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BENGALURU CITY UNIVERSITY

Office of the Registrar, Central College Campus, Dr. B.R. AmbedkarVeedhi, Bengaluru – 560 001.
PhNo.080-22131385, E-mail: registrar@bcu.ac.in

No.BCU/BoS/SEP/Micro-Biotech-UG/ 146 /2025-26 Date: 24.07.2025.

NOTIFICATION

Sub: B.Sc. III & IV Semesters Microbiology & Biotechnology Syllabus of Bengaluru City University-reg.

Ref: 1. Recommendations of Board of Studies in the Microbiology & Biotechnology (UG)
2. Academic Council resolution No.03 dated. 09.07.2025
3. Approval of the Vice-Chancellor dated.24.07.2025

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In pursuance of the resolution of the Academic Council under ref (2) above and with the approval of the Vice-Chancellor the Syllabus of III & IV Semester Microbiology and Biotechnology subject, recommendation in the BoS in Microbiology & Biotechnology (UG) is hereby notified for information of the concerned. This Syllabus will be effective from the academic year 2025-26.

The copy of the Syllabus is notified in the University Website: www.bcu.ac.in for information of the concerned.

REGISTRAR

To:
The Registrar (Evaluation), Bengaluru City University, Bengaluru.

Copy to;
1. The Dean, Faculty of Science, BCU.
2. The Chairman & Members of BoS in Microbiology and Biotechnology (UG), BCU.
3. The P.S. to Vice-Chancellor/Registrar/Registrar (Evaluation), BCU.
4. Office copy / Guard file / University Website: www.bcu.ac.in

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BE BOUNDLESS

BENGALURU CITY UNIVERSITY

Central College Campus, Bengaluru – 560 001

BIOTECHNOLGY Syllabus for Under-Graduate (UG) Program

From 2024-25 onwards

Framed according to the State Education Policy
(SEP 2024)

BENGALURU CITY UNIVERSITY
REGULATIONS AND SYLLABUS FOR BIOTECHNOLOGY

in

Three Year BSc Course (SEP 2024)

Eligibility

1. Only those candidates who have passed 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 B Sc course.

Scheme of Instruction/ Examination

1) **Theory Examination**: The theory question paper for each subject shall comprehensively cover all topics outlined in the syllabus, with weightage proportionate to the number of instructional hours allocated to each topic.

2) **Practical Classes**: Practical sessions shall be conducted in batches of 10 students per teacher (with a maximum of 12), in accordance with the University norms for the Faculty of Science. The teacher shall provide instruction, explain experimental principles, supervise the conduct of experiments, and evaluate students' practical records.

3) **Student Participation**: Each student is expected to actively perform and learn the experiments during the practical sessions.

4) **Use of Instruments**: Students must utilize biotechnology instruments and tools to carry out experiments and record the outcomes in their practical record books during each session.

5) **Practical Record Evaluation**: The maximum marks allotted for practical records in the final examination is 5.

6) **Study Tour/Industrial Visit**: A study tour or visit to industries and research institutes is strongly recommended. This provides students with practical exposure to the applications of Biotechnology in fields such as Industry, Agriculture, Medicine, 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
III	**BTT 301**	Biomolecules – Theory	04	03	20	80	100	3
	BTP 302	Biomolecules – Practical	04	03	10	40	50	2
	DSEBT1 (Elective1)	Applications of Biotechnology in Agriculture	02	1.5	10	40	50	2
IV	**BTT 401**	Molecular biology Theory	04	03	20	80	100	3
	BTP 402	Molecular biology Practical	04	03	10	40	50	2
	DSEBT2 (Elective2)	Bioinformatics and Bioresearch	02	1.5	10	40	50	2
	Skill- 1	Compulsory Skill Development 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) 3 x 10 marks = 30 Marks

Questions 21 to 25.

B.Sc. Biotechnology - Third Semester

Paper 3: BTT 301 Biomolecules

Course Title:, BTT 301, Biomolecules	
Course Code: **BTT301**	L-T-P per week: 4-0-0
Total Contact Hours: **56**	Course Credits: 0**4**
Formative Assessment(IA) Marks: **20**	Duration of ESA/Exam: **3 h**
Model Syllabus Authors: **Curriculum Committee**	Summative Assessment Marks: **80**

B.Sc. Biotechnology, Third Semester

Paper 3: BTT 301 Biomolecules

Content of Course 03: Theory: BTT 301: Biomolecules	**56 h**
Unit – 1: Introduction, Carbohydrates & Lipids	**14 h**
Introduction to molecular basis of life. **a. Carbohydrates:** Introduction, sources, classification of carbohydrates. Structure, properties and function of carbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives. Oligosaccharides – Sucrose and Fructose. Polysaccharides – Classification as homo and heter polysaccharides, Homo polysaccharides - storage polysaccharides (starch and glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure, properties), Hetero polysaccharides - glycoproteins and proteoglycans. **b. Lipids** Classification and function of lipids, properties (saponification value, iodine number, rancidity), Hydrogenation of fats and oils, saturated and unsaturated fatty acids. General structure and biological functions of - phospholipids, sphingolipids, glycolipids, lipoproteins, prostaglandins and cholesterol.	
Unit – 2: Aminoacids, proteins, vitamins & Nucleic acids	**14 h**
a. Amino Acids and Proteins Introduction, classification and structure of amino acids. Concept of – Zwitterion and isoelectric point, Essential and nonessential amino acids. Peptide and peptide bond. Classification of proteins based on structure and function, Structural organization of proteins - primary, secondary(α, β & triplehelix) tertiary and quaternary. Fibrous and globular proteins, Denaturation and renaturation of proteins. **b. Vitamins** Water and fat soluble vitamins, dietary source and biological role of vitamins Deficiency manifestation of vitamin A, B, C, D, E and K **c. Nucleic acids** Introduction and discovery. Structures of purines and pyrimidines, nucleosides and nucleotides of RNA and DNA.	

Unit – 3: Enzymes & Hormones	**14 h**
a. Enzymes Introduction, nomenclature and classification. Enzyme kinetics, factors influencing enzyme activity, activation energy and transition state, enzyme activity- specific activity. Coenzymes and their functions (one reaction involving FMN, FAD, NAD), metalloenzymes. Enzyme inhibition- Irreversible and reversible (competitive, non-competitive and uncompetitive inhibition with an example each) Zymogens (trypsinogen, chymotrypsinogen and pepsinogen), Isozymes (LDH). **b. Hormones** General introduction, protein hormones (insulin and growth hormone) steroid hormones (glucocorticoids, androgens, oestrogens and progesterone) and their basic functions. Mechanism of steroid hormone action.	
Unit – 4: Bioanalytical tools & techniques	**14 h**
a. pH and buffer concepts Basics of pH and buffer concepts and chemical bonds stabilizing biomolecules (ionic bond, covalent bond, hydrogen bond and hydrophobic interactions). **b. Chromatography:** Principle, procedure and applications of - paper chromatography and thin layer chromatography. **c. Spectroscopy:** Principle, procedure and applications of UV and Visible spectrophotometry; mass spectroscopy and atomic absorption spectroscopy. **d. Electrophoresis:** Principle, procedure and applications of electrophoresis - agarose gel electrophoresis and SDS- PAGE.	

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, Third Semester

Course 03: Practical: BTP302: Biomolecules

Course Title: **Biomolecules**	Course Credits: **02**
Course Code: **BTP 302**	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	Preparation of buffers – Acetate buffer & phosphate buffer	1
2	Definition and calculations of normality and molarity.	1
3	Study of construction and working principle of Colorimeter.	1
4	Estimation of reducing sugars (glucose & maltose) by DNS method.	2
5	Estimation of protein by biuret and Lowry' s methods.	2
6	Separation of aminoacids or plant pigments by Paper chromatography.	2
7	Extraction and partial estimation of protein from plant tissue by salting out method.	2
8	Estimation of alpha amylase activity by DNS method.	1

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

B.Sc. Biotechnology, Third Semester: Practical: BTP302: Biomolecules

Practical examination paper:

Duration: 3 Hrs **Max. Marks: 40**

Q 1. Estimate the amount of glucose in the given sample by DNS method & report.

Or

Estimate the amount of protein in the given sample by biuret method & report. 15

Q 2. Perform a paper chromatography experiment to separate the aminoacids/pigments from the given material. Write the principle and procedure involved. 12

Q 3. Prepare a buffer of given pH. 04

Q 4. Write the principles of salting out method or colorimetry. 04

Q 5. Class Record. 05

Text Books/References

1. David Plummer; 2001. 3rd Edition. An Introduction to Practical Biochemistry, Tata McGraw HillEdu.Pvt.Ltd. New Delhi, India.

2. Sadashivam,S.Manickam, A.1995. Biochemical Methods,1st Edition, New Age International Publishers, India.

3. Sawhney, S. K. & Randhir Singh. Introductory Practical biochemistry, (ed) Narosa Publishing. House,New Delhi, ISBN 81-7319-302-9.

4. Beedu Sasidhar Rao & Vijay Despande. Experimental Biochemistry: A Student Companion, (ed) I.K.International Pvt. LTD, New Delhi. ISBN 81-88237-41-8

5. Thimmaiah, S. K. (ed), Kalyani Publishers, Standard Methods of Biochemical Analysis, LudhianaISBN 81-7663-067
6. Principles of Biochemistry- Albert Lehninger CBS Publishers & Distributors.
7. Biochemistry-LUbretStryer Freeman International Edition.
8. Biochemistry-KeshavTrehan Wiley Eastern Publications.
9. Fundamentals of Biochemistry J.L. Jain S.Chand and company.
10. Biochemistry, Prasaranga, Bangalore University.
11. . Fundamental of Biochemistry-Dr. A.C. Deb.
12. Textbook of Organic Chemistry (A Modern approach) P.L. Soni, Sultan Chand and Sons, Publishers.
13. . The Biochemistry of Nucleic acid-tenth Edition-Roger L.P. Adams, John T. Knower and David P. Leader, Chapman and Hall Publications.
14. Essentials of Biophysics, New Age Int. Pub. New Delhi.
15. Roy R.N. (1999) A Text Book of Biophysics New Central Book Agency.

B.Sc. Biotechnology- Third Semester
Discipline Specific Elective -1

DSEBT01 – Application of Biotechnology in Agriculture

Course Title: **DSEBT01 – Application of Biotechnology in Agriculture**	Course Credits: **02**
Course Code: **DSEBT01**	L-T-P per week: 0-0-2
Total Contact Hours: **28**	Duration of ESA/Exam: 1.5 h
Formative Assessment (IA) Marks: **10**	Summative Assessment Marks: **40**

DSEBT01 – Application of Biotechnology in Agriculture

Content of Course: DSEBT01 – Application of Biotechnology in Agriculture	**28 h**
Unit – 1: Transgenic plants	**14 h**
a. Introduction to Transgenic plants. Production of Pest resistant plants- Bt Cotton and Bt Brinjal. Transgenic Rice with vitamin-A. Antisense RNA technology for extending shelf life of fruits and shelf life of flowers. **b.** Plants as bio-factories for molecular farming: Production of edible vaccines, plantibodies, nutraceuticals. Production of Hirudin in *Brassica napus*. **c.** Safety and ethical issues associated with GM crops.	
Unit – 2: Bio fertilizers and bio pesticides	**14 h**
a. Introduction to biofertilizers and their importance. **b.** Mass production of *Azatobacter, Rhizobium* and their field applications. Blue-Green algae as biofetizers and their field applications. **c.** Biopesticides – introduction. Characteristics and Advantages of biopesticides. Microbial pesticides – bacteria, virus and fungi as biopesticides.	

SCHEME OF EXAMINATION FOR DISCIPLINE SPECIFIC ELECTIVE

Duration: 1.5Hrs **Max. Marks: 40**

I. Answer any Four of the following: (out of 6) 4 x 5 marks = 20 Marks

Questions 1 to 6

II. Answer any 2 of the following: (out of 4) 2 x 10 marks = 20 Marks

Questions 7 to 10

Text Books/References

1. Ramavat K.G, Shaila Goyal. Comprehensive Biotechnology, S.Chand & Company.
2. Kumaresan V. Biotechnology. SaraS Publication.
3. Glick, B.R and Pasternak, J.J 1998. Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press.
4. Howe. C. 1995. Gene cloning and manipulation, Cambridge University Press, USA.
5. Dubey R.C. A Text Book of Biotechnology, S. Chand & Company.

B.Sc. Biotechnology - Fourth Semester

Paper 4: BTT401, Molecular biology

Course Title: BTT401, Molecular biology	
Course Code: **BTT402**	L-T-P per week: 4-0-0
Total Contact Hours: **56**	Course Credits: 0**4**
Formative Assessment Marks: **20**	Duration of ESA/Exam: **3 h**
Model Syllabus Authors: **Curriculum Committee**	Summative Assessment Marks: **80**

B.Sc. Biotechnology – 4th Semester

Content of Course 04: Theory: BTT401, Molecular biology	**56 h**
Unit – 1: Introduction to DNA & Replication	**14 h**
a. An introduction to DNA and RNA. Experimental proof of DNA as genetic material. Structure and functions of DNA and RNA (Watson and Crick model of DNA) and forms of DNA (A and Z). **b.** DNA Replication Replication in prokaryotes and eukaryotes - Enzymes in DNA replication and mechanism of replication. Models of replication (Theta, rolling circle and semiconservative models). Differences between prokaryotic and eukaryotic replication. **c.** DNA damage & repair Causes of damage and mechanisms of repair – photoreactivation, excision repair, mis-match repair and SOS repair.	
Unit – 2: Gene structure & Transcription	**14 h**
a. Central dogma. Concept of Gene – functional unit, prokaryotic and eukaryotic gene (introns and exons), Genome. **b.** Genetic code, its properties and Wobble hypothesis. **c.** Transcription & RNA processing. Transcription in prokaryotes and eukaryotes – promoters, RNA polymerases, direction of transcription and mechanism of transcription. Post transcriptional processing of eukaryotic mRNA.	
Unit – 3: Translation	**14 h**
a. Ribosome: prokaryote and eukaryote ribosome. **b.** Translation - in prokaryotes and eukaryotes Enzymes and factors involved in translation. Mechanism of translation – activation of amino acid, aminoacyl tRNA synthesis, initiation, elongation and termination of polypeptide chain. **c.** Protein folding and Post translational modifications of proteins. **d.** Inhibitors of translation and fidelity of translation.	
Unit – 4: Regulation of gene expression.	**14**
a. Gene regulation in prokaryotes – Transcription control mechanism, negative control and positive control. Operon concept: Lac operon and tryptophan operon. **b.** Gene regulation in eukaryotes – Transcriptional activation and galactose metabolism in yeast. **c.** Gene organization and expression in Mitochondria and chloroplast.	

d. Introduction to genomics, proteomics & Bioinformatics- Definition of genomics(Structural & functional genomics), benefits of Human genome Project, Definition of proteomics and its main areas, Definition of bioinformatics and importance of bioinformatics.	

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- 4th Semester

Molecular biology Laboratory Content

Practical: BTT402, Molecular biology

Course Title: **BTT402, Molecular biology**	Course Credits: **02**
Course Code: **BTT402**	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	Isolation of DNA from yeast, plant and animal source.	3
2	Estimation of DNA by DPA method.	1
3	Estimation of RNA by orcinol method.	1
4	Extraction and partial estimation of protein from animal tissue by organic solvent extraction method.	1
5	Study of conjugation, transformation and transduction.	2
6	Separation of protein by SDS PAGE –Demonstration.	1
7	Preparation of DNA models of different forms of DNA	1
8	Visit to industry or Research institute.	2

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

Text Books/References

1. Bruce Alberts, Alexander Johnson, Julian Lewis, et al., 2014 Molecular Biology of Cell – Garland publications.
2. Daniel L. Hartl, E.W. Jones, Jones, 2005. Genetics: Analysis of Genes and Genomes, Barlett Publishers.
3. De Robertis and EMF Robertis, 1980. Cell Biology & Molecular Biology – EDP Saunder College.
4. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 2000. Molecular Cell Biology - Daniel, Scientific American Books.
5. Glick, B.R and Pasternak, J.J 1998. Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press
6. Howe. C. 1995. Gene cloning and manipulation, Cambridge University Press, USA
   Lewin, B. Gene VI New York, Oxford University Press
7. Rigby, P.W.J. 1987 Genetic Engineering Academic Press Inc. Florida, USA
8. Sambrook et al 2000. Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory PressNew York, USA.
9. Walker, J. M. and Ging old, E.B. 1983. Molecular Biology & Biotechnology (Indian Edition) RoyalSociety of Chemistry U.K.
10. Karp. G 2002. Cell & Molecular Biology, 3rd Edition, John Wiley & Sons.
11. Karp. G 2002. Cell & Molecular Biology, 3rd Edition, John Wiley & Sons;

B.Sc. Biotechnology- 4th Semester
Discipline Specific Elective -2
DSEBT02 – Bioinformatics and Bio-research

Course Title: **DSEBT02 – Bioinformatics and Bio-research.**	Course Credits: **02**
Course Code: **DSEBT02**	L-T-P per week: 0-0-2
Total Contact Hours: **28h**	Duration of ESA/Exam: 1.5 h
Formative Assessment (IA) Marks: **10**	Summative Assessment Marks: **40**

Unit – 1: Bioinformatics	**14 h**
a. Introduction to bioinformatics. Knowledge base in biology. IT in biology. Skills required to become a successful bioinformatician. Basics of computers-hardware and software, system software, application software, operating systems and software related to bioinformatics. Applications of	

bioinformatics. **b.** Data bases: Database structure and management of data base. File formats, annotated sequence databases, genome and organism specific data bases. Retrieval of biological data. Accessing databases – PubMed, Nucleic acid sequence databank-NCBI and EMBL, Protein sequence databank- NBRF-PIR, SWISSPROT, Structural databases-protein databank-PDB. **c.** Tools of biological data retrieval -VASMOL, FASTA, BLAST, PubMed. Sequence alignment, scoring matrices, multiple sequence alignment.	
Unit – 2: Bio-research	**14h**
a. Introduction and importance of research in biology. Objectives, motivation and types of research. Significance of research. Major biological research institutes in India – IISc, NCBS, CCMB, ICMR, IBAB, NIV, Serum Institute, JNCASR. Top 10 biotech companies in India and world and their products. **b.** Research problem identification and formulation. Necessity of a research design, features of a good research design and experimental design. Data preparation, data analysis and data interpretation. **c.** Research Paper and Project writing – Layout of a research paper. Use of encyclopaedias, research guides and handbooks. Publication, Impact factor for Journals and Plagiarism. Basic skills of project writing, Importance of documentation.	

SCHEME OF EXAMINATION FOR DISCIPLINE SPECIFIC ELECTIVE

Duration: 1.5Hrs **Max. Marks: 40**

I. Answer any Four of the following: (out of 6) 4 x 5 marks = 20 Marks

Questions 1 to 6

II. Answer any 2 of the following: (out of 4) 2 x 10 marks = 20 Marks

Questions 7 to 10

Text Books/References

1. Gladis Helen Hepsyba & Hemalatha C.R, Basic Bioinformatics, MJP Publishers.
2. Sundarlingam R & Kumaresan V, Bioinformatics, Saras Publication.
3. Kumaresan V. Biotechnology. SaraS Publication.
4. Sharma, Munjal & Shnkar, a Text book of Bioinformatics, Rastogi Publications.
5. SC Rastogi, N Mendiratta & P Rastogi, Bioinformatics – Methods & Applications, Fourth Edition, PHI Learning Pvt. Ltd.
6. Bryan Bergeron M.D, Bioinformatics Computing. PHI Learning Pvt. Ltd.

Compulsory Skill development Practical

Skill -1 Practical: Biochemical Analysis

Course Title: **Skill -1 , Biochemical Analysis**	Course Credits: **02**
Course Code: **BTSkill -1**	L-T-P per week: 0-0-3
Total Contact Hours: **30**	Duration of ESA/Exam: 3 h
Formative Assessment (IA) Marks: **10**	Summative Assessment Marks: **40**

Sl. No.	Experiments	Units
1	Assay of Nutritional drinks: Estimation of glucose and maltose from Nutritional drinks – Horlics, Boost, Maltova, etc...by Nelson-Somogyi's method & DNS method.	3
2	Estimation of protein from Nutrient drinks – Horlics, Boost, Maltova, etc.. by Bradford method and biuret method.	2
3	Qualitative test for lipids in Nutrient drinks – Horlics, Boost, Maltova, etc. by solubility test, emulsification test & Sudan black B test.	2
3	Extraction of proteins from different grains (sprouted) by salt precipitation and estimation by biuret method, Lowry's method & Bradford method.	4

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