

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: I Sem Session: 2025-2026
1	Course Code	BTSC-01-T
2	Course Title	Cell Biology and Biochemistry
3	Course Type	Core Course
4	Pre-requisite (if any)	As per program
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to – • Explore and validate the Indian knowledge system and its significance in the field of biotechnology. • Understand cellular organization, their division for the continuation of life, and the 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	03 Credits (Credit = 15 Hours - learning & observation)
7	Total Marks	Max. Marks: 100 Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Basics and IKS 1. The modern concept of the origin of life. 2. Contribution of Indian scientists in biology. 3. Significance of ancient Indian knowledge system in medical science. 4. Structure of cell.	12 (12 Hrs)
II	Cell structure and division 1. Ultrastructure of cell organelles. 2. Ultrastructure of chromosomes. 3. Cell division- Mitosis and meiosis. 4. Biology of cancer cells and apoptosis.	11 (11 Hrs)
III	Basics of biochemistry 1. Carbohydrates- Structure and classification. 2. Lipid- Structure and classification. 3. Amino acids - Structure and classification. 4. Three-dimensional structure of proteins.	11 (11 Hrs)
IV	Metabolism 1. Enzymes- Nomenclature and classification, mechanism of action, and factors affecting enzyme action. 2. Carbohydrate metabolism- Glycolysis, Krebs cycle, gluconeogenesis, glycogenesis. 3. Lipid metabolism- Beta oxidation of fatty acids, fatty acid biosynthesis. 4. Protein metabolism- Transamination, deamination, and synthesis of amino	11 (11 Hrs)

	acids.	
Keywords	Cell, Biomolecules, Cell Division.	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
➤ Text Book- ➤ Biotechnology- U Satyanarayana. ➤ Cell Biology- C B Powar ➤ Cell and Molecular Biology- P K Gupta	
Reference Book- • Practical Biochemistry- Wilson & Walker. ○ Cell biology – C.B.Powar ○ Molecular Biology of the Cell – Alberts ○ Molecular Cell Biology – Lodish ○ Cell and Molecular Biology – Gerald Karp ○ The Cell – Cooper ○ Lehninger- Principles of Biochemistry ○ Nelson & Cox. - Biochemistry ○ Voet& Pratt. – Biochemistry	
Online resources- ➤ https://onlinecourses.nptel.ac.in/noc22_cy06/preview ➤ https://nptel.ac.in/courses/104105076	

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit- 4x10=40 Marks	

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2025-26.

Name and Signatures	Expert from other subject – Prof. G. S. Thakur.....
University Nominee - Prof. K.K. Sahu	Teacher Representation - Dr. Nikhil Mishra
Subject Expert- Dr. Pramod Mahish	Industrial Representation – Mr. Premanjan Biswas
Subject Expert- Prof. M. M. Rai	Student Representation – Mr. Somendra Kumar
Chairperson – Dr. Shweta Pandey	Faculty Member – Mr. Dinesh Kumar

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: I Sem Session: 2025-2026
1	Course Code	BTSC-01-P
2	Course Title	Cell Biology and Biochemistry
3	Course Type	Core Course- Practical
4	Pre-requisite (if any)	As per the program
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to – • Identify animal and plant cells and its replication. • Understand karyogram. • Analyze biomolecules. • Develop expertise in chromatographic techniques.
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50 Min Passing Marks: 20
Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	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. The action of salivary amylase on starch. 9. The action of trypsin on proteins. 10. Separation of amino acids by chromatography. 11. Separation of chlorophyll by chromatography.	30
Keywords	Mitotic index, Giant chromosome, biomolecules.	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
➤ Text Book- ➤ Biotechnology- U Satyanarayana. ➤ Cell Biology- C B Powar ➤ Cell and Molecular Biology- P K Gupta
Reference Book- • Practical Biochemistry- Wilson & Walker. ○ Cell biology – C.B.Powar ○ Molecular Biology of the Cell – Alberts ○ Molecular Cell Biology – Lodish ○ Cell and Molecular Biology – Gerald Karp

○ The Cell – Cooper ○ Lehninger- Principles of Biochemistry ○ Nelson & Cox. - Biochemistry ○ Voet& Pratt. - Biochemistry
Online resources- ➤ https://onlinecourses.nptel.ac.in/noc22_cy06/preview ➤ https://nptel.ac.in/courses/104105076

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: A. On spot Assessment - 20 B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: BSc in Life Sciences (Certificate/ Diploma/Degree/Honors)		Semester: I Sem	Session: 2025-2026
1	Course Code	VAC-01	
2	Course Title	Plants-based Secondary Metabolites	
3	Course Type	Value Added Course	
4	Pre-requisite (if any)	As per requirement.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand the medicinal values applicable to the Indian knowledge system. • Identify the plants with medicinal viability. • Explore the scientific validation of our traditional knowledge. • Develop competency for exploration of secondary metabolites and their application.	
6	Credit Value	02 credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
Part B: Content of Course (Theory)			
Total No. of Teaching-learning Periods (01 Hr. per period)- 30 Periods (30 Hours)			
Unit	Topic (Course content)	No. of Period	
I	Medicinal plants and their viability 1. General account of medicinal plant. 2. Scope of medicinal plants in the Indian market and abroad. 3. Role of medicinal plants in human health, advantage and limitation. 4. The basic theory of instrumental mechanism e.g. Soxhlet, oven, lyophilizer, etc.	08 (08 Hrs)	
II	Significance of the Indian knowledge system 1. Extraction techniques used for secondary metabolite isolation. 2. Secondary metabolite storage. 3. Systems of Indian medicines: Ayurveda, Unani, Siddha, and Homeopathy. 4. Classification of crude drugs: Morphological, taxonomical, chemical, and pharmacological.	07 (07 Hrs)	
III	Methods for phytochemical screening 1. Preparation technique of herbal infusions, decoctions, lotions, etc. 2. Introduction to phytochemical screening-alkaloids, polyphenolic compounds. 3. Introduction to phytochemical screening- glycosides. 4. Introduction to biological testing of herbal drugs (analgesics, anti-inflammatory and antianxiety agents).	08 (08 Hrs)	
IV	Essential industrial regulations 1. Calibration and validation as per ICH and USFDA guidelines. 2. Production management, supply chain management & challenges 3. Government subsidy & industries,	07 (07 Hrs)	

	4. Types of diseases by controlled bioagent formulations.	
Keywords	Secondary metabolite, alkaloids, medicinal plants, phytochemicals.	

Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text Book- Plants Secondary Metabolites- AK Sharma
Plant Secondary Metabolites for Human Health- Dr. M M Abid Ali Khan
- Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur. - Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta – 700 006. - Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers, P.B.No. 91, Jodhpur, India. - A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.
Online resources- https://onlinecourses.nptel.ac.in/noc20_bt34/preview http://acl.digimat.in/nptel/courses/video/102106080/lec14.pdf

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar - 05 Total Marks - 35	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 05 x1= 05 Mark; Q2. Short answer type- 5x2 =10 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x05=20 Marks	

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Four Year Undergraduate Program (2024-28)**Department of Biotechnology****Course Curriculum – 2024-28**

Part A: Introduction			
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: II Sem	Session: 2025-2026
1	Course Code	BTSC-02-T	
2	Course Title	Microbiology and Molecular Biology	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand various categories of microbes in the living world. • Develop the capability to culture and maintenance of microbes. • Understand the regulatory mechanism for the precursor of life-DNA • Understand the mechanism of genetic expression for the regulation of life.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching-learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Maintenance of microbes 1. Classification of microorganisms and taxonomy. 2. Molecular basis of microbial taxonomy. 3. Growth media for culture of bacterial, viral, and fungal microbes; sterilization. 4. Isolation, purification, and culture methods of microbes (bacteria, virus, and fungi).	12 (12 Hrs)
II	Microbial life 1. Bacterial reproduction- Conjugation, transduction, and transformation. 2. Mycoplasma- Classification, structure, and pathogenesis. 3. Virus- Structure, classification, multiplication, pathogenesis and bacteriophages. 4. Food and water microbes.	11 (11 Hrs)
III	Nuclear maintenance and expression 1. DNA replication. 2. DNA damage and repair. 3. Transcription in prokaryotes and eukaryotes. 4. Processing of RNA- Capping, polyadenylation, and splicing.	11 (11 Hrs)
IV	Genetic expression 1. Genetic code. 2. Translation in prokaryotes and eukaryotes. 3. Operon concept. 4. Recombination.	11 (11 Hrs)
Keywords	Microbial taxonomy, RNA, DNA, operon.	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
Text Books- ➤ Textbook of Microbiology- A K Kushwaha. ➤ Microbiology – Dr. Preeti Sharma. ➤ Introduction To Medical Microbiology- Ananthnarayana's ➤ Cell and Molecular Biology- P K Gupta	
Reference Book- • 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 Dagainawala • Microbiology – Tortora.	
Online resources- https://archive.nptel.ac.in/courses/102/103/102103015/ https://onlinecourses.nptel.ac.in/noc24_bt07/preview	

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

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Four Year Undergraduate Program (2024-28)**Department of Biotechnology****Course Curriculum – 2024-28**

Part A: Introduction		
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: II Sem Session: 2025-2026
1	Course Code	BTSC-02-P
2	Course Title	Microbiology and Molecular Biology
3	Course Type	Core Course
4	Pre-requisite (if any)	As per program/12 th .
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to - • Maintenance of microbes. • Identification of microbes. • Isolation of nucleic acid from microbes. • Elucidations of nucleic acids of microbes.
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50 Min Passing Marks: 20
Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	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. 11. Estimation of DNA. 12. Estimation of RNA. 13. Elucidation of DNA bands by electrophoresis.	30
Keywords	Microbes, sterilization, RNA, DNA.	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text Books- ➤ Textbook of Microbiology- A K Kushwaha. ➤ Microbiology – Dr. Preeti Sharma. ➤ Introduction To Medical Microbiology- Ananthnarayana's ➤ Cell and Molecular Biology- P K Gupta
Reference Book- • 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.

Online resources- <https://archive.nptel.ac.in/courses/102/103/102103015/>
https://onlinecourses.nptel.ac.in/noc24_bt07/preview

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: D. On spot Assessment - 20 Marks E. Spotting based on tools & technology (written) – 10 Marks F. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: II Sem	Session: 2025-2026
1	Course Code	BTSEC-01	
2	Course Title	Biopesticides and Biofertilizer	
3	Course Type	Skill Enhancement Course	
4	Pre-requisite (if any)	As per requirement.	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand the basic concept of biofertilizers and biopesticides. • Understand the significance and applications of biofertilizers and biopesticides. • Develop skills for the production and application of biofertilizers. • Develop skills for the production and application of biopesticides.	
6	Credit Value	02 credits (1C + 1C) Credit=15 hours- Theoretical learning and = 30 hours laboratory or field learning/ training.	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
Part B: Content of Course (Theory)			
Total No. of Teaching-learning Periods Theory- 15 Periods (15 Hrs) and Lab or Field learning/Training 30 periods (30 Hours)			
Module	Topic (Course content)		No. of Period
Theory Contents	Concept of biofertilizers and biopesticides 1. Biofertilizers: classification and applications. 2. Symbiotic and asymbiotic process for nitrogen fixation. 3. Methods for production of biofertilizers. 4. Study of VA-mycorrhiza and its application. 5. Biopesticides: classification and applications. 6. Process of production of biopesticides. 7. Importance of <i>Trichoderma</i>, <i>Pseudomonas</i>, and <i>Bacillus</i> species as biocontrol agents. 8. Factors responsible for the effectiveness of bioagents against seed-borne and soil-borne pathogens.		15
Lab/Field Training Contents	1. Media preparation to culture microorganisms. 2. Collection and isolation of agriculturally important microorganisms. 3. Identification and characterization of microorganisms. 4. Screening of superior strains using in vitro techniques. 5. Inoculum development. 6. Preparation of carrier. 7. Mixing of inoculum and carrier. 8. Efficiency check of developed inoculant by using pot experiments.		30
Keywords	Biofertilisers, biopesticides, bioagents.		

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text Book- Biofertilisers and biopesticides – K Acharya, S Sen, M Rai • <u>S. Kannaiyan</u>- Biofertiliser Technology-Scientific Publishers. • Environmental Biotechnology- Himalaya Publishing House.
Reference Book- • Dr. Himadri Panda- The Complete Technology Book on Biofertilizer and Organic Farming- NPCS.
Online resources- https://archive.nptel.ac.in/courses/126/105/126105024/ https://archive.nptel.ac.in/courses/102/105/102105058/

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Marks Continuous Internal Assessment (CIA): 15 Marks End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory/Field Skill Performance: On spot Assessment G. Performed the task based on learned skill - 20 Marks H. Spotting based on tools (written) – 10 Marks I. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2025-26.

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Four Year Undergraduate Program (2024-28)
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Part A: Introduction			
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: III Sem	Session: 2025-2026
1	Course Code	BTSC-03-T	
2	Course Title	Genetics and Biophysics	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand classical genetics of inheritance • Understand variation in genes and its impact. • Understand the use of basic physical tools for the measurement of biological processes.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching-learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Chromosome and gene 1. Techniques to study chromosomes: Karyotyping, banding, chromosome labeling, comparative genome hybridization. 2. Change in chromosome number & structure: Ploidy and rearrangement (Deletion, Duplication, Inversion & Translocation). 3. Concept of gene: Fine structure of gene, split gene, pseudogenes, non-coding genes, overlapping genes & multigene family. 4. Mutation: Classification, mechanism, repair, role in evolution.	12 (12 Hrs)
II	Classical genetics 1. Mendelian genetics- basic principles and interaction of genes. 2. Linkage, Crossing Over. 3. Sex-linked inheritance and pedigree. 4. Cytoplasmic inheritance.	11 (11 Hrs)
III	Instrumentation I 1. Simple microscopy, phase contrast microscopy, fluorescence, 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.	11 (11 Hrs)
IV	Instrumentation II 1. Introduction to electrophoresis. Starch-gel, agarose-gel electrophoresis, immuno-electrophoresis.	11 (11 Hrs)

	2. 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. 3. Introduction to Biosensors and their applications. 4. Radioisotopes in Biology. Autoradiography, DNA fingerprinting.	
Keywords	Gene, Genetic alteration, Spectrophotometry, Electrophoresis.	

Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
Text Book-	
➤ Genetics- PS Verma ➤ Genetics- BD Singh ➤ Genetics- Veer Bala Rastogi	
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons. - Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. - Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings. - Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley& Sons. Inc. - De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia. - Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.	
Online resources- https://archive.nptel.ac.in/courses/102/104/102104052/ https://onlinecourses.swayam2.ac.in/cec21_bt05/preview	

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks	

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Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: III Sem Session: 2025-2026
1	Course Code	BTSC-03-P
2	Course Title	Genetics and Biophysics
3	Course Type	Core Course
4	Pre-requisite (if any)	As per program
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Perform cellular replication. • To conduct genetic inheritance and interpretation. • Nucleic acid estimation. • Perform biological extraction, identification and measurement.
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50 Min Passing Marks: 20

Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Permanent and temporary mount of mitosis and meiosis. 2. Karyotyping with the help of photographs. 3. Problems regarding Genetics and Mendelian deviations in dihybrid crosses. 4. Pedigree charts of some common characteristics like blood group, color blindness, and PTC tasting. 5. Temporary mount of Giant chromosome. 6. Photometric (colorimetric/spectrophotometric) estimation of nucleic acid. 7. Cellular fractionation by centrifugation. 8. Maintenance and operation of laminar airflow. 9. Extraction by using the Soxhlet method. 10. To identify lipids in a given sample by TLC. 11. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH. 12. Operation of electrophoresis for protein.	30
Keywords	Gene, Genetic alteration, Spectrophotometry, Electrophoresis.	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
Text Book-	➤ Genetics- PS Verma ➤ Genetics- BD Singh

➤ Genetics- Veer Bala Rastogi
• Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons. • Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. • Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings. • Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley& Sons. Inc. • De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia. • Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
Online resources- https://archive.nptel.ac.in/courses/102/104/102104052/ https://onlinecourses.swayam2.ac.in/cec21_bt05/preview

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: A. On spot Assessment - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

The syllabus for B.Sc. Biotechnology is hereby approved for the session 2025-26.

Name and Signatures	Expert from other subject – Prof. G. S. Thakur.....
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Subject Expert- Dr. Pramod Mahish	Industrial Representation – Mr. Premanjan Biswas
Subject Expert- Prof. M. M. Rai	Student Representation – Mr. Somendra Kumar
Chairperson – Dr. Shweta Pandey	Faculty Member – Mr. Dinesh Kumar

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: III Sem	Session: 2025-2026
1	Course Code	BTSE-01-T	
2	Course Title	Environmental Biotechnology	
3	Course Type	Elective course	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand wastewater management. • Understand the significance and scope of biodegradation. • Develop skills for bioremediation. • Develop skills for the management of xenobiotics.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching-learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Environmental treatments 1. Domestic (municipal) and industrial wastewater treatments: primary, secondary and tertiary. 2. Important microorganisms in wastewater treatment, principles of their growth and plasmid-borne metabolic activities. 3. Aerobic biological treatments: activated sludge process rotating biological contactors. 4. Anaerobic biological treatments: airlift membrane bioreactors packed bed (column reactor.)	12 (12 Hrs)
II	Environmental degradation 1. Biodegradation: definition and concept, ready biodegradation, ultimate biodegradation and inherent biodegradation. 2. Aerobic and anaerobic degradation pathways in microbes. 3. Biodegradation of hydrocarbon with suitable example. 4. Concept of municipal solid waste management.	11 (11 hrs)
III	Environmental remediation 1. Introduction, definition and concept, methods of bioremediation (in situ and ex-situ methods) 2. Bioremediation of soil (saline soil and alkaline soil) 3. Phytoremediation: concept and types. 4. Applications of bioremediation.	11 (11 hrs)
IV	Environmental contamination 1. Xenobiotics and recalcitrancy. 2. Xenobiotics degradation: pesticide degradation, herbicide degradation 3. Metabolism of xenobiotics.	11 (11 hrs)

	5. Cytochrome p450 system, phase I, phase II, metabolic reactions.	
Keywords	Wastewater management, biodegradation, bioremediation, xenobiotics.	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text Book- • Murugesan A. G. and Rajakumari C-Environmental Science and Biotechnology: Theory & Techniques, MJP • Asthana D.K. and Asthana M.,-Environment: Problems and Solutions- S. Chand • Chatterji A.K., Introduction to Environmental Biotechnology, Prentice Hall of India Pvt. Ltd
Reference Book- • Jogdand S.N.- Environmental Biotechnology- Himalaya Publishing House • Kalaichelvan P.T., I Arul Pandi- Bioprocess Technology, MJP Publishers • Rajendran, Gunashekar- Microbial Bioremediation-MJP • Hammer & Hammer-Water & Wastewater Technology-PHI • Metcalf & Eddy-Waste water Engineering-TMH • Indushekar Thakur- Environmental Biotechnology-I K International
Online resources- https://onlinecourses.nptel.ac.in/noc21_bt41/preview http://acl.digimat.in/nptel/courses/video/102105088/102105088.html

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40 Marks	

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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: III Sem	Session: 2025-2026
1	Course Code	BTSE-01-P	
2	Course Title	Environmental Biotechnology	
3	Course Type	Elective course (Practical)	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand and analyze physical and chemical parameters of the water bodies. • Estimate biological pollutants from the water bodies. • Determine physical and nutritional conditions of the soil. • Estimate various inorganic and organic contents from pollutants.	
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training	
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Determination of DO, and BOD, from polluted water sample. 2. Determination of COD from a polluted water sample. 3. Bacterial examination of water by MPN test. 4. Coliform test. 5. Determination of soil pH and total organic carbon. 6. NPK determination from soil. 7. Determination of alkalinity and hardness of water. 8. Estimation of total nitrogen in Kjeldahl's method.	30
Keywords	Wastewater management, biodegradation, bioremediation, xenobiotics.	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
Text Book- • Murugesan A. G.and Rajakumari C-Environmental Science and Biotechnology: Theory &Techniques, MJP • Asthana D.K. and Asthana M.,-Environment: Problems and Solutions- S. Chand • Chatterji A.K., Introduction to Environmental Biotechnology, Prentice Hall of India Pvt. Ltd	
Reference Book- • Jogdand S.N.- Environmental Biotechnology- Himalaya Publishing House • Kalaichelvan P.T., I Arul Pandi- Bioprocess Technology, MJP Publishers • Rajendran, Gunashekar- Microbial Bioremediation-MJP • Hammer & Hammer-Water & Wastewater Technology-PHI	

• Metcaf & Eddy-Waste water Engineering-TMH • Indushekhar Thakur- Environmental Biotechnology-I K Internation
Online resources- https://onlinecourses.nptel.ac.in/noc21_bt41/preview http://acl.digimat.in/nptel/courses/video/102105088/102105088.html

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Marks Continuous Internal Assessment (CIA): 15 Marks End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: J. On spot Assessment - 20 K. Spotting based on tools & technology (written) – 10 Marks L. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

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Subject Expert- Prof. M. M. Rai	Student Representation – Mr. Somendra Kumar
Chairperson – Dr. Shweta Pandey	Faculty Member – Mr. Dinesh Kumar

Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction			
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: IV Sem	Session: 2025-2026
1	Course Code	BTSC-04-T	
2	Course Title	Recombinant DNA technology	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - • Understand various tools of genetic engineering. • Develop competency in genetic exploitation for human welfare. • Understand the practical application of recombinant DNA technology. • Understand the use of information technology in the field of genome and proteome analysis.	
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)	
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching-learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Prerequisites of rDNA technology 1. Recombinant DNA technology: General concept. Steps 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 (12 Hrs)
II	Gene transfer 1. Vectors: Based on Plasmid, Bacteriophages, Cosmid. 2. High capacity vectors. 3. The basic concept of Gene Transfer Methods: Microinjection, Electroporation, Lipofection, and Microprojectile. 4. Selection and Screening of Recombinants: Genetic and Hybridization methods.	11 (11 Hrs)
III	Genomic validation 1. PCR: Types of PCR, Steps, Applications, Advantages and Limitations of PCR. 2. Molecular Marker-RFLP, RAPD, and Microarray. 3. Human Genome Project. 4. Gene Library: Genomic and cDNA library, Chromosome walking and jumping.	11 (11 Hrs)
IV	Application of genetic technology 1. Gene Therapy: <i>In vivo</i> and <i>Ex vivo</i>, germline and somatic gene therapy. 2. Basic idea of stem cell technology: Types of stem cell cultures and their	11 (11 Hrs)

	Significance. 3. Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. 4. 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, and Hydrophobic interactions.	
Keywords	Recombinant DNA, Vectors, PCR, cDNA library.	

Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
Text Book-	
➤ P S Verma and A K Agrawal ➤ An introduction to genetic engineering- S T Tischoll	
- 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.	
- Online resources- https://onlinecourses.swayam2.ac.in/cec21_bt05/preview https://archive.nptel.ac.in/courses/102/104/102104052/	

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Internal Assessment (CIA):		30 Marks
End Semester Exam (ESE):		70 Marks
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark ; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40 Marks	

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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: IV Sem Session: 2025-2026
1	Course Code	BTSC-04-P
2	Course Title	Recombinant DNA technology
3	Course Type	Core Course
4	Pre-requisite (if any)	As per program
6	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - - Isolate nucleic acid from biological cells. - Estimate and manipulate nucleic acid. - Amplify nucleic acid. - Analyse nucleic acid on the basis of database.
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50 Min Passing Marks: 20

Part B: Content of Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation of chromosomal DNA from plant cells 2. Isolation of chromosomal DNA from <i>E.coli</i> 3. Qualitative and quantitative analysis of DNA using spectrophotometer 4. Plasmid DNA isolation 5. Restriction digestion of DNA. 6. Ligation of DNA. 7. Transformation of competent cells. 8. Demonstration of PCR. 9. Use of SNP databases at NCBI and other sites. 10. Use of OMIM database 11. Detection of Open Reading Frames using ORF Finder	30
Keywords	Recombinant DNA, Vectors, PCR, cDNA library.	

Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text Book- ➤ P S Verma and A K Agrawal ➤ An introduction to genetic engineering- S T Tischoll
• 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.
• Online resources- https://onlinecourses.swayam2.ac.in/cec21_bt05/preview • https://archive.nptel.ac.in/courses/102/104/102104052/ •

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Marks Continuous Internal Assessment (CIA): 15 Marks End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA) (By course teacher):	Internal Test / Quiz-(2): 10 +10 Assignment / Seminar + Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Degree/Honors)		Semester: IV Sem Session: 2025-2026
1	Course Code	BTSE-02-T
2	Course Title	Bioprocess Engineering
3	Course Type	Elective course
4	Pre-requisite (if any)	As per program
5	Course Learning Outcomes (CLO)	After completing this course, the students will be able to - - Understand the prerequisite of bioprocess engineering. - Develop skills for the operation of bioreactors. - Develop skills for industrial production. - Understand the geological exploitation by the process of bioprocess engineering.
6	Credit Value	03 Credits (Credit = 15 Hours - learning & observation)
7	Total Marks	Max. Marks: 100 Min Passing Marks: 40

Part B: Content of Course (Theory)		
Total No. of Teaching-learning Periods (01 Hr. per period)- 45 Periods (45 Hours)		
Unit	Topic (Course content)	No. of Period
I	Concept of bioprocess engineering - Introduction to bioprocess engineering. - Isolation, preservation, and maintenance of industrial microorganisms. - Media for industrial fermentation. - Kinetics of microbial fermentation.	12 (12 Hrs)
II	Bioreactors - Types of fermentation processes. - Operations of bioreactors. - Measurement and control of bioprocess parameters. - Downstream processing.	11 (11 hrs)
III	Bioproducts - Production of alcohol, acids and solvents. - Production of antibiotics. - Production of amino acids. - Whole cell immobilization for industrial application.	11 (11 hrs)
IV	Microbial role and regulation - Application of microbes in mineral beneficiation. - Application of microbes for oil recovery. - Quality control, quality assurance and standard operating procedures of fermenter. - Good manufacturing practices.	11 (11 hrs)
Keywords	Fermentation, bioreactors, fermentation-based production, mineral beneficiation.	

Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text book- Industrial Biotechnology- D Das Industrial Microbiology- A.H. Patel.
Reference Book- - Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, Inc., Tata Mcgraw Hill, N. Delhi. - Microbiology- Pelczar&Pelczar. - Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi. - Principles of Fermentation Technology; Stanburry. - Industrial Microbiology; Casida.
Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/ http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
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End Semester Exam (ESE): 70 Marks		
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Four Year Undergraduate Program (2024-28)
Department of Biotechnology
Course Curriculum

Part A: Introduction		
Program: Bachelor in Life Sciences (Diploma/Degree/Honors)		Semester: IV Sem Session: 2025-2026
1	Course Code	BTSE-02-P
2	Course Title	Bioprocess Engineering
3	Course Type	Elective course (Practical)
4	Pre-requisite (if any)	As per program
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to - - Isolate and maintain industrially significant microbes. - Develop skills for alcoholic production. - Develop skills for acid production. - Develop skills for antibiotic and enzyme production.
6	Credit Value	01 Credits Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50 Min Passing Marks: 20

Part B: Content of Course (Theory)		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Isolation of industrially important microorganisms for microbial process. 2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganisms. 3. Comparative studies of ethanol production using different substrates. 4. Microbial production of citric acid using <i>Aspergillus niger</i> . 5. Microbial production of antibiotics (<i>Penicillin</i>) 6. Production and estimation of alkaline protease.	30
Keywords	Fermentation, bioreactors, fermentation-based production, mineral beneficiation.	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Text book- Industrial Biotechnology- D Das Industrial Microbiology- A.H. Patel.
Reference Book- - Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, Inc., Tata Mcgraw Hill, N. Delhi. - Microbiology- Pelczar&Pelczar. - Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi. - Principles of Fermentation Technology; Stanburry. - Industrial Microbiology; Casida.
Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/ http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
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