

DEPARTMENT OF BIOTECHNOLOGY
COURSE CURRICULUM & MARKING SCHEME

B.Sc. I, II, III, IV Semester

BIOTECHNOLOGY

(Based on Choice Based Credit System)

SESSION : 2023-24



ESTD : 1958

**GOVT. V.Y.T. PG AUTONOMOUS COLLEGE,
DURG, 491001 (C.G.)**

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

**GOVT.V.Y.T.PG. AUTONOMOUS COLLEGE,
DURG, 491001 (C.G.)**

(Former Name – Govt. Arts & Science College, Durg)

NACC Accredited Grade 'A' College; College with Potential of Excellence (UGC)

Phone-0788-2211688, Fax- 0788-2212030

Website – www.govtsciencecollegedurg.ac.in Email – pprinci2010@gmail.com

DEPARTMENT OF BIOTECHNOLOGY



SUBJECT – BIOTECHNOLOGY

BACHELOR OF SCIENCE (B.Sc.)

Semester- I, II, III & IV

(Based on Choice Based Credit System)

2023-24

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc I Sem	Year: 2022 Session:2022-2023
1	Course Code	BBT01	
2	Course Title	Cell Biology, Biochemistry and Metabolism	
3	Course Type	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biology in class 12 th .	
5	About the course	The course is designed to develop understanding about Cell Biology, organizational structure of Biochemicals and their Metabolic process for regulation of life.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand Cellular organization, their division for continuation of life, and natural cellular death mechanism. • Understand the basic Biochemicals for organizational and functional expression of life. • Understand the metabolic regulations for survival and continuation of life. 	
6	Credit Value	Theory :3 + Practical 1 Total credit : 4	
7	Total Marks	Max. Marks: 75+25=100 Min Passing Marks :40%	
8		External: Internal assessment is 80: 20 (in percentage)	

Part B: Content of the Course		
Total No. of Lecturer (in hours per week):		
Total Lecturer: 60		
Unit	Topics	No. of Lectures
I	1. Cell theory. 2. Prokaryotic cell structure- Function and ultrastructure of cell (Gram positive and Gram negative), plasma membrane, flagella, pilli, endospore and capsule. 3. Eukaryotic cell structure- Cell wall. 4. Cell division- Mitosis and meiosis. 5. Plasma membrane- Structural and physiological concepts.	12
II	1. Cell organelles- Plasma membrane, mitochondria, Golgi bodies, endoplasmic reticulum, ribosome, chloroplast etc. 2. Nucleus- Organisation and chromosomes. 3. Cytoskeleton- microtubules, microfilaments and intermediate filaments. 4. Biology of cancer cells. 5. Apoptosis.	12

III	<ol style="list-style-type: none"> 1. Carbohydrates- Structure and classification. 2. Lipid- Structure and classification. 3. Amino acids - Structure and classification. 4. Three dimensional structure of proteins. 	12
IV	<ol style="list-style-type: none"> 1. Nucleic acid- DNA and RNA. 2. Enzymes- Nomenclature and classification. 3. Enzymes- Mechanism of action and factors affecting enzyme action. 4. Hormones- Plant and animal hormones. 	12
V	<ol style="list-style-type: none"> 1. Carbohydrate metabolism- Glycolysis, Krebs cycle, pentose phosphate pathway. 2. Lipid metabolism- β oxidation of fatty acid. 3. Protein metabolism- Transamination/deamination, urea cycle, amino acid synthesis of glutamic acid and phenylamine. 4. Nucleic acid metabolism. 	12

• Part C - Learning Resource

Text Books, Reference Books, Other Resources -

Molecular Biology of the Cell – Alberts
 Molecular Cell Biology – Lodish
 Cell and Molecular Biology – Gerald Karp
 Cell biology – C.B.Powar
 The Cell – Cooper
 Lehninger- Principles of Biochemistry
 Nelson & Cox. - Biochemistry
 Voet & Pratt. - Biochemistry
 Practical Biochemistry- Wilson & Walker.

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation – Mr. Premanjan Biswas.....
Chairperson – Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

B. Sc. I Sem Practical Total No. of Classes (in hours per week): Total Credit: 01 (Classes 30) CODE-BBP01
--

**B. Sc. I Sem
PRACTICALS**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Preparation of mitotic index from plants and animals.
2. Preparation of slide of blood cells.
3. Preparation of slide of giant chromosomes.
4. Preparation of slide of epithelial cells.
5. Biochemical test of carbohydrates.
6. Biochemical test of lipids.
7. Biochemical test of proteins.
8. Action of salivary amylase on starch.
9. Action of trypsin on proteins.
10. Effect of temperature, pH and substrate concentration on action of enzymes.
11. Separation of amino acids by chromatography.
12. Separation of chlorophyll by chromatography.

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

	Marks
1. Any two practicals from Cell Biology and two from Biochemistry and metabolism section	(4X4 = 16)
2. Viva-Voce -	04
3. Field work – (CCE)-	2.5
4. Practical record –(CCE)-	2.5

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert– Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson–Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation–Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
---	---

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc I Sem	Year: 2022 Session:2022-2023
1	Course Code	BBT01-SEC01	
2	Course Title	Enzymology	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biology in class 12 th .	
5	About the course	The course is designed to develop understanding about basic knowledge of Enzyme, its actions and applications.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand scientific presentation of enzyme system. • Different forms of enzyme and their mechanism for regulation of life. • Methods for enzyme production and their application for enterprenureship. • Practically apply techniques of enzymatic applications. 	
6	Credit Value	Theory:1 + Practical :1; Total Credit 2	
7	Total Marks	Max. Marks: 25+25=50 Min Passing Marks : 40%	
8		External : Internal assessment is 80:20 (in percentage)	

Part B: Content of the Course		
Total No. of Lecturer (in hours per week):		
Total Lecturer: 30		
Unit	Topics	No. of Lectures
I	1. Enzyme catalysis, inhibition and regulation. 2. Techniques for studying enzymatic action. 3. Multienzyme complex 4. Methods of enzyme production. 5. Immobilization of enzymes-Methods and Applications. 6. Allosteric enzymes with special reference to Phosphofructo Kinase. 7. Industrial applications of enzymes. 8. Emzymatic Assays.	30

• Part C - Learning Resource

Text Books, Reference Books, Other Resources -

- Lehninger Principles of Biochemistry- Nelson & Cox. B
- Biochemistry-Voet& Pratt.
- Principles of Enzymology- Price & Stevens.
- Enzyme Biocatalysis, Principle & Applications- Andres Illanes.
- Enzyme Kinetics- Hans Bisswanger

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation–Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

B. Sc. I Sem Practical Total No. of Classes (in hours per week): Total Credit: 01 (Classes 15) CODE-SEC01
--

**B. Sc. I Sem
PRACTICALS (SEC)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention –

1. Practical exploration of isolation of enzymes.
2. Practical exploration of purification of enzymes.
3. Practical exploration of immobilisation of enzymes.
4. Practical exploration of effect of temperature, pH and substrate concentration on enzyme action.
5. Practical exploration of action of salivary amylase.
6. Practical exploration for production of enzymes

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

	Marks
1. Any 2 practicals from list	(2X8 = 16)
2. Viva-Voce -	04
2. Field work – (CCE)-	2.5
3. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert – Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson – Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation – Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
--	---

Part A: Introduction			
Program: BSc Biotechnology	Class: BSc II Sem	Year: 2022	Session: 2022-2023
1	Course Code	BBT02	
2	Course Title	Microbiology and Molecular Biology	
3	Course Type	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biotechnology in Semester First.	
5	About the course	The course is designed to develop understanding about Microbial world and Molecular mechanisms for regulation of life. After successful completion of first year course, student will be able to earn a Certificate in Biotechnology.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand various categories of microbes of living world. • Develop capability to culture and maintenance of microbes. • Understand regulatory mechanism for precursor of life-DNA • Understand mechanism of genetic expression for regulation of life. 	
6	Credit Value	Theory : 3 + Practical 1 Total credit : 4	
7	Total Marks	Max. Marks: 75+25	Min Passing Marks : 40%
8		External: Internal assessment is 80:20 (in percentage)	

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava
Subject Expert – Dr. Pramod Mahish	Teacher Representation – Dr. Shweta Pandey
Subject Expert – Prof. M. M. Rai	Industrial Representation – Mr. Premanjan Biswas
Chairperson – Prof. Anil Kumar	Student Representation – Dr. Nikhil Mishra

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 60		
Unit	Topics	No. of Lectures
I	<ol style="list-style-type: none"> 1. Classification of microorganisms and taxonomy. 2. Molecular basis of microbial taxonomy. 3. Growth media for culture of bacterial, viral and fungal microbes; sterilisation. 4. Isolation, purification and culture methods of microbes (bacteria, virus and fungi). 	12
II	<ol style="list-style-type: none"> 1. Bacterial reproduction- Conjugation,transduction and transformation. 2. Mycoplasma- Classification, structure and pathogenesis. 3. Virus- Strucuture, classification, multiplication, pathogenesis and bacteriophages. 4. Food and water microbes. 	12
III	<ol style="list-style-type: none"> 1. DNA replication. 2. DNA damage and repair. 3. Transcription in prokaryotes and eukaryotes. 4. Processing of RNA. 	12
IV	<ol style="list-style-type: none"> 1. Genetic code. 2. Translation in prokaryotes and eukaryotes. 3. Post tranlstional modification of proteins. 4. Operon concept. 	12

V	<ol style="list-style-type: none"> 1. Recombination- Homologous and non-homologous recombination. 2. Recombination- Site specific recombination and transposons. 3. Molecular markers. 4. Catalytic RNAs (si RNA and miRNA) 	12
---	---	----

<ul style="list-style-type: none"> • Part C - Learning Resource
Text Books, Reference Books, Other Resources - <ul style="list-style-type: none"> • Molecular Biology; Watson. • Gene VIII; Benjamin Lewin. • The Cell, A molecular Approach; Geoffrey M. Cooper. • Molecular Biology of the Cell; Alberts • Cell and Molecular Biology; Lodish. • Microbiology – Prescott • Microbiology – Pelczar&Pelczar • General Microbiology I and II – Powar and Daginawala • Microbiology – Tortora

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert– Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson–Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation-Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
---	---

B. Sc. I Sem Practical

Total No. of Classes (in hours per week):
Total classes: 30

**B. Sc. II Sem
PRACTICALS (BBP02)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Various techniques for sterilization.
2. Preparation of microbial media.
3. Isolation and culture of microbes from air, soil and water.
4. Determination of Gram positive and Gram negative bacteria.
5. Streak plate method for culturing of microbes.
6. Pour plate method for culturing of microbes.
7. Spread plate method for culturing of microbes.
8. Broth culture method for culturing of microbes.
9. Determination of bacterial growth curve.
10. Isolation of DNA from bacteria, plant and animal cells.
11. Estimation of DNA.
12. Estimation of RNA.
13. Elucidation of DNA bands by electrophoresis.

Scheme of Practical Examination

Duration : 3 Hours

**Maximum marks : 25
Pass marks: 33%**

Distribution of Marks :

	Marks
1. Any two practicals from Molecular Biology and two from Microbiology (Total 4 practicals)	(4X4 = 16)
2. Viva-Voce -	04
3. Field work – (CCE)-	2.5
4. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc II Sem	Year: 2022 Session: 2022-2023
1	Course Code	BBT02-SEC02	
2	Course Title	Nanobiotechnology	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biotechnology in Semester First.	
5	About the course	The course is designed to generate knowledge of Nanoscience technology and its applications for industrial applications.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand the various forms of Nanoscience. • Understand the mechanism for synthesis of Nanomaterials. • Understand Characterisation techniques of Nanomaterials. • Apply various forms of Nanomaterials to resolve problems of life. • Develop practical competency for Nanomaterial synthesis, characterization and applications. 	
6	Credit Value	Theory :1; Practical : 1; Total credit : 2	
7	Total Marks	Max. Marks: 25+25= 50	Min Passing Marks : 40%
8		External: Internal assessment is 80:20 (in percentage)	

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert – Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation – Mr. Premanjan Biswas.....
Chairperson – Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 30		
Unit	Topics	No. of Lectures
I	1. Nanoscience and nanotechnology, classification of nanomaterials. 2. Size dependent properties of nanomaterials (chemical, thermal, electronic, optical and magnetic). 3. Nanoparticle- synthesis, properties and application. 4. Synthesis of nanomaterials by chemical vapour deposition. 5. Synthesis of nanomaterials by physical vapour deposition . 6. Carbon nanotubes- types, synthesis and applications. 7. Characterization of nanomaterials by optical (UV-Vis/fluorescence) and X-ray diffraction method. 8. Characterisation of nanomaterials by imaging and size (TEM/SEM). 9. Characterization of nanomaterials by vibrational (FT-IR)	30

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2022-23-24-25.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert – Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson – Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation – Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
--	---

• Part C - Learning Resource

Text Books, Reference Books, Other Resources -
<ul style="list-style-type: none"> • Biochemistry – Voet, Voet and Pratt • Nanoparticle Technology for Drug Delivery- R.B. Gupta • Biophysical Chemistry – Upadhyaya and Nath • Biophysics- VasanthaPattabhi and N. Gautham

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert – Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson – Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation – Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
--	---

B. Sc. II Sem Practical
Total No. of Classes (in hours per week): Total Credit: 01 (Classes 15) CODE-SEC02

**B. Sc. II Sem
PRACTICALS (SEC)**

The practical work will be based on the theory syllabus and the students will be required

1. Practical demonstration of synthesis of silver nanoparticles using organic and inorganic compounds.
2. Practical demonstration of synthesis of ZnO nanoparticles using organic and inorganic compounds.
3. Practical demonstration of synthesis of green nanoparticles using silver/gold/ZnO/others.
4. Practical demonstration of characterization of nanoparticles by available instruments in the lab.
5. Practical demonstration of antimicrobial, insecticidal, environmental and other applications of nanoparticles.

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

	Marks
1. Any 2 practicals from list	(2X8 = 16)
2. Viva-Voce -	04
4. Field work – (CCE)-	2.5
5. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation–Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc III Sem	Year: 2023 Session: 2023-2024
1	Course Code	BBT03	
2	Course Title	Genetics and Biophysics	
3	Course Type	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biology in class 12 th .	
5	About the course	The course is designed to develop understanding about Genetics and Bio analytical tools.	
6	Course Learning Outcomes (CLO)	After completing this course the students will be able to - <ul style="list-style-type: none"> • Understand classical genetics of inheritance • Understand variation in genes in the form of mutation. • Understand the use of basic physical tools for measurement of biological processes. 	
6	Credit Value	Theory : 3 + Practical 1 Total credit : 4	
7	Total Marks	Max. Marks: 75+25=100	Min Passing Marks : 40%
8		External:Internal assessment is 80:20 (in percentage)	

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 60		
Unit	Topics	No. of Lectures
I	1. Chromosomal organization & chromatin structure: Histone, DNA and nucleosome morphology, metaphase chromosome. 2. Techniques to study chromosome: Karyotyping, banding, chromosome labelling, comparative genome hybridization. 3. Change in chromosome number & structure: Ploidy and rearrangement (Deletion, Duplication, Inversion & Translocation). 4. Mutation: Classification, mechanism, repair, role in evolution.	12
II	1. Concept of gene: Fine structure of gene, split gene, pseudogenes, non-coding genes, overlapping genes & multigene family. 2. Variation at genetic level: DNA marker- VNTR, STR, microsatellite, SNP, RFLP, RAPD, AFLP. 3. Gene Expression: Transcription, Post transcriptional modification, Translation. 4. Gene Regulation: Prokaryotic gene regulation, Eukaryotic gene regulation-	12

	Transcriptional control, post transcriptional regulation, RNA mediated control.	
III	<ol style="list-style-type: none"> 1. Population genetics: calculating genotypic and allele frequencies. 2. Hardy Weinberg law: Deviation from the law due to nonrandom mating, mutation, migration, genetic drift and natural selection. 3. Evolutionary genetics: Molecular variation and protein variation, DNA sequence variation. 4. Speciation and phylogenetic trees. 	12
IV	<ol style="list-style-type: none"> 1. Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM). 2. pH meter, absorption and emission spectroscopy 3. Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), 4. Centrifugation principle and its types. 5. Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC. 	12
V	<ol style="list-style-type: none"> 1. Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno- electrophoresis, isoelectric focusing, 2. Western blotting. 3. Introduction to Biosensors and their applications. 4. Radioisotopes in Biology. 5. Autoradiography, DNA fingerprinting. 	12

• Part C - Learning Resource

Text Books, Reference Books, Other Resources -

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition.

Benjamin Cummings.

4. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
5. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
6. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

B. Sc. III Sem Practical

Total No. of Classes (in hours per week):

Total Credit: 01 (Classes 15)

CODE-BBP03

**B. Sc. III Sem
PRACTICALS (BBP03)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Permanent and temporary mount of mitosis and meiosis.
2. Karyotyping with the help of photographs.
3. Problems regarding Mendelian deviations in dihybrid crosses.
4. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.
5. Temporary mount of Giant chromosome.
6. Separation of chlorophyll by chromatography.
7. Separation of amino acids by paper chromatography.
8. To identify lipids in a given sample by TLC.
9. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.
10. Agarose gel electrophoresis.

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

	Marks
1. Any one practical from each section (Total 4 practicals)	(4X4 = 16)
2. Viva-Voce -	04
1. Field work – (CCE)-	2.5
2. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta PandFey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc III Sem	Year: 2023 Session: 2023-2024
1	Course Code	BBT03-SEC03	
2	Course Title	Molecular Diagnostics	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biology in class 12 th .	
5	About the course	The course is designed to develop understanding about basic knowledge of tools for diagnosis of various genetic variations.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand use of molecular tools for diagnosis of genetic and structural variations. • Understand the use of enzymes as a diagnostic tool. 	
6	Credit Value	Theory 1+ Practical 1; Total credit : 2	
7	Total Marks	Max. Marks: 25+25=50	Min Passing Marks : 40%
8		External:Internal assessment is 80:20 (in percentage)	

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 30		
Unit	Topics	No. of Lectures
I	<ol style="list-style-type: none"> 1. Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. 2. Solid phases used in enzyme immunoassays. Homogeneous and heterogeneous enzyme immunoassays. 3. Enzyme immunoassays after immuno blotting. Enzyme immuno histochemical techniques. 4. Use of polyclonal or monoclonal antibodies in enzymes immuno assays. Applications of enzyme immunoassays in diagnostic microbiology. 5. Molecular methods in clinical microbiology: Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism and plasmid finger printing in clinical microbiology 6. Laboratory tests in chemotherapy: Susceptibility tests: Micro-dilution and macro-dilution broth procedures. 7. Susceptibility tests: Diffusion test procedures. 8. Susceptibility tests: Tests for bactericidal activity. Automated procedures for antimicrobial susceptibility tests. 	30

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
<ul style="list-style-type: none"> • Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker • Bioinstrumentation, Webster • Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic • Ananthanarayan R and Paniker CKJ. (2005). Textbook of Microbiology. 7th edition (edited by Paniker CKJ). University Press Publication

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert – Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation – Mr. Premanjan Biswas.....
Chairperson – Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

B. Sc. III Sem Practical
Total No. of Classes (in hours per week): Total classes: 30

**B. Sc. III Sem
PRACTICALS (SECP03)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Perform/demonstrate RFLP and its analysis
2. Kirby-Bauyer method (disc-diffusion method) to study antibiotic sensitivity of a bacterial culture
3. A kit-basd detection of a microbial infection (Widal test)
4. Perform any one immuno diagnostic test (Typhoid, Malaria, Dengue)

Scheme of Practical Examination

**Duration : 3 Hours
25**

Maximum marks :

Pass marks: 40%

Distribution of Marks :

3. Any one practical from each section
(Total 4 practicals)
4. Viva-Voce -
3. Field work – (CCE)-
4. Practical record –(CCE)-

Marks
(4X4 = 32)

04

2.5

2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

<p>Name and Signatures</p> <p>University Nominee – Prof. K. K. Sahu</p> <p>Subject Expert– Dr. Pramod Mahish.....</p> <p>Subject Expert – Prof. M. M. Rai.....</p> <p>Chairperson–Prof. Anil Kumar.....</p>	<p>Expert from other subject – Prof. Ranjana Shrivastava.....</p> <p>Teacher Representation – Dr. Shweta Pandey.....</p> <p>Industrial Representation-Mr. Premanjan Biswas.....</p> <p>Student Representation – Dr. Nikhil Mishra.....</p>
--	--

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc IV Sem	Year: 2023 Session:2023-2024
1	Course Code	BBT04	
2	Course Title	Recombinant DNA technology and Genomics and Proteomics	
3	Course Type	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Biotechnology in Semester First.	
5	About the course	The course is designed to develop understanding about Recombinant DNA technology and Genomics and proteomics. After successful completion of second year course, student will be able to earn a Diploma in Biotechnology.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand various tools of genetic engineering. • Understand practical application of recombinant DNA technology. • Understand the use of information technology in the field of genome and proteome analysis. 	
6	Credit Value	Theory : 3 + Practical 1 Total credit : 4	
7	Total Marks	Max. Marks: 75+25=100 Min Passing Marks : 40%	
8		External:Internal assessment is 80:20 (in percentage)	

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 60		
Unit	Topics	No. of Lectures
I	<ol style="list-style-type: none"> 1. Recombinant DNA technology: General concept. Steps in gene cloning and application. 2. Host controlled Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq, Pfu polymerase. 3. Nuclease (Endo, Exo and restriction endonuclease). 4. Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyltransferase). Reverse Transcriptase. 	12
II	<ol style="list-style-type: none"> 1. Vectors: Based on Plasmid, Bacteriophages, Cosmid, 2. High capacity vectors. 3. Basic concept of Gene Transfer Methods: Microinjection, Electroporation, Lipofection and Microprojectile. 4. Selection and Screening of Recombinants: Genetic and Hybridization methods. 	12
III	<ol style="list-style-type: none"> 1. PCR: Types of PCR, Steps (Denaturation, Annealing and Extension); 2. Applications, Advantages and Limitation of PCR. 3. Molecular Marker-RFLP, RAPD and Micro array. 4. Human Genome Project. 	12
IV	<ol style="list-style-type: none"> 1. Gene Library: Genomic and cDNA library. 2. Chromosome walking and jumping. 3. Gene Therapy: <i>In vivo</i> and <i>Ex vivo</i>, Germ line and Somatic gene therapy. 4. Basic idea of Stem cell technology: Types of stems cell cultures and their Significance. 	12

V	<ol style="list-style-type: none"> 1. Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. Recombination- Site specific recombination and transposons. 2. Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. 3. Determination of sizes (Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE, Determination of covalent structures – Edman degradation. 4. Introduction to Proteomics, Analysis of proteomes. 2D-PAGE. Sample preparation, solubilization, reduction, resolution. 	12
---	--	----

• Part C - Learning Resource

Text Books, Reference Books, Other Resources -

- Molecular Biology; Watson.
- Gene VIII; Benjamin Lewin.
- The Cell, A molecular Approach; Geoffrey M. Cooper.
- Molecular Biology of the Cell; Alberts
- Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.
- Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
- Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001.

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

<p>Name and Signatures</p> <p>University Nominee – Prof. K. K. Sahu</p> <p>Subject Expert– Dr. Pramod Mahish.....</p> <p>Subject Expert – Prof. M. M. Rai.....</p> <p>Chairperson–Prof. Anil Kumar.....</p>	<p>Expert from other subject – Prof. Ranjana Shrivastava.....</p> <p>Teacher Representation – Dr. Shweta Pandey.....</p> <p>Industrial Representation-Mr. Premanjan Biswas.....</p> <p>Student Representation – Dr. Nikhil Mishra.....</p>
--	--

B. Sc. IV Sem Practical
Total No. of Classes (in hours per week): Total classes: 30

**B. Sc. IV Sem
PRACTICALS (BBP04)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Isolation of chromosomal DNA from plant cells
2. Isolation of chromosomal DNA from *E.coli*
3. Qualitative and quantitative analysis of DNA using spectrophotometer
4. Plasmid DNA isolation
5. Restriction digestion of DNA
6. Transformation of competent cells.
7. Demonstration of PCR.
8. Use of SNP databases at NCBI and other sites
9. Use of OMIM database
10. Detection of Open Reading Frames using ORF Finder

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

5. Any one practical from each section (Total 4 practicals)	Marks (4X4 = 32)
6. Viva-Voce -	04
5. Field work – (CCE)-	2.5
6. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert– Dr. Pramod Mahish..... Subject Expert – Prof. M. M. Rai..... Chairperson–Prof. Anil Kumar.....	Expert from other subject – Prof. Ranjana Shrivastava..... Teacher Representation – Dr. Shweta Pandey..... Industrial Representation–Mr. Premanjan Biswas..... Student Representation – Dr. Nikhil Mishra.....
---	---

Part A: Introduction			
Program: BSc Biotechnology		Class: BSc IV Sem	Year: 2023 Session: 2023-2024
1	Course Code	BBT04-SEC04	
2	Course Title	Bioinformatics	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if any)	To study this course, a student must have/had the subject Bioinformatics in Semester First.	
5	About the course	The course is designed to generate knowledge of Bioinformatics and its applications.	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - <ul style="list-style-type: none"> • Understand the various software tools for dry lab analysis. • Understand the database management system. • Submit and retrieve of data on online bioinformatics databases. 	
6	Credit Value	Theory: 1 + Practical: 1	Total credit : 2
7	Total Marks	Max. Marks: 25+25=50	Min Passing Marks : 40%

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures University Nominee – Prof. K. K. Sahu Subject Expert – Dr. Pramod Mahish Subject Expert – Prof. M. M. Rai Chairperson – Prof. Anil Kumar	Expert from other subject – Prof. Ranjana Shrivastava Teacher Representation – Dr. Shweta Pandey Industrial Representation – Mr. Premanjan Biswas Student Representation – Dr. Nikhil Mishra
---	---

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): Total Lecturer: 30		
Unit	Topics	No. of Lectures
I	1. History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, 2. Understanding the structure of each source and using it on the web. 3. Protein Information Sources, PDB, SWISSPROT, TREMBL. 4. Understanding the structure of each source and using it on the web Sequence and Phylogeny analysis, Detecting 5. Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, 6. Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis. 7. Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. 8. Genome Annotation: Pattern and repeat finding, Gene identification tools.	30

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
<ul style="list-style-type: none"> • Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press. • Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell. • Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....

B. Sc. IV Sem Practical
Total No. of Classes (in hours per week): Total classes: 30

**B. Sc. IV Sem
PRACTICALS (SECP04)**

The practical work will be based on the theory syllabus and the students will be required to perform practical knowledge of the following content as below mention -

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W

Scheme of Practical Examination

Duration : 3 Hours

Maximum marks : 25

Pass marks: 40%

Distribution of Marks :

	Marks
7. Any one practical from each section (Total 4 practicals)	(4X4 = 32)
8. Viva-Voce -	04
7. Field work – (CCE)-	2.5
8. Practical record –(CCE)-	2.5

Total marks 25

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2023-24-25-26.

Name and Signatures	
University Nominee – Prof. K. K. Sahu	Expert from other subject – Prof. Ranjana Shrivastava.....
Subject Expert– Dr. Pramod Mahish.....	Teacher Representation – Dr. Shweta Pandey.....
Subject Expert – Prof. M. M. Rai.....	Industrial Representation-Mr. Premanjan Biswas.....
Chairperson–Prof. Anil Kumar.....	Student Representation – Dr. Nikhil Mishra.....