

DAVANGERE



UNIVERSITY

DAVANGERE-577007

CURRICULUM CONTENTS

IN

BIOTECHNOLOGY

NEW SYLLABUS (2024-25)

Undergraduate Course B.Sc.

1<sup>st</sup> and 2<sup>nd</sup> semester

Corrected  
Final copy

13/06/24

DAVANGERE UNIVERSITY

SHIVAGANGOTRI

DAVANGERE-577007

13/06/2024

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Department of Studies in Biotechnology  
Davangere University  
Shivagangotri, Davangere - 577 007.

## Curriculum Structure for Undergraduate Programme Biotechnology for 2024-25

Sl. No.	Course/PaperCode	Title of the Paper	Subject Category	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examinationn Duration
1	2	3	4	5	6	7	8	9	10
Semester-I									
1	24-MCBT-I BASICS OF CELL BIOLOGY AND GENETICS		MCBT-T	04	80	20	100	03	3 Hrs.
	Practical – I BASICS OF CELL BIOLOGY AND GENETICS		MCBT-P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-II									
2	24- MCBT -II PRINCIPLES OF MICROBIOLOGY AND MICROBIOLOGICAL METHODS		MCBT -T	04	80	20	100	03	3 Hrs.
	Practical – II PRINCIPLES OF MICROBIOLOGY AND MICROBIOLOGICAL METHODS		MCBT -P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-III									
3	24- MCBT –III – FUNDAMENTALS OF BIOMOLECULES		MCBT -T	04	80	20	100	03	3 Hrs.
	Practical – III FUNDAMENTALS OF BIOMOLECULES		MCBT -P	04	40	10	50	02	3 Hrs.
	Elective– IA*BIOCHEMICAL TECHNIQUES IB ENZYMOLOGY AND METABOLISM		ELBT-IA or ELBT-IB	02	40	10	50	02	2 Hrs.
	Total			10	160	40	200	07	---
Semester-IV									
4	24-MCBT-IV - MOLECULAR BIOLOGY		MCBT-T	04	80	20	100	03	3 Hrs.
	Practical – IV MOLECULAR BIOLOGY		MCBT-P	04	40	10	50	02	3 Hrs.
	Elective IIA*BIOINFORMATICS IIB APPLICATIONS OF BIOTECHNOLOGY IN HEALTH		ELBT-IIA ELBT-IIB	02	40	10	50	02	2 Hrs.
	Total			10	160	40	200	07	---
Semester-V									
5	24-MCBT-VA - RECOMBINANT DNA TECHNOLOGY		MCBT-T	04	80	20	100	03	3 Hrs.
	24-MCBT-VB - IMMUNOLOGY		MCBT-T	04	80	20	100	03	3 Hrs.
	Practical – V RECOMBINANT DNA TECHNOLOGY AND IMMUNOLOGY		MCBT-P	04	40	10	50	02	3 Hrs.
	Total			12	160	50	250	08	---
Semester-VI									
6	24-MCBT-VIA PLANT AND ANIMAL BIOTECHNOLOGY		MCBT-T	04	80	20	100	03	3 Hrs.
	24-MCBT-VIB INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY		MCBT-T	04	80	20	100	03	3 Hrs.
	Practical – VI PLANT AND ANIMAL BIOTECHNOLOGY INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY		MCBT-P	04	40	10	50	02	3 Hrs.
	Dissertation/Project		AEDP	02	40	10	50	02	2 Hrs.
	Total			14	160	60	300	10	---
	Grand total			62	880	250	1250	42	

MC: Major Course; MC-T: Major Course Theory; MC-P: Major Course Practical;  
EI/Op: Elective/Optional; AEDP: Apprenticeship Embedded Degree Programme.

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**Continuous Assessment Programme/Internal Assessment/Formative Assessment**  
**Major Courses**

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
(1)	(2)	(3)
01	Two Session Tests with proper record for assessment (5+5 = 10)	10
02	Assessment of Skill Development activities/Seminars/Group Discussion/Assignment etc., with proper record	05
03	• Attendance with proper record	05
<b>TOTAL MARKS</b>		<b>20</b>

• **Attendance Marks-breakup**

<75%	-	00 Marks
75-80%	-	01 Mark
80-85%	-	02 Marks
85-90%	-	03 Marks
90-95%	-	04 Marks
>95%	-	05 Marks

**Continuous Assessment Programme/Internal Assessment/Formative Assessment**  
**Elective/Optional Papers**

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
(1)	(2)	(3)
01	Two Session Tests with proper record for assessment (2+2 = 4)	04
02	Assessment of Skill Development activities/Seminars/Group Discussion/Assignment etc., with proper record	03
03	• Attendance with proper record	03
<b>TOTAL MARKS</b>		<b>10</b>

• **Attendance Marks-breakup**

<75%	-	00 Marks
75-80%	-	01 Mark
85-90%	-	02 Marks
90-100%	-	03 Marks

  
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**THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS**

**(Semesters I –VI)**

**B.Sc. Semester-I Degree Examination; 2024-25**

**(Semester Scheme; New Syllabus: 2024-25)**

**SUBJECT: Biotechnology**

**Paper – \_\_\_\_\_ : \_\_\_\_\_**

**Paper Code: \_\_\_\_\_**

**Time: 3 Hours**

**Max. Marks: 80**

***Instructions to candidates:***

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

**SECTION-A**

**1. Answer *all* the following questions:**

**(2×10=20)**

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

**SECTION-B**

**Answer any *SIX* of the following:**

**(5×6=30)**

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

  
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**SECTION -C**

Answer **Any Three** of the following:

**(10×3=30)**

10.

11.

12.

13.

(one question from each unit)

—

**THEORY EXAMINATION QUESTION PAPER PATTERN FOR**  
**ELECTIVE/OPTIONAL PAPERS**  
**(Semesters III & IV)**

**B.Sc. Semester-I/II/III/IV/V Degree Examination; 2024-25**  
**(Semester Scheme; New Syllabus: 2024-25)**

**SUBJECT: Biotechnology**

**Paper – ELECTIVE/OPTIONAL III & IV \_\_\_\_\_:** \_\_\_\_\_

**Paper Code:** \_\_\_\_\_

**Time: 2 Hours**

**Max. Marks: 40**

***Instructions to candidates:***

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

**SECTION-A**

Answer **all** the following questions:

**(2×5=10)**

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

**SECTION-B**

Answer any **SIX** of the following:

**(5×6=30)**

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

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## SEMESTER-1

### 24MCBT-1: PAPER-1: BASICS OF CELL BIOLOGY AND GENETICS

**Total Hours:56hrs**

#### Course Learning Objective:

- a) To study the basics of cell structure, division and principles of genetics
- b) To learn the structure, functions of cell, its organelles and cell interactions.
- c) To understand the structure, function of chromosome, regulation of cell cycle and significance of stem cells
- d) To get the knowledge about principles of Mendelian inheritance
- e) To understand the chromosome theory, mutation and sex determination

#### Course Outcome: After completion of this course, students will be able to-

- a) Explain the cell structure, function and cell interaction
- b) Describe the structure, function of chromosome, cell cycle and significance of stem cells
- c) Explain about Mendelian genetics and inheritance
- d) Explain about chromosomal rearrangements, types of mutation and concept of sex determination

#### Unit – I: Cell structure and function

**14Hrs**

**Introduction:** Introduction to Biotechnology, Cell discovery and theory of cell, Prokaryotes vs eukaryotes, Ultra structure of a eukaryotic cell- (Both plant and animal cells), Cell architecture: Structural organization and functions of plasma membrane and cell wall. Cytoskeleton: components and structural function – microfilaments, intermediate filaments and microtubule organization .

**6 hrs**

**Cellular Organelles:** Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus, Vacuoles.

**4 hrs**


**Extracellular Matrix and Cell Interactions:** Matrix structural proteins, matrix polysaccharides, matrix adhesion proteins, cell-matrix interactions; adhesion junctions, tight junctions, gap junctions, plasmodesmata.

**4 hrs**

#### Unit- II. Chromosomes and Cell Division

**14 hrs**

**General Introduction:** Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and

  
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Heterochromatin, Chemical composition and Karyotype. nucleosome models. Special type of chromosomes: Salivary gland and Lampbrush chromosomes. **6hrs**

**Cell Division and cell death:** Cell cycle, phases cell division. Mitosis and Meiosis, regulation of cell cycles, cell cycle checkpoints, and enzymes involved in regulation, Significance of cell cycle, programmed cell death – events of apoptosis. **6 hrs**

**Stem cells :** proliferation of differentiated cells, stem cells characteristics, embryonic stem cells, induced pluripotent stem cells, applications of adult stem cells. **2 hrs**

### **Unit-III. Mendelian Genetics and Heredity**

**14hrs**

**Mendelian genetics:** Brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross. Deviations to Mendelian inheritance **5hrs**

**Gene interaction:** Supplementary factors: comb pattern in fowls, Complementary genes- Flower color in sweet peas, Multiple factors–Skin colour in human beings, Epistasis– Plumage colour in poultry, Multiple allelism: Blood groups in Humans. **5hrs**

**Genetic Inheritance:** Inheritance patterns: maternal and paternal: Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in paramecium, Sex-linked inheritance: Examples of Color blindness, haemophilia, Y-linked disorders. **4 hrs**

### **Unit-IV. Chromosomal behavior and mutation**

**14hrs**

**Introduction:** Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Chromosomal variations: A general account of structural and numerical variations. chromosomal evolution of wheat and cotton. **4 hrs**

**Mutations:** Gene Mutations: Nonsense, Missense and Frame shift mutations; Point mutations, Physical, Chemical and Biological mutagens. Transposition - Transposable genetic elements in prokaryotes and eukaryotes; Mechanisms of transposition; Role of transposons in mutagenesis. **5 hrs**

Sex Determination: Concept of allosomes and autosomes, XXXY, XX-XO, ZW-ZZ, ZO-ZZ types. Human Genetics: Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome) **5 hrs**



**References:**

1. Jocelyn E Krebs, Elliott S Goldstein Jones and Bartlett. . Lewin's Genes XII, Student Edition. Jones and Bartlett India Pvt Ltd, New Delhi.
2. David P Clark and Nanette J Pazdernilc. Molecular Biology, 3<sup>rd</sup> Edition. Academic Press is an Imprint of Elsevier, USA.
3. Krebs J.E, Goldstein E.S and Kilpatrick S.T, Lewin's Genes XII, Jones and Bartlett Publishers, Massachusetts (USA) .
4. S Shanmugham, T Sathish Kumar and K PannerSelvam. 2010. Laboratory on Biochemistry. Phi Learning Private Limited, New Delhi.
5. Bruce Alberts and Dennis Bray. 2009. Essential Cell Biology, 3rd Edition. Garland Science Taylor and Francis Group, New York.
6. Bruce Alberts and Dennis Bray. Essential Cell Biology, 4<sup>th</sup> Edition. Garland Science Taylor and Francis Group, New York.
7. Gerald, K., Cell and Molecular Biology, Concept and Experiment.
8. Cooper, The Cell - A Molecular Approach,. 2013. Sunderland (MA), Sinauer Associates, Inc. USA.
9. Robert, F., Weaver, Molecular biology, McGraw-Hill.
10. Basic Genetics. Hartl, D.L. Jones and Bartlett Pub.
11. CB Powar, Cell Biology, Himalaya Publishing House.

### **Practical- BASICS OF CELL BIOLOGY AND GENETICS**

1. Use of Micrometer and calibration, measurement of onion epidermal cells and yeast.
2. Cell division : Mitotic studies in onion root tips
3. Meiotic studies in grasshopper testes and flower buds
4. Study of polytene chromosomes
5. Buccal smear – Barr bodies
6. Karyotype analysis – Man and Onion  
Man – Normal and Abnormal – Down and Turner’s syndromes (with the help of slides)
7. Simple genetic problems (Problems and Interaction of genes)
8. Plasmolysis and deplasmolysis
9. Demonstration of chloroplast isolation
10. Blood smear – differential staining

EACH STUDENT IS REQUIRED TO SUBMIT 5 PERMANENT SLIDES

(MITOSIS & MEIOSIS – at least two from each)

### **Practical Proper Examination I semester**

**Duration: 3Hrs**

• Experimentation	-	30 Marks
(Major 10		
Minor 8		
Spotters 12)		
• Viva Voice	-	10 Marks
	<b>Total</b>	<b>40 Marks</b>

### **Internal Assessment for Practical Paper I semester**

• Attendance	-	05 Marks
• Record/Journal	-	05 Marks
	<b>Total</b>	<b>10 Marks</b>

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## SEMESTER-II

### 24MCBT-II: PAPER-II: PRINCIPLES OF MICROBIOLOGY AND MICROBIOLOGICAL METHODS

**TOTAL HOURS-56**

#### **Course Learning Objective:**

- a) To understand the basics of microbiology and techniques in microbiology.
- b) To study about the scope, contributions in microbiology, structure and classification of microbes
- c) To know the microscopy and staining techniques
- d) To learn the aseptic techniques to control microorganisms
- e) To acquire knowledge about growth, culture media, pure culture methods and culture preservation

**Course Outcome:** On successful completion of the course, the student will able to:

- a) Explain the scope, contribution made by microbiologists, microbes' structure and classifications, principle and uses of microscopes
- b) Describe the use of various microscopes and staining techniques for observing microbes.
- c) Perform aseptic techniques to control microorganisms
- d) Explain the importance of culture media, methods for culturing and maintenance of microbes.

#### **Unit-I Introduction**

**14 hrs**

**History:** Scope and relevance of microbiology, important contributions by Antony Von Leeuwenhoek, Jenner, Pasteur, Robert Koch, Flemming, Iwanowsky

**4 hrs**

**General account on Microbes:** General account on structure, classification and reproduction of bacteria, virus, fungi. General characteristics of algae and protozoa.

**5hrs**

**Microbial Classification:** Taxonomy, Whittaker's classification, Carl woes three domain classification, Bergey's systematic classification of bacteria, molecular approaches.

**5hrs**

**Unit-II Microscopy and staining techniques** **14hrs**

**Light Microscopy:** Principles of microscopy, resolving power, numerical aperture, principles and applications of Light microscopy: Bright, Dark field, Phase contrast, Confocal microscope, Fluorescence Microscope, **6 hrs**

**Electron microscopy-** SEM, TEM, sample preparation. **4 hrs**

**Stains and staining techniques:** Principles of staining, Types of stains-simple stains, structural stains, differential stains. **4 hrs**

**Unit-III Control of microorganisms** **14hrs**

**Definition of terms:** Sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agents and antimicrobial agents. **2 hrs**

**Physical and chemical methods of sterilization** – Principle, construction and applications of moist heat sterilization- Boiling, Pasteurization, Fractional Sterilization-Tyndallisation and Auto clave. Dry heat sterilization- Incineration and Hot air oven, Filtration- Laminar air flow, Seitz filter, sintered filter and membrane filter. Radiation-UV and Gamma Rays. Chemical method (Disinfectants) - Alcohol, Aldehydes, Phenols, Halogens and gaseous agents. **6 hrs**

**Antimicrobial 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 Mechanism of action of Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine **6 hrs**

**Unit-IV Cultivation and maintenance of microorganisms** **14 hrs**

**Growth:** Bacterial growth curve, physical conditions affecting growth, nutritional categories of microorganisms **3 hrs**

**Culture Media:** Definition, general composition of culture media, types of media-natural and synthetic media, enriched, enrichment, selective, differential, indicator, assay, sugar, transport and anaerobic media. **7 hrs**

**Pure culture methods:** Serial dilution and plating methods (Pour, Spread, Streak plate methods), cultivation, maintenance, preservation/stocking of pure cultures. Cultivation of anaerobic bacteria. **4 hrs**

### **TEXT AND REFERENCE BOOKS:**


1. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7th edition.  
Orient Longman Ltd. 2005.
2. Parija S.C, Textbook of Microbiology& Immunology, Elsevier, India.2009
3. Pelczar M. J, Chan ECS, King NR, McGraw – Hill, Jnc.NY. Microbiology- Concepts  
and Applications. Tata Mac. Graw Hill.2001
4. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7th edition.  
Orient Longman Ltd. 2005
5. Pelzar. Microbiology, 5th edition. Tata Mac Graw Hill.2000
6. Ingraham, J.L. and C.A. Ingraham, Introduction to microbiology, 2nd edition.  
Brooks/Cole, Thomson Learning, USA.2000.
7. Kathleen Park Talaro and Talaro, A. Foundation in microbiology, 3rd edition. Mac  
Graw – Hill.1999.
8. Cappucino, J.G and Sharman, N. Microbiology: A laboratory manual, 4th edition.  
Additional Wesley Longbman, Incorporation.1999.
9. Prescott. L.M., Microbiology. III Edition, Wm. C. Brown Publishers, London. 1996.

## **24MC-P-II: PRACTICAL PAPER-II: PRINCIPLES OF MICROBIOLOGY AND MICROBIOLOGICAL METHODS**

1. To study the principle, working and applications of instruments-Laminar air flow, Hot air oven, Autoclave, Incubator, Light microscope.
2. Preparation of culture media (NB, NA and PDA)
3. Sterilization of glassware using Hot air oven and assessment of sterility
4. Sterilization of medium using Autoclave and assessment of sterility
5. Plating techniques-Spread plate, Pour plate and Streak plate
6. Isolation of bacteria and fungi from soil, water and air.
7. Staining Techniques (Simple, Gram staining) Fungi-Lactophenol cotton blue staining
8. Temporary mounting of Rhizopus, Penicillium and Aspergillus.
9. Bacterial cell motility test by Hanging drop method
10. Biochemical Characterization of Bacteria– IMViC test
11. Enzyme based biochemical characterizations-Catalase test and Urease test
12. Antibiotic sensitivity test-Kirby-Bauer assay

### **TEXT AND REFERENCE BOOKS:**

1. Bharucha, F.D. and A.I. Mehta, Handbook of Microbiological Methods and Media. Sevak Printers, Mumbai. 2000.
2. Cappuccino, J.G. and N. Sherman, Microbiology-A Lab Manual. Pearson Education, Singapore. 2004.
3. Dubey, R.B. and E. Maheswari, Practical Microbiology. S. Chand and Co. Publishers, New Delhi. 2004.
4. Goldman, E. and H. G. Lorrence, Practical Handbook of Microbiology. II Edition, CRC press, London. 2008.
5. Kannan, N., Laboratory Manual in General Microbiology. Palani Paramount Publishers, Palani, Tamil Nadu. 2002.

  
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## Practical Proper Examination II semester

Duration: 3Hrs

• Experimentation (Major 10 Minor 8 Spotters 12)	-	30 Marks
• Viva Voice	-	10 Marks
	<b>Total</b>	<b>40 Marks</b>

## Internal Assessment for Practical Paper II semester

• Attendance	-	05 Marks
• Record/Journal	-	05 Marks
	<b>Total</b>	<b>10 Marks</b>

  
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