



BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(as per SEP 2024)

Syllabus for I & II Semester B.Sc. Biotechnology

2024-25

BENGALURU CITY UNIVERSITY

Regulations and Syllabus for BIOTECHNOLOGY

in

Three-Year BSc Course (SEP 2024)

Eligibility

1. Only those candidates who have passed a Pre-University course or an equivalent course with BIOLOGY as one of the optional subjects are eligible to take Biotechnology as one of the optional subjects in the B.Sc., course.

Scheme of Instruction/ Examination

1. The theory question paper for each paper shall cover all the topics in the pertaining syllabus with proportional weightage to the number of hours of instruction prescribed.
2. The practical Classes are to be conducted in batches of 10 students per batch (maximum 12) per teacher as per the University norms for the faculty of science for giving instructions, explaining the principles of experiments, supervising the conduct of experiments, and correction Records.
3. It is expected that each student conducts and learns the experiments in the practical classes.
4. Students are required to use biotechnology instruments and tools to run the experiments and record the outputs to the practical records in each practical class.
5. Maximum marks for practical records in the examinations is 5.
6. A study tour or visit to industries and research institutes for the students is strongly recommended to gain practical knowledge of applications of Biotechnology in Industries/Agriculture/Medical field and research.

B.Sc., SEMESTER SCHEME (SEP 2024)
BIOTECHNOLOGY
SCHEME OF INSTRUCTIONS AND CREDITS

SEM	COURSE CODE	COURSE TITLE	THEORY/ PRACTICAL HOURS PER WEEK	DURATION OF EXAM (Hr)	CIA MARKS	ESE MARKS	TOTAL	CREDITS
I	BTT 101	Cell Biology & Genetics Theory	04	03	20	80	100	3
	BTP 102	Cell Biology & Genetics Practical	03	03	10	40	50	2
II	BTT 201	Microbiological Methods Theory	04	03	20	80	100	3
	BTP 202	Microbiological Methods Practical	03	03	10	40	50	2

B.Sc. SEMESTER SCHEME (SEP 2024)

BIOTECHNOLOGY

SCHEME OF THEORY EXAMINATION

Duration: 3 Hrs

Max. Marks: 80

I. Answer any 10 of the following: (out of 12)

10 x 2 marks = 20 Marks

Questions 1 to 12

II. Answer any 6 of the following: (out of 8)

6 x 5 marks = 30 Marks

Questions 13 to 20

III. Answer any 3 of the following: (out of 5)

5 x 10 marks = 30 Marks

Questions 21 to 25.

B.Sc. Biotechnology - First Semester

Paper 1: BTT 101 Cell Biology & Genetics

Course Title:, BTT 101, Cell Biology & Genetics	
Course Code: BTT101	L-T-P per week: 4-0-0
Total Contact Hours: 56	Course Credits: 04
Formative Assessment(IA) Marks: 20	Duration of ESA/Exam: 3 h
Model Syllabus Authors: Curriculum Committee	Summative Assessment Marks: 80

B.Sc. Biotechnology, First Semester

Paper 1: BTT 101 Cell Biology & Genetics

Content of Course 01: Theory: BTT 101: Cell Biology & Genetics	56 h
Unit – 1: Introduction, Cell and cellular organelles	14 h
Introduction, applications, and Scope of Biotechnology. Cell: Historical perspectives. Discovery of cell, the cell theory, ultrastructure of a eukaryotic cell- (both plant and animal cells). Structural organization and functions of cell wall and plasma membrane. Structure and functions of cell organelles: Cytosol, endoplasmic reticulum, Golgi complex, mitochondria, chloroplast, ribosomes, lysosomes, nucleus, nucleolus, vacuole and cytoskeletal structures (microtubules, microfilaments and intermediate filaments).	
Unit – 2: Chromosomes and cell division	14 h
General introduction, discovery, morphology, and structural organization of chromosome (Metaphase chromosome)–Centromere, secondary constriction, telomere, chromonema, euchromatin and heterochromatin, chemical composition. Classification based on centromere. Karyotype- Definition. Ultrastructure of chromosome - nucleosome model. Special types of chromosomes: Salivary gland chromosomes and lamp brush chromosomes. Cell cycle, phases of cell division, mitosis and meiosis. Cell senescence and programmed cell death. Structural and numerical chromosomal aberrations.	
Unit – 3: Inheritance and Gene Interaction	14 h
History of genetics: Mendelian theory; Laws of inheritance - dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, and back cross. Maternal inheritance: Plastid inheritance in <i>Mirabilis</i> , Kappa particles in paramecium, and Petite characters in yeast, Sex-linked inheritance. Gene interaction: Supplementary factors- comb pattern in fowls, Complementary genes – flower colour in sweet peas, Epistasis – plumage colour in poultry, Multiple allelism- blood groups in human beings.	

Unit – 4: Linkage and Mutations	14 h
<p>Linkage: General introduction, coupling, and repulsion hypothesis. Linkage in Maize and Drosophila. Mechanism of crossing over and its importance. Chromosome mapping - linkage map in maize.</p> <p>Mutations: Introduction, types- spontaneous and induced mutations. Mutagens – Physical and chemical. Mutations at the molecular level.</p> <p>Sex determination: Concept of allosomes and autosomes. Sex determination in plants and animal- XX-XY, XX-XO, ZW-ZZ, ZO-ZZ types.</p> <p>Chromosomal syndromes- chromosomal syndromes in man- Allosomal (Klinefelter syndrome and Turner's syndrome), autosomal (Down's syndrome and Cri-Du-Chat syndrome) conditions.</p>	

Formative Assessment/ Internal Assessment:	Total - 20
Assessment Occasion	Weightage
House Examination/Test	10
Written Assignment/Presentation/Project / Term	05
Class performance/Participation	05

B.Sc. Biotechnology, First Semester

Course 01: Practical's: BTP101: Cell Biology & Genetics

Course Title: Cell Biology, Genetics	Course Credits: 02
Course Code: BTP101	L-T-P per week: 0-0-3
Total Contact Hours: 36	Duration of ESA/Exam: 4 hours
Formative Assessment(IA) Marks: 10	Summative Assessment Marks: 40

Sl. No.	Experiments	Units
1	Operation and working principle of a simple and compound microscope.	1
2	Study of micrometry, measurement of onion epidermal cells and yeast.	2
3	Study of mitosis in onion root tips – preparation of temporary squash.	2
4	Study of meiosis in grasshopper testes/onion/Rhoeo flower buds – preparation of temporary squash.	2
5	Preparation of buccal epithelial smear – Barr bodies.	1
6	Isolation and staining of mitochondria/chloroplast.	1
7	Karyotype analysis – human (normal & abnormal) and onion.	2
8	Simple genetic problems on the interaction of genes.	1

Formative Assessment/ Internal Assessment:	Total - 10
Assessment Occasion	Weightage
House Examination/Test	05
Class performance/Participation	05

B.Sc. Biotechnology, First Semester : Practical: BTP101: Cell Biology & Genetics

Practical examination paper:

Duration: 3 Hrs

Max. Marks: 40

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| Q 1. Measure the size of the given material 'A' using a micrometer. | 08 |
| Q 2. Prepare temporary squash of given material 'B' for mitosis or meiosis and comment on the observed stage. | 10 |
| Q 3. Prepare a buccal epithelial smear and report the observation. | 04 |
| Q 4. Identify and comment on the Karyotypes 'C & D' | 2 x 4 = 08 |
| Q 5. Solve the given genetic problem. | 05 |
| Q 6. Class Record. | 05 |

Text Books/References

1. Ambrose, and Dorothy, M., Easty 1970. Cell Biology, ELBS Publications.
2. Benjamin Lewin, 1985. Genes II –Wiley & Sons Publications.
3. Benjamin Lewin, 1987. Genes III Wiley & Sons Publications.
4. Benjamin Lewin, 1994. Genes V. By Oxford University Press, Oxford and New York, 1,272 pp.
5. Bruce Alberts, Alexander Johnson, Julian Lewis, et al., 2014 Molecular Biology of Cell – Garland publications.
6. Daniel L. Hartl, E.W. Jones, Jones, 2005. Genetics: Analysis of Genes and Genomes, Barlett Publishers.
7. De Robertis and EMF Robertis, 1980. Cell Biology & Molecular Biology – EDP Saunder College.
8. Edgar Altenburg, 1970. Genetics, Oxford & IBH publications.
9. Gardener, E.J., Simmons M.J. and Snustad D.P. 1991. Principles of Genetics –John Wiley and Son Publications.
10. Gupta P.K., 2018-19. Genetics - 5th Revised Edition, Rastogi Publication, Meert, India.
11. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 2000. Molecular Cell Biology - Daniel, Scientific American Books.
12. Jack D Bruke. 2002. Cell Biology, The William Twilkins Company.
13. Monroe W Strickberger, 1976. Genetics, Macmillain Publishers, New York
14. Powar, C.B. 2019. Cell Biology, Himalaya Publications.
15. Sandy, B. Primrose, Richard Twyman, 2006. Principles of Gene Manipulations 7th Edition Black Well Scientific Publications.
16. Sharp, L.W. 1943. Fundamentals of Cytology - New York, McGraw-Hill Book Company, inc.
17. Sinnott, L.C. Dunn, Dobzhansky 1985. Principles of Genetics - McGraw-Hill.
18. White, M.J.D. 1980. Animal Cytology and Evolution, Cambridge University Publications.
19. Willson and Marrison, 1966. Cytology, Reinform Publications.

B.Sc. Biotechnology - Second Semester

Paper 2: BTT102, Microbiological Methods

Course Title: BTT202, Microbiological Methods	
Course Code: BTT102	L-T-P per week: 4-0-0
Total Contact Hours: 56	Course Credits: 04
Formative Assessment Marks: 20	Duration of ESA/Exam: 3 h
Model Syllabus Authors: Curriculum Committee	Summative Assessment Marks: 80

B.Sc. Biotechnology - Second Semester

Content of Course 02: Theory: BTT202: Microbiological Methods	56 h
Unit – 1: Introduction & Instrumentation	14 h
General introduction, scope, and relevance of microbiology. Concept of prokaryotes and eukaryotes. Introduction, general structure, and classification of bacteria, viruses, and fungi – bacterial classification based on shape, flagellum, and staining reaction with examples; virus classification based on host and genetic material with examples; basic classification of fungi with examples. Microscopy: Principles of Microscopy-resolving power and numerical aperture. Working principle and applications of light microscope, compound microscope, and Electron microscope - TEM and SEM.	
Unit – 2: Sterilization and Analytical Techniques	14 h
Definition of terms - sterilization, disinfectant, antiseptic, germicide, microbicidal agents, microbiostatic agents, and antimicrobial agents. Methods of sterilization: a) Physical methods- Principle and applications of moist heat sterilization, dry heat sterilization, and filtration (Seitz filter, membrane filter, and HEPA) b) Radiation: Ionizing radiation – γ -rays and non-ionizing radiation – UV rays c) Chemical methods: Alcohols, aldehydes, phenols, halogen, metallic salts, Analytical techniques: Working principle and applications of centrifuge, ultracentrifuge, and photo-colorimeter. Chromatography: paper and TLC.	
Unit – 3: Microbiological techniques	14 h
Culture Media: Nutritional requirements of bacteria, components of media. Natural and synthetic media, chemically defined media, complex media, selective, differential, and enriched media. Pure culture methods: Isolation, culture, identification, and preservation of bacteria and fungi- Serial dilution and plating methods (pour, spread, streak). Cultivation of anaerobic bacteria. Maintenance and preservation/stocking of pure cultures. Stains and staining techniques: Principles of staining, bacterial staining techniques – Simple staining and differential staining(Gram staining & acid-fast staining). Types of stains-simple stains and differential stains. Bacterial counting techniques – plate(colony) counting and turbidometry.	

Unit – 4: Control of microorganisms and Antimicrobial agents	14 h
Microbes and spoilage of food: Milk, bread, egg, meat, fruits, and vegetables. Protection of food from microbes: Pasteurization, Temperature (High and low temperature), dehydration, irradiation, and chemical agents. Modes of action of antimicrobial agents: Antifungal agents; Amphotericin B, Griseofulvin. Antiviral agents; Acyclovir, Azidothymine Antibacterial agents; Plazomicin, Erythromycin, Omadacycline. Challenges in antimicrobial therapy; Emergence of bacterial resistance.	

Formative Assessment/ Internal Assessment:	Total - 20
Assessment Occasion	Weightage
House Examination/Test	10
Written Assignment/Presentation/Project / Term	05
Class performance/Participation	05

B.Sc. Biotechnology- Second Semester

Microbiology Methods Laboratory Content

Practical: BTT202: Microbiological Methods

Course Title: BTT202: Microbiological Methods	Course Credits: 02
Course Code: BTT202	L-T-P per week: 0-0-3
Total Contact Hours: 36	Duration of ESA/Exam: 4 h
Formative Assessment (IA) Marks: 10	Summative Assessment Marks: 40

Sl. No.	Experiments	Units
1	Study instruments – Autoclave, Hot-air Oven, LAF, Incubator, Inoculation loop, and glass spreader.	1
2	Preparation and sterilization of media – nutrient broth, nutrient agar & MRBA media.	1
3	Isolation of bacteria from soil – serial dilution and plating techniques.	2
4	Isolation of bacteria and fungi from the air–exposure plate method.	1
5	Study of colony characteristics of bacteria.	1
6	Staining technique – Bacteria- Simple staining and gram’ staining, Fungal staining.	2
7	Isolation of bacteria from water.	1
8	Biochemical tests – Catalase test and Starch hydrolysis test.	1
9	Visit to Dairy or Research institutes or the water purification industry	2

Formative Assessment/ Internal Assessment:	Total - 10
Assessment Occasion	Weightage
House Examination/Test	05
Class performance/Participation	05

B.Sc. Biotechnology, Second Semester - Practical: BTT202: Microbiological Methods

Practical examination paper:

Duration: 3 Hrs

Max. Marks: 40

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|---|----|
| Q 1. Perform the gram staining on given material 'A' and comment on the observation. | 10 |
| Q 2. Perform the fungal staining with given material 'B' and comment on the result. | 08 |
| Q 3. Perform the biochemical test on given material 'C' and comment (Catalase). | 04 |
| Q 4. Identify and comment on the spotters 'C & D' (Instrument & Starch hydrolysis). 2 x 4 = | 08 |
| Q 5. Report on Industry/Research institute visit | 05 |
| Q 6. Class Record. | 05 |

Text Books/References

1. Atlas, R.M. 1997. Principles of Microbiology. 2nd edition. W.M.T. Brown Publishers.
2. Black, J.G. 2008. Microbiology: Principles and Explorations. 7th edition. Prentice Hall Bull, A.T. 1987. Biotechnology, International Trends of perspectives.
3. Cappucino, J. and Sherman, N. 2010. Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.
4. Frobisher, Saunders and Toppan 1974. Fundamentals of Microbiology Publications
5. Madigan, M.T, and Martinko, J.M. 2014. Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
6. Paul A. Ketchum, 1988. Microbiology, Concepts and applications, Wiley Publications.
7. Pelczar Jr M.J., Chan, E.C.S. and Krieg, N.R. 2004. Microbiology. 5th edition Tata McGraw Hill.
8. Salley, 1984. Fundamentals of Bacteriology, Tata McGraw Hill Education.
9. Singh, R.B. 1990. Introductory Biotechnology, C.B.D. India
10. Srivastava, S and Srivastava, P.S. 2003. Understanding Bacteria. Kluwer Academic Publishers, Dordrecht.
11. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 2005. General Microbiology. 5th edition McMillan.
12. Tortora, G.J., Funke, B.R. and Case, C.L. 2008. Microbiology: An Introduction. 9th edition Pearson Education.
13. Willey, J.M., Sherwood, L.M. and Woolverton, C.J. 2013. Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
14. Aneja K.R., Pranay Jain and Raman Aneja, 2008. A Textbook of Basic and Applied Microbiology, New Age International Publication.