

THEORY PAPER
II B.Sc. Microbiology (According to SEP-2024)
III- SEMESTER
THEORY PAPER-III: MICROBIAL PHYSIOLOGY
TOTAL HOURS: 56

Course learning objectives

- a. To acquire knowledge of the basic concepts of microbial physiology
- b. To learn the types of growth, kinetics and the factors affecting growth
- c. To study the importance of the pathways of carbohydrate metabolism
- d. To illustrate macromolecular synthesis and its processing

Course outcome: At the end of the course the student will be able to

- a. Understand the basics of microbial physiology
- b. List the importance of growth and types of membrane transport for nutrient uptake
- c. Appreciate biochemical pathways and processes integrated into a network, which provides robustness of life
- d. Comprehend the interactions between microbes and the environment

Content	
Unit-I: Microbial nutrition and growth	14 hrs
a. Micronutrients and macronutrients, nutritional classification of microorganisms- active, passive and facilitated transfer.	
b. Microbial growth- growth curve, factor affecting microbial growth, synchronous and diauxic growth, growth measurement techniques- viable count (standard plate count and membrane filter count), total count (direct microscopic count, turbidometric method and by using hemocytometer).	
Unit-II: Biomolecules	14hrs
a. Definition, properties, classification, structure and importance of carbohydrates	
b. Definition, properties, classification, structure and importance of lipids	
c. Definition, properties, classification, structure and importance of proteins.	
d. Enzymes	
i. Structure and properties of enzymes, nomenclature, classification, mechanism of action of enzymes	
ii. Models of enzyme action -Lock and Key and Induced fit theory. Factors influencing enzyme activity	
iii. Inhibition of enzyme- Competitive, Non-competitive, Feed-back inhibition	
Unit-III: Microbial Metabolism	14 hrs
a) Bioenergetics: Terminologies, laws of thermodynamics, concepts of enthalpy, entropy and free energy. High energy compounds- Pyrophosphate (ATP), Acyl phosphates, Enolic phosphates, thiol esters and guanidine phosphates	
b) Cellular Respiration: Concept of aerobic respiration, anaerobic respiration and fermentation. Glycolysis, citric acid cycle, Substrate level phosphorylation, electron transport chain and oxidative phosphorylation.	
c) Fermentation: Alcoholic, Lactic acid and Acetic acid	
Unit- IV: Photosynthesis & Secondary Metabolism	14 hrs
a. Photosynthesis: definition, photosynthetic apparatus and pigments	
b. Types of photosynthesis-oxygenic (cyanobacteria), anoxygenic photosynthesis (purple and green bacteria) Cyclic and non-cyclic photophosphorylation and Calvin cycle	
c. Secondary Metabolism: Antibiotic- Penicillin, Toxin-Aflatoxin, Pigment- Pyocyanin, Terpenoid- Geosmin	

Internal Assessment

Sl. No	Continuous Assessment Programme/ Internal assessment	Maximum Marks
01.	Two session tests with proper record for assessment	10
02.	Assessment of skill development activities/ seminars/ Group discussion/Assignment etc., with proper record	05
03.	• Attendance with proper record	05
	TOTAL MARKS	20

• **Attendance marks break-up**

75% - 00 Marks

75-80% - 01 mark

80-85 % - 2 Marks

85-90% -3 Marks

90-95% -4 Marks

95-100% - 5 Marks

References

- 1) Nelson David L. and Cox Michael M. Lehninger Principles of Biochemistry, Macmillan Press/Worth Publishers, New Delhi.
- 2) Pelczar M.J. Chan E.C.S and Krieg N.R. Microbiology McGraw Hill Book Company, New York.
- 3) Prescott Lansing M. Harley John P. and Klein Donald A. Microbiology, WCB, McGraw-Hill New York.
- 4) Salle A.J. Fundamental Principles of Bacteriology, Tata McGraw-Hill Publishing Company Limited, New Delhi.
- 5) Stanier R.Y. Ingrnam J.L. General Microbiology, Prentice Hill of India Private Limited New Delhi.

1. Colorimetric estimation of protein by biuret method.
2. Colorimetric estimation of sugar by DNS method.
3. Biochemical tests used for the identification of bacteria.
 - a) Fermentation of glucose, sucrose and lactose.
 - b) Starch hydrolysis
 - c) Gelatin hydrolysis
 - d) Catalase test
 - e) Oxidase test
 - f) IMViC test.
 - g) Urease test
4. a. Determination of bacterial growth curve by turbidometric method
b. Determination of fungal growth curve by colony diameter method
5. Effect of pH and temperature on bacterial growth
6. Charts -respiratory pathways and photosynthesis

Internal Assessment for Practical**Attendance****05 Marks****Record/ Journal****05 Marks****II BSc., III SEMESTER****PRACTICAL – III MICROBIAL PHYSIOLOGY****SCHEME OF EXAMINATION****TIME: 3 HOURS****MAX MARKS: 40**

1. Estimate the protein Content of the given sample **A** by Biuret method/ reducing sugar content DNS method / growth curve of the bacteria by turbidometric method/ growth curve of the fungus by colony diameter method. **12**
Performance-6 Principle & Procedure-4 Result- 2
2. Conduct the biochemical tests & Write the principle, procedure and report the results for **B** **08**
Performance-4 Principle & Procedure, & result- 4
3. Comment on C, D, E, F & G **3 X 5=15**
Effect of pH/temperature on bacterial growth/ Biochemical tests/ Charts -respiratory pathways and photosynthesis
4. Viva –voce **05**

NOTE: candidates should submit evaluated class records without: which he/she will not be allowed to take up the practical examination

THEORY PAPER
B.Sc. Microbiology SEMESTER- IV: GENETICS AND MOLECULAR BIOLOGY
TOTAL HOURS: 56

Course Learning Objectives:

- a. Basic concepts of Medelian laws and inheritance
- b. To learn the concept of replication, transcription, translation and regulation of gene expression
- c. Acquire knowledge of genetic recombination and mutations
- d. Study the methods of production of novel microorganisms useful for mankind

Course outcome: After the successful completion of the course, students will be able to understand:

- a. Fundamental molecular principles of genetics
- b. Understand the structure of DNA, replication, transcription, translation and regulation of gene regulation
- c. Understand genetic recombination & mutations in microorganisms
- d. Student will gain the knowledge of the processes and production of genetically engineered products

Content	
UNIT- I Fundamentals of Genetics	14 hrs
a. Definition, terminologies, contribution of geneticists, Mendelian concept of genetics, monohybrid and dihybrid cross. b. Chemical basis of heredity, DNA as genetic material, Griffith experiment, Avery's experiment and Hershey and Chase experiment. c. Structure of DNA: Watson-Crick, forms of DNA. DNA replication models, RNA: types, structure and functions	
UNIT- II Gene expression and Regulation	14 hrs
a. Central dogma of molecular biology, transcription, Genetic code, translation b. Gene regulation- post transcriptional and translation modifications. c. DNA modifying enzymes: DNA polymerases, methylases, terminal deoxynucleotidyl transferase, kinases and phosphatases and operon concept (<i>lac</i> operon and <i>trp</i> operon).	
UNIT-III Genetic recombination, mutation and DNA repair	14 hrs
a. Genetic recombination: transformation: conjugation (F^+ , F^- and Hfr) F' and transduction (generalized and specialized). b. Mutation- definition, types -induced, spontaneous, point mutation, frame shift mutation. Biochemical and molecular basis of mutation, transposons, insertion elements. c. DNA repair: DNA repair mechanisms, excision repair, SOS repair, post replication repair and recombination repair.	
UNIT-IV Genetic engineering	14 hrs
a. Definition, steps in gene cloning, tools of genetic engineering- restriction enzymes, ligases, cloning Vectors-Plasmids, Cosmids, Phagemids and bacteriophages, BACs and YACs. b. DNA transfer methods microinjection, Electroporation, calcium mediated DNA transfer, c. Transgenic plants and humulin production and others applications of genetic engineering in Medicine, Agriculture & Industries.	

Internal Assessment

Sl. No	Continuous Assessment Programme/ Internal assessment	Maximum Marks
01.	Two session tests with proper record for assessment	10
02.	Assessment of skill development activities/ seminars/ Group discussion/Assignment etc., with proper record	05
03.	• Attendance with proper record	05
	TOTAL MARKS	20

• **Attendance marks break-up**

- <75% - 00 Marks
- 75-80% - 01 mark
- 80-85 % - 2 Marks
- 85-90% - 3 Marks
- 90-95% - 4 Marks
- 95-100% - 5 Marks

References:

- 1) Freifelder David, Microbial Genetics, Narosa Publishing House, New Delhi.
- 2) Gerald Karp, Cell Biology McGraw Hill Book Company New York.
- 3) Moat A.G. and Foster S.W. Microbial Physiology, John Wiley and Sons, New York.
- 4) Nelson David L and Cox Michael M. Lehninger Principles of Biochemistry, Macmillan Press/Worth Publishers, New Delhi.
- 5) Pelzer M.J. Chan E.C.S and Krieg N.R. Microbiology McGraw Hill Book Company, New York.
- 6) Prescott Lansing M. Harley John P. and Klein Donald A. Microbiology, WCB McGraw-Hill New York.
- 7) Salle A.J. Fundamental Principles of Bacteriology, Tata McGraw-Hill Publishing Company Limited, New Delhi.
- 8) Stonier R.Y. Ingraham J.L. General Microbiology, Prentice Hall of India Private Limited, New Delhi.
- 9) Stick Berger M.W. Genetics, Prentice Hall of Indian Private Limited, New Delhi.
- 10) Voet D and Voet J.G. Biochemistry, John Wiley and Sons, New York.

B.Sc. Microbiology SEMESTER- IV PRACTICAL IV: GENETICS AND MOLECULAR BIOLOGY
4 HRS/ WEEK

1. Estimation of DNA by Diphenylamine method
2. Estimation of RNA by Orcinol method
3. Genetic problem on Monohybrid and Dihybrid cross
4. Chart: DNA and RNA structure, DNA replication, lac operon concept, Griffith experiments, Avery's experiments and Hershey and Chase experiments
5. Chart: Cloning vector, Gene cloning, Transformation, Conjugation and Transduction, Transgenic plant and Humulin production
6. Demonstration of agarose gel electrophoresis
7. Isolation of antibiotic resistant mutants by gradient plate technique
8. Demonstration of replica plating technique
9. Isolation of bacterial/fungal DNA

Internal Assessment for Practical

Attendance
Record/ Journal

05 Marks
05 Marks

II B.Sc. IV SEMESTER
PRACTICAL – IV GENETICS & MOLECULAR BIOLOGY
SCHEME OF EXAMINATION

TIME: 3 HOURS

MAX MARKS: 40

1. Estimate the DNA of the given sample A by DPA method/ RNA by Orcinol method /DNA isolation from bacteria, fungi 12

Performance-6 Principle & Procedure-4 Result- 2

2. Perform the experiment B– Gradient Plate technique/ Replica plate technique/ / Problems on Dihybrid/ Monohybrid cross 08

Performance-4 Principle & Procedure, & result- 4

3. Comment on C, D, E, F & G 3 X 5=15
Cloning vector, Gene cloning, Transformation, Conjugation and Transduction, Transgenic plant and Humulin production, Gel electrophoresis, DNA and RNA structure, DNA replication, lac operon concept, Griffith experiments, Avery's experiments and Hershey and Chase experiments

4. Viva –voce 05

NOTE: candidates should submit evaluated class records without: which he/she will not be allowed to take up the practical examination

B.Sc. III Semester


ELECTIVE/ OPTIONAL: Microbial Technology for Human Welfare

2 hrs/week / TOTAL: 32 Hrs

CONTENT	
UNIT-I Food and Fermentation Microbial Technology	08 Hrs
Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods	
UNIT-II Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks	08 Hrs
UNIT-III: Agriculture Microbial Technology	08 Hrs
Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production	
UNIT-IV: Pharmaceutical Microbial Technology	08 Hrs
Microbial Drugs – Types and Development of novel drugs, enzymes & Industrial Products– Vaccines- types, bulk production & applications with emphasis national vaccination schedule	

B.Sc. Microbiology SEMESTER- IV**Elective/ Optional IV Semester:****Microbial Entrepreneurship****Total 32 hours**

Content	
Microbial Entrepreneurship	
Unit I General Entrepreneurship	08 Hrs
Entrepreneurship and microbial entrepreneurship - Introduction and scope, Business development, product marketing, HRD, Biosafety and Bioethics, IPR and patenting, Government organization/ institutions/ schemes, Opportunities and challenges.	
Unit II Industrial Entrepreneurship Microbiological industries – Types, processes and products, Dairy products, Fermented foods, Bakery and Confectionery,	08 Hrs
Unit III Alcoholic beverages, Enzymes – Industrial production and applications. Biofertilizers and Biopesticides, SCP (Mushroom and Spirulina) etc.	08 Hrs
Unit IV Healthcare Entrepreneurship	08 Hrs
Production and applications: Sanitizers, Antiseptic solutions, Polyphenols (Flavonoids), Alkaloids, Cosmetics, Bio-pigments and Bioplastics, vaccines, Diagnostic tools and kits.	


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Question paper pattern for B.Sc. Microbiology
_____ semester B.Sc. Examination 2025-26
Semester Scheme New SEP syllabus 2024-25
MICROBIOLOGY

Paper: _____
Paper Code: _____

Time 3 hrs.

Maximum marks: 80

Instructions to candidates :

1. All the sections are compulsory.
2. Draw neat and labeled diagrams wherever necessary

Section- A

1. Answer all the following:

10x2=20

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.

Section- B

Answer any SIX of the following:

6x5=30


2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit III
7. From Unit III
8. From Unit IV
9. From Unit IV

Section- C

Answer any THREE of the following:

3x10=30

10. From Unit I
11. From Unit II
12. From Unit III
13. From Unit IV



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Theory examination question paper pattern for B.Sc. Open elective

_____semester B.Sc. Examination 2025-26

Semester Scheme New SEP syllabus 2024-25

MICROBIOLOGY

Open elective Paper: _____

Paper Code: _____

Time 2 hrs.

Maximum marks: 40

Instructions to candidates :

1. All the sections are compulsory.
2. Draw neat and labeled diagrams wherever necessary

Section- A

Answer all the following:

5x2=10

- 1.
- 2.
- 3.
- 4.
- 5.

Section- B

Answer any SIX of the following:

6x5=30

6. From Unit I
7. From Unit I
8. From Unit II
9. From Unit II
10. From Unit III
11. From Unit III
12. From Unit IV
13. From Unit IV



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