic complexes and functional groups present in organic molecules. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct demonstration classes by taking lecture followed by practical hands on training per requirement of the course. The tutorials and required assignments will acquaint the students with practical problem-solving techniques led by the course coordinator. After finishing this course, students from different disciplines will strongly acquire the hands-on training via experiencing practical lab sessions with the coordinator.

Course Content:

Practical IIa: **(25 h)**

1. Determination of E^0 of Fe^{+3}/Fe^{+2} couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using $KMnO_4$, or, $K_2Cr_2O_7$ as standard.

2.Determination of concentration of (i) $AgNO_3$ solution and (ii) solubility product of AgC1 by potentiometric titration of standard KC1 solution against $AgNO_3$ solution.

3.Detection of some acid and basic radicals present in water, soil etc.

Practical IIb: **(20 h)**

1.To study the kinetics of inversion of sucrose using polarimeter.

2.Experiment A: Detection of special elements (N, Cl, and S) in organic compounds. Experiment B: Solubility and Classification (solvents: H20, dil. HC1, dil. NaOH) Experiment C: Detection of functional groups -NO2, -NH2, -COOH, carbonyl (-CHO, >C=0), -OH (phenolic) in solid organic compounds.

Text Books:

T1. Das, S.C. Advanced Practical Chemistry, Sixth edition

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

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

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

Mapping between Cos and POs		
CO1	**Learn**quantitative determination of pH, conductivity, redox potential using Potentiometer, pH meter, conductometer etc.	**PO1, PO3, PO4**
CO2	**Assess** qualitative determination of various acid and basic radicals in a given inorganic sample.	**PO4, PO3, PO8**
CO3	**Establish** optical activity of sucrose/ glucose with polarimeter	**PO1,PO3, PO4**
CO4	**Estimate** various functional groups in the given organic samples.	**PO1, PO2, PO9, PO4**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM12154	Elective Chemistry II Lab	3	-	2	3	1	-	-	2	1	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: CHM12154- Elective Chemistry II Lab
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

SECTION A (Attempt all questions)

1	**Determine** the solubility product of AgCl by potentiometric titration. (**An**)	**10**	**CO1**
2	**Identify** at least three radicals in an unknown inorganic sample A. (**An**)	**10**	**CO2**
3	**Identify** the functional group/groups present in the given organic sampleusing classification tests. (**An**)	**10**	**CO4**
SECTION B (Attempt all questions)			
4	Viva-voce (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**
5	Practical copy (U/Ap/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**

SDS11507	**Elective Statistics II**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours -90**	5	1	0	6
Pre-requisites/Exposure	Basic Statistics				
Co-requisites	--				

Course Objectives:

This course aims to build up the advanced knowledge on the basic statistics. Here students will learn more tools and techniques which are useful for analyzing economic issues in real life. The difference between population and sample, why sampling is required for any study, has to be understood clearly before one delves into statistical analysis. In this paper students will get an idea of sampling theory and techniques, sampling distribution and its different forms, test of hypothesis and also learn business index numbers.

Course Outcomes

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

CO1. **Recall** basic terminologies of sampling, hypothesis testing.

CO2. **Illustrate** sampling distribution of statistics and test of significance for large sample and small sample.

CO3. **Explain** several methods of estimation to estimate population parameters.

CO4. **Classify** several types of index numbers to measure relative changes.

Course Description:

This course introduces basic concepts and techniques statistical theory. It emphasizes the intuitive logic that underlie the theory and techniques, and valid interpretation of the results obtained using the techniques.

This course contains sampling techniques , estimation, test of hypothesis and index numbers.

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:

Unit-I **(25h)**

Definitions of random sample, parameter and statistic, null and alternative hypotheses, simple and composite hypotheses, level of significance and probabilities of Type I and Type II errors, power of a test and critical region. Sampling distribution of a statistic, sampling distribution of sample mean, standard error of sample mean.

Unit-II **(25h)**

Large sample tests for single mean, difference of means, standard deviation and difference of standard deviations. Sampling distributions of chi-sq, t and F: definitions, properties and relationships between them. Tests of Significance based on Chi-square (goodness of fit and independence of attributes), t distribution and F- distribution using classical and p-value approach.

Unit-III **(20h)**

Methods of estimation: maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem and Lehmann-Schaffer theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances.

Unit-IV **(20h)**

Basic concept of index numbers – simple and weighted index numbers – concept of weights - types of index numbers – Business index number – CPT, WPI, Sensex, Niffy, Production Index.

Text book

T1. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.

T2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.

Reference book

R1. V.K. Rohtagi and A.K. Md. E. Saleh (2009): *An Introduction to Probability and Statistics*, 2nd Edition, John Wiley and Sons.

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

Examination Scheme:

Components	Mid term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs, POs		
Course Outcomes (COs)		**Mapped POs**
CO1	**Recall** basic terminologies of sampling, hypothesis testing.	**PO1, PO2, PO4, PO6**
CO2	**Illustrate** sampling distribution of statistics and test of significance for large sample and small sample.	**PO1, PO2, PO3, PO5**
CO3	**Explain** several methods of estimation to estimate population parameters.	**PO1, PO5**
CO4	**Classify** several types of index numbers to measure relative changes.	**PO1, PO2, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
SDS11507	Elective Statistics II	3	3	2	1	3	2	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: SDS11507- Elective Statistics II
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **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 (Answer all)

1.	**Find** the distribution of sample mean taken from a population which follows normal distribution. (R)	**5**	**CO1**
2.	A drug given to each of the 12 persons resulted in the following changes in the blood pressure from normal $-3, 2, 8, -1, 3, 0, 7, -2, 1, 5, 0, 4.$ **Explain** whether the differences is significant or not. Given, $t_{11,\ 0.05} = 2.228$. (U)	**5**	**CO2**
3.	**Show** that if $\hat{\theta}$is an unbiased estimator of $\theta,$then it does not imply that $\sqrt{\hat{\theta}}$is also an unbiased estimator of $\sqrt{\theta}.$ (U)	**5**	**CO3**
4.	State and **explain** Rao-Blackwell theorem and Lehmann-Scheffe theorem. (U)	**5**	**CO3**

SECTION B (Attempt any Two Questions)

5.	**Find** the MLE of the mean of an exponential distribution? (U)	**15**	**CO3**
6.	a) State and **explain** Type-I error and Type-II error. (R) b) A random sample of size 3 is drawn without replacement from a population of size 5 having units 3, 6, 7, 8, 10. Verify that the sample mean is an unbiased estimator of population mean. And **show** that the sample variance of sample mean is $\frac{\sigma^2}{n} \times \frac{N-n}{N-1}$, where σ^2 is the population variance. (U)	**5** **10**	**CO1** **CO3**
7.	a) A sample of 1600 members is found to have a mean of 5.7. **Explain** it could be reasonably regarded as a simple sample from a large population whose mean is 4.5 and standard deviation is 2.8? (U) b) **Explain** business index numbers WPI and Sensex. (U)	**10** **5**	**CO2** **CO4**

PHY11024	**Elective Physics II**	L	T	P	C
Version 1.0	Contact Hours: 60	3	1	0	4
Pre-requisites/Exposure	Knowledge of Class12 level Physics				
Co-requisites	Basic concept of Differential and Integral Calculus				

Course Objectives

8. To understand the principles of kinetic theory of gasses.
9. To apply basic postulates of thermodynamics and to understand the first and second law of thermodynamics.
10. To analyse different experimental evidence related to the concept of Quantum theory and discuss the development of the subject.
11. To apply the knowledge of quantum mechanics to different systems.
12. To explore the elementary idea about different theories of statistical mechanics.
13. To understand the basic working principle of LASER.
14. To understand the structural configuration of different materials.

Course Outcomes

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

CO1: Acquire the basic concepts of kinetic theory of gasses.

CO2: Develop the preliminary concepts of thermodynamics.

CO3: Build up the fundamental knowledge of quantum mechanics and apply it to few simple quantum mechanical systems.

CO4:Develop the elementary idea about the distribution functions of statistical mechanics.

CO5: Develop the basic knowledge of different topics of modern physics like LASER and fibre optics, solid state physics, band theory of solids and magnetism.

Catalogue Description

Elective Physics II gives an advance overview of modern physics. It deals with the fundamental area of physics in which one can explore a large domain starting from the collective behavior of gas particles, fundamentals of quantum mechanics, solid state physics and many more.

Course Content

1. Kinetic Theory of Gases (10h)

Maxwell's distribution of molecular velocities (statement only). Calculation of r.m.s, mean and most probable velocities.

2. Thermodynamics (15h)

Basic concepts: (Thermodynamic system, Surroundings and boundary, Thermodynamic coordinates, State, State function Thermodynamic equilibrium), First law of thermodynamics and its application. Isothermal and adiabatic changes and their relations, indicator diagrams. Reversible and irreversible processes, second law of thermodynamics, Carnot cycle and its efficiency calculation, entropy and its physical interpretation.

3. Quantum Physics (15h)

Planck's concept of blackbody radiation and radiation formula (statement only), qualitative discussion of photo-electric effect and Compton effect in support of quantum theory, wave-particle duality, Heisenberg uncertainty principle, and Schrödinger equation, particle in a one-dimensional infinite well, energy eigenvalues, wave function and its probabilistic interpretation. Bohr's theory of hydrogen spectra, concept of quantum number, Pauli Exclusion Principle.

4. Statistical Physics: (10h)

Elementary idea about three distribution functions (Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics), Concepts of Bosons and Fermions.

5. Modern Physics: (10h)

LASER and Fibre Optics, Einstein's A, B coefficient, Population Inversion, He-Ne LASER, Ruby LASER.

Concept of Lattice structure, Bravais Lattice, Free electron theory, Electrical and Thermal conductivity, Band Theory, Elementary idea about Magnetism and Superconductivity.

Test Books:

T1. Arthur Beiser, S RaiChoudhury, Shobhit Mahajan, (2009), Concept of Modern Physics, 6th Edition, Tata-McGraw Hill.
T2. A J Dekker, Solid State Physics, Mcmillan India Ltd, 1st Ed. 2009

Reference Books:

R1. Thermal Physics, Roy and Gupta
R2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Acquire** the basic concepts of kinetic theory of gasses.	**PO1, PO2, PO4**
CO2	**Develop** the preliminary concepts of thermodynamics.	**PO1, PO2, PO3, PO4**
CO3	**Build** up the fundamental knowledge of quantum mechanics and apply it to few simple quantum mechanical systems.	**PO1, PO2, PO4, PO5**
CO4	**Develop** the elementary idea about the distribution functions of statistical mechanics.	**PO1, PO2, PO4**
CO5	**Develop** the basic knowledge of different topics of modern physics like LASER and fiber optics, solid state physics, band theory of solids and magnetism.	**PO1,PO3, PO4**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY11024	Elective Physics II	3	3	2	3	2	-	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: PHY11024- Elective Physics II
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt any **five** questions from **Section A** (each carrying 2 marks); **all**questions from **Section B** (each carrying 20 marks)**.**

Section A (Answer any five)

Q. No. 1

(a)	Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and a critical field of 0.064 MAm^{-1}at 0 K. **Find** the critical field at 4K. (**Ap**)	**2**	**CO5**
(b)	**Show** that for a simple cubic lattice, $d_{100}:d_{110}:d_{111} = \sqrt{6}:\sqrt{3}:\sqrt{2}$, where d is interplanar spacing. (**B**)	**2**	**CO5**
(c)	**Compute** the line energy of dislocations in Aluminium. Aluminium exists in FCC crystalline form with lattice parameter a = 4.05 Å. The Burgers vector in Aluminium is of the 1/2<110> type. The shear modulus of Aluminium is 26 GNm^{-2}. (**R**)	**2**	**CO5**
(d)	**Define** operator. Prove that the position operator and its conjugate momentum operator don't commute. (**R**)	**2**	**CO3**
(e)	In developing the kinetic theory of gasses several idealized assumptions are made about the behavior of ideal gas, **mention** at least four of them. (**R**)	**2**	**CO1**
(f)	**Define** thermodynamics. What do you mean by thermodynamic system, boundary of the system and surroundings? (**R**)	**2**	**CO2**

Section B(Answer all questions)

Q. No. 2

(a)	**Determine** the interplanar spacing between the two parallel planes with Miller indices (h, k, l) in a cubic crystal. (**U**)	**5**	**CO5**

(b)	**Show** that, NA of optical fiber could be expressed as $sin i_m$, i_m is acceptance angle. (**R**)	**5**	**CO5**
(c)	**Show** mathematically that population inversion is necessary for the amplification of light intensity (laser action). (**R**)	**5**	**CO5**
(d)	Write down distribution function for Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics. Explain the requirement of statistical distribution function, mentioning different kinds of particles. (**R**)	**5**	**CO4**
Q. No. 3			
(a)	**Explain** the hysteresis loop formation according to domain model of ferromagnetism. Explain the B-H loop of soft and hard magnetic material? (**E**)	**5**	**CO5**
(b)	**Explain** Meissner effect of the superconductive materials. Which type of semiconductor does not follow the Meissner effect strictly? (**An**)	**10**	**CO5**
(c)	**Describe** Josephson effect underlying a SQUID. Discuss application od SQUID. (**R**)	**5**	**CO5**

PHY12025	Elective Physics II Lab	L	T	P	C
Version 1.0	Contact Hours -45	0	0	3	2
Pre-requisites/Exposure	Knowledge about basic higher secondary physics.				
Co-requisites	--				

Course Objectives:

To provide the knowledge about the thermal properties of a bad conductor. To give a basic idea about the behaviour of different non ohmic elements in the electrical circuits and to explore the behaviour of different electronic devices.

Course Outcome:

CO1: Students shall be able to **estimate** the thermal conductivity of a bad conductor.

CO2: Students shall be able to **verify** different laws of network theorems of electrical circuits.

CO3: Students shall be able to **study** of the response of various non-ohmic devices like inductance, capacitance in the electrical circuits.

CO4: Students shall be able to **study** the characteristic curves of junction diodes and bipolar junction transistors.

Catalogue Description

This course introduces basic concepts about the experiments related to different domains of physics starting from thermal physics to electrical and electronic devices.

Course Content:

List of Experiments:

1. Determination of thermal conductivity of a bad conductor of heat by Lee's and Charlton's method. (**9h**)

2. To verify the Thevenin and Norton theorem, Superposition theorem, and Maximum Power Transfer theorems. (**6h**)

3. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width. (**9h**)
4. To study V-I characteristics of PN junction diode, and Light emitting diode. (**6h**)
5. To study the V-I characteristics of a Zener diode and its use as voltage regulator. (**9h**)
6. To study the characteristics of a Bipolar Junction Transistor in CE configuration.(**6h**)

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

Examination Scheme:

Components	**Class Assessment**	**End Term**
Weightage (%)	**50**	**50**

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

Mapping between COs and POs

Course Outcomes (COs)		**Mapped POs**
CO1	Students shall be able to **estimate** the thermal conductivity of a bad conductor.	**PO2, PO3, PO1, PO5**
CO2	Students shall be able to **verify** different laws of network theorems of electrical circuits.	**PO1, PO2, PO3, PO5**
CO3	Students shall be able to **study** of the response of various non-ohmic devices like inductance, capacitance in the electrical circuits.	**PO1, PO2, PO3, PO5**
CO4	Students shall be able to **study** the characteristic curves of junction diodes and bipolar junction transistors.	**PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PHY12025	Elective Physics II Lab	2	3	2	-	1	-	-	-	-	-	-	-

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

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: PHY12025- Elective Physics II Lab
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 Max. Marks: 50

Instructions:
Read the question carefully. Determine the values of nuclear g factor of the samples and compare the results for different samples.

Q 1 :	**Study** response curve of the given Series LCR circuit. Determine the following: (**U**) (i) Resonant frequency (ii) Impedance at resonance (iii) Quality factor Q (iv) Band width i. Demonstration of the Theory (**U**) j. Illustrate the working formula to determine the values (**U**) k. Design of circuit &Experiment to study response curve (**Ap**) l. Demonstrate of results in Tabular form(**U**) m. Graphical representation of response curve **(U)** n. Estimate the values resonance frequency, impedance at resonance, quality factor, band width(**E**) o. Discus the precautionary measurements (**C**) p. Viva voce	15+ 5+5 +3+ 2+2 +3+ 15	**CO2**

CSE11643	Elective Computer Science II	L	T	P	C
Version 1.0	**Contact Hours: 60**	4	0	0	4
Pre-requisites/Exposure	Basics of computer knowledge				
Co-requisites	--				

Course Objectives

5. To understand the basic procedural programming skills.
6. To apply the conditional constructs to solution of different problems.
7. To understand the iterative way of programming.
8. To design solution to different problem scenarios using the programming constructs.

Course Outcomes

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

CO1: **Understanding** a functional hierarchical code organization.
CO2: **Ability** to define and manage data structures based on problem subject domain.
CO3: **Ability** to work with textual information, characters and strings.
CO4: **Design** algorithms to solve simple problems.
CO5: **Demonstrate** the ability to correct, test and debug Processing programs.

Catalogue Description

This course introduces the students to the basics of programming skills. It familiarizes them with the procedural programming approach and design solutions to problems using conditional constructs, iterative programming and functions. They learn to create user-defined functions to solve different problem scenarios and grasp knowledge about string handling functions.

Course Content

Unit I: (8 h)

Basics of C Programming: Characters used in C, Identifiers, Keywords, Data type & sizes, Constants &Variables, Different types of Operators, Standard Input/output functions.

Unit II: (8 h)

Control Flow: Control Flow, if-else, switch-case, Loop Control Statements, for loop, while loop, do-while loop, nested loop, break, continue, goto label and exit( ) function.

Unit III: (15 h)

Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays - Row Major Order, and Column Major Order, Application of arrays – searching and sorting, Sparse Matrices and their representations.

Unit IV: (9 h)

String: Definition of a String, Declaration of a String, Initialization of a String, Various String Handling Functions with example.

Unit V: (10 h)

Pointers: Definition of Pointer, Declaration of Pointer, Operators used in Pointer, Pointer Arithmetic, Functions with Pointer.

Unit VI: (10 h)

Functions: Basic Concept of Function, Declaration or Prototype of Function, Types of Functions, Call by Value, Call by Reference, Recursion, Tail Recursion.

Text Books

T1. "The C Programming Language", 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI

Reference Books

R1. "Schaum's Outline of Programming with C", 2nd Edition, Byron S. Gottfried, Mcgraw Hill Education

R2. "The Complete Reference", 4th Edition by Herbert Schildt, Tata Mcgraw Hill Education

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

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Understanding** a functional hierarchical code organization.	**PO1, PO5**
CO2	Ability to **define** and manage data structures based on problem subject domain.	**PO8, PO2**
CO3	Ability to **work** with textual information, characters and strings.	**PO3, PO8, PO5**
CO4	**Design** algorithms to solve simple problems.	**PO5, PO8**
CO5	**Demonstrate** the ability to correct, test and debug Processing programs.	**PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE11643	Elective Computer Science II	1	-	1	-	2	-	-	3	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS
UNIVERSITY
PURSUE EXCELLENCE

Course: CSE11643- Elective Computer Science II
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:

SECTION A (Attempt any Three questions)

1	What is a data type? **Explain** about any two data types. (**An**)	**2** **3**	**CO1**
2	**Explain** nested if else statement with example. (**An**)	**5**	**CO2**
3	Write a C program to display the reverse of a number. **What** is ternary operator? (**U**)	**3** **2**	**CO4**
4	What is the **use** of break statement? **Explain** with a suitable example. (**An**)	**3** **2**	**CO2**

SECTION B (Attempt all questions)

5	a) Write a C program to find the largest among three numbers. (**Ap**) b) **What** is string? What is the use of strlen function? (**An**)	**3** **2** **2**	**CO3**
6	a)**What** is a pointer? Explain with suitable example. (**An**) b)Write short notes on Pointer arithmetic. (**U**)	**3** **2** **2**	**CO3**
7	a) **Differentiate** between row major and column major array representation. (**Ap**) b)Write a C program to swap two variables without using third variable. (**U**) c)Write a C program to print the elements of a one-dimensional array. (**U**)	**2** **3** **2**	**CO3, CO5**
8	a) Write a C program to search for an element in a given array. (**U**) b) What is a two-dimensional array? **Cite** an example. (**An**) c) What is a function? (**U**)	**3** **2** **2**	**CO4, CO5**
9	a) **Differentiate** between call by value and call by reference method of passing the parameters. (**Ap**) b)Write a C program to **examine** whether a number is palindrome by using user-defined function. (**U**)	**3** **4**	**CO1, CO2, CO5**

CSE12644	**Elective Computer Science II Lab**	L	T	P	C
Version 1.0	**Contact Hours: 45**	0	0	3	2
Pre-requisites/Exposure	Basics of computer skills				
Co-requisites	--				

Course Objectives

1. To understand the basic procedural programming skills.
2. To apply the conditional constructs to solution of different problems.
3. To understand the iterative way of programming.
4. To design solution to different problem scenarios using the programming constructs.

Course Outcomes

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

CO1: **Identify** situations where computational methods and computers would be useful.
CO2: Given a computational problem, identify and **abstract**the programming task involved.
CO3: **Approach** the programming tasks using techniques learned and write pseudo-code.
CO4: **Choose** the right data representation formats based on the requirements of the problem.
CO5: **Write** the program on a computer, edit, compile, debug, correct, recompile and run it.
CO6: **Identify** tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

Catalogue Description

This course introduces the students to the basics of programming skills. It familiarizes them with the procedural programming approach and design solutions to problems using conditional constructs, iterative programming and functions. They learn to create user-defined functions to solve different problem scenarios and grasp knowledge about string handling functions.

Course Content

List of experiments:

7. Introduction to C Programming (**9h**)
8. C program to implement different aspects of Control Flow (**6h**)
9. C program to implement different aspects ofArrays (**9h**)
10. C program to implement different aspects of String (**6h**)
11. C program to implement different aspects of Pointers (**9h**)
12. C program to implement different aspects of Functions (**6h**)

Text Books

T1. "The C Programming Language", 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI

Reference Books

R1. "Schaum's Outline of Programming with C", 2nd Edition, Byron S. Gottfried, Mcgraw Hill Education

R2. "The Complete Reference", 4th Edition by Herbert Schildt, Tata Mcgraw Hill Education

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Identify** situations where computational methods and computers would be useful.	**PO1,PO3,PO6**
CO2	Given a computational problem, identify and **abstract** the programming task involved.	**PO5,PO3**
CO3	**Approach** the programming tasks using techniques learned and write pseudo-code.	**PO3,PO6,PO1**
CO4	**Choose** the right data representation formats based on the requirements of the problem.	**PO3,PO6,PO1**
CO5	**Write** the program on a computer, edit, compile, debug, correct, recompile and run it.	**PO3,PO6,PO1**
CO6	**Identify** tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.	**PO3,PO6,PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CSE12644	Elective Computer Science II Lab	3	-	3	-	-	3	-	2	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: CSE12644- Elective Computer Science II Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 40**

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

Section A (Attempt any three)

1	d. To convert the temperature from Celsius to Fahrenheit. (**Ap**) e. To **check** whether a number is odd or even. (**An**) **f.** To display the elements of an 1D array. (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1,CO2**
2	d. To print the reverse of a number. (**Ap**) e. To **evaluate** whether a string is palindrome or not. (**An**) f. To swap two variables using third variable (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1,CO2**
3	d. To print the largest among three numbers. (**Ap**) e. To search for a given element in an array. (**An**) f. To print the sum of first n natural numbers (**Ap**)	**3** **3** **4**	**CO3,CO5,CO6,CO1,CO2**
4	d. To **apply** user defined function to find the Fibonacci series upto n terms. (**Ap**) e. To display the factorial of a given number. (**An**) f. To **find** the average of an array of integers. (**Ap**)	**4** **3** **3**	**CO3,CO5,CO6,CO1,CO2,CO4**
	SECTION B is compulsory		
5	Viva-voce (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**
6	Practical copy (U/Ap/E)	**10**	**CO1** **CO2** **CO3**

			CO4 **CO5** **CO6**

R=Remember; U=understand; Ap= Application; E=Evaluation; C=Create; An=Analysis

CHM11153	Elective Chemistry II	L	T	P	C
Version 1.0	**Contact Hours: 60**	3	1	0	4
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

8. To introduce important concepts required in the field of the course advanced elective chemistry. This course gives students a thorough understanding regarding fundamental knowledge of various branches of chemistry.
9. To introduce clear understanding of regarding the stabilization of colloidal systems and how solution properties are affected with different dissolutions.
10. To impart the basic notions of chemical equilibrium.
11. To impart detailed descriptions of basic properties of organic molecules and their related reaction mechanism which play major roles in everyday life cycle.
12. To learn the elementary concepts of acid-base chemistry required for daily life chemistry.
13. To understand the major role of inorganic complexes in living organisms which are very essential concepts in the course curriculum of some disciplines.
14. To introduce important tools of different spectroscopic methods required in structure analysis of molecules.

Course Outcomes

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

CO1	**Describe** fundamental principles and theories for stabilisation/destabilisation of colloidal systems.
CO2	**Learn** using LeChâtelier's Principle, how the equilibrium quantities of reactants and products are shifted by changes in the parameters of the chemical reactions.
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.
CO4	**Understand** reasonable mechanism for a chemical reaction.
CO5	**Learn** the acid-base concept in aqueous and non-aqueous media and reactions in non-aqueous media.
CO6	**Understand** the fundamental tasks performed by inorganic elements in living organisms as well as the related methods.
CO7	**Identify** the structure of unknown/new compounds with the help of different spectroscopic methods like UV-Visible, IR and NMR spectroscopic Technique.

Catalogue Description:

This course gives a detailed understanding of the basics of physical, organic, bioinorganic and spectroscopic knowledge required in other disciplines. This course will include expert instructors who will introduce the importance of chemical equilibrium, property of colloidal states, preliminary concepts of organic chemistry, stereochemistry and some and their various mechanisms, basic bioinorganic chemistry and spectroscopic methods required in analysing chemical structures. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct theory classes by taking lecture as well as power point presentations, audio visual virtual lab sessions as per requirement of the course. After finishing this course, students from different disciplines will strongly grasp the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content:

Physical Chemistry-II

Unit-I: Colloids (5 h)

Colloids and crystalloids; classification of colloids; Preparation and purification of colloids; Properties of colloids: Brownian motion, peptization, dialysis, Tyndal effect and its applications. Protecting colloids, Gold number, Isoelectric points, Coagulation of colloids by electrolytes, Schulze-Hardy rule

Unit II: Chemical and Ionic equilibrium (10 h)

Concept of Gibbs Free Energy; Criteria for thermodynamic equilibrium and spontaneity of a process; Chemical equilibria of homogeneous and heterogeneous systems, Derivation of expression of equilibrium constants; Temperature, pressure and concentration dependence of equilibrium constants (Kp, K. Kx); Le Chatelier's principle of dynamic equilibrium. Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).Concept of salt hydrolysis; Buffer solution and buffer capacity.

Organic Chemistry I

Unit-I:

Fundamentals of Organic Chemistry and Stereochemistry: (5 h)

Functional group-based classification and nomenclature; Sources I origin of different compounds; Concept of hybridization; resonance (including hyperconjugation); inductive effect; steric effect; steric inhibition of resonance. Orbital pictures of bonding (spa, sp^2, sp: C-C, C-N & C-O system).

Stereochemistry: Symmetry elements, Molecular chirality, Concept of Stereo Centre, Representation of molecules in Fischer projection, Concept of E/Z and Cis-Trans stereo-isomers.

Unit-II: (3 h)

Mechanistic classification: ionic, radical and pericyclic; heterolytic and homolytic bond cleavage and bond formation; representation of mechanistic steps using formalism. Reactive intermediates: carbocations (cabenium and carbonium ions), Carbanions, Carbon radicals, Carbenes-structure using orbital picture, Electrophilic/nucleophilic behaviour, Stability, generation and fate (elementary idea); Nucleophilic and electrophilic substitution reaction (only sp centre); Introduction to Elimination reaction and its types.

Unit-III: (7 h)

Basic Organic Reactions: (Addition, Substitution, Elimination, Rearrangement Reactions) Addition Reactions: Halogenations, Hydration, Hydrogenation, Epoxidation, Hydroxylation, Ozonolysis, electrophilic addition to diene; Hydroboration-oxidation reaction; Radical addition: HBr addition, Birch Reduction. Nucleophilic addition to carbonyl group.

Substitution Reactions: SN 1 , SN2, NGP, Elimination Reactions: El, E2, Elimination vs. Substitution, Rearrangement Reactions: Rearrangement to electron-deficient carbon: Wagner-Meerwein rearrangement, pinacol-pinacolon and related rearrangements, dienone-phenol.

Inorganic Chemistry-II:15L

Unit-I: (7 h)

Acids-Bases and Redox: Bronsted- Lowry concept of acid-base reaction, solvated proton, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle. Theory of acid-base titration and significance of Acid-base indicators. Common ion effect ;Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials with sign conventions; Nernst equation (without derivation); redox indicators

Unit-II: (8 h)

Bioinorganic Chemistry:

Elements of life: essential major, trace and ultra-trace elements; Basic chemical reactions in the biological systems and the role of metal ions (specially Na+, K+, Mg2+, Ca2+, Fe3+, 12+ , Cu2+, R- ,and Zn2+);Biological functions of haemoglobin and myoglobin.

Spectroscopy: (15 h)

Unit-I:

UV-Vis Spectra: Electronic transition, relative positions of k-max, Woodward's empirical rule; Labert-Beers Law.

Unit-II:

IR Spectra: Modes of molecular vibrations, application of Hooke's law, characteristic stretching frequencies and factors effecting stretching frequencies.

Unit-III:

NMR Spectra: Preliminary idea of NMR, Nuclear spin, NMR active nuclei, Equivalent and non-equivalent carbons and protons; Chemical shift 6; Shielding deshielding, Upfield and Downfield shifts.

Unit-IV:

Photochemistry: Fluorescence and phosphorescence; Quantum Yield; Jablonsky diagram

Text Books:

T1.D. A. Mcquarrie and J. D. Simon: Physical Chemistry — A Molecular Approach
T2. D. Nasipuri: Stereochemistry of organic compounds: Principles and Applications
T3. Bioinorganic Chemistry. Asim K. Das.
T4.Organic Spectroscopy. William Kemp.

Reference Books:

Physical Chemistry:
R1. G. W. Castellan: Physical Chemistry
R2. P. W. Atkins: Physical Chemistry
Organic Chemistry:
R1. P. Sykes: A Guide to Mechanism in Organic Chemistry
R2. R. T. Morrison and R. N. Boyd: Organic Chemistry

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

Examination Scheme:

Components	**Mid term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

Relationship between the Course Outcomes (COs) with Program Outcomes (POs) and Program Educational Outcomes (PEOs)

Mapping between COs, POs and PEOs

CO1	**Describe** fundamental principles and theories for stabilisation/destabilisation of colloidal systems.	**PO1, PO3, PO4**
CO2	**Learn** using LeChâtelier's Principle, how the equilibrium quantities of reactants and products are shifted by changes in the parameters of the chemical reactions.	**PO5, PO4**
CO3	**Understand** the properties of solutions that depends on the number of dissolved particles in solution, but not on the identities of the solutes.	**PO6, PO4**
CO4	**Understand** reasonable mechanism for a chemical reaction.	**PO1, PO8, PO9**
CO5	**Learn** the acid-base concept in aqueous and non-aqueous media and reactions in non-aqueous media.	**PO3, PO10**
CO6	**Understand** the fundamental tasks performed by inorganic elements in living organisms as well as the related methods.	**PO1, PO3, PO4, PO5**
CO7	**Identify** the structure of unknown/new compounds with the help of different spectroscopic methods like UV-Visible, IR and NMR spectroscopic Technique.	**PO3, PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM11153	Elective Chemistry II	3	-	3	1	1	-	-	2	1	1	-	-

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

Model Question Paper

Name:
Enrolment No:

Course: CHM11153- Elective Chemistry II
Program: B.Sc. Microbiology Time: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

Instructions:
Attempt **all** questions

SECTION A (Attempt all questions)

1	a) Convert 1-propene to 1-propanol and 2-propanol. b) **Write** the mechanism and the rate law of E2reaction. (**E**)	**2** **3**	**CO3**
2	**Distinguish** between SN1 and SN2 reactions showing the mechanism of both. b) What are enantiomersand diastereoisomers? Explain with examples. (**An**)	**5**	**CO3,** **CO4**
3	a) What is configuration and conformation? **Explain** with examples. b) **Write** the mechanism offormation of nitrobenzene from benzene. (**Ap**)	**2** **3**	**CO3**
4	**Describe** the properties of a stable colloidal solution. Is soap a colloid? (**An**)	**2** **3**	**CO1**
5	**Describe** the effects of temperature and pressure on a chemical equilibrium. (**E**)	**5**	**CO2**
6	**Why** is aniline a weaker base compared to methyl amine? What is optical rotation? (**Ap**)	**2** **3**	**CO3,** **CO4**
7	**State** the structural differences between haemoglobin and myoglobin. (**An**)	**5**	**CO5**
8	**Describe** Bohr effect. State the functional differences of haemoglobin and cytochrome C. (**An**)	**5**	**CO6**
9	**Describe** Lambert-Beers law. State the required characteristics of a molecule to execute UV-Vis spectra. (**E**)	**5**	**CO7**
10	**Why** pyridine is more basic than aniline? State the required characteristics of a molecule to show chirality.(**R**)	**5**	**CO4**

CHM12154	Elective Chemistry II Lab	L	T	P	C
Version 1.0	Contact Hours: 45	0	0	3	2
Pre-requisites/Exposure	Physics and Chemistry of class 12 or 10+2 level				
Co-requisites	Partial differentiation, model making, graph plotting				

Course Objectives

5. To introduce important concepts required in the field of the practical field of elective chemistry. This course gives students a detailed understanding of lab-based chemistry knowledges in their course curriculums.
6. To introduce hands on training of small instruments required for quantitative elemental determination.
7. To impart hand on training on qualitative determination of various acid and base radicals in inorganic complexes.
8. To introduce practical training on qualitative determination of functional groups present in an organic molecule.

Course Outcomes

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

CO-1	**Learn**quantitative determination of pH, conductivity, redox potential using Potentiometer, pH meter, conductometer etc.
CO-2	**Detect** qualitative determination of various acid and basic radicals in a given inorganic sample.
CO-3	**Establish** optical activity of sucrose/ glucose with polarimeter
CO-4	**Estimate** various functional groups in the given organic samples.

Course Description:

This course gives a detailed understanding of the basics of chemistry lab techniques required in other disciplines. This course will include expert instructors who will introduce a detailed description of lab-based chemistry knowledges in their course curriculums, methods of using small instruments like potentiometer, conductometer for quantitative titration,determination of acid and basic radicals in inorganic complexes and functional groups present in organic molecules. All the lectures will be devoted on discussions of elementary concepts and cutting-edge topics, focusing on practical implementation of knowledge. Instructors will conduct demonstration classes by taking lecture followed by practical hands on training per requirement of the course. The tutorials and required assignments will acquaint the students with practical problem-solving techniques led by the course coordinator. After finishing this course, students from different disciplines will strongly acquire the hands-on training via experiencing practical lab sessions with the coordinator.

Course Content:

Practical IIa: **(25 h)**

1. Determination of E^0 of Fe^{+3}/Fe^{+2} couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using $KMnO_4$, or, $K_2Cr_2O_7$ as standard.

2.Determination of concentration of (i) $AgNO_3$ solution and (ii) solubility product of AgC1 by potentiometric titration of standard KC1 solution against $AgNO_3$ solution.

3.Detection of some acid and basic radicals present in water, soil etc.

Practical IIb: **(20 h)**

1.To study the kinetics of inversion of sucrose using polarimeter.

2.Experiment A: Detection of special elements (N, Cl, and S) in organic compounds. Experiment B: Solubility and Classification (solvents: H20, dil. HC1, dil. NaOH) Experiment C: Detection of functional groups -NO2, -NH2, -COOH, carbonyl (-CHO, >C=0), -OH (phenolic) in solid organic compounds.

Text Books:

T1. Das, S.C. Advanced Practical Chemistry, Sixth edition

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

Examination Scheme:

Components	**Class Assessment**	**End Term**
Weightage (%)	**50**	**50**

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

Mapping between Cos and POs		
CO1	**Learn**quantitative determination of pH, conductivity, redox potential using Potentiometer, pH meter, conductometer etc.	**PO1, PO3, PO4**
CO2	**Assess** qualitative determination of various acid and basic radicals in a given inorganic sample.	**PO4, PO3, PO8**
CO3	**Establish** optical activity of sucrose/ glucose with polarimeter	**PO1,PO3, PO4**
CO4	**Estimate** various functional groups in the given organic samples.	**PO1, PO2, PO9, PO4**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CHM12154	Elective Chemistry II Lab	3	-	2	3	1	-	-	2	1	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: CHM12154- Elective Chemistry II Lab
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**

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

SECTION A (Attempt all questions)

1	**Determine** the solubility product of AgCl by potentiometric titration. (**An**)	**10**	**CO1**
2	**Identify** at least three radicals in an unknown inorganic sample A. (**An**)	**10**	**CO2**
3	**Identify** the functional group/groups present in the given organic sampleusing classification tests. (**An**)	**10**	**CO4**
SECTION B (Attempt all questions)			
4	Viva-voce (U/An/Ap/R/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**
5	Practical copy (U/Ap/E)	**10**	**CO1** **CO2** **CO3** **CO4** **CO5** **CO6**

SDS11507	**Elective Statistics II**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours -90**	5	1	0	6
Pre-requisites/Exposure	Basic Statistics				
Co-requisites	--				

Course Objectives:

This course aims to build up the advanced knowledge on the basic statistics. Here students will learn more tools and techniques which are useful for analyzing economic issues in real life. The difference between population and sample, why sampling is required for any study, has to be understood clearly before one delves into statistical analysis. In this paper students will get an idea of sampling theory and techniques, sampling distribution and its different forms, test of hypothesis and also learn business index numbers.

Course Outcomes

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

CO5. **Recall** basic terminologies of sampling, hypothesis testing.
CO6. **Illustrate** sampling distribution of statistics and test of significance for large sample and small sample.
CO7. **Explain** several methods of estimation to estimate population parameters.
CO8. **Classify** several types of index numbers to measure relative changes.

Course Description:

This course introduces basic concepts and techniques statistical theory. It emphasizes the intuitive logic that underlie the theory and techniques, and valid interpretation of the results obtained using the techniques.

This course contains sampling techniques , estimation, test of hypothesis and index numbers.

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:

Unit-I **(25h)**

Definitions of random sample, parameter and statistic, null and alternative hypotheses, simple and composite hypotheses, level of significance and probabilities of Type I and Type II errors, power of a test and critical region. Sampling distribution of a statistic, sampling distribution of sample mean, standard error of sample mean.

Unit-II **(25h)**

Large sample tests for single mean, difference of means, standard deviation and difference of standard deviations. Sampling distributions of chi-sq, t and F: definitions, properties and relationships between them. Tests of Significance based on Chi-square (goodness of fit and independence of attributes), t distribution and F- distribution using classical and p-value approach.

Unit-III **(20h)**

Methods of estimation: maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem and Lehmann-Schaffer theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances.

Unit-IV **(20h)**

Basic concept of index numbers – simple and weighted index numbers – concept of weights - types of index numbers – Business index number – CPT, WPI, Sensex, Niffy, Production Index.

Text book

T1. A.M. Goon, M.K. Gupta and B. Dasgupta (2003): *An outline of Statistical Theory* (Vol. I), 4th Ed., World Press, Kolkata.

T2. S.C. Gupta and V.K. Kapoor (2007): *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons.

Reference book

R1. V.K. Rohtagi and A.K. Md. E. Saleh (2009): *An Introduction to Probability and Statistics*, 2nd Edition, John Wiley and Sons.

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

Examination Scheme:

Components	Mid term	Class Assessment	End Term
Weightage (%)	20	30	50

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

Mapping between COs, POs		
Course Outcomes (COs)		**Mapped POs**
CO1	**Recall** basic terminologies of sampling, hypothesis testing.	**PO1, PO2, PO4, PO6**
CO2	**Illustrate** sampling distribution of statistics and test of significance for large sample and small sample.	**PO1, PO2, PO3, PO5**
CO3	**Explain** several methods of estimation to estimate population parameters.	**PO1, PO5**
CO4	**Classify** several types of index numbers to measure relative changes.	**PO1, PO2, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
SDS11507	Elective Statistics II	3	3	2	1	3	2	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

Course: SDS11507- Elective Statistics II

Program: B.Sc. Microbiology Time: 03 Hrs.

Semester: Even 2020-21 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 (Answer **all)**			
1.	**Find** the distribution of sample mean taken from a population which follows normal distribution. (R)	**5**	**CO1**
2.	A drug given to each of the 12 persons resulted in the following changes in the blood pressure from normal $-3, 2, 8, -1, 3, 0, 7, -2, 1, 5, 0, 4$. **Explain** whether the differences is significant or not. Given, $t_{11,\ 0.05} = 2.228$. (U)	**5**	**CO2**
3.	**Show** that if $\hat{\theta}$is an unbiased estimator of θ, then it does not imply that $\sqrt{\hat{\theta}}$is also an unbiased estimator of $\sqrt{\theta}$. (U)	**5**	**CO3**
4.	State and **explain** Rao-Blackwell theorem and Lehmann-Scheffe theorem. (U)	**5**	**CO3**
SECTION B (Attempt any **Two Questions)**			
5.	**Find** the MLE of the mean of an exponential distribution? (U)	**15**	**CO3**
6.	a) State and **explain** Type-I error and Type-II error. (R) b) A random sample of size 3 is drawn without replacement from a population of size 5 having units 3, 6, 7, 8, 10. Verify that the sample mean is an unbiased estimator of population mean. And **show** that the sample variance of sample mean is $\frac{\sigma^2}{n} \times \frac{N-n}{N-1}$, where σ^2 is the population variance. (U)	**6** **9**	**CO1** **CO3**
7.	a) A sample of 1600 members is found to have a mean of 5.7. **Explain** it could be reasonably regarded as a simple sample from a large population whose mean is 4.5 and standard deviation is 2.8? (U) b) **Explain** business index numbers WPI and Sensex. (U)	**9** **6**	**CO2** **CO4**

MIB11025	**FOOD AND DAIRY MICROBIOLOGY (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic knowledge of Microbiology				
Co-requisites	--				

Course Objectives

1. To provide the students with understanding of factors affecting microbial spoilage.
2. It will also provide in depth knowledge of various microorganisms associated with food spoilage as well as fermented foods
3. To study the methods of enumerating and identifying food spoilage and causative agent.
4. To study the concept of food sanitation and control.

Course Outcomes

On completion of this course,

CO1: Students will be able to **classify** the microbes present in different types of food and demonstrate the factors controlling the survival of the microbes in foods.

CO2: Students will be able to **illustrate** and distinguish between the spoilage types of different foods.

CO3: Students will be able to and demonstrate and **analyze** the different methods of food preservations.

CO4: Students will be able to **summarize** and distinguish between the different types of fermented dairy foods as well as **demonstrate** the various food sanitation methods.

CO5: Students will be able to **compare** and contrast between the aetiologies of food-borne diseases and cultural methods of the food borne pathogens

Catalogue Description

The core-course of food and dairy microbiology deals with food as a substrate for microorganisms, various types of food spoilage, fermented food product and also food borne diseases. Food sanitation, control and detection methods are also dealt.

Course Content

Food and Dairy Microbiology (MIB11025)

Unit 1 Foods as a substrate for microorganisms (10h)

Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

Unit 2 Spoilage of food bymicroorganisms (10h)

Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned foods

Unit 3 Methods of food preservation and their working principle (10h)

Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins

Unit 4 Fermented foods (10h)

Dairy starter cultures, fermented dairy products: yoghurt, acidophilus milk, kumiss, kefir, dahi and cheese(types), other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market. Prebiotics – Types and health benefits.

Unit 5 Food borne diseases(causative agents, symptoms and preventive measures) (10h)

Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and *mycotoxins;* Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli,* Salmonellosis, Shigellosis, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*

Unit 6 Food sanitation and control (5h)

HACCP, Indices of food sanitary quality and sanitizers

Unit 7 Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology (5h)

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

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **classify** the microbes present in different types of food and demonstrate the factors controlling the survival of the microbes in foods	**PO1, PO2, PO3, PO6**
CO2	Students will be able to illustrate and **distinguish** between the spoilage types of different foods	**PO1, PO2, PO3**

CO3	Students will be able to and demonstrate and **analyze** the different methods of food preservations	**PO1, PO2, PO3, PO4, PO6**
CO4	Students will be able to **summarize** and distinguish between the different types of fermented dairy foods as well as demonstrate the various food sanitation methods	**PO1, PO2, PO3, PO4, PO6**
CO5	Students will be able to **compare** and contrast between the etiologies of food-borne diseases and cultural methods of the food borne pathogens	**PO1, PO2, PO5,PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11025	Food and dairy microbiology	3	3	2	3	1	1	-	-	-	-	-	-

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

Model Question Pape

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester: V
Paper Code: MIB11025
Time: 03 Hrs. Total pages: 03
Max. Marks: 50Total number of questions: 08

Instructions:			
SECTION A (Attempt**all questions)**			
1.	**Define** Intrinsic factor. Mention its role in food spoilage. (R, Ap)	**2+3**	**CO1**
2.	What is TA spoilage? **Mention** the responsible microorganisms. (U, Ap)	**3+2**	**CO2**
3.	**Compare** the advantages of DMC and SPC method. (An)	**5**	**CO3**
4.	Fermented food products have a higher shelf life: **Justify** (An)	**5**	**CO4**
5	**Contrast** between food borne infection and intoxication with suitable examples. (E)	**5**	**CO5**
6	**Mention** the outcomes of infestation of food samples with mycotoxins.	**5**	**CO5**
	SECTION B (Attempt any **Two questions)**		
6.	A pure culture of bacteria grew from 100 cells to 1000 cells in 66 minutes. Find out the generation time of the said bacteria. **Mention** the role of antimicrobial constituents in food itself that prevents spoilage. (An, U)	**6+4**	**CO1**
7.	What can be the strategies to prevent microbial spoilage of food? Write a short note on: TDT and D-value. **Mention** reasons for non-microbial spoilage of food.(U, R)	**2+3+3+2**	**CO2, CO3**
8.	**Illustrate** the microbial association in the production of yogurt. Explain the role of *Salmonella sp* in food borne infection. (Ap, U)	**5+5**	**CO4, CO5**

MIB12026	**FOOD AND DAIRY MICROBIOLOGY LAB (PRACTICAL)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To provide the students with understanding of factors affecting microbial spoilage.
2. It will also provide in depth knowledge of various microorganisms associated with food spoilage as well as fermented foods
3. To study the methods of enumerating and identifying food spoilage and causative agent.
4. To study the concept of food sanitation and control.

Course Outcomes

On completion of this course,

CO1: Students will be able to **classify** the microbes present in different types of food and demonstrate the factors controlling the survival of the microbes in foods.
CO2: Students will be able to **illustrate** and distinguish between the spoilage types of different foods.
CO3: Students will be able to and **demonstrate** and analyze the different methods of food preservations.
CO4: Students will be able to **summarize** and distinguish between the different types of fermented dairy foods as well as **demonstrate** the various food sanitation methods.
CO5: Students will be able to **conduct** analysis of food product and detect food adulteration.

Catalogue Description

The core-course of food and dairy microbiology lab deals with food as a substrate for microorganisms, various types of food spoilage, fermented food product and also food borne diseases. Food sanitation, control and detection methods are also dealt.

Course Content

Food and Dairy Microbiology Lab (MIB12026)

1. MBRT of milk samples and their standard plate count. (8h)
2. Alkaline phosphatase test to check the efficiency of pasteurization of milk. (5h)
3. Isolation of food borne bacteria from various food products. (8h)

4. Isolation of spoilage microorganisms from spoiled vegetables/fruits. (8h)
5. Isolation of spoilage microorganisms from bread/cake.(8h)
6. Preparation of Yoghurt/Dahi. (8h)
6. Preparation of Yoghurt/Dahi. (8h)

Text book:

Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P)Limited Publishers, New Delhi, India.

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **classify** the microbes present in different types of food and demonstrate the factors controlling the survival of the microbes in foods	**PO1, PO2, PO3, PO6**
CO2	Students will be able to **illustrate** and distinguish between the spoilage types of different foods	**PO1, PO2, PO3**
CO3	Students will be able to and demonstrate and **analyze** the different methods of food preservations	**PO1, PO2, PO3, PO4, PO6, PO8**
CO4	Students will be able to **summarize and** distinguish between the different types of fermented dairy foods as well as demonstrate the various food sanitation methods as per	**PO1, PO2, PO3, PO4, PO6, PO7, PO8**
CO5	Students will be able to **conduct** analysis of food product and detect food adulteration.	**PO1, PO2, PO3, PO4, PO6, PO9, PO11**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12026	Food and dairy microbiology Lab	3	3	2	3	1	1	1	1	1	-	1	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

Name of Program: B.Sc. Microbiology
Semester: V
Paper Code: MIB12026
Time: 03 Hrs. **Total pages: 01**
Max. Marks: 50 **Total number of questions: 06**

SECTION A (Attempt **ALL questions)**

1.	**Identify** the type of food spoilage in the sample provided (A) and comment on it. (E)	**5**	**CO2**
2.	**Identify** the causative agent of the food spoilage (Sample B) using Gram's staining. (An, E)	**5**	**CO1**
	SECTION B (Attempt any **One question)**		
3.	**Conduct** HACCP analysis of the given industry: (Fruit Juice, Packaged Drinking Water) (E)	**20**	**CO5**

4.	As a QC Microbiologist prescribe a plan for detection of adulterant in milk sample at the milk receiving end in a dairy industry. (An)	**20**	**CO5**
SECTION C			
5.	Practical Record (U, R, An, Ap, E)	**10**	**CO1-CO5**
6.	Viva-voce (U, R, An, Ap, E)	**10**	**CO1-CO5**

MIB11027	**Recombinant DNA Technology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic concept of Microbiology and Molecular Biology				
Co-requisites	--				

Course Objectives:

1. To introduce to students that various tools, techniques and methods available for study of molecular cloning
2. To give an overview of different types of PCR and Sequencing
3. To outline the construction of genomic and cDNA library
4. To outline the applications of recombinant DNA technology

Course Outcomes

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

CO1. **Design** appropriate cloning strategies

CO2. **Explain** tools, techniques and methods used in molecular cloning

CO3. **Compare** and contrast among different types of DNA amplification and sequencing strategies

CO4. **Differentiate** between genomic and cDNA library

CO5. **List** applications of Recombinant DNA Technology

Catalogue Description:

Recombinant DNA Technology involves manipulation of DNA. In this course, a thorough foundation of the concepts of rDNA Technology will be covered in detail including molecular cloning, gene libraries, PCR, techniques related to DNA, RNA and proteins and sequencing. Applications of rDNA technology will be covered in this course.

Course Content:

Recombinant DNA Technology (MIB11027)

Unit 1 Introduction to Genetic Engineering (4h)

Milestones in genetic engineering and biotechnology

Unit 2 Molecular Cloning- Tools and Strategies (16h)

Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyltransferase, kinases and phosphatases, and DNA ligases ; Cloning Vectors: Definition and Properties; Plasmid vectors: pBR and pUC series; Bacteriophage lambda and M13 based vectors; Cosmids, Phagemids, BACs, YACs; Use of linkers and adaptors; Expression vectors: *E.coli* lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors

Unit 3 Methods in Molecular Cloning (12h)

Transformation of DNA: Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery, *Agrobacterium* (Ti plasmid)- mediated delivery; DNA, RNA and Protein analysis: Agarose gel electrophoresis, PAGE, Southern - and Northern - blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting.

Unit4 DNA Amplification and DNA sequencing (10h)

PCR: Basics of PCR, RT-PCR, Real-Time PCR; Sanger's method and (Maxam Gilbert) Dideoxymethod of DNA Sequencing: traditional and automated sequencing; Primer walking and shotgun sequencing

Unit 5 Construction and Screening of Genomic and cDNA libraries (8h)

Genomic and cDNA libraries: Preparation and Application, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping

Unit 6 Applications of Recombinant DNA Technology (10h)

Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, Gene therapy, recombinant vaccines, protein engineering and site directed mutagenesis.

Text Books

T1. Brown TA. (2010). Gene Cloning and DNA Analysis.6th edition. Blackwell Publishing, Oxford,U.K

Reference Books

R1. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

R2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA

R3. Glick, B.R.; Pasternak, J.J.; Patten, C.L. (2010). Molecular biotechnology: Principles and applications of recombinant DNA. ASM Press.

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

Examination Scheme:

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

<u>Course Outcomes for MIB11027</u>

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **design** appropriate cloning	**PO1, PO2,**

	strategies	**PO3,PO4,PO5, PO6**
CO2	Students will be able to **explain** tools, techniques and methods used in molecular cloning	**PO1, PO2, PO3,PO4,PO5, PO6**
CO3	Students will be able to **compare** and contrast among different types of DNA amplification and sequencing strategies	**PO1, PO2, PO3,PO4,PO5, PO6, PO8**
CO4	Students will be able to **differentiate** between genomic and cDNA library	**PO1, PO2, PO3,PO4,PO5, PO6**
CO5	Students will be able to **list** applications of Recombinant DNA Technology	**PO1, PO2, PO3,PO4,PO5, PO6, PO11**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11027	Recombinant DNA Technology	3	3	2	2	2	2	-	1	1	2	1	-

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

Model Question Paper

Name:

Enrolment No:

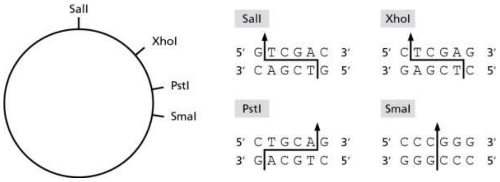
ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

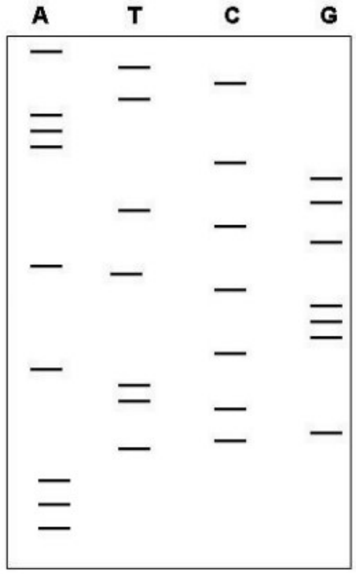
Name of Program: B.Sc. MicrobiologySemester: V
Paper Code: MIB11027
Time: 03 Hrs. **Total pages: 03** **Max. Marks: 50** **Total number of questions: 08**

Instructions:

Section A
(Attempt all questions**)**

1.	**List** major features of a cloning vector. What additional features might be present in expression vector? (R, U)	**5**	**CO1 CO2**
2.	A genetic engineer wants to isolate a gene from a scorpion that encodes the deadly toxin found in its stinger, with the ultimate purpose of transferring this gene to bacteria and producing the toxin for use as a commercial pesticide. Isolating the gene requires a DNA library. Should the genetic engineer create a genomic library or a cDNA library? **Explain** your reasoning. (An)	**5**	**CO4 CO6**
3.	**Why** are heat-stable DNA polymerases from thermophilic bacteria required for the polymerase chain reaction? (U)	**5**	**CO3**
4.	Assuming the human genome is 3 x 10^6 Kilobases (Kb) in size and that a lambda vector (maximum insert size = 20Kb) is used to make a gene library, how many actual clones would be required to achieve a 95% probability of including a particular gene sequence? (E)	**5**	**CO4**
5.	You have purified DNA from your recently deceased goldfish. Which of the following restriction nucleases would you **use** if you wanted to end up with DNA fragments with an average size of 70 kilobase pairs (kb) after complete digestion of the DNA? The recognition sequence for each enzyme is indicated in the right-hand column. (a)Sau3AI GATC	**5**	**CO1 CO2**

	(b)BamHI GGATCC (c)NotI GCGGCCGC (d)XzaI GAAGGATCCTTC (E)		
6.	What is the significance of primer walking?	**5**	**CO3**
	SECTION B (Attempt any two questions**)**		
7.	**Outline** the strategies for production of recombinant insulin. (Ap)	**10**	**CO5**
8.	Figure 1 shows the recognition sequences and sites of cleavage for the restriction enzymes SalI, XhoI, PstI, and SmaI, and also a plasmid with the sites of cleavage for these enzymes marked  **Figure 1** A. After which of the five treatments listed below can the plasmid shown in Figure 1 re-form into a circle simply by treating it with DNA ligase? Assume that after treatment any small pieces of DNA are removed and it is the larger portion of plasmid that will reassemble into a circle.After digestion with ___________. i. SalI alone ii. SalI and XhoI iii. SalI and PstI iv. SalI and SmaI v. SmaI and PstI B. After which of the treatments can the plasmid re-form into a circle by the addition of DNA ligase after treating the cut DNA with DNA polymerase in a mixture containing the four deoxyribonucleotides? Again, assume that you are trying to get the larger portion of plasmid to reassemble into a circle. (E, An)	**10**	**CO2**
9.	a. **What** is the purpose of the dideoxynucleoside triphosphate in the dideoxy sequencing reaction? b. The autoradiogram shown was generated	**10**	**CO3**

	by the dideoxy sequencing method. Define the DNA sequence of the template strand that was used in this sequencing reaction, noting the 5′ and 3′ ends of this template strand.(R, U)  		

MIB12028	Recombinant DNA Technology Lab	L	T	P	C
Version 1.0	**Contact Hours - 45**	0	0	2	2
Pre-requisites/Exposure	Basic Molecular Biology				
Co-requisites	--				

Course Objectives:

1. To provide hands on training on tools and techniques for study of molecular cloning
2. To prepare competent cells and transformation of competent cells
3. To be able to perform PCR and interpret sequencing electropherogram
4. To be able to demonstrate southern blotting

Course Outcomes

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

CO1. **Prepare** competent cells and demonstrate transformation
CO2. **Demonstrate** restriction digestion, ligation and interpret agarose gel electrophoresis
CO3. **Design** experiments for selection and screening of positive clones
CO4. **Design** primers and perform PCR to amplify a gene of interest
CO5. Demonstrate Southern blotting technique and **interpret** sequencing gel

Catalogue Description:

Recombinant DNA Technology lab focuses on tools and techniques to study molecular cloning and covers competent cell preparation. Transformation, restriction digestion, ligation, screening of clones, PCR, sequencing gel interpretation and Southern blotting techniques.

Course content

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1. Preparation of competent cells for transformation by $CaCl_2$ method. (5h)
2. Demonstration of bacterial transformation and calculation of transformation efficiency. (5h)
3. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis (5h)
4. Ligation of DNA fragments (5h)
5. Cloning of DNA insert and Blue white screening of recombinants. (5h)
6. Interpretation of sequencing gel electropherograms (5h)
7. Designing of primers for DNA amplification (5h)
8. Polymerase chain reaction for DNA amplification (5h)
9. Demonstration of Southern blotting (5h)

Text Book

Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

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

Mapping between COs and POs

	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **prepare** competent cells and demonstrate transformation	**PO1, PO2, PO3, PO4, PO5, PO6**
CO2	Students will be able to **demonstrate** restriction digestion, ligation and interpret agarose gel electrophoresis	**PO1, PO2, PO3, PO4, PO5, PO6**
CO3	Students will be able to **design** experiments for selection and screening of positive clones	**PO1, PO2, PO3, PO4, PO5, PO6**
CO4	Students will be able to **design** primers, perform and interpret PCR to amplify a gene of interest	**PO1, PO2, PO3, PO4, PO5, PO6**
CO5	Students will be able to **demonstrate** southern blotting technique and interpret sequencing gel	**PO1, PO2, PO3, PO4, PO5, PO6**

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

Examination Scheme:

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

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12028	Recombinant DNA Technology lab	3	3	2	2	2	2	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

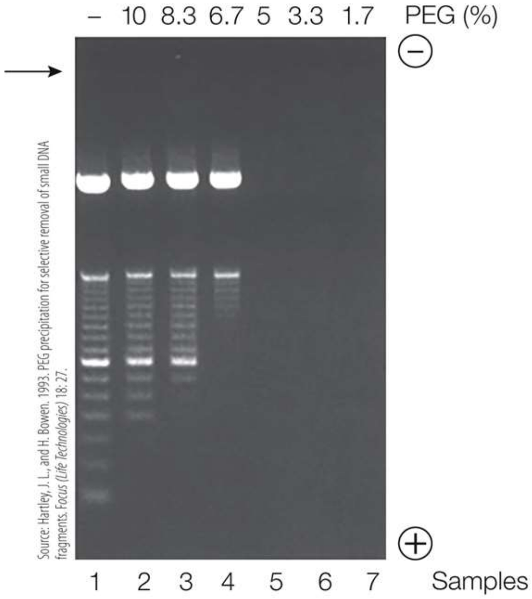
ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

Name of Program: B.Sc. MicrobiologySemester: V
Paper Code: MIB12028
Time: 03 Hrs. Total pages: 02Max. Marks: 50
Total number of questions: 03

Instructions:
Attempt all questions

Section A
(Attempt all questions**)**

1.	Prepare competent cells from the bacterial cells in Petri dish marked A. What kind of controls and precautions would you require for this experiment? **How** would you select for transformed cells if you want to introduce a pUC18 plasmid in this competent cells? (U, R, An)	**10+5**	**CO1 CO3**
2.	A 50 base pair (bp) DNA ladder solution (containing DNA fragments of several lengths differing by 50 bp) was divided into 7 samples. One was left untreated (sample 1). The others were treated with polyethylene glycol (PEG) at the following final concentrations: 10% (sample 2), 8.3% (sample 3), 6.7% (sample 4), 5% (sample 5), 3.3% (sample 6) and 1.7% (sample 7). Samples 2 to 7 were centrifuged, the pellets were dissolved in a gel loading buffer, and all seven samples were electrophoresed in an agarose gel. The positions of the electrodes (+ and -) during electrophoresis and the loading wells (→) are indicated.	**5+5+5**	**CO2**

	 Source: Hartley, J. L., and H. Bowen. 1993. PEG precipitation for selective removal of small DNA fragments. *Focus (Life Technologies)* 18: 27. A .**How** are DNA molecules visualized in a gel after electrophoresis? B. **Why** do DNA molecules migrate toward the + electrode? What determines the rate of their migration? C. **What** is the effect of PEG on DNA fragments of different sizes? How is this influenced by the concentration of PEG? (Ap, E)		
3.	Lab notebook and viva (U. R. An, Ap, E)	**20**	**CO1 CO2 CO3 CO4 CO5**

MIB11029	**Bioinformatics (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic knowledge of microbiology and computer				
Co-requisites	--				

Course Objectives

1. To provide those students with apt understanding of informatics for biological data.
2. It will also provide in depth knowledge of data basses, sequence analysis, alignment and phylogeny.
3. It will also offer an outline of basic prediction methods for biological system.
4. In depth understanding of structure prediction for proteins and RNA.

Course Outcomes

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

CO1: Students will be able to **explain** various components of data base, data transfer and data bases & organize them accordingly.
CO2: Students will be able to **examine**, relate and interpret various biological data bases and file formats
CO3: Students will be able to **perceive** alignment, perform phylogenetic analysis and build the same
CO4: Students will be able to organize and **deduct** the omics data, primarily genomics and proteomics
CO5: Students will be able to **design**, set up experiments for structural modelling also summarize drug designing protocols.

Catalogue Description

The course of 'bioinformatics' will help to understand the basic concept and application of computational biology. This course includes comprehensive approach through studying data bases, sequence alignment and phylogenetic analysis. Furthermore, the application of computation structure prediction will also be elaborated. 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

Unit 1 Introduction to Computer Fundamentals (12h): RDBMS - Definition of relational database Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer

Unit 2 Introduction to Bioinformatics &Biological Databases (12h)

Biological databases - nucleic acid, genome, protein sequence and structure, gene expressiondatabases, Database of metabolic pathways, Mode of data storage – File formats - FASTA, BLAST, Genbankand Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB

Unit 3Molecular Phylogeny(12h)

Sequence Alignments, Phylogeny and Phylogenetic trees- Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, Gap penalties, ClustalW, scoring matrices, PAM & BLOSUM series of matrices Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA,Neighbour joining, Maximum Parsimony, Maximum likelihood

Unit 4 Genome organization and analysis (12h)

Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes, Genome, transcriptome, proteome, 2-D gel electrophoresis, Maldi Toff spectroscopy, Majorfeatures of completed genomes: *E.coli, S.cerevisiae, Arabidopsis*, Human

Unit 5 Predictions regarding protein structures (12h)

Hierarchy of protein structure - primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains Protein structure prediction in presence and absence of structure template Energy minimizations and evaluation by Ramachandran plot
Protein structure and rational drug design

Text Book:

1. Essential Bioinformatics, Jin XIONG, CAMBRIDGE

Reference Books:

1. Sanjay S (2003). A First Course in Computers, Vikas Publishing House
2. Pradeep and SinhaPreeti (2007). Foundations of Computing, 4th ed., BPB Publications
4. Rastogi SC., Mendiratta N. and Rastogi P. (2007). Bioinformatics: methods and applications,genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003). Principles of Genome Analysis & Genomics.Blackwell

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

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** various components of data base, data transfer and data bases &organize them accordingly.	**PO1, PO3**
CO2	Students will be able to **examine,** relateandinterpret various biological data bases and file formats	**PO1, PO2, PO4**
CO3	Students will be able to **perceive** alignment, perform phylogenetic analysis and build the same	**PO1, PO2, PO4**
CO4	Students will be able to organizeand **deduct** the omics data, primarily genomics and proteomics	**PO1, PO2, PO5, PO8**
CO5	Students will be able to design, set up experiments for structural modelling also **summarize** drug designing protocols.	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11029	Bioinformatics (THEORY)	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester: V
Code: MIB11029Paper title: Bioinformatics
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 09

Instructions:

SECTION A (Attempt**all questions)**

1.	What are *tuples* and *attributes* in a relational data base? How are they organized to **build** up the data base? (R, Ap)	**2+3**	**CO1**
2.	**Mention** a scenario with the rationale when you will chose PAM matrices over BLOSUM for scoring an alignment.(An)	**5**	**CO2**
3.	Write a brief note on *PRALINE*, **mentioning** its applicability (R, Ap)	**5**	**CO3**
4.	**Outline** the features of eukaryotic genes. Name two gene prediction tools. (U, R)	**3+2**	**CO4**
5	Define *motif* and *domain* of a protein. (U, R)	**2.5X2**	**CO5**
6	How can you visualize structure from PDB file?	**5**	**CO5**
	SECTION B (Attempt any **Two questions)**		
6.	**Compare***rooted* and *unrooted* phylogenetic trees. What is the significance of out-group in an evolutionary tree? **What** are the differences in phyllogram and cladogram? (An, U, An)	**4+2+4**	**CO3**
7.	How gene phylogeny differs with species phylogeny? **Discuss** the basis of building up a NJ tree? (E, U)	**5+5**	**CO1** **CO2**
8.	**What** can be the possible criterion for *ab initio* operon prediction? Fix scoring criterion for operon prediction considering *lac* operon as a model. (An, Ap)	**5+5**	**CO1** **CO2**

MIB11030	Biomathematics and Biostatistics (DSE – I)	L	T	P	C
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic concept of Mathematics and biology				
Co-requisites	--				

Course Objectives

1. To provide those students with apt the knowledge to Biostatistics
2. It will also provide in depth knowledge of the collection of data, tabulation and presentation of data.
3. Elaborating the measures of central tendency, Correlation and
4. Explore the knowledge of the statistical inference and applications of biostatistics

Course Outcomes

On completion of this course,

CO1: Students will be able to **explain** basic of biostatistics.

CO2: Students will be able to **explore** collection of data, tabulation and presentation of data.

CO3: Students will be able to **demonstrate** the different measures of central tendency

CO4: Students will be able to **explain** the correlation and regression

CO5: Students will be able to **demonstrate** the statistical inference and applications of biostatistics as well as current research activities in the field of biostatistics

Catalogue Description

The course of 'Biomathematics and Biostatistics' will help to understand the introductory level knowledge to statics in the field of biological science. This course is a beginning to the biostatistics, the application of different biostatistics methods to biological data analysis, different measures of central tendency, correlation and regression and some possible applications of biostatistics. Furthermore, the current research activities in the field of biostatistics 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

Biomathematics and Biostatistics [MIB11030]

Unit 1 Biomathematics (30h)

Sets. Functions and their graphs: polynomial, sine, cosine, exponential and logarithmic functions. Motivation and illustration for these functions through projectile motion, simple pendulum, biological rhythms, cell division, muscular fibres etc., increasing, decreasing and, periodicity of the functions. Sequences - finite sequences, recursion and difference equations, the Fibonacci sequence branching habit of trees and breeding habit of rabbits.Intuitive idea of algebraic relationships and convergence.Infinite Geometric Series. Series formulas, log (1+x), sin x, cos x. Step function. Intuitive idea of discontinuity, continuity and limits. Differentiation, Conception to be motivated through simple concrete examples as given above from Biological and Physical Sciences. Use of methods of differentiation like Chain rule, Product rule and Quotient rule. Second order derivatives of above functions. Integration as reverse process of differentiation. Integrals of the functions introduced above. Differential Equations of first order, Linear Differential Equations. Points in plane and space and coordinate form. Examples of matrices arising in Biological Sciences and Biological networks. Sum and Product of matrices upto order 3.

Unit 2 Biostatistics(30h)

Measures of central tendency, Measures of dispersion; skewness, kurtosis; Elementary Probability and basic laws; Discrete and Continuous Random variable, Mathematical Expectation; Curve Fitting; Correlation and Regression. Emphasis on examples from Biological Sciences; Mean and Variance of Discrete and Continuous Distributions namely Binomial, Poisson, Geometric, Weibull, Logistic and Normal distribution. Fitting of Distributions; Statistical methods: Scope of statistics: utility and misuse. Principles of statistical analysis of biological data.Sampling parameters. Difference between sample and Population, Sampling Errors, Censoring, difference between parametric and non-parametric statistics; Sampling Distributions, Standard Error, Standard Deviation and Correlation,Testing of Hypothesis, Level of Significance and Degree of Freedom; Large Sample Test based on Normal Distribution, Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test - Chi-square test; Basic introduction to Multivariate statistics, etc.

Text Books:

1. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
2. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

Reference Books:

1. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
2. Danial W (2004) Biostatistics: A foundation for Analysis in Health Sciences, John Wiley andSons Inc.

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** basic of biostatistics.	**PO1, PO2**
CO2	Students will be able to **explore** collection of data, tabulation and presentation of data.	**PO1, PO2,PO3**

CO3	Students will be able to **demonstrate** the different measures of central tendency.	**PO1, PO2, PO3**
CO4	Students will be able to **explain** the correlation and regression	**PO1, PO2, PO5, PO6**
CO5	Students will be able to **demonstrate** the statistical inference and applications of biostatistics as well as current research activities in the field of biostatistics	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO1 0	PO11	PO12
MIB1 1030	Biomathematics and Biostatistics (THEORY)	3	3	1	-	2	1	-	1	-	-	-	-

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

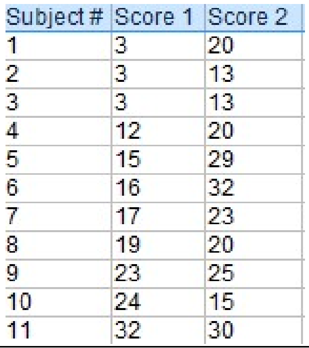
Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology Semester: V
Code: MIB11030Paper title: Biomathematics & Biostatistics
Time: 03 Hrs. Total pages: 02Max. Marks: 50
Total number of questions: 09

Instructions:

<table>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">SECTION A (AttemptAny four questions)</td></tr>
<tr><td>1.</td><td>What is Variables? Enlist different types of Variables? (U, R)</td><td>2+3</td><td>CO1</td></tr>
<tr><td>2.</td><td>Demonstrate the types and methods of data collection (E)</td><td>5</td><td>CO2</td></tr>
<tr><td>3.</td><td>Explainmean, median, mode, geometric mean. (U)</td><td>5</td><td>CO3</td></tr>
<tr><td>4.</td><td>Enlist the similarities and dissimilarities of correlation and regression . (An)</td><td>5</td><td>CO4</td></tr>
<tr><td>5</td><td>Demonstrate the statistical inference (An)</td><td>2+3</td><td>CO5</td></tr>
<tr><td></td><td>SECTION B (Attempt any Three questions)</td><td colspan="2"></td></tr>
<tr><td>6.</td><td>Calculate student 't' test for the following data: (E)

<table>
<tr><th>Subject #</th><th>Score 1</th><th>Score 2</th></tr>
<tr><td>1</td><td>3</td><td>20</td></tr>
<tr><td>2</td><td>3</td><td>13</td></tr>
<tr><td>3</td><td>3</td><td>13</td></tr>
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<tr><td>10</td><td>24</td><td>15</td></tr>
<tr><td>11</td><td>32</td><td>30</td></tr>
</table></td><td>2+3+5</td><td>CO2
CO5</td></tr>
<tr><td>7.</td><td>Demonstrate the different methods of sampling from a population. (An)</td><td>10</td><td>CO1
CO2</td></tr>
<tr><td>8.</td><td>Heights of some trees are observed as following:
100 cm, 150 cm, 200 cm, 250 cm, 300 cm, 350 cm, 400 cm,
Calculate the mean, variance and standard deviation (E)</td><td>5+5</td><td>CO3
CO5</td></tr>
<tr><td>9</td><td>“Correlation is a statistical measure that expresses the extent to which two variables are linearly related” Explain this statement. Enlist differenttypes of correlation. (An +R)</td><td>5+5</td><td>CO4
CO5</td></tr>
</table>

MIB11031	**Plant Pathology (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	10+2 level knowledge in Biology				
Co-requisites	--				

Course Objectives

This course:

1. Introduce students to the basic principles and concepts of plant pathology.
2. Familiarize students with the basic vocabulary of plant pathology and plant disease management using flashcards with images and audio files.
3. Introduce and illustrate the major groups of organisms that cause plant diseases.
4. Enhance student's understanding of scientific research, especially as it applies to the science of plant pathology and the study of microorganisms.
5. Improve the written and oral communication skills of students through class, group and individual projects.

Course Outcomes

Upon successful completion of the course, the students will:

CO1: Understand and **describe** the history of plant pathology.
CO2:Explain the stages in plant disease development.
CO3: Comprehend the role of plant disease epidemiology in **developing** successful integrated disease management programs.
CO4:Recognize the virulence factors of pathogens and explain host-pathogen interaction.
CO5:Identify common plant diseases and device control measures.

Catalogue Description

Plant Pathology is an introductory course that offers a broad introduction to plant diseases and the organisms that cause them. The material focuses on the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors, the students will begin to understand the nature of plant disease epidemics and how to manage them.

Course Content

Plant Pathology (MIB11031)

Unit 1 Introduction and History of plant pathology(15h)

Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, economic losses and social impact of plant diseases. Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, Burrill, E. Smith, Adolph Mayer, Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank, molecular Koch's postulates. Contributions of eminent Indian plant pathologists.

Unit 2 Stages in development of a disease(5 h)
Infection, invasion, colonization, dissemination of pathogens and perennation.

Unit 3 Plant disease epidemiology(5h)
Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases and its relevance in Indian context.

Unit 4 Host Pathogen Interaction(15h)
A. Microbial Pathogenicity Virulence factors of pathogens: enzymes, toxins (host specific and non-specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).
B. Genetics of Plant Diseases Concept of resistance (R) gene and avirulence (avr) gene; gene for gene hypothesis, types of plant resistance: true resistance– horizontal & vertical, apparent resistance.
C. Defense Mechanisms in Plants Concepts of constitutive defense mechanisms in plants, inducible structural defenses (histological cork layer, abscission layer, tyloses, gums), inducible biochemical defenses [hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins, pathogenesis related (PR) proteins, plantibodies, phenolics, quinones, oxidative bursts].

Unit 5 Control of Plant Diseases(10h)
Principles & practices involved in the management of plant diseases by different methods, viz. regulatory - quarantine, crop certification, avoidance of pathogen, use 41 of pathogen free propagative material culture - host eradication, crop rotation, sanitation, polyethylene traps and mulches chemical - protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals. biological - suppressive soils, antagonistic microbes-bacteria and fungi, trap plants genetic engineering of disease resistant plants- with plant derived genes and pathogen derived genes

Unit 6 Specific Plant diseases(10h)
Study of some important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control
A. Important diseases caused by fungi White rust of crucifers - *Albugo candida* Downy mildew of onion - Peronospora destructor Late blight of potato – *Phytophthora infestans* Powdery mildew of wheat - *Erysiphegraminis* Ergot of rye – *Claviceps purpurea* Black stem rust of wheat – *Puccinia graministritici* Loose smut of wheat - *Ustilagonuda* Wilt of tomato - *Fusariumoxysporumf.*sp. lycopersici Red rot of sugarcane – *Colletotrichum falcatum* Early blight of potato - *Alternariasolani*
B. Important diseases caused by phytopathogenic bacteria: Angular leaf spot of cotton, bacterial leaf blight of rice, crown galls, bacterial cankers of citrus
C. Important diseases caused by phytoplasmas: Aster yellow, citrus stubborn
D. Important diseases caused by viruses: Papaya ringspot, tomato yellow leaf curl, banana bunchy top, rice tungro

E. Important diseases caused by viroids: Potato spindle tuber, coconut cadangcadang Importance of tissue culture technique for growing disease-free plants. Application of immunology blotting in plant disease diagnosis.

Textbook:

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
2. Prescott & Dunn's Industrial Microbiology by G Reed, 2004

Reference books:

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. Elsevier Science: 2013.
2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
3. Bioprocess Engineering Principles by Pauline M. Doran, 2012.

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to understand and **describe** the history of plant pathology.	**PO1**
CO2	Students will be able to **explain** the stages in plant disease development.	**PO1, PO2, PO3**
CO3	Students will comprehend the role of plant disease epidemiology in **developing** successful integrated disease management programs.	**PO1, PO2, PO3, PO4**
CO4	Students will be able to **recognize** the virulence factors of pathogens and explain host-pathogen interaction.	**PO1, PO2, PO3, PO4, PO5, PO6**
CO5	Students will be able to **identify** common plant diseases and device control measures.	**PO1, PO2, PO3, PO4, PO5, PO7**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MIB1 1031	Plant Pathology (Theory)	3	3	3	3	1	1	1	-	-	-	-	-

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

M

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB11031Paper title: Plant Pathology
Time: 03 Hrs. **Total pages: 01Max. Marks: 50**
Total number of questions: 09

Instructions:

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

1.	Briefly **describe** five landmarks in the history of phytopathology. (R)	**5**	**CO1**
2.	Define plant disease and describe various symptoms produced on crop plants as a result of host-pathogen interactions. (R, U)	**1+4**	**CO4**
3.	**Discuss** the three components that are absolutely necessary in order for a disease to occur in any plant. (An)	**5**	**CO2**
4.	Who is the father of plant disease epidemiology? How do plants use	**1+4**	**CO3,**

	genes for gene recognition? **Describe** in detail. (R, E)		**CO4**
5	**Write** down the top four methods of controlling plant diseases. (R)	**5**	**CO5**
6	**Discuss** the modes of entry of plant pathogens.	**5**	**CO2**
	SECTION B (Attempt a **questions)**		
7.	What is the role of epidemics in plants? What is Epiphytotic disease? **Discuss** the concept of monocyclic and polycyclic diseases. (An, R, U)	**3+2 +5**	**CO3**
8.	**Discuss** the basic concepts in plant disease symptomatology. Write down the limitations of Koch's postulates. **Describe** the basic procedures in the diagnosis of plant diseases. (An, E, R)	**4+2 +4**	**CO1** **CO5**
9.	**Describe** the role of plant disease epidemiology in developing successful integrated disease management programs. Who advanced the gene for gene concept of disease and resistance and susceptibility? **Discuss** the role of phenolic compounds and phytoalexins in plant defense. (U, R, An)	**5+1 +4**	**CO4,** **CO5**

MIB12032	**Bioinformatics lab (Practical)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. Developing knowledge of computational biology
2. To have general perception of data base and data structure
3. To get accustomed with basic bioinformatics methods
4. To obtain the broader perspective of application of bioinformatics

Course Outcomes

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

CO1: Students will be able to **utilize** various operating systems

CO2: Students will be able to survey and **combine** information from biological data bases

CO3: Students will be able to **deducce** evolutionary relationship through sequence alignment and build phylogenetic tree

CO4: Students will be able to **interpret** ORFs from DNA sequence data and design specific primers for performing PCR

CO5: Students will be able to **construct** structural models of proteins and DNA; perceive the basis of drug designing protocols.

Catalogue Description

The core-course of ‘bioinformatics lab’ will help to understand the basic concept and application of computational biology. This course includes comprehensive approach through studying data bases, sequence alignment and phylogenetic analysis. The couse will primarily target hands on exposure to bioinformatics analysis softwares and tools.

Course Content

Bioinformatics lab (Practical) (MIB12032)

1. Introduction to different operating systems - UNIX, LINUX and Windows (10h)

2. Introduction to bioinformatics databases (any three):

NCBI/PDB/DDBJ, Uniprot, PDB (5h)

3. Sequence retrieval using BLAST, PSI-BLAST (5h)

4. Sequence alignment & phylogenetic analysis using ClustalW &phylip (5h)

5. Picking out a given gene from genomes using Genscan or other softwares (promoter regionidentification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primerdesigning, Genscan/Genetool (10h)

6. Protein structure prediction: primary structure analysis, secondary structure prediction using psipred,homology modeling using Swissmodel. Molecular visualization using jmol, Protein structuremodel evaluation (PROCHECK) (5h)

7. Prediction of different features of a functional gene (5h)

Text Book:

1. Essential Bioinformatics, Jin XIONG, CAMBRIDGE

Reference Books:

1. Sanjay S (2003). A First Course in Computers, Vikas Publishing House
2. Pradeep and SinhaPreeti (2007). Foundations of Computing, 4th ed., BPB Publications

4. Rastogi SC., Mendiratta N. and Rastogi P. (2007). Bioinformatics: methods and applications,genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003). Principles of Genome Analysis & Genomics.Blackwell

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **utilize** various operating systems	**PO1, PO3**
CO2	Students will be able to **survey** andcombineinformation frombiological data bases	**PO1, PO2, PO4**
CO3	Students will be able to **deduct** evolutionaryrelationship through sequence alignment and build phylogenetic tree	**PO1, PO2, PO4**
CO4	Students will be able to **interpret** ORFs from DNA sequence data anddesignspecific primers for performing PCR	**PO1, PO2, PO5, PO8**
CO5	Students will be able to **construct** structural models of proteins and DNA; perceive the basis ofdrug designing protocols.	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12032	Bioinformatics Lab	3	3	1	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name: **Enrolment No:**	

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB12032Paper title: Bioinformatics Lab
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 09

Instructions:
Attempt all questions.

SECTION A (Attempt**all questions)**

1.	**Design** primer for cloning *Leishmania infantum* AQP1 gene in pET16b vector for expressing an N-terminally His-tagged LiAQP1. (E)	**20**	**CO1**
2.	**Predict** conserved motifs and domains for LiAQP1. (An)	**10**	**CO2**
3.	Lab note book. (R, U, Ap, An)	**10**	**CO1, CO2, CO3, CO4**
4.	Viva-voce. . (R, U, Ap, An)	**10**	**CO1, CO2, CO3, CO4**

MIB12033	**Biomathematics and Biostatistics Lab (DSE I) (PRACTICAL)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	10+2 level biology and mathematics				
Co-requisites	--				

Course Objectives

1. To provide students with hands-on activities designed to encourage interest in the field of biostatistics, as well as promote greater understanding of the concepts presented in lecture.
2. Students will need to become proficient with terms, techniques, and applications.

Course Outcomes

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

CO1. Students will be able to **explain**basic of biostatistics.

CO2. Students will be able to **explore** collection of data, tabulation and presentation of data.

CO3. Students will be able to **understand** the different measures of central tendency such as mean, standard deviation and standard error.

CO4. Students will be able to **learn** the probability

CO5. Students will be able to **learn** andapply the knowledge of using different modern tools and techniques in the field of biostatistics which will help in their further academics.

Catalogue Description

Biostatistics Lab (Practical) is the overall learn and apply the knowledge of using different modern tools and techniques in the field of biostatistics. This course covers laboratory techniques describes different modern practical methods related to biostatistics, such as collection of data, tabulation and presentation of data, central tendency as well as probability. 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

Biomathematics and Biostatistics Lab (PRACTICAL) [MIB12033]

1. Calculation of mean, standard deviation and standard error. **(15h)**
2. Calculation of correlation coefficient values and finding out the probability.**(15h)**
3. Calculation of 'F' value and finding out the probability value for the F value.**(15h)**

SUGGESTED BOOKS:

1. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
2. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

3. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
4. Danial W (2004) Biostatistics: A foundation for Analysis in Health Sciences, John Wiley andSons Inc.

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** basic of biostatistics.	**PO1, PO3**
CO2	Students will be able to **explore** collection of data, tabulation and presentation of data	**PO1, PO3, PO4, PO6**
CO3	Students will be able to **understand** the different measures of central tendency such as mean, standard deviation and standard error.	**PO1, PO2, PO3, PO4, PO6**
CO4	Students will be able to **learn** probability	**PO1, PO3, PO4**
CO5	Students will be able to learn and **apply** the knowledge of using different modern tools and techniques in the field of biomathematics and biostatistics which will help in their further academics.	**PO1, PO2, PO4, PO8, PO10**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12
MIB1 2033	Bio mathematics & Biostatistics Lab (Practical)	3	3	2	2	-	2	-	1	-	1	-	-

1=weakly mapped
2= moderately mapped

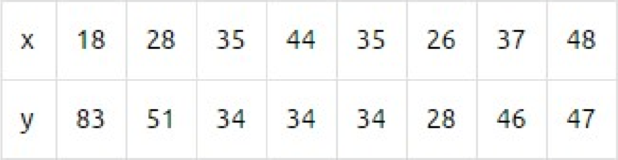
3=strongly mapped

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB12033Paper title: Biomathematics & Biostatistics Lab
Time: 03 Hrs. **Total pages: 01**
Max. Marks: 50Total number of questions: 06
Instructions:
Attempt any **two** questions from **Section A** (each carrying 10 marks); **Section B** is Compulsory (carrying 10 marks**).**

<table>
<tr><td colspan="4">Section A (Attempt any Two)</td></tr>
<tr><td>1.</td><td>Suppose, you have selected some fishes from fish population. The length of the sish are observed as following:
15 cm, 20 cm, 25 cm, 30 cm, 35cm, 40 cm, 45 cm,
Calculate the mean, variance and standard deviation.(E)</td><td>15</td><td>CO1
CO2
CO3
CO5</td></tr>
<tr><td>2.</td><td>What iscorrelation coefficient?Calculate the correlation coefficient from following data: (U, E)
<table><tr><td>x</td><td>18</td><td>28</td><td>35</td><td>44</td><td>35</td><td>26</td><td>37</td><td>48</td></tr><tr><td>y</td><td>83</td><td>51</td><td>34</td><td>34</td><td>34</td><td>28</td><td>46</td><td>47</td></tr></table></td><td>5
10</td><td>CO1
CO2
CO5</td></tr>
<tr><td>3.</td><td>Calculate the ‘F’ value and finding out the probability for the given sample. (E, An)</td><td>5
10</td><td>CO3
CO4
CO5</td></tr>
<tr><td>4.</td><td>What isprobability? Draw a line of probability. Explain different types of probability with proper statistical explanation. (U, Ap, An)</td><td>2
3
10</td><td>CO4
CO5</td></tr>
<tr><td></td><td>SECTION B is compulsory</td><td colspan="2"></td></tr>
<tr><td>5.</td><td>Viva-voce(U, R, An, Ap)</td><td>10</td><td>CO1
CO2
CO3
CO4
CO5</td></tr>
<tr><td>6.</td><td>Practical copy(U, R, E, An, Ap)</td><td>10</td><td>CO1
CO2</td></tr>
</table>

			CO3 **CO4**

MIB12034	**Plant pathology Lab (DSE I) (PRACTICAL)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Basic concept of biology				
Co-requisites	--				

Course Objectives

The aim of the course is to give the students both theoretical and practical skills in plant pathology.Upon completion of the course the student will be able to:

1. Describe the concepts of what constitutes disease in plants.
2. Identify major principles of plant pathology.
3. Recognize the etiological agents of disease.
4. Employ methods to diagnose and manage a wide range of plant diseases.
5. Describe aspects of integrated pest management.

Course Outcomes

On completion of this course,

CO1: Students will be able to **demonstrate** Koch's postulates in bacterial, fungal and plant pathogens.

CO2: Students will be able to **examine** important diseases of crop plants by cutting sections of infected plant material.

CO3: Students will be able to isolate and **identify** organisms from diseased leaf and root surface.

Catalogue Description

This course explains basic understanding of plant diseases, plant pathogens, their isolation and identification processes.

Course Content

1. Demonstration of Koch's postulates in fungal, bacterial and viral plant pathogens. (15h)

2. Study of important diseases of crop plants by cutting sections of infected plantmaterial - Albugo, Puccinia, Ustilago, Fusarium, Colletotrichum. (15h)

3. Isolation and identification of organisms from diseased leaf and root surface (15h)

Books & Other Resources

Text Book(s)	
T1	Agrios G N. (2006). Plant Pathology.5th edition. Academic press, San Diego
T2	Lucas JA. (1998). Plant Pathology and Plant Pathogens.3rd edition. Blackwell Science, Oxford.

T = Text Book

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **demonstrate** Koch's postulates in bacterial, fungal and plant pathogens.	**PO1, PO2**
CO2	Students will be able to **examine**important diseases of crop plants by cutting sections of infected plantmaterial.	**PO1, PO2, PO3, PO4, PO5**
CO3	Students will be able to isolate and **identify**organisms from diseased leaf and root surface.	**PO1, PO2, PO3, PO4, PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12034	Plant Pathology Lab	3	2	2	3	2	1	-	-	-	-	-	-

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

Model Question Paper

Name:
Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB12034Paper title: Plant Pathology Lab
Time: 03 Hrs. Total pages: 01
Max. Marks: 50Total number of questions: 06

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) **Identify** the disease shown in the given picture. (Ap) b) Identifyand **discuss** the role of the causal agent of the plant disease and make reliable conclusions. (An)	**2** **2** **4** **2**	**CO2**
2.	a) **Discuss**the steps and uses of blotter technique. (Ap) b) **Write** down the principle and procedure of Gram-staining.(An)	**5** **5**	**CO2** **CO3**
3.	a) **Write** downthe steps of isolation and purification of a phytopathogenic bacteria.(Ap/ An)	**5** **5**	**CO3**
4.	**a) Describe** the steps Koch's postulates.(Ap) **b) Write** down the principle and procedure of Baermann Technique.	**4** **6**	**CO1** **CO3**
	SECTION B is compulsory		
5.	**Viva-voce** (U/An/Ap/R/E)	**15**	**CO1** **CO2** **CO3**
6.	**Practical copy**(U/Ap/E)	**15**	**CO1** **CO2**

			CO3

MIB11035	**Microbial Biotechnology**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	12th level Biology and basic concept of microbiology				
Co-requisites	--				

Course Objectives:

1. To provide an overview of applications of microbes in biotechnology
2. To introduce to tools and techniques to manipulate microbes to solve problems in biotechnology
3. To provide an outline of roles of microbes in biotransformations, bioenergy and environment

Course Outcomes

On completion of this course, the students will be able to
CO1. **List**applications of microbes in biotechnology
CO2. **Explain**tools, techniques usedin microbial biotechnology
CO3. **Compare** the role of microbes in biotransformation, bioremediation and bioenergy
CO4. **Choose** techniques to recover andpurify microbial products
CO5. **Explain** the importance of intellectual property rights

Catalogue Description:

Microbial Biotechnology focuses on the use of microbes in Biotechnology. This course provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems in biotechnology. This course also highlights the use and importance of Intellectual property rights.

Course Content:

Unit 1 Microbial Biotechnology and its Applications (10h)
Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), industrial, environmental, and food technology Use of prokaryotic and eukaryotic microorganisms in biotechnological applications Genetically engineered microbes for industrial application: Bacteria and yeast, Ti Plasmid, Plasmids and vectors

Unit 2 Therapeutic and Industrial Biotechnology (10h)
Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine) Microbial polysaccharides and polyesters, Microbial production of bio-fertilizers, bio-pesticides, bioplastics Microbial biosensors

Unit 3 Applications of Microbes in Biotransformations (10h)
Microbial based transformation of steroids and sterols Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute

Unit 4 Microbial Products and their Recovery (10h)
Microbial product purification: filtration, ion exchange, size exclusion& affinity chromatography techniques Immobilization methods and their application: Whole cell immobilization

Unit 5 Microbes for Bio-energy and Environment (10h)
Bio-ethanol, bio-butanoland bio-diesel production: commercial production from lignocellulosic wastes, wastewaters and algal biomass, Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents

Unit 6 RNAi (5h)
RNAi and its applications in silencing genes, drug resistance, therapeutics and host pathogen interactions

Unit 7 Intellectual Property Rights (5h)
Patents, Copyrights, Trademarks

Text Book:
Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, Cambridge University Press.

Reference Book:

1. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition, ASM Press.
2. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12, 195–201.
3. Prescott, Harley and Klein’s Microbiology by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, McGraw Hill Publishers.
4. Gupta PK (2009) Elements of Biotechnology 2nd edition, Rastogi Publications,
5. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, Cambridge University Press
6. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press
7. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2nd edition., Elsevier Science
8. Crueger W, Crueger A (1990) Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauer associates, Inc.

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

Examination Scheme:

Components	Internal	Mid Term	End Term

Weightage (%)	**30**	**20**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to l**ist** applications of microbes in biotechnology	**PO1, PO2, PO3,PO4,PO5, PO6**
CO2	Students will be able to **explain** tools, techniques usedin microbial biotechnology	**PO1, PO2, PO3,PO4,PO5, PO6**
CO3	Students will be able to **compare** the role of microbes in biotransformation, bioremediation and bioenergy	**PO1, PO2, PO3,PO4,PO5, PO6**
CO4	Students will be able to **choose** techniques to recover andpurify microbial products	**PO1, PO2, PO3,PO4,PO5, PO6**
CO5	Students will be able to **explain** the importance of intellectual property rights	**PO1, PO2, PO3,PO4,PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11035	Microbial Biotechnology	3	3	2	2	2	2	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. MicrobiologySemester : V
Code: MIB11035Paper title: Microbial Biotechnology
Time: 03 Hrs. Total pages: 01
Max. Marks: 50Total number of questions: 06
Instructions:

Section A
(Attempt all questions**)**

1.	**Explain** at least two differences between a traditional pharmaceutical product and a biotechnology product. (An)	**5**	**CO1 CO2**
2.	Name and very briefly **describe** the three strategies for making vaccines. (R)	**5**	**CO1 CO2**
3.	**Compare** and contrast among patents and copyright and trademark. (E)	**5**	**CO5**
4.	**Contrast** among ion exchange, size exclusion and affinity chromatography techniques for purification of a microbial protein. (E, An)	**5**	**CO4**
5	**Describe** the role of RNA interference in gene silencing.	**5**	**CO5**
6	**Explain** the role of microbes in bioremediation.	**5**	**CO4**
	SECTION B (Attempt all questions**)**		
7.	**Describe** how yeast differs from bacteria, and describe the roles of yeast in at least two important biotechnology applications. (U, An)	**10**	**CO2 CO3**
8.	**Explain** phage therapy, advantages of phage therapy, and discuss how a way that phage theory can incorporate CRISPR-Cas. (U, E)	**10**	**CO2**

MIB11036	**ADVANCES IN MICROBIOLOGY (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Concept of microbiology from first two years of UG level				
Co-requisites	--				

Course Objectives

1. Students will learn to outline different techniques of classical and next generation sequencing and make use of them for interpretation of prokaryotic and eukaryotic genome.
2. Students will be able to understand concepts of meta-genomics/ Transcriptomics and proteomics and appraise bacterial diversity using it
3. Students will be able to interpret and analyse different types of host-microbe interactions.
4. Students will learn to assess the molecular aspects and significance of host-microbe interaction in environment, health care and antimicrobial resistance
5. Students will be adept of evaluating and formulating network in microbiology and molecular biology

Course Outcomes

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

CO1. The students will be able to **explain** the importance of microbial diversity, functionality and their interaction with other microbes, host, and environment.

CO2. The students will be able to **explain** about different advanced technologies use for genomic and metagenomics analyses of microorganisms and compare and contrast between them.

CO3. The knowledge of the subject will encourage students to **illustrate** and analyze the role of microorganisms in pathogenesis, signaling and ecosystem

CO4. The knowledge of the subject will enable students to **appraise** connection between different components of life (molecules/ microorganisms) with the concept of network biology

Catalogue Description

The student will be able to use the knowledge obtained for understanding the working principle of different high-throughput technologies of classical and next-gen sequencing that will enable them to characterize the prokaryotes and eukaryotes at genomic level. Students will be able to appraise bacterial diversity through metagenomic and meta-transcriptomic analysis. The host microbe interaction in environment, health care and antimicrobial resistance will also be clarified. Different life science events can be connected and correlated by the idea of network biology obtained from this course. 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

Advances in Microbiology (MIB11036)

Unit 1 Evolution of Microbial Genomes (15 h)

Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome, Horizontal gene transfer (HGT), Evolution of bacterial virulence – Genomic islands, Pathogenicity islands (PAI) and their characteristics, next generation sequencing techniques

Unit 2 Metagenomics (15 h)

Brief history and development of metagenomics, Understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using metagenomics. Basic knowledge of viral metagenomics, metatranscriptomics, metaproteomics and metabolomics.

Unit 3 Molecular Basis of Host-Microbe Interactions (15 h)

Epiphytic fitness and its mechanism in plant pathogens, Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens, Biofilms: types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance

Unit 4 Systems and Synthetic Biology (15 h)

Networking in biological systems, Quorum sensing in bacteria, Co-ordinated regulation of bacterial virulence factors, Basics of synthesis of poliovirus in laboratory, Future implications of synthetic biology with respect to bacteria and viruses

Text Book(s)

T1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press

T2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004,ASM Press

T3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press

T4. Sangdun C. Introduction to Systems Biology, 2007, Humana Press

T5. Klipp E, Liebermeister W. Systems Biology – A Textbook, 2009, Wiley –VCH Verlag

T6. Caetano-Anolles G. Evolutionary Genomics and Systems Biology, 2010, John Wiley and Sons

Reference books

R1. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms,14th edition, Pearson-Bejamin Cummings

R2. Wilson BA, Salyers AA Whitt DD and Winkler ME (2011)Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,

R3. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International

R4. Voit EO (2012) A First Course in Systems Biology, 1st edition, Garland Science

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will learn to **outline** different techniques of classical and next generation sequencing and make use of them for interpretation of prokaryotic and eukaryotic genome.	**PO1, PO3, PO4**
CO2	Students will be able tounderstandconcepts of meta-genomics/ Transcriptomics and proteomics and **appraise** bacterial diversity using it	**PO1, PO2, PO5**
CO3	Students will be able to **interpret** and analysedifferent types of host-microbe interactions.	**PO2**
CO4	Students will learn to **assess** the molecular aspects and significance of host-microbe interaction in environment, health care and antimicrobial resistance	**PO1, PO2, PO5, PO6**
CO5	Students will be adept of **evaluating** and formulating network in microbiology and molecular biology	**PO1, PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
MIB11036	Advances in Microbiology (THEORY)	2	3	2	3	3	1	-	3	-	-	-	-

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

Model Question Paper

Name:

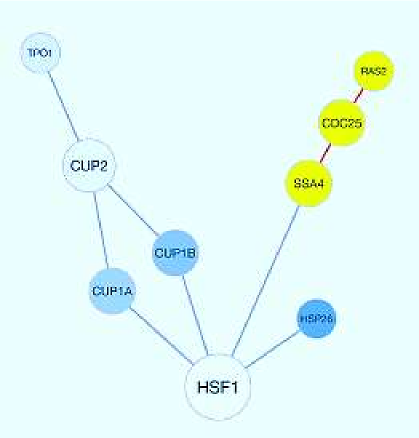
Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB11036Paper title: Advances in Microbiology
Time: 03 Hrs. **Total pages: 02Max. Marks: 50**
Total number of questions: 08

Instructions:

SECTION A (Attempt**all questions)**

1.	Write short notes on Riboprinter. (U) **What** are the methods of short read sequencing? (R)	**3+2**	**CO1**
2.	**Compare** open pangenome with closed pangenome with suitable examples. (U) Define DNA barcoding. (R)	**3+2**	**CO1, CO2**
3.	Give the pictorial representation of PAMP- induced hypersensitive response if the pathogen is a fungus like Phytophthora megasperma. (U)	**5**	**CO3**
4.	**Illustrate** the indirect regulation of competence in *Bacillus subtilis* by Quorum sensing. (An) Name two microorganisms where Phr-Rap system is seen. (R)	**3+2**	**CO4**
5	Name the factors required for **construction** of a complex network of biological system starting from individual molecular units. (R) **How** is systems biology related to synthetic biology? (An)	**3+2**	**CO5**
6	**Describe** the process of synthesizing polio virus in lab. (An)	**5**	**CO5**
	SECTION B (Attempt all **questions)**		
7	How is the Illumina sequencing data processed and **analyzed**? (An) Give the graphic representation to show the library preparation of SOLiD sequencing. (U) Schematically **show** different steps of metagenomics analysis using 16S rRNA as a phylogenetic marker. (U)	**3+3+4**	**CO1+CO2**

8.	Name two universal bases used in probes of ABI SOLiD sequencing. (R) What type of information is conveyed by edges and nodes of a cell signaling network? (U) Draw the adjacency matrix for the following network. (An) 	**4+6**	**CO1+CO2 +CO5**

MIB11037	**Inheritance biology (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. To provide those students with apt understanding of genetic priciples.
2. It will also provide in depth knowledge of mutations and recombination
3. It will also offer an outline of basic prdrgree analysis and statistical approaches in genetics.
4. In depth understanding of population genetics.

Course Outcomes

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

CO1: Students will be able to **explain** various components of data Mendelian genetics
CO2: Students will be able to **examine**, relate and interpret mutation
CO3: Students will be able to **perceive** extra chromosomal inheritance, linkage and recombination
CO4: Students will be able to **organize** and deduct the pedigrees
CO5: Students will be able to **interpret** principles of genetics at population level

Catalogue Description

The course of 'Inheritance Biology' will help to understand the basic concept and application of genetics. This course includes comprehensive approach through studying pedigree and linkage analysis. 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

Unit 1 Introduction to Genetics (8h)

Historical developments Model organisms in genetic analyses and experimentation: *Escherichia coli, Saccharomyces cerevisiae, Neurospora crassa, Caenorhabditis elegans Drosophila melanogaster, Arabidopsis thaliana*

Unit 2 Mendelian Principles (10h)

Mendel's Laws: Dominance, segregation, independent assortment, deviation from Mendelian inheritance, Rediscovery of Mendel's principles, Chromosome theory of inheritance: Allele, multiple alleles, pseudoallele, complementation tests, Extensions of Mendelian genetics: Allelic interactions, concept of dominance, recessiveness, Incomplete dominance and co-dominance, Multiple alleles, Epistasis, penetrance and expressivity

Unit 3 Linkage and Crossing over (8h)

Linkage and recombination of genes, Cytological basis of crossing over, Crossing over at four-strand stage, Molecular mechanism of crossing over, mapping

Unit 4 Extra-Chromosomal Inheritance (4h)

Rules of extra nuclear inheritance, Organelle heredity - Chloroplast mutations in Chlamydomonas, mitochondrial, mutations in Saccharomyces, Maternal effects – Shell coiling in Limnaeaperegra Infectious heredity - Kappa particles in Paramecium

Unit 5 Characteristics of Chromosomes (10h)

Structural organization of chromosomes - centromeres, telomeres and repetitive DNA, Packaging DNA molecules into chromosomes, Concept of euchromatin and heterochromatin, Normal and abnormal karyotypes of human chromosomes, Chromosome banding, Giant chromosomes: Polytene and lampbrush chromosomes, Variations in chromosome structure: Deletion, duplication, inversion and translocation, Variation in chromosomal number and structural abnormalities - Klinefelter syndrome, Turner syndrome, Down syndrome

Unit 6 Recombination (5h)

Homologous and non-homologous recombination, including transposition, site-specific recombination.

Unit 7 Human genetics (5h)

Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Unit 8 Quantitative genetics (10h)

Polygenic inheritance, heritability and its measurements, QTL mapping.

Programmed cell death in plant system and its regulation. Transgenic plants: advantages and hazards. Gene transformation of plants by Agrobacterium.

Text Book:

Russell PJ. (2009). i Genetics - A Molecular Approach. 3rd Ed, Benjamin Cummings

Reference Book:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
2. Snustad DP, Simmons MJ (2011). Principles of Genetics.6th Ed. John Wiley and Sons Inc.
3. Weaver RF, Hedrick PW (1997). Genetics. 3rd Ed. McGraw-Hill Education
4. Klug WS, Cummings MR, Spencer CA, Palladino M (2012). Concepts of Genetics. 10th Ed. Benjamin Cummings
5. Griffith AJF, Wessler SR, Lewontin RC, Carroll SB. (2007). Introduction to Genetic Analysis. 9th Ed. W.H.Freeman and Co., New York
6. Hartl DL, Jones EW (2009). Genetics: Analysis of Genes and Genomes. 7th Ed, Jones and Bartlett Publishers

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

Examination Scheme:

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **explain** various components of data Mendelian genetics	**PO1, PO3**
CO2	Students will be able to examine, relate and **interpret** mutation Students will be able to perceive extra chromosomal inheritance, linkage and recombination	**PO1, PO2, PO4**
CO3	Students will be able to **perceive** extra chromosomal inheritance, linkage and recombination	**PO1, PO2, PO4**
CO4	Students will be able to organizeand **deduct** the pedigrees	**PO1, PO2, PO5, PO8**
CO5	Students will be able to **interpret** principles of genetics at population level	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11037	Inheritance Biology (THEORY)	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology Semester : V
Code: MIB11037Paper title: Inheritance Biology
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 08

Instructions:

SECTION A (Attempt**all questions)**

1.	What is epistasis? **Explain** co-dominance and multiple allele. (U, An)	**2+3**	**CO1**
2.	**Cite** examples of extrachromosomal inheritance in Chlamydomonas. What are petites? (R, U)	**4+1**	**CO3**
3.	Write a brief note on sex determination of Drosophila. (U)	**5**	**CO3**
4.	**Outline** the features of composite transposon. How those are linked to antibiotic resistance? (An, Ap)	**3+2**	**CO2**
5	Can Herdy Weinberg principle be **applied** in a bacterial population? –explain (E)	**5**	**CO4 CO5**
6	How structural aberration of chromosomes is **linked** to cancer?	**5**	**CO2**
	SECTION B (Attempt **all questions)**		
6.	How base analogues can induce mutation? How can you **determine** rate of spontaneous mutation of a novel bacteria? Outline DSB repair system. (An, Ap, E)	**3+4+3**	**CO2 CO4**
7.	How can you **associate** a gene with recombination process in bacteria? **Outline** the role of proteins associated with Holiday junction. Cite an example of site specific recombination. (E, E, R)	**4+4+2**	**CO1** **CO2**

MIB12038	Microbial Biotechnology Lab	L	T	P	C
Version 1.0	**Contact Hours - 45**	0	0	2	2
Pre-requisites/Exposure	Basic Molecular Biology				
Co-requisites	--				

Course Objectives:

1. To provide hands on training on tools and techniques for study of microbial biotechnology
2. To demonstrate immobilization of yeast cells, enzymes and biogas production
3. To determine if a given microbe is capable of producing lipase or xylanase

Course Outcomes

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

CO1: Demonstrate immobilization of yeast cells
CO2: Demonstrate enzyme immobilization technique
CO3: Demonstrate production of biogas
CO4: Isolate xylanase or lipase producing bacteria

Catalogue Description:

Microbial Biotechnology lab focuses on tools and techniques to study immobilization of cells or enzymes, biogas production and isolation of xylanase or lipid producing bacteria.

Course content

1. Study yeast cell immobilization in calcium alginate beads
2. Study enzyme immobilization by sodium alginate method
3. Demonstration of Bio-gas production by microbial cultures-Tarson's anaerobic jar
4. Isolation of xylanase or lipase producing bacteria

Text Book

Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition, ASM Press.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **demonstrate** immobilization of yeast cells	**PO1, PO2, PO3, PO4, PO5, PO6**
CO2	Students will be able to **demonstrate** enzyme immobilization technique	**PO1, PO2, PO3, PO4, PO5, PO6**

CO3	Students will be able to **demonstrate** production of biogas	**PO1, PO2, PO3, PO4, PO5, PO6**
CO4	Students will be able to **isolate** xylanase or lipase producing bacteria	**PO1, PO2, PO3, PO4, PO5, PO6**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12038	Microbial Biotechnology Lab (Practical)	3	3	2	2	2	2	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. MicrobiologySemester : V
Code: MIB12038Paper title: Microbial Biotechnology Lab
Time: 03 Hrs. Total pages: 01Max. Marks: 50Total number of questions: 03

Instructions:
Attempt all questions

Section A
(Attempt all questions**)**

1.	**Perform** experiment as instructed to demonstrate yeast cell immobilization. (U, Ap, An)	**20**	**CO1**
2.	Based on microbes provided in plates marked A and B, **determine** if they are capable of producing xylanase or lipase. (U, E, An)	**20**	**CO4**
3.	Lab notebook and viva (U+R+E+An+Ap)	**10**	**CO1 CO2 CO3 CO4 CO5**

MIB12039	**Advances in microbiology lab (PRACTICAL)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Concept of microbiology from first two years of UG level				
Co-requisites	--				

Course Objectives

1. Students will learn to isolate and characterize microorganisms of clinical and industrial significance from natural resources.
2. Students will be able to understand concepts of meta-genomics/ Transcriptomics and proteomics and appraise bacterial diversity using it.
3. Students will be able to discern between pathogenic and non-pathogenic strains of a microorganism.
4. Students will learn to assess the molecular aspects and significance of host-microbe interaction in environment, health care and antimicrobial resistance.
5. Students will be adept of evaluating and formulating network in microbiology and molecular biology

Course Outcomes

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

CO1. Students will be able to **identify** industrially and clinically important microorganisms from natural resources and characterize them
CO2. They will learn to **evaluate** and compare mode of action of similar type of microbiological products
CO3. Students will be able to **outline** the process of metagenomics analysis
CO4. Students will be able to **design** experiments to distinguish pathogenic and non-pathogenic strains of a microorganism
CO5. Students will learn to **construct** networking of metabolic pathways in bacteria

Catalogue Description

The student will be able to use the knowledge obtained for understanding the working principle of different high-throughput technologies of classical and next-gen sequencing that will enable them to characterize microorganisms with metagenomic approach. Students will be able to appraise bacterial diversity through metagenomic and meta-transcriptomic analysis. Students will be able to identify microorganisms of commercial and clinical importance from their natural habitat and characterize them. Different life science events can be connected and correlated by the idea of network biology obtained from this course. 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 the coordinator.

Course Content

Advances in Microbiology Lab (MIB12039)

(5 h)

1. Extraction of metagenomic DNA from soil and elucidating the limitations in metagenomic DNA extraction from soil. (12 h)
2. PCR amplification of metagenomic DNA using universal primers (8h)
3. Primary screening of antibiotic/vitamin/ enzyme producing microorganisms from soil sample. (10 h)
4. Characterization and Comparative analysis of products of microbial origin with commercially available products by secondary screening. (5 h)
5. Evaluation of biofilm producing capacity of microorganisms and identifying pathogenic and non-pathogenic strains on the basis of this property. (5 h)
6. Network analysis in biological system. (5 h)

Text Book(s)

T1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press

T2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004,ASM Press

T3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press

Reference books

R1. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms,14th edition, Pearson-Bejamin Cummings

R2. Wilson BA, Salyers AA Whitt DD and Winkler ME (2011)Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,

R3. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **identify** industrially and clinically important microorganisms from natural resources and characterize them	**PO1, PO2, PO3, PO5**
CO2	They will learn to **evaluate** and compare mode of action of similar type of microbiological products	**PO2, PO3, PO5**

CO3	Students will be able to **outline** the process of metagenomics analysis	**PO2, PO4, PO5, PO7**
CO4	Students will be able to **design** experiments to distinguish pathogenic and non-pathogenic strains of a microorganism	**PO2, PO5, PO6**
CO5	Students will learn to **construct** networking of metabolic pathways in bacteria	**PO2, PO4, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12039	Advances in Microbiology Lab (Practical)	1	3	3	3	3	2	1	2	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

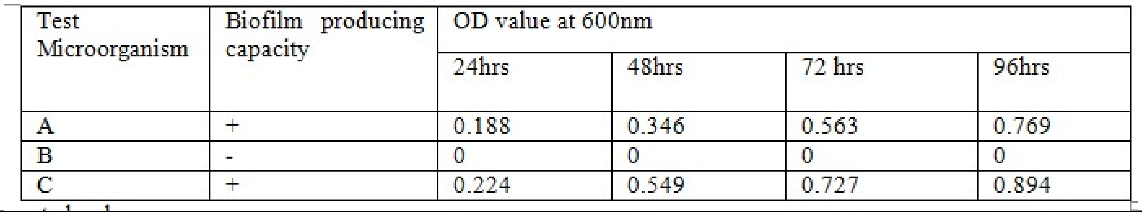
ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB12039Paper title: Advances in Microbiology Lab
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 04

Instructions:
Answer the following questions”

SECTION A

1.	You have been instructed to isolate metagenomic DNA from soil collected from a paddy field. a) What will be the constituents of extraction buffer?	**4+2+4**	**CO1**

	c) Why is heating essential in your experiment? d) **Mention** the use of PEG and sodium acetate in DNA isolation. (U +An +R)		
2.	An experiment is to be performed to compare biofilm producing capacity of microorganisms a) **Design** a protocol to estimate biofilm producing capacity of the microorganisms quantitatively. b) How will you interpret the result? c) Graphically **show** the biofilm production of candidate microorganisms using the data provided below: (U+ U+ An)	**3+3+4**	**CO1, CO2**



Test Microorganism	Biofilm producing capacity	OD value at 600nm			
		24hrs	48hrs	72 hrs	96hrs
A	+	0.188	0.346	0.563	0.769
B	-	0	0	0	0
C	+	0.224	0.549	0.727	0.894

	SECTION B		
3.	Lab note book (R+ An)	**15**	**CO1, CO2, CO3, CO4. CO5**
4.	Viva(U+ An)	**15**	**CO1, CO2, CO3, CO4. CO5**

MIB12040	**Inheritance biology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	PLUS TWO (12^{th}) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

1. Developing knowledge of Mendelian genetics
2. To have general perception of genetic mapping
3. To analyze pedigrees
4. To implement statistical analysis on genetic observation

Course Outcomes

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

CO1: Students will be able to **assess** microbial growth parameters and will compare various strategies for measuring growth

CO2: Students will be able to **design** strategies to determine physical parameters of microbial growth

CO3: Students will be able to **identify** nutritional requirement, formulate media composition for microbial growth

CO4: Students will be able to **examine** and apply microbial fermentation.

CO5: Students will be able to **identify** and categorize mutants linked to growth requirements.

Catalogue Description

The course of 'Inheritance Biology lab' will help to understand the basic concept and application of Genetics. Furthermore, the pedigree analysis and chi-square will also be elaborated. All the lab sessions will be both demonstrative and performing. The classes will aim maximal individual skill enhancement.

Course Content

1. Mendelian deviations in dihybrid crosses (6h)
2. Studying Barr Body with the temporary mount of human cheek cells (6h)
3. Studying Rhoeo translocation with the help of photographs (6h)
4. Karyotyping with the help of photographs (6h)
5. Chi-Square Analysis (8h)
6. Study of polytene chromosomes using temporary mounts of salivary glands of Chiromonas / Drosophila larvae (4h)
7. Study of pedigree analysis (4h)
8. Analysis of a representative quantitative trait (5h)

Text Book:

Russell PJ. (2009). i Genetics - A Molecular Approach. 3rd Ed, Benjamin Cummings

Reference Book:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
2. Snustad DP, Simmons MJ (2011). Principles of Genetics.6th Ed. John Wiley and Sons Inc.
3. Weaver RF, Hedrick PW (1997). Genetics. 3rd Ed. McGraw-Hill Education

4. Klug WS, Cummings MR, Spencer CA, Palladino M (2012). Concepts of Genetics. 10th Ed. Benjamin Cummings
5. Griffith AJF, Wessler SR, Lewontin RC, Carroll SB. (2007). Introduction to Genetic Analysis. 9th Ed. W.H.Freeman and Co., New York
6. Hartl DL, Jones EW (2009). Genetics: Analysis of Genes and Genomes. 7th Ed, Jones and Bartlett Publishers

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **assess** structural features of chromosomes	**PO1, PO3**
CO2	Students will be able to **design** strategies todeterminephysicalchromosomal anomalies	**PO1, PO2, PO4**
CO3	Students will be able to, **formulate** analysis strategy for pedigrees	**PO1, PO2, PO5**
CO4	Students will be able to examine and **apply**chi square test	**PO1, PO2, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12040	Inheritance biology Lab	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name: **Enrolment No:**	

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB12040Paper title: Inheritance Biology Lab
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 04

Instructions:

SECTION A (Attempt**all questions)**

1.	**Perform** experiment to visualize polytene chromosome under microscope (E)	**15**	**CO1**
2.	Note down the principle and observation for the experiment. (U, An)	**15**	**CO2**
3.	Lab note book. (U, R, E, An)	**10**	**CO1, CO2, CO3, CO4, CO5**
4.	Viva-voce. . (U, R, E, An, Ap)	**10**	**CO1, CO2, CO3, CO4, CO5**

MIB14041	**Industry Internship**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Basic concept about microbial techniques				
Co-requisites	-				

Course Objectives

1. To provide students the opportunity to test their interest in a particular career before permanent commitments are made.
2. To develop skills in the application of theory to practical work situations.
3. To develop skills and techniques directly applicable to their careers.
4. Internships will increase a student's sense of responsibility and good work habits.
5. To expose students to real work environment experience gain knowledge in writing report in technical works/projects.

Course Outcomes

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

CO1. **Develop** an interest in their chosen career path
CO2. **Connect** between theory and practical work
CO3. **Develop** practical work skills
CO4. **Develop** good work habits and responsibility.
CO5. **Improve** technical communications

Catalogue Description

The purpose of Industrial Internship is to expose students to real industry experience and also to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics,communication, management and others. Moreover, this practical training program allowsstudents to relate theoretical knowledge with its application in the industry.

Course Content

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1. Visit industry or labs or research institutes related to Microbiology or allied life sciences and gain hands on experience related to practical work.

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

Components	**Report**	**Presentation**
Weightage (%)	**50**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **develop** an interest in their chosen career path	**PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9**
CO2	Students will be able to **link** theory with practical work.	**PO1, PO2, PO6, PO7, PO8, PO10, PO11**
CO3	Students will be able to **apply** knowledge, skills, experience to a work environment	**PO2, PO4, PO5, PO6, PO7, PO9, PO10**
CO4	Students will be able to **demonstrate** professional skills in the workplace	**PO1, PO2, PO3, PO4, PO6, PO7,PO9**
CO5	Students will be able to **communicate** effectively in a professional environment.	**PO1, PO2, PO3, PO4, PO5, PO7, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB14041	Industry Internship	2	3	3	3	3	3	3	3	3	2	1	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

Name of Program: B.Sc. Microbiology
Semester : V
Code: MIB14041Paper title: Industry Internship
Time: 03 Hrs. Total pages: 01Max. Marks: 100

Presentation on the industry experience + report

MIB11042	**MEDICAL MICROBIOLOGY (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Concept of microbiology from first two years of UG level				
Co-requisites	--				

Course Objectives

1. Students will learn to discriminate pathogens from non-pathogenic microorganisms and comprehend their role in development of diseases.
2. Students will be able to identify appropriate techniques for disease diagnosis and sample collection.
3. Students will be able to interpret and analyze the pathomechanism of different diseases of microbial origin.
4. Students will learn to assess the epidemiology of different infectious disease and elucidate preventive measures to combat the diseases.
5. Students will be adept of evaluating mode of action of antimicrobial agents and formulating their application.

Course Outcomes

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

CO1. Students will be able to **distinguish** pathogens and non-pathogenic microorganisms and understand the basis of development of diseases caused by microorganisms.
CO2. Students will learn to **apply** proper techniques for sample collection, transport and diagnosis
CO3. Students will be able to interpretand **appraise** the basic mechanism of different types of microbial diseases
CO4. Students will be able to **determine** the preventive measures against different diseases
CO5. Students will understand mode of action of different antimicrobial agents and **apply** them for disease prognosis.

Catalogue Description

The student will be able to use the knowledge obtained for understanding difference between pathogens from non-pathogenic ones and the basic mechanism by which they initiate the disease process. Students will be able to appraise pathomechanism and risk factors for many diseases caused by bacteria, fungi, protozoa and virus and also explicate preventive measures against them. The mode of action of antimicrobial resistance will also be clarified. 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

Medical Microbiology (MIB11042)

Unit 1 Normal microflora of the human body and host pathogen interaction (12h)

Major developments in medical microbiology, Koch's postulate, Factors responsible for microbial pathogenicity, Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract. Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS

Unit 2 Sample collection, transport and diagnosis (4 h)

Collection, transport and culturing of clinical samples, principles of different diagnostic tests (ELISA, Immuno-fluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes).

Unit 3 Bacterial diseases (12 h)

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Respiratory Diseases: Hemophilic influenza, tuberculosis, leprosy, Pneumonia Gastrointestinal Diseases: Diarrhea, Typhoid, Cholera, Shigellosis, diphtheria, Peptic ulcer. Others: Tetanus, Anthrax, Colitis, Syphilis, Gonorrhea.

Unit 4 Viral diseases (12 h)

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control, Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, measles, Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis,

Unit 5 Protozoan diseases (4 h)

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control
Malaria, Kala-azar, Amoebiasis

Unit 6 Fungal diseases (4 h)

Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention
Cutaneous mycoses: Tineapedis (Athlete’s foot)
Systemic mycoses: Histoplasmosis
Opportunistic mycoses: Candidiasis

Unit 7 Epidemiology of microbial diseases

Concepts in epidemiology, parameters defining epidemiology of diseases, Epidemiology of (any three) AIDs, Influenza (Antigen shift, antigen drift), SARS-CoV1, SARS-CoV2, Ebola

Unit 8 Antimicrobial agents: General characteristics and mode of action (12 h)

Antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis;
Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis;
Inhibitor of metabolism
Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin
Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine
Antibiotic resistance, MDR, XDR, MRSA, NDM-1

Text Book:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, UniversityPress Publication

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick andAdelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4thedition. Elsevier

Reference books:

1. Willey JM, Sherwood LM, and Woolverton CJ.(2013) Prescott, Harley and Klein's Microbiology.9thedition. McGraw Hill Higher Education

2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition

3. Murray, P.R.; Rosenthal, K.S.; Pfaller, M.A. Medical microbiology. Elsevier Health Sciences: 2012.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **distinguish** pathogens and non-pathogenic microorganisms and understand the basis of development of diseases interpret and caused by microorganisms.	**PO1, PO2, PO5**
CO2	Students will learn to **apply** proper techniques for sample collection, transport and diagnosis	**PO3, PO4, PO5, PO11**
CO3	Students will be able to interpret and **appraise** the basic mechanism of different types of microbial diseases	**PO1, PO2, PO3**
CO4	Students will be able to **determine** the preventive measures against different diseases	**PO1, PO2, PO5, PO8**
CO5	Students will understand mode of action of different antimicrobial agents and **apply** them for disease prognosis	**PO1, PO2, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11042	Medical Microbiology (THEORY)	3	3	2	1	3	1	-	2	-	2	1	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
UNIVERSITY
PURSUE EXCELLENCE

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : VI
Code: MIB11042Paper title: Medical Microbiology
Time: 03 Hrs. **Total pages: 01Max. Marks: 50**
Total number of questions: 08

Instructions:

SECTION A (Attempt**all questions)**

1.	**How***Streptococcus mutans* cause dental caries? (U) Why is skin not an ideal habitat for microorganisms to grow? (U)	**3+2**	**CO1**
2.	**What** is the significance of Widal Test? (An) What is the basis of urea breathe test? (An)	**3+2**	**CO1, CO2**
3.	Give a **comparative** statement on lepromatous and tuberculoid form of leprosy. (U)	**5**	**CO3**
4.	**Elaborate** the symptoms, cause and cure for thrush. (R)	**2+2+1**	**CO4**

5	**What** is the mode of action of Vancomycin? (U) Name the producer organism(s) of Bacitracin. (R) Name the key intermediate of cephalosporin production. (R)	**2+2+1**	**CO5**
6	Write a note on food borne disease caused by Enterotoxigenic *E.coli.* (R)	**5**	**CO2**
	SECTION B (Attempt **allquestions)**		
7	Give a **comparative** statement about acute & chronic infections with suitable examples. (U) Define MIC. (R) How can we distinguish between staphylococcal and streptococcal infection biochemically? (An) Distinguish between common cold and influenza. (U)	**3+2+3+2**	**CO1+CO3 +CO4+ CO5**
8	**Illustrate** competitive antagonism considering the example of Sulphanilamide. (An) Describe the importance of multiple generations of a drug with reference to Cephalosporin. (U) What is the mode of action of tetanus toxin? (U)	**4+4+2**	**CO5+CO3 +CO4**

MIB12043	**Medical microbiology Lab (Practical)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Basic concept of microbiology				
Co-requisites	--				

Course Objectives

1. To provide those students with apt understanding ofclinical sample handing.
2. It will also provide in depth knowledge of anti-microbial analysis.
3. It will also offer an outline of basic diagnostic methods for microbial pathogens.

Course Outcomes

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

1. Students will learn to experiment with and assess cultural, biochemical and morphological characteristics of b pathogens (9h)
2. Students will learn to isolate & identify microorganisms from clinical samples. (9h)
3. Students will be able to estimate and compare antimicrobial activity of different antimicrobial agents. (9h)
4. Students will learn to interpret symptoms of several diseases from photographs. (9h)
5. Students will learn to decide proper prognosis for different microbial diseases. (9h)

Catalogue Description

The course of '**Medical microbiology Lab**' will help to understand the basic concept and application of Medical Microbiology. This course includes comprehensive approach through studying clinical samples and pathogens. The lab-courses would be demonstrative and would include maximal individual training.

Course Content

1. Identify bacteria (any three of E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
2. Study of bacterial flora of skin by swab method
3. Perform antibacterial sensitivity by Kirby-Bauer method
4. Determination of minimal inhibitory concentration (MIC) of an antibiotic.
5. Study of various stages of malarial parasite in RBCs using permanent mounts.

Text Book:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

Reference book:

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

2. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4thedition. Elsevier

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will learn to **experiment** with and assess cultural, biochemical and morphological characteristics of different pathogens	**PO1, PO3**
CO2	Students will be able to isolate and **identify** microorganisms from clinical samples.	**PO1, PO2, PO4**
CO3	Students will be able to **estimate** and compare antimicrobial activity of different antimicrobial agents,	**PO1, PO2, PO4**
CO4	Students will be able to **interpret** symptoms of different diseases from photographs	**PO1, PO2, PO5, PO8**
CO5	Students will learn to **decide** proper prognosis for different microbial diseases.	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12043	Medical microbiology Lab (Practical)	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : VI
Code: MIB12043Paper title: Medical Microbiology Lab
Time: 03 Hrs. Total pages: 01Max. Marks: 50
Total number of questions: 04

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)**

1.	**Determine** MIC for E. coli against Kanamycin (E, An)	**15**	**CO1**
2.	Note down the principle, result and methodology of the procedure (R, Ap)	**15**	**CO2**
3.	Lab notebook (U, R, E, An, Ap)	**10**	**CO3**
4.	Viva-voce (U, R, E, An, Ap)	**10**	**CO4**

MIB11044	Industrial Microbiology (THEORY)	L	T	P	C
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic concept of microbiology and biotechnology				
Co-requisites	--				

Course Objectives

The course will enable students to apply the learning of microbiology concepts toward the exploitation of microbial population for industrial and human benefits. The strategies for development of microbial strains, process optimization, large scale production and product recovery will be covered for industrially relevant microbial products and therapeutic proteins.

Course Outcomes

Upon successful completion of the course, the students:

CO1: will **develop** understanding on industrially important microbes, recent developments in fermentation processes and various optimization strategies at fermenter level.
CO2: can **discuss** the concept of methods and principles of batch, fed-batch and continuous processes and learns about the design, types of fermenters and various critical components of bioreactors.
CO3: will **develop** understanding about down-stream processing and various media optimization strategies.
CO4: can **explain** about various industrially relevant microbial products and their production process.
CO5: will be able to **discuss** various strategies of enzyme immobilization.

Catalogue Description

The course discusses on industrially important microbes, recent development in fermentation processes and various optimization strategies at fermenter level. This course explicates the connection between microbial growth, product formation, mass transfer and environment. Likewise, this course gives an overview of the design, types of fermenters and various critical components of bioreactors. Downstream processing will be discussed. This course explains the processes and techniques used for extraction and purification of a product from culture medium.

Course Content

Industrial Microbiology (MIB11044)

Unit 1

Isolation of microorganisms of commercial significance& fermentation media(15h)

Sources of industrially important microbes and methods for their isolation, maintenance of industrial strains, strain improvement, Crude and synthetic media; molasses, corn steep liquor, sulphite waste liquor, whey, yeast extract, beef extract and protein hydrolysates

Unit 2 Types of fermentation processes, bio-reactors and measurement of fermentation parameters(15h)

Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (eg. baker's yeast) and continuous fermentations Components of a typical bio-reactor, Types of bioreactors-Laboratory, pilot- scale fermenters, constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration

Unit 3 Down-stream processing (10h)
Cell disruption, filtration, centrifugation, solvent extraction, pervaporation, precipitation, lyophilization and spray drying

Unit 4 Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and uses) (15h)
Citric acid, ethanol, butanol, hydrogen, biodiesel, penicillin, glutamic acid, Vitamin B12 Enzymes (amylase, protease, lipase) Wine, beer, cheese, breads, Single cell protein

Unit 5 Enzyme immobilization (5h)
Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

Textbook:

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
2. Prescott & Dunn's Industrial Microbiology by G Reed, 2004

Reference books:

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. Elsevier Science: 2013.
2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
3. Bioprocess Engineering Principles by Pauline M. Doran, 2012.

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **develop** understanding on industrially important microbes, recent developments in fermentation processes and various optimization strategies at fermenter level.	**PO1**
CO2	Students will be able to **discuss** the concept of methods and principles of batch, fed-batch and continuous processes and learns about the design, types of fermenters and various critical components of bioreactors.	**PO1, PO2, PO3**

CO3	Students will **develop** understanding about down-stream processing and various media optimization strategies.	**PO1, PO2, PO3, PO4, PO5**
CO4	Students will be able to **explain** about various industrially relevant microbial products and their production process.	**PO1, PO2, PO3, PO4, PO5, PO6**
CO5	Students will be able to **discuss** various strategies of enzyme immobilization.	**PO1, PO2, PO3, PO4, PO5, PO7**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11044	Industrial Microbiology	3	3	3	3	2	3	1	-	-	-	-	-

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

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : VI
Code: MIB11044Paper title: Industrial microbiology
Time: 03 Hrs. Total pages: 01Max. Marks: 50Total number of questions: 09

Instructions:

SECTION A (Attempt**all questions)**

1.	**Discuss** in detail, the techniques of improving the efficiency of industrially important bacterial strains. (R, An)	**5**	**CO1**

2.	Which type of reactor, aeration is generally accomplished in a separate vessel? What is the unit of influent flow rate? **Differentiate** in detail airlift loop reactors and fluidized bed reactors. (U, R, An)	**1+1+3**	**CO2**
3.	**Write** short notes on different chemical methods of cell disruption. (U,R)	**5**	**CO3**
4.	**Describe** in detail the fermentative production and recovery of alcohol. (R, E)	**3+2**	**CO4**
5	**Write** down about industrial applications of immobilized enzymes. (Ap, An)	**5**	**CO5**
6	**Explain** the methods of on-line and off-line biomass estimation. (An)	**5**	**CO2**
	SECTION B (Attempt **any twoquestions)**		
7.	**Explain** in brief about affinity chromatography and reverse phase chromatography. (U, An)	**10**	**CO3**
8.	**Distinguish** between primary and secondary metabolites. Give one example for each. List the industrially useful microorganisms. Explain in detail about the methods of immobilization. (An, R, R, U)	**2+1+3+4**	**CO1** **CO5**
9.	**Describe** in detail the fermentation production of (i) penicillin (ii) Vitamin B 12 (R)	**5+5**	**CO4**

MIB12045	**Industrial Microbiology Lab (Practical)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 45**	0	0	3	2
Pre-requisites/Exposure	Basic concept of microbiology and biotechnology				
Co-requisites	--				

Course Objectives

The aim of the course is to give the students broad theoretical and practical skills in industrial microbiology.This course covers the principles of various processes associated with the production and recovery of differentbio-products derived from microorganisms. The students will be able to discuss the role of microorganismsin industry, as well as to carry out experiments to produce microbial metabolites.

Course Outcomes

On completion of this course,

CO1 Students will be able to **discuss** different parts of a fermenter.

CO2 Students will be able to **explain** the production and estimation of enzymes via microbial fermentations.

CO3 Students will be able to **explain** the production and estimation of amino acids via microbial fermentations.

CO4 Students will be able to **explain** the production and estimation of alcohols via microbial fermentations.

CO5 Students will be able to **sketch** a diagram of the fermentation process and downstream processing operations through an educational visit to any fermentation industry.

Catalogue Description

Throughout the course, we will discuss the role of microbial genetics and molecular biology in the advancement of science and society. This course explains microbial growth, growth kinetics, microbial metabolism, industrial microbial strains: isolation andcharacteristics, fermentation techniques and types of fermenters, application for some microbialindustries (organic acids, antibiotics, enzymes, etc), immobilization techniques and itsapplication.

Course Content

1. Study different parts of a fermenter/bioreactor (5h)

2. Microbial fermentations for the production and estimation (qualitative and quantitative) of:

(a) Enzymes (Amylase and Protease)

(b) Amino acid (Glutamic acid, Lysine)

(c) Organic acid (Citric acid, Acetic acid)

(d) Alcohol (Ethanol, butanol) (35h)

3. A visit to any educational institute/industry to see an industrial fermenter, andother downstream processing operations. (5h)

Books & Other Resources

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology.1st edition. Bios ScientificPublishers Limited. USA.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **discuss** different parts of a fermenter.	**PO1, PO2**
CO2	Students will be able to **explain**the production and estimation of enzymes via microbial fermentations.	**PO1, PO2, PO3, PO4, PO5**
CO3	Students will be able to **explain**the production and estimation of amino acids via microbial fermentations.	**PO1, PO2, PO3, PO4, PO5**
CO4	Students will be able to **explain**the production and estimation of alcohols via microbial fermentations.	**PO1, PO2, PO3, PO4, PO5**
CO5	Students will be able to sketch a **diagram** of the fermentation process and downstream processing operations through an educational visit to any fermentation industry.	**PO1, PO2, PO3, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12045	Industrial Microbiology Lab	3	3	3	3	3	-	-	1	-	-	-	-

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

Model Question Paper

Name:
Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. Microbiology
Semester : VI
Code: MIB12045Paper title: Industrial microbiology lab
Time: 03 Hrs. **Total pages: 01Max. Marks: 50**
Total number of questions: 06
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) **Identify** the instrument shown in the picture. (Ap) b) **Write** the operating principle and uses of this instrument. (An)	**2** **4** **4**	**CO1**
2.	a) **Explain**the uses of amylase. (Ap) b) **Write** down the principle and procedure for the microbial production of alpha-amylase.(An)	**2** **4** **4**	**CO2**
3.	a) **State** the industrial uses of Citric Acids.(Ap) b) **Write** down the principle and procedure for the microbial production of citric acid. (An)	**2** **5** **3**	**CO3**
4.	**Describe** the steps for the microbial production of glutamic acid.(An) **Write** down the principle and procedure for the microbial production of ethanol. (An)	**5** **5**	**CO3** **CO4**
	SECTION B is compulsory		
5.	**Viva-voce** (U/An/Ap/R/E)	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**
6.	**Practical copy**(U/Ap/E)	**15**	**CO1** **CO2** **CO3** **CO5**

MIB11046	**Microbial Physiology (Theory)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 60**	3	1	0	4
Pre-requisites/Exposure	Basic concept of microbiology and biochemistry				
Co-requisites	--				

Course Objectives

1. Developing knowledge of microbial growth
2. To have general perception of microbial metabolism
3. To analyze roles of nutrients as carbon and nitrogen source and utilization
4. To identify photosynthesis and ETC as basis of energy metabolism

Course Outcomes

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

CO1: Students will be able to **distinguish** and compare microorganism based on growth requirement demonstrate the evolutionary trends.
CO2: Students will be able to **model**, analyse and explain uptake of nutrients
CO3: Students will be able to **interpret** the basis of bacterial aerobic and anaerobic respiration
CO4: Students will be able to **discuss** and interpret chemoithotrophy and phototrophy
CO5: Students will be able to **explain** the mechanism of Nitrogen fixation evaluate its importance and application

Catalogue Description

The course of 'Microbial Physiology' will help to understand the basic concept and application of microbial growth and metabolism. This course includes comprehensive approach through studying impact of conditions on growth and metabolism. Furthermore, students will be able to classify based on nutritional parameters and elaborate energy metabolism. 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

UNIT 1 (15h)

Nutritional classification of microorganisms based on carbon, energy and electron sources, Metabolite Transport, Diffusion: Passive and facilitated, Primary active and secondary active transport, Group translocation (phosphotransferase system), symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron.
Microbial stress responses: oxidative stress, osmotic stress, thermal stress, heat shock, nutrient stress, starvation stress response.

UNIT 2 (15h)

Microbial Growth. Definition of growth, balanced and unbalanced growth, growth curve, the mathematics of growth-generation time, specific growth rate, batch and continuous culture, synchronous growth, diauxic growth curve. Measurement of microbial growth.

UNIT 3 (15h)

Effect of the environment on microbial growth Temperature- temperature ranges for microbial growth, pH-classification based on pH ranges and adaptations, solutes and water activity, oxygen concentration, radiation and pressure. Chemolithotrophic metabolism, Physiological groups of aerobic and anaerobic chemolithotrophs. Hydrogen-oxidizing bacteria and methanogens.

UNIT 4 (15h)

Phototrophic metabolism. Historical account of photosynthesis, diversity of phototrophic bacteria, anoxygenic and oxygenic photosynthesis, photosynthetic pigments: action and absorption spectrum, type, structure and location, physiology of bacterial photosynthesis: light reactions, cyclic and non-cyclic photophosphorylation. Carbon dioxide fixation, Calvin cycle and reductive TCA cycle.Carbohydrate metabolism: Glycolysis, TCA cycle and PPP pathway. Oxidation- of fatty acid, Biosynthesis of fatty acids and sterol.Biosynthesis of purine and pyrimidine.

Energy production: Substrate level phosphorylation, Oxidation- reduction, Redo potential, Electron transport chain, Oxidative phosphorylation. Generation of ATP in alkalophiles and Chromolithograph.

Text Books:

Madigan MT and Martinko JM (2014). Brock Biology of Microorganisms.14th edition. PrenticeHall International Inc.

Reference books:

1. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition. John Wiley & Sons
2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
3. Gottschalk G. (1986). Bacterial Metabolism.2nd edition. Springer Verlag
4. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition,McMillan Press.
5. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9th edition.McGraw Hill Higher Education.
6. Albert G. Moat, John W. Foster, Michael P. Spector. Microbial Physiology.4th edition.John Wiley & Sons, 2003.

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

Components	**Mid Term**	**Class Assessment**	**End Term**
Weightage (%)	**20**	**30**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	Students will be able to **distinguish** and compare microorganism based on growth requirement demonstrate the evolutionary trends.	**PO1, PO3**
CO2	Students will be able to **model**, analyze and explain uptake of nutrients	**PO1, PO2, PO4**
CO3	Students will be able to **interpret** the basis of bacterial aerobic and anaerobic respiration	**PO1, PO2, PO4**
CO4	Students will be able to discuss and **interpret** chemoithotrophy and phototrophy	**PO1, PO2, PO5, PO8**
CO5	Students will be able to explain the mechanism of Nitrogen fixation **evaluate** its importance and application	**PO1, PO2, PO3, PO5, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11046	Microbial Physiology (Theory)	3	3	2	2	2	1	-	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. MicrobiologySemester : VI
Code: MIB11046Paper title: Microbial Physiology
Time: 03 Hrs. Total pages: 02Max. Marks: 50Total number of

questions: 08 **Instructions:**			
SECTION A (Attempt **all questions)**			
1.	What are the possible sources for energy for bacteria? How bacteria are **classified** according to their energy requirement? Define “auxotroph”. (R, E, U)	**2+3**	**CO1**
2.	2. **Justify** the following statements: a. Substrate level phosphorylation always occurs during fermentation b. All the enzymes of TCA cycle are localized in mitochondrial matrix (E)	**5**	**CO2**
3.	Name two metabolic pathways where transketolase reaction takes place. **Mention** a reaction catalysed by transketolases. What are the two enzymes which shunt TCA cycle to glyoxalate cycle? (R, An)	**5**	**CO3**
4.	What are the rate limiting reactions of ED pathway? In which organism ED path ways are found and **why** is it preferred despite being energy inefficient?	**3+2**	**CO4**
5	Why molecular Oxygen is toxic for nitrogenases? Briefly **discuss** various strategies adopted by different groups of N_2-fixers to overcome this impediment? (E, U)	**2.5X2**	**CO5**
6	**Design**an experiment to study the role of any gene (say ftsZ) on bacterial cell division	**5**	**CO2**
	SECTION B (Attempt all **questions)**		
7	**Cite** an example of a protein which forms beta helix and why it does form. Where porin proteins do localize? If you are assessing C^{14} tagged Lactose transport in presence of increasing concentrations of 2,4 DNP (uncoupler) graphically represent the rate of lactose transport vs. conc. of DNP. (E, R, An)	**4+2+4**	**CO3**
8	What is the significance of mitochondrial outermembrane in light of chemiosmotic theory? **Which** chemical feature of ubiquinone do you consider crucial for ETC? Explain the basis of cyanide toxicity. Name a copper containing component of ETC. (An, U, R)	**5+5**	**CO1** **CO2**

MIB11047	**BIOSAFETY AND IPR (THEORY)**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours - 90**	4	2	0	6
Pre-requisites/Exposure	PLUS TWO (12th) LEVEL BIOLOGY				
Co-requisites	--				

Course Objectives

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

Course Outcomes

On completion of this course,

6. Students will be able to categorizevarious components of IPR and **justify** or evaluate the feasibility of an invention/ innovation to be protected through IPR.
7. Students will be able to **identify** various ethical issues pertaining to biotechnological aspects and develop critical opinion on them.
8. Students will be able to classify biosafety levels and **illustrate** their role in a laboratory.
9. Students will be able to **develop** skills for entrepreneurship through biotechnological innovation.

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

Biosafety and IPR (MIB11047)

Unit 1 **(15h)**

Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types;Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms, BSL – 1, 2, 3

Unit 2 **(15h)**

Biosafety Guidelines: Biosafety guidelines and regulations (National and International);GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety

Committees (IBSC), RCGM,GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; RiskAnalysis; Risk Assessment; Risk management and communication; Overview of InternationalAgreements - Cartagena Protocol.

Unit 3 (5h)

AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions.

Unit 4 (15h)

Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights,Industrial Design and Rights, Traditional Knowledge, Geographical Indications- importance of IPR –patentable and non patentables – patenting life – legal protection of biotechnological inventions –World Intellectual Property Rights Organization (WIPO).

Unit 5 (20h)

Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional,Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing andagreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patentowner.

Unit 6 (20h)

Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement;WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV &Brene conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

Text Book:

Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.

Reference Book:

1. Bare Act, 2007.Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt.Ltd., New Delhi.
2. Mittal, D.P. (1999). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
3. Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
4. Goel D &Prashar S (2013). IPR, Biosafety and Bioethics. Pearson
5. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management.Jasen Publications, Tiruchirappalli, India.

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **categorize** various components of IPR and justify or evaluate the feasibility of an invention/ innovation to be protected through IPR.	**PO1, PO2, PO3, PO4, PO5, PO6, PO11**
CO2	Students will be able to identifyvarious ethical issues pertaining to biotechnological aspects and **develop** critical opinion on them.	**PO1, PO2, PO6, PO3, PO11**
CO3	Students will be able to classify biosafety levels and **illustrate** their role in a laboratory.	**PO1, PO2, PO3, PO6, PO7, PO8, PO11**
CO4	Students will be able to **develop** skills for entreprenership through biotechnological innovation.	**PO2, PO3, PO6, PO8, PO9, PO10, PO11, PO12**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB11047	Biosafety and IPR	3	3	2	1	2	3	1	1	1	1	2	1

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

Model Question Paper

Name:

Enrolment No:

Course: MIB11047– BIO-ETHICS AND INTELLECTUAL PROPERTY RIGHTS (THEORY)
Program: B.Sc. MicrobiologyTime: 03 Hrs.
Semester: Even 2020-21 **Max. Marks: 50**
Instructions:

SECTION A (Attempt**all questions)**

1.	**Define** IPR and Mention its components (R)	**2+3**	**CO1**
2.	**Analyze** the ethical issues of using GM crops (An)	**5**	**CO2**
3.	Which **category** of Biosafety is required to work with COVID:19? Mention the facilities required in such lab.(An)	**1+4**	**CO3**
4.	**Identify** and enlist the skill-sets required to become an Entrepreneur. (R, U)	**5**	**CO4**
5	Write a short role on Infringement of Patent (R, U)	**5**	**CO5**
6	**Name** one convention related to Biosafety of biodiversity anddescribe major amendments of that convention.	**5**	**CO4**
	SECTION B (Attempt **allquestions)**		
7	**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, U, An)	**2+2+2+4**	**CO1**
8	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. (R, U, An)	**2+4+3+1**	**CO1,CO2**

MIB12048	**Microbial Physiology Lab**	**L**	**T**	**P**	**C**
Version 1.0	**Contact Hours -45**	0	0	3	2
Pre-requisites/Exposure	Basic concept of microbiology				
Co-requisites	--				

Course Objectives

1. Developing knowledge of microbial culture methods
2. To have general perception of physical and chemical effects on growth
3. To analyze roles of nutrients as carbon and nitrogen source
4. To demonstrate alcohol fermentation as model metabolic reaction

Course Outcomes

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

CO1: Students will be able to **assess** microbial growth parameters and will compare various strategies for measuring growth
CO2: Students will be able to **design** strategies to determine physical parameters of microbial growth
CO3: Students will be able to **identify** nutritional requirement, formulate media composition for microbial growth
CO4: Students will be able to **examine** and apply microbial fermentation.
CO5: Students will be able to **identify** and categorize mutants linked to growth requirements.

Catalogue Description

The core-course of ‘Microbial Physiology and metabolism’ will help to understand the basic concept and application of Microbial Growth. Furthermore, the application of microbial fermentation will also be elaborated. All the lab sessions will be both demonstrative and performing. The classes will aim maximal individual skill enhancement.

Course Content

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1. To study and plot the growth curve of *S. cerevisiae* using turbidometric method and to calculate specific growth rate and generation time. (5h)
2. To study and plot growth curve of *Aspergillus niger* by radial growth measurements. (5h)
3. To study the effect of pH on the growth of E. coli (5h)
4. To study the effect of temperature of Aspergillusniger by dry weight method. (5h)
5. Demonstration of the thermal death time and decimal reduction time of E. coli. (10h)

Text Books:

Madigan MT and Martinko JM (2014). Brock Biology of Microorganisms.14th edition.PrenticeHall International Inc.

Reference books:

1. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition. John Wiley & Sons
2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
3. Gottschalk G. (1986). Bacterial Metabolism.2nd edition. Springer Verlag
4. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General

Microbiology. 5th edition,McMillan Press.
5. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9th edition.McGraw Hill Higher Education.
6. Albert G. Moat, John W. Foster, Michael P. Spector. Microbial Physiology.4th edition.John Wiley & Sons, 2003.

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)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **assess** microbial growth parameters and will compare various strategies for measuring growth	**PO1, PO3**
CO2	Students will be able to **design** strategies todeterminephysicalparameters of microbial growth	**PO1, PO2, PO4**
CO3	Students will be able to identifynutritional requirement, **formulate** media composition for microbial growth	**PO1, PO2, PO5**
CO4	Students will be able to examine and **apply** microbial fermentation.	**PO1, PO2, PO5, PO8**
CO5	Students will be able to identify and **categorize** mutants linked to growth requirements.	**PO1, PO2, PO3, PO5**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB12048	Microbial Physiology Lab	3	3	2	2	2	1	-	-	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION
Name of Program: B.Sc. MicrobiologySemester : VI
Code: MIB12048Paper title: Microbial Physiology Lab
Time: 03 Hrs. Total pages: 02Max. Marks: 50
Total number of questions: 04

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**all questions)**

1.	**Perform** experiment to plot the growth curve of *Aspergillus niger* by radial growth measurements (E, An)	**15**	**CO1**
2.	Note down the principle and observation for the experiment.(U, R)	**15**	**CO2**
3.	Lab note book. (U, R, E, An. Ap)	**10**	**CO1, CO2, CO3, CO4, CO5**
4.	Viva-voce. . (U, R, E, An. Ap)	**10**	**CO1, CO2, CO3, CO4, CO5**

MIB15049	**Dissertation**	**L**	**T**	**P**	**C**
Version 1.0		0	0	4	4
Pre-requisites/Exposure	Concept of Microbiology and allied subjects at UG				
Co-requisites	--				

Course Objectives

1. This will enable students to design, evaluate and present scientific work
2. Students will learn to deduce evidence-based conclusions.
3. Skill of presentation and scientific content writing will be improved.

Course Outcomes

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

CO1. **Review**novel ideas to enrich their scientific interest

CO2. **Apply** biotechnological and microbiological skills for identification, culturing and preservation of microorganisms important for industrial and research purpose.

CO3. C**ompare** different microbiological techniques and analyze the results obtained.

CO4. D**esign** and evaluate scientific investigations

CO5. D**educe** evidence-based conclusions.

Catalogue Description

The core-course of 'dissertation' will enable the students to nurture their research interest by compiling basic knowledge obtained in three years of their education together with novel ideas from contemporary research. An idea about appropriate application of microbiological and biotechnological skill for industrial and research purpose can be developed. With the potential to design and evaluate scientific investigations the students will learn to comprehend conclusions based on experimental evidences. The entire literature review work and experimentation focuses on practical implementation of knowledge. Students will perceive the basic concepts of the subject via exercise and discussions with the mentor.

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

Components	**Report/Thesis submission**	**Presentation**
Weightage (%)	**50**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Students will be able to **reviewliterature** and **develop**novel ideas to enrich their scientific interest	**PO2, PO3, PO5**

CO2	Students will be able to use their theoretical and practical knowledge obtained to **apply** biotechnological and microbiological skills for identification, culturing and preservation of microorganisms important for industrial and research purpose.	**PO5, PO7, PO8, PO10**
CO3	Students will be able to **compare** different microbiological techniques and analyze the results obtained.	**PO5, PO6, PO7**
CO4	Students will be able to **design** and evaluate scientific investigations	**PO5, PO6, PO8, PO10**
CO5	Students will be able to **deduce** evidence-based conclusions	**PO6, PO7, PO8**

		Fundamental Knowledge	Critical thinking	Skill Development	Modern tools and techniques	Research	Problem Solving	Data Analysis	Professional Development	Collaboration	Life Long Learning	Ethics	Global citizen
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MIB15049	Dissertation	3	3	1	-	2	1	1	1	-	-	-	-

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

Model Question Paper

Name:

Enrolment No:

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
END-SEMESTER EXAMINATION

Name of Program: B.Sc Microbiology
Semester : VI
Code: MIB15049
Paper title: Dissertation
Time: 03 Hrs. **Max. Marks: 100**

1. Submission of Project report.
2. Presentation of work done.

ADAMAS UNIVERSITY
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY

Department of Microbiology

B.Sc. (Hons) Microbiology (2020-21)

CO-PO mapping:

Paper code	**Paper name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
MIB 11001	Introduction to Microbiology and Microbial Diversity	3	3	3	3	3	3	3	3	-	-	-	-
MIB 12002	Introduction to Microbiology and Microbial Diversity Lab	3	3	3	3	-	3	3	-	-	-	-	-
MIB 11003	Biochemistry	3	3	-		-	-						
MIB 12004	Biochemistry Lab	3	3	3	3	3	3	3	3	-	3	-	-

ENG 11057	English language and literature	-	-	-					-			-	3
DGS 11001	Design Thinking		3	-		-	3		-	3	3	-	-
BOT 11001	Elective Botany I	3	3	-		-	-		-				
BOT 12002	Elective Botany I Lab	3	-	3	-		-		-	-	-	-	-
ZOL 11001	Elective Zoology I	3	3	-		-	-		-	-		-	-
ZOL 12002	Elective Zoology I Lab	3	-	3	-		-		-	-	-	-	-
MIB 11005	Bacteriology	3	3	-	-	-	-	-	-	-	-	-	-
MIB 12006	Bacteriology Lab	3	3	-	-	-	-	-	-	-	-	-	-
MIB 11007	Virology	3	3	-		-	-		-				
MIB 12008	Virology Lab	3	3	3	-	-							
EVS 11105	Environmental Science and Energy Resources	-	-			-	-		-	-	3	3	-
IDP14001	Interdisciplinary Project	-	3	3	3	3	3	-	-	3	-	-	-
BOT 1100	Elective	3	3	-		-	-		-				

3	Botany II												
BOT 12004	Elective Botany II Lab	3	3	-		-	-		-				
ZOL 11003	Elective Zoology II	3	-	-	-	-	-	-	-		-	-	-
ZOL 12004	Elective Zoology II Lab	3	-	3	-	3	3	-	-	-	-	-	-
MIB 11009	Cell Biology	3	3	-	-	-	-	-	-	-	-	-	-
MIB 12010	Cell Biology Lab	3	3	-	-	-	-	-	-	-	-	-	-
MIB 11011	Microbial Genetics	3	3	-	3	-	-	-					
MIB 12012	Microbial Genetics Lab	3	3	3	3	3		-					
MIB 11013	Environmental Microbiology	3	-	-	-	3	-		-		-	-	3
MIB 12014	Environmental Microbiology Lab	-	3	3	-	3	-						
MIB 11016	Food Fermentation Techniques	3	3	-	-	-	-		3		-		
MIB 11015	Microbial QC in Food and Pharma	3	3	3	3	-	3	3	3	-		-	

	Ind												
SOC14100	Community Service								3	3	3	3	3
EIC11001	Venture Ideation		-	-		-	-		3	3	-	3	-
PHY11015	Elective Physics I	3	3	3	-	-	3	-			-		-
PHY12016	Elective Physics I Lab	3	3	-	3	-	-	-	-	-	-	-	-
CSE11641	Elective Computer Science I	3	-	3	-	-			-				-
CSE12642	Elective Computer Science I Lab	3		3		3		-	-				-
CHM11151	Elective Chemistry I			3	-	-		-	-	-	-		
CHM12152	Elective Chemistry I Lab			-	3	-		-	-	-	-		
SDS11506	Elective Statistics I	3	3			-	-	3					
MIB11017	Molecular Biology	3	3			-							
MIB12018	Molecular Biology Lab	3	-	-	-	-	-	-	-			-	

MIB 11019	Immunology	3	3	3	3	3	-						
MIB 12020	Immunology Lab (Practical)	-	3	3	3	3	-	3	-				
MIB 11021	Microbial Physiology and Metabolism (Theory)	3	3	-	-	-	-		-				
MIB 12022	Microbial Physiology and metabolism Lab	3	3	-	-	-	-		-				
MIB 11023	Microbial Diagnosis in Health Clinics	3	3	-	-	-	-		-				
MIB 11024	Management of Human Microbial Diseases	3	-	-	-	-	-		-				
PSG 11021	Human Values and Professional Ethics								-			3	
PHY 11024	Elective Physics II	3	3	-	3	-							
PHY	Electiv	-	3	-		-							

12025	e Physics II Lab												
CSE 11643	Elective Computer Science II	-		-		-			3				
CSE 12644	Elective Computer Science II Lab	3		3			3	-	-				
CHM11153	Elective Chemistry II			3	-	-		-	-	-	-		
CHM12154	Elective Chemistry II Lab			3	-	-		-	-	-	-		
SDS 11507	Elective Statistics II	3	3	-	-	3	-	-					
MIB 11025	Food and Diary Microbiology	3	3	-	3	-	-	-					
MIB 12026	Food and Diary Microbiology Lab	3	3	-	3	-	-	-	-	-		-	
MIB 11027	Recombinant DNA Technology	3	3	-	-	-	-	-	-	-	-	-	
MIB 12028	Recombinant DNA Technology	3	3	-	-	-	-	-					

	Lab												
MIB 11029	Bioinformatics	3	3	-	-	-	-		-				
MIB 11030	Biostatistics	3	3	-		-	-		-				
MIB 11031	Plant Pathology	3	3	3	3	-	-	-					
MIB 12032	Bioinformatics Lab	3	3	-	-	-	-		-				
MIB 12033	Biostatistics Lab	3	3	-	-			-	-		-		
MIB 12034	Plant Pathology Lab	3	-	-	3	-	-						
MIB 11035	Microbial Biotechnology	3	3	-	-	-	-	-					
MIB 11036	Advances in Microbiology	-	3	-	3	3	-	3	3				
MIB 11037	Inheritance Biology	3	3	-	-	-	-		-				
MIB 12038	Microbial Biotechnology Lab	3	3	-	-	-	-	3					
MIB 12039	Advances in Microbiology Lab	-	3	3	3	3	-	-	-				
MIB 12040	Inheritance Biology Lab	3	3	-	-	-	-		-				
MIB 14041	Industry Interns	-	3	3	3	3	3	3	3	3	-	-	

	hip												
MIB 11042	Medical Microbiology	3	3	-	-	3	-		-		-	-	
MIB 12043	Medical Microbiology Lab	3	3	-	-	-	-		-				
MIB 11044	Industrial Microbiology	3	3	3	3	-	3	-					
MIB 12045	Industrial Microbiology Lab	3	3	3	3	3			-				
MIB 11046	Microbial Physiology	3	3	-	-	-	-		-				
MIB 12048	Microbial Physiology Lab	3	3	-	-	-	-						
MIB 11047	Biosafety and IPR	3	3	-	-	-	3	-	-	-	-	-	-
MIB 15049	Dissertation	3	3	-		-	-	-	-				
MIB 15050	Seminar on Contemporary Research in Microbiology	3	3	3	3	3	3	3	-	-	-	-	-
	Total Appearance of PO	63	60	26	23	17	13	10	9	5	4	6	3
	Total	189	180	78	69	51	39	30	27	15	12	18	9

	Count of Points (PO)												
	AVG based on Appearance	3	3	3	3	3	3	3	3	3	3	3	3
	Total Courses	81	81	81	81	81	81	81	81	81	81	81	81
	AVG based on Total Courses	2.333333	2.222222	0.962963	0.851852	0.62963	0.481481	0.37037	0.333333	0.185185	0.148148	0.222222	0.111111