ಆಗು ನೀ ಅನಿಕೇತನ
BE BOUNDLESS

BENGALURU CITY UNIVERSITY

REGULATIONS AND SYLLABUS FOR
B.Sc. Biotechnology

CHOICE BASED CREDIT SYSTEM
(SEMESTER SCHEME)

2020-2021

B.Sc. CBCS SEMESTER SCHEME
BIOTECHNOLOGY
SCHEME OF INSTRUCTIONS AND CREDITS

Paper No.	Title of Paper	Type of Paper	Hours/ Week	Duration of Examination	IA Marks	Exam Marks	Total Marks	Credits
	I Semester							
BTP- 101	Biotechnology – I Cell biology, Genetics & Biochemistry	Theory	4	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for I semester						150	6
	II Semester							
BTP-201	Biotechnology - II Microbiology	Theory	4	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for II semester						150	6
	III Semester							
BTP-301	Biotechnology – III Molecular biology	Theory	4	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for III semester						150	6
	IV Semester							
BTP-401	Biotechnology – IV Genetic Engineering	Theory	4	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for IV semester						150	6
	V Semester							
BTP-501	Biotechnology – V Environmental Biotechnology & Immunotechnology	Theory	3	3	30	70	100	4
		Practical	3	3	15	35	50	2
BTP-502	Biotechnology – VI Plant & Animal Biotechnology	Theory	3	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for V semester						300	12
	VI Semester							
BTP-601	Biotechnology –VII Industrial Biotechnology	Theory	3	3	30	70	100	4
		Practical	3	3	15	35	50	2
BTP-602	Biotechnology – VIII Bioinformatics, Bio entrepreneurship & Research	Theory	3	3	30	70	100	4
		Practical	3	3	15	35	50	2
	Total Marks and Credits for VI semester						300	12

CHAIRMAN
Department of Microbiology
& Biotechnology
Bangalore University, JB Campus,
Bangalore - 560 056.

Bengaluru City University

B Sc Biotechnology (CBCS) Syllabus 2020-21

B Sc I Semester – Biotechnology Paper I: Cell Biology, Genetics and Biochemistry

B Sc II Semester – Biotechnology Paper II: Microbiology

B Sc III Semester – Biotechnology Paper III: Molecular Biology

B Sc IV Semester – Biotechnology Paper IV: Genetic Engineering

B Sc V Semester – Biotechnology Paper V: Environmental Biotechnology and Immunotechnology

Biotechnology Paper VI: Plant and Animal Biotechnology

B Sc VI Semester – Biotechnology Paper VII: Industrial Biotechnology

Biotechnology Paper VIII: Bioinformatics, Bio entrepreneurship and research

B Sc III Semester

Biotechnology Paper III: Molecular biology & Biophysics

Theory: 60 Hours

Unit 1 **Introduction to DNA** and **DNA Replication**

1.1 Genetic material – Characteristics of genetic material, Experiments to prove DNA and RNA as genetic material. Structure and chemical nature of DNA (B, A & Z Models), RNA and their functions. 3 Hr

1.2 Concept of Gene – functional unit, prokaryotic and eukaryotic gene, promoters, introns and exons. 3 Hr

1.3 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. 4 Hr

1.4 DNA Repair – causes of damage and mechanisms of repair – photoreactivation, excision repair, mis-match repair and SOS repair. 3 Hr

1.5 DNA Recombination - Transformation, conjugation and transduction in prokaryotes. 2 Hr

Unit 2 **Protein synthesis**

2.1 Transcription - Central Dogma. Genetic code, its properties and Wobble hypothesis. Transcription in prokaryotes and eukaryotes – promoters, RNA polymerases, Direction of transcription and mechanism of transcription. Post transcriptional modification of eukaryotic mRNA. 7 Hr

2.2 Translation - in prokaryotes and eukaryotes – ribosome, enzymes and factors involved in translation. Mechanism of translation – activation of amino acid, aminoacyl tRNA synthesis, initiation, elongation and termination of polypeptide chain. Brief note on protein folding and modifications. 8 Hr

Unit 3 **Regulation of gene expression**

3.1 Gene regulation in prokaryotes – Transcription control mechanism, negative control and positive control. Operon concept: Lac operon and tryptophan operon. 6 Hr

3.2 Gene regulation in eukaryotes – Transcriptional activation and galactose metabolism in yeast. 3 Hr

3.3 General account of Insertional elements and transposons. Transposable elements in *Maize* and *Drosophila*. 3 Hr

3.4 Gene organization and expression in Mitochondria and chloroplast. 3 Hr

Unit 4 **Biophysics**

4.1 Basics of biophysics: pH and buffer concepts and chemical bonds stabilizing biomolecules (ionic bond, covalent bond, hydrogen bond, hydrophobic interactions and Van der Waals forces). 3 Hr

4.2 Spectroscopy: Beer and Lambert's Laws, Principles and applications of Colorimetry, UV and visible spectrophotometry, absorption spectroscopy, fluorescence spectroscopy, X-ray crystallography and NMR imaging. 6 Hr

4.3 Separation techniques: Principles and applications of Chromatography – paper, thin layer, adsorption, affinity, ion exchange chromatography and HPLC. 4 Hr

4.4 Centrifugation: Basic principles, types and applications. 2 Hr

Practical III: Molecular biology

15 Units of 3 Hours each

1. Colorimetric estimation of DNA by DPA method. 2 units
2. Colorimetric estimation of RNA by Orcinol method. 2 units
3. Determination of Tm value of DNA. 1 unit
4. Separation of amino acids or plant pigments by ascending paper chromatography. 2 units
5. Column Chromatography. 2 units
6. Extraction and estimation of protein from plant tissue by salt precipitation method. 2 units
7. Extraction and estimation of protein from animal tissue by organic solvent method. 2 units
8. Preparation of DNA models. 1 unit
9. Preparation of Charts of conjugation, transformation and transduction. 1 unit

B Sc IV Semester

Biotechnology Paper IV: Genetic engineering

Theory: 60 Hours

Unit 1 **Introduction and Tools of Genetic engineering**

1.1 Importance, history, concepts, developments and steps of genetic engineering. 3 hr

1.2 Enzymes used in genetic engineering: Restriction endonucleases – nomenclature, types and mode of action, DNA ligase, alkaline phosphatase, phosphokinase, DNA polymerases, Taq polymerase and reverse transcriptase. 6 hr

1.3 Gene cloning vectors: Introduction, general characteristics and types- plasmids (pUC18 and pBR322), bacteriophage vectors (lambda and M13) and cosmids, shuttle vectors and expression vectors. 6 hr

Unit 2 **Creation of recombinant DNA and techniques**

2.1 Techniques used in genetic engineering: Principle, procedure and applications of Electrophoresis (AGE and PAGE), PCR, DNA sequencing (Sanger's and Maxam-Gilbert method), DNA finger printing and Blotting techniques. 6hr

2.2 In vitro construction of recombinant DNA molecule: Isolation and preparation of desired DNA – isolation from genomic DNA, preparation of cDNA and chemical synthesis; restriction digestion and ligation of desired DNA with vector DNA. 4 hr

2.3 Introduction of recombinant DNA molecule into hosts: Bacteria – calcium chloride method and electroporation method; plant host – Agrobacterium mediated and Gene gun method; animal host–Microinjection and Liposome fusion method. 5 hr

Unit 3 **Screening and selection of recombinants and expression of cloned gene**

3.1 Screening and selection – Insertional inactivation of antibiotic resistance gene and lac Z gene, Colony hybridization and immunological screening. 4 hr

3.2 Expression of cloned gene – in prokaryotes and eukaryotes. 3 hr

3.3 Gene libraries – construction of genomic DNA and cDNA libraries and applications. 4 hr

3.4 Human genome project: Introduction, salient features, general techniques used and applications of human genome project. 4 hr

Unit 4 **Applications of genetic engineering**

4.1 Applications in human health care – Production of recombinant insulin, growth hormone, recombinant vaccine (hepatitis) and interferon; gene therapy (in cancer). 5 hr

4.2 Applications in agriculture - production of GM crops -pesticide resistant plants (Bt cotton), nutritionally rich crops (Golden rice) and improved shelf life (Tomato - antisense mRNA technology). 4 hr

4.3 Application in environment and forestry – clearing of oil spills (GM *Pseudomonas putida*), invitro propagation of forest plants and medicinal plants and conservation of germplasm. 3 hr

4.4 Applications in food and dairy industry – genetically modified foods, transgenic fish, biotechnological approach in food processing and dairy. 3 hr

Practical IV: Genetic Engineering

15 Units of 3 Hours each

1. Handling of instruments- Centrifuge, Electrophoresis unit, micro pipettes. 1 unit
2. Isolation of DNA from bacteria, animal and plant tissue. 4 units
3. Quantification of DNA by spectrophotometry. 2 units
4. Agarose gel electrophoresis of DNA. 2 units
5. Competent cell preparation. 2 units
6. Bacterial transformation. 1 unit
7. Testing of efficiency of competent cells. 1 unit
8. Visit to agriculture/ forest research institute or food processing/ dairy industry and submission of report in practical exam. 2 units

REFERENCES BOOKS

CELL BIOLOGY

1.Molecular Biology of Cell - Bruce Alberts et al, Garland publications. 2. Animal Cytology and Evolution – MJD, White Cambidge University Publications. 3. Molecular Cell Biology –Daniel, Scienific American Books. 4. Cell Biology - Jack d Bruke, The William Twilkins Company. 5. Principles of Gene Manipulations – Old & Primrose, Black Well Scientific Publications. 6. Cell Biology – ambrose & Dorouthy M Easty, ELBS Publications. 7. Fundamentals of Cytology – Sharp, McGraw Hill Company. 8. Cytology – Willson & Marrison, Reinform Publications. 9. Molecular Biology – Smith Faber & Faber Publications. 10. Cell Biology & Molecular Biology – EDP Roberties & EMF Roberties, Saunder College. 11. Cell Biology – C.B Powar, Himalaya Publications.

GENETICS

1. Basic Genetics – Daniel L. Hartl, Jones &Barlett Publishers USA. 2. Human Genetics and Medicine lark Edward Arnold P London. 3. Genetics – Monroe W Strickberger, Macmillain Publishers, New York. 4. Genes V - Benjamin Lewin, Oxford University Press. 5. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi. 6. Genes II - Benjamin Lewin, Wiley & Sons Publications 7. Genes III- Benjamin Lewin, Wiley & Sons Publications. 8. Principles of Genetics – Winchester Sinnot & Dom. 9. Genetics – Blue print of life by Sandhya Mitra, Tata McGraw Hill Publication. 10. Genetics – Edgar Altenburg Oxford & IBH publications. 11. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications.

MICROBIOLOGY

1. Microbiology-Pelzer, Chan, Krieg Tata McGraw Hill Publications. 2. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications. 3. Fundamentals of Microbiology – Furbisher, Saunders & Toppan Publications. 4. Microbiology –Ronald M.Atals. 5. Introductory Biotechnology-R.B Singh C.B.D. India (1990). 6. Industrial Microbiology-Casual Wiley Eastern Ltd. 7. Fundamentals of Bacteriology – Salley. 8. Fontiers in Microbial technology-P.S. Bison, CBS Publishers. 9. Biotechnology, International Trends of perspectives A. T. Bull, G. HollM.D.Lilly Oxford & T Publishers. 10. General Microbiology –C.B. Powar, H.F. Daginawala, Himalayan Publishing House.

BIOCHEMISTRY

1.Principles of Biochemistry- Albert Lehninger CBS Publishers & Distributors. 2. Biochemistry-LUbretStryer Freeman International Edition. 3. Biochemistry-KeshavTrehan Wiley Eastern Publications. 4. Fundamentals of Biochemistry J.L. Jain S.Chand and company. 5. Biochemistry, Prasaranga, Bangalore University. 6. Fundamental of Biochemistry-Dr. A.C. Deb.
7. Textbook of Organic Chemistry (A Modern approach) P.L. Soni, Sultan Chand and Sons, Publishers. 8. The Biochemistry of Nucleic acid-tenth Edition-Roger L.P. Adams, John T. Knower and David P. Leader, Chapman and Hall Publications.

BIOPHYSICS

1.Essentials of Biophysics, New Age Int. Pub. New Delhi. 2. Bliss, C.J.K. (1967) Statistics in Biology, Vol. I McGraw hill. New York. 3. Campbell R.C. (1974) Statistics for Biologists, Cambridge Univ, Press, Cambridge. 4. Daniel (1999) Biostatistics (3rd edition) Panima Publishing, Compotation. 5. Sward law, A. C. (1985) Practical Statistics for Exponents Biologists, John Wiley and Sons, Inc. 6. Khan (1999) Fundamentals of Biostatistics Publishing Corporation. 7. Roy R.N. (1999) A Text Book of Biophysics New Central Book Agency.

MOLECULAR BIOLOGY

1. Glick, B.R and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press.
2. Howe. C. (1995) Gene cloning and manipulation, Cambridge University Press, USA
3. Lewin, B., Gene VI New York, Oxford University Press.
4. Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc. Florida, USA.
5. Sambrook et al (2000) Molecular cloning Volumes I, II & III, Cold spring Harbor Laboratory Press New York, USA
6. Walker J. M. and Ging old, E.B. (1983) Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K.
7. Karp. G (2002) Cell & Molecular Biology, 3rdEdition, John Wiley & Sons; I

Genetic Engineering

1. Christopher H; Gene cloning and Manipulation, Cambridge University Press.
2. Nicholls D.S.T; An Introduction to Genetic Engineering, Cambridge University Press.
3. Old R.W and Primrose S. B; Principles of Gene manipulation, Blackwell Scientific Publication.
4. Kucherlpati R and Smith G.R. Editors; genetic recombination, American Society for Microbiology.
5. Lewin B; gene VI, Oxford University Press.
6. Jogdand S.N; Gene Biotechnology, Himalaya Publishing House.
7. Kumaresan V; Biotechnology, Saras Publication.
8. Glick B.R and Pasternak J.J; Molecular Biotechnology, Principles and Applications of recombinant DNA technology, ASM Press, Washington D.C.
9. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Bioinformatics

1. Dubey R. C.; A Text Book of Biotechnology, S Chand Publicatins.
2. Kumaresan V; Biotechnology (6th Edition), Saras Publication.
3. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.
4. Gladis Helen Hepsyba & Hemalatha C.R; Basic Bioinformatics, MJP Publishers.
5. Sundaralingam R. & Kuaresan V; Bioinformatics, Saras Publication

Environmental Biotechnology

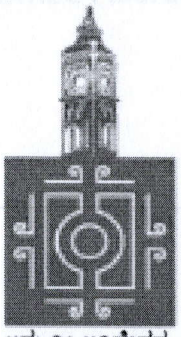
1. Alexander N., Glazer Hiroshi N Ikaido; Microbial Biotechnology, W.H. freeman and Company.
2. Fungal Ecology and Biotechnology, Rastogi Publications.
3. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.

Immunology

1.Willium E.Paul; Fundamental Immunology, Raven Press, New York.
2. Willium R Clark; The Experimental Foundations of Modern Immunology, John Wiley and Sons, NY.
3. Shyamasree Ghosh; Immunology & Immunotechnology, Books and Allieds Publication.
4. Dulsy Fatima and Arumugam N; Immunology; Saras Publication
5. Ivan M. Roitt; Immunology, Blackwell Scientific Publication.

Animal Biotechnology

1. Ian Freshney; Animal Cell culture (4th Edition)
2. Gupta P.K; Elements of Biotechnology, Rastogi Publications
3. Kumaresan V; Biotechnology(6th Edition), Saras Publication.
4. Dubey R. C.; A Text Book of Biotechnology, S Chand Publicatins
5. Animal Biotechnology; MJP Publishers.
6. Ramavat K. G, Shaily Goyal; Comprehensive Biotechnology(4th Revised Editon), S Chand & Co.



BENGALURU CITY UNIVERSITY

REGULATIONS AND SYLLABUS FOR
B.Sc. Biotechnology

CHOICE BASED CREDIT SYSTEM

Scheme of Examination in Theory and Practical

2020-2021

B.Sc. III Semester:

Biotechnology Paper III (Molecular Technology):

Duration – 3 Hours Maximum Marks – 35

Q 1. Estimate DNA or RNA from the given sample by DPA/Orcinol method. 8

Q 2. Determine the Tm value of given sample of DNA. 5

Q 3. Separate the compounds (amino acids) in the given sample by ascending paper chromatography and report the Rf value. 6

Q 4. Spotters a) forms of DNA(any one)
b) Bacterial recombination(any one chart) 3+3=6

Q 5. VIVA VOCE 5

Q6. Class record 5

Scheme of valuation:
Q1. Performanace – 4m
Protocol table - 2m
Graph & result – 2m
Note: Candidate must perform the experiment for 7 tubes

Q2. Calculation & result-5m

Q3: Performance – 4m
Calculation & result – 2m

Q4: Identification – 1m
Points of relevance – 2m

Q 5. Viva voce – questions related to practical syllabus only.

B.Sc. IV Semester:

Biotechnology Paper IV (Genetic Engineering)

Duration – 3 Hours Maximum Marks – 35

Q 1. Isolate genomic DNA from the given sample(animal/plant). 8

Q 2. Quantify the given sample of DNA by Spectrophotometry. 8

Q 3. Spotters a) instruments(any one)

b) Photographs of competent cell preparation or screening techniques. 3x2= 6

Q 4. Industrial Report (industry/institute) 3

Q 5.VIVA VOCE 5

Q6. Class record 5

Scheme of valuation:

Q1. Performance – 4m
Principle - 2m
Result – 2m

Q2. Performance – 4m
Principle - 2m
Result – 2m

Q3: Identification – 1m
Points of relevance – 2m

Q 5. Viva voce – questions related to practical syllabus only.