

SYLLABUS FOR THE ONE-YEAR POSTGRADUATE PROGRAMME

Only Course Work

As per provisions of NEP_2020 to be implemented from academic year 2026 onwards

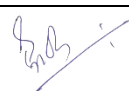
Subject: Biotechnology

Core/ DSC (3+1)	MDC (4)
Sem 1 Basics of Gene Manipulation Sem 1 Immunobiology Sem 1 Bioprocessing Sem 2 Bioinformatics Sem 2 Biotechnology Tools Sem 2 Human Genomics and Proteomics	Sem 1 IPR and Bioethics in Biotechnology Sem 2 Food Biotechnology
DSE (3+1)	PC (4)
Sem 1 Biotechnology for Environment Sem 1 Industrial Products of Biotechnology Sem 2 Animal Cell Culture and Applications Sem 2 Research Methodology	Sem 1 Water Quality: Analysis and Improvement Sem 2 Biological Database Management and Drug Discovery
SEC (2)	VAC (2)
Sem 1 Entrepreneurship in Biotechnology	Sem 2 Nano-Biotechnology

Semester	SCHEME OF SEMESTER EXAMINATION FOR SESSION 2026-27				
	Department of Biotechnology, Govt. Digvijay P. G. College, Rajnandgaon, (C.G.)				
	One Year M. Sc. BIOTECHNOLOGY (Semester I to II)				
First Semester	Paper	Title of Paper	Credit	(External)	(Internal)
	DSC-I	Basics of Gene Manipulation	3+1	70	30
	DSC-II	Immunobiology	3+1	70	30
	DSC-III	Bioprocessing	3+1	70	30
	DSE - I	Biotechnology for Environment	3+1	70	30
	DSE - II	Industrial Products of Biotechnology	3+1	70	30
	MDC	IPR and Bioethics in Biotechnology	4	70	30
	PC	Water Quality: Analysis and Improvement	4	70	30
	SEC	Entrepreneurship in Biotechnology	2	35	15
Second Semester	Paper	Title of Paper		(External)	(Internal)
	DSC-I	Bioinformatics	3+1	70	30
	DSC-II	Biotechnology tools	3+1	70	
	DSC-III	Human Genomics and Proteomics	3+1	70	30
	DSE - I	Animal Cell Culture and Applications	3+1	70	30
	DSE - II	Research Methodology	3+1	70	30
	MDC	Food Biotechnology	4	70	30
	PC	Biological Database management and Drug Discovery	4	70	30
	VAC	Nano-Biotechnology	2	35	15

Department of Biotechnology
Semester I
Scheme of Examination

Paper Code	Title of Theory/Practical Paper	Marks Theory		Marks Practical	
DSC-I	Basics of Gene Manipulation	70	30	35	15
DSC-II	Immunobiology	70	30	35	15
DSC-III	Bioprocessing	70	30	35	15
DSE - I	Biotechnology for Environment	70	30	35	15
DSE - II	Industrial Products of Biotechnology	70	30	35	15
MDC	IPR and Bioethics in Biotechnology	70	30	NA	NA
PC	Water Quality: Analysis and Improvement	70	30	NA	NA
SEC	Entrepreneurship in Biotechnology	35	15	NA	NA

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Basics of Gene Manipulation	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Explain principles, tools, and techniques used in genetic engineering. • Construct and analyze recombinant DNA using suitable vectors and hosts. • Apply molecular cloning, library screening, and gene mapping techniques. • Evaluate genome editing approaches including CRISPR-Cas9 and mutagenesis. • Assess applications of recombinant DNA technology in biotechnology and medicine.	
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	Fundamentals of Genetic Engineering and Gene Manipulation • Scope, History and Applications of Genetic Engineering • Principles and Steps of Gene Cloning • Molecular Tools in Genetic Engineering • Restriction Enzymes: Nomenclature, Classification and Cleavage Patterns • DNA Modification Enzymes and Their Applications • DNA Cutting, Joining and Ligation Strategies • Linkers, Adaptors and Homopolymer Tailing Techniques • Advanced Techniques for Gene Manipulation and DNA Construction	12 (12 Hrs)
II	Cloning Vectors, Libraries and Host Systems • Characteristics and Types of Gene Cloning Vectors • Plasmids, Bacteriophages, Phagemids and Cosmids • Artificial Chromosomes and Yeast Artificial Chromosomes (YACs) • Isolation, Purification and Preparation of Desired DNA Fragments • Genomic and cDNA Libraries: Construction and Screening	11 (11 Hrs)

	• Vector–Insert Ligation and Recombinant DNA Formation • Selection of Suitable Host Cells and Expression Systems • Identification and Selection of Recombinant Clones	
III	Advanced Gene Cloning and Genome Engineering • Strategies for Molecular Cloning and Recombinant DNA Library Construction • Gene Probe Design, Labeling and Hybridization Techniques • Screening and Identification of Recombinant Clones • Gene Mapping and Molecular Marker-Based Analysis • Site-Directed Mutagenesis and Protein Engineering • CRISPR–Cas9 Technology and Genome Editing • T-DNA and Transposon Tagging Techniques • Phage Display Technology and Its Applications	11 (11 Hrs)
IV	Gene Transfer, Analysis and Applications of Genetic Engineering • Gene Transfer Methods: Transformation, Transduction and Transfection • Electroporation, Microinjection, Liposome-Mediated and Particle Bombardment Techniques • Agrobacterium-Mediated Gene Transfer in Plants • Analysis of Cloned Genes and DNA Amplification Techniques • Colony Hybridization, Plaque Hybridization and Reporter Gene Systems • Southern, Northern and Western Blotting Techniques • Applications of Recombinant DNA Technology: Recombinant Proteins and Edible Vaccines • Gene Therapy, Vector Engineering and Applications of Genetic Engineering in Human Welfare	11 (11 Hrs)
Keywords	Gene Cloning, Recombinant DNA Technology, Genome Editing Cloning Vectors, Gene Transfer and Gene Therapy	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Principles of Gene Manipulation and Genomics, Authors: Sandy B. Primrose and Richard Twyman, Edition/Year: 8th Edition, 2016, Publisher: Wiley-Blackwell • Molecular Biotechnology: Principles and Applications of Recombinant DNA, Authors: Bernard R. Glick, Jack J. Pasternak and Cheryl L. Patten, Edition/Year: 5th Edition, 2017, Publisher: ASM Press • Recombinant DNA: Genes and Genomes—A Short Course, Authors: James D. Watson, Amy A. Caudy, Richard M. Myers and Jan A. Witkowski, Edition/Year: 4th Edition, 2018, Publisher: W.H. Freeman • Gene Cloning and DNA Analysis: An Introduction, Author: Terry A. Brown, Edition/Year: 8th Edition, 2020, Publisher: Wiley-Blackwell • Genomes 4, Author: Terry A. Brown, Edition/Year: 2017, Publisher: Garland Science • Molecular Cloning: A Laboratory Manual, Authors: Michael R. Green and Joseph Sambrook, Edition/Year: 4th Edition, 2012, Publisher: Cold Spring Harbor Laboratory Press • Lewin's Genes XII, Authors: Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T.

Kilpatrick, Edition/Year: 2018, Publisher: Jones & Bartlett Learning

- **From Genes to Genomes: Concepts and Applications of DNA Technology**, Authors: Jeremy W. Dale and Malcolm von Schantz, Edition/Year: 3rd Edition, 2011, Publisher: Wiley-Blackwell
- **CRISPR-Cas Systems: RNA-Mediated Adaptive Immunity in Bacteria and Archaea**, Editors: Rodolphe Barrangou and John van der Oost, Edition/Year: 2013, Publisher: Springer
- **Introduction to Genetic Engineering**, Authors: Desmond S. T. Nicholl, Edition/Year: 4th Edition, 2018, Publisher: Cambridge University Press
- NPTEL – **Genetic Engineering & Applications**, <https://nptel.ac.in/courses/102103013>
- SWAYAM - Genetic Engineering and Its Recent Advancements https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_bt03

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
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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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Approval of the Board of Studies

Date: 03-09-2026

Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-2027
1	Course Code	BT/DSC-1C-PR	
2	Course Title	Basics of Gene Manipulation	
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 – • Isolate, quantify and analyze genomic, plasmid DNA and RNA from microorganisms. • Perform restriction digestion, ligation and recombinant DNA construction. • Apply transformation techniques for introduction of recombinant DNA into host cells. • Utilize PCR and electrophoresis for molecular analysis of nucleic acids. • Interpret experimental results related to gene cloning and genetic engineering.	
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	•Extraction of Genomic DNA from Escherichia coli (E. coli). •Estimation of Bacterial DNA by Spectrophotometric Methods. •Separation of Bacterial Genomic DNA by Agarose Gel Electrophoresis. •Isolation of Plasmid DNA from E. coli. •Quantification and Purity Assessment of Plasmid DNA using UV spectrophotometry. •Restriction Digestion of DNA Using Restriction Endonucleases. •Analysis of Restriction Digestion Products by Agarose Gel Electrophoresis. •Ligation of DNA Fragments Using T4 DNA Ligase. •Preparation of Competent E. coli Cells by calcium chloride method. •Transformation of Competent E. coli with Recombinant Plasmid DNA. •Selection and Screening of Recombinant Clones using antibiotic selection and blue-white screening. •Preparation of Total Cellular RNA from E. coli by Hot Phenol Method. •Estimation of Cellular RNA by Spectrophotometric Methods. •Polymerase Chain Reaction (PCR) Amplification of Target DNA.	30	

	• Analysis of PCR Products by Agarose Gel Electrophoresis and Documentation.	
Keywords	Recombinant DNA Technology, Plasmid DNA, Restriction Enzymes, Gene Cloning, Transformation	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Molecular Cloning: A Laboratory Manual, Authors: Michael R. Green and Joseph Sambrook, 4th Edition, 2012, Publisher: Cold Spring Harbor Laboratory Press. • Current Protocols in Molecular Biology, Editors: Frederick M. Ausubel et al., Latest Edition, Publisher: Wiley. • Principles and Techniques of Biochemistry and Molecular Biology, Authors: Keith Wilson and John Walker, 8th Edition, 2018, Publisher: Cambridge University Press. • Molecular Biotechnology: Principles and Applications of Recombinant DNA, Authors: Bernard R. Glick, Jack J. Pasternak and Cheryl L. Patten, 5th Edition, 2017, Publisher: ASM Press. • Laboratory Manual in Biotechnology, Author: P. Gunasekaran, 2019 Edition, Publisher: New Age International Publishers.

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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment / Seminar + Attendance-	05	
	Total Marks -	15	
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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Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: I Sem (1YR)	Session:2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Immunobiology	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Explain the organization, components, and functions of the immune system. • Describe mechanisms of antigen recognition and immune effector responses. • Analyze roles of immune cells, cytokines, and MHC molecules. • Interpret immunological disorders, hypersensitivity, autoimmunity, and immunodeficiencies. • Evaluate applications of transplantation, monoclonal antibodies, and immunotechnology.	
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	Fundamentals of Immunology and Immune Recognition • Introduction to Immunology and Evolution of the Immune System • Innate and Adaptive Immunity: Components and Characteristics • Organization and Structure of Primary and Secondary Lymphoid Organs • Antigens: Properties, Types and Immunogenicity • Antibody Structure, Classes and Biological Functions • Antigen-Binding Sites and Antigen Recognition Mechanisms • Antigen–Antibody Interactions and Their Characteristics • Applications of Antigen–Antibody Reactions in Immunodiagnostic	12 (12 Hrs)
II	Immune System Components and Effector Mechanisms • Major Histocompatibility Complex (MHC): Structure and Functions • Antigen Processing and Antigen Presentation Pathways • Complement System: Components, Activation Pathways and Functions • Hematopoiesis and Differentiation of Immune Cells	11 (11 Hrs)

	• B Lymphocytes and Antibody-Mediated Immunity • T Lymphocytes and Cell-Mediated Immunity • Macrophages, Dendritic Cells and Natural Killer Cells • Eosinophils, Neutrophils and Mast Cells in Immune Responses	
III	Immune Regulation and Immunopathology • Generation of Humoral and Cell-Mediated Immune Responses • Activation, Proliferation and Differentiation of B and T Lymphocytes • Cytokines and Their Role in Immune Regulation • Immunological Tolerance and Maintenance of Self-Tolerance • Cell-Mediated Cytotoxicity: T Cell and NK Cell Mechanisms • Antibody-Dependent and Macrophage-Mediated Cytotoxicity • Hypersensitivity Reactions: Types and Mechanisms • Autoimmunity and Autoimmune Disorders	11 (11 Hrs)
IV	Applied Immunology and Immunotechnology • Principles and Types of Transplantation • Transplant Rejection and Immunological Compatibility • Immunity to Intracellular Pathogens, Helminths and Viruses • AIDS and Other Immunodeficiency Disorders • Hybridoma Technology and Monoclonal Antibody Production • Applications of Monoclonal Antibodies in Diagnosis and Therapy • Immunological Techniques in Biomedical Research • Recent Advances in Immunotherapy and Vaccine Development	11 (11 Hrs)
Keywords	Innate and Adaptive Immunity, Antigen–Antibody Interactions, Major Histocompatibility Complex (MHC), Immune Regulation and Immunopathology Monoclonal Antibodies and Immunotechnology	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Kuby Immunology, Authors: Jenni Punt, Sharon A. Stranford, Patricia P. Jones and Judy A. Owen, Edition/Year: 9th Edition, 2022, Publisher: W.H. Freeman and Company • Janeway's Immunobiology, Authors: Kenneth Murphy and Casey Weaver, Edition/Year: 10th Edition, 2022, Publisher: Garland Science • Cellular and Molecular Immunology, Authors: Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai, Edition/Year: 11th Edition, 2023, Publisher: Elsevier • Roitt's Essential Immunology, Authors: Ivan Roitt, Jonathan Brostoff and David Male, Edition/Year: 14th Edition, 2024, Publisher: Wiley-Blackwell • Immunology: A Short Course, Authors: Richard Coico and Geoffrey Sunshine, Edition/Year: 8th Edition, 2021, Publisher: Wiley-Blackwell • Basic Immunology: Functions and Disorders of the Immune System, Authors: Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai, Edition/Year: 7th Edition, 2023, Publisher: Elsevier • Immunology, Authors: David Male, Jonathan Brostoff, David B. Roth and Ivan Roitt, Edition/Year: 10th Edition, 2020, Publisher: Elsevier • Essentials of Immunology, Authors: C. V. Rao, Edition/Year: 3rd Edition, 2018, Publisher: Narosa Publishing House • Textbook of Immunology, Authors: S. K. Mohanty and U. K. Chaturvedi, Edition/Year:

Revised Edition, 2019, Publisher: Jaypee Brothers Medical Publishers

- Medical Immunology, Authors: Tristram G. Parslow, Daniel P. Stites, Abba I. Terr and John B. Imboden, Edition/Year: Reprint Edition, 2015, Publisher: McGraw-Hill Education
- NPTEL – Immunology, <https://nptel.ac.in/courses/102105083>
- SWAYAM – Fundamentals of General Immunology, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_bt52

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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar -	10	
	Total Marks -	30	
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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Date: 03-09-2026

Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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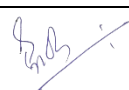
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Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-2027
1	Course Code	BT/DSC-1C-PR	
2	Course Title	Immunobiology	
3	Course Type	Core Course- Practical	
4	Pre-requisite (if any)	As per the program	
5	Course Learning Outcomes (CLO)	After completing this practical course, the students will be able to – • Demonstrate basic hematological and immunological laboratory techniques. • Analyze blood components and serum proteins using biochemical and immunological methods. • Perform and interpret antigen–antibody interaction assays. • Apply immunodiagnostic techniques for detection and characterization of antibodies and antigens. • Evaluate immunological data for clinical, diagnostic and research applications	
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	• Enumeration of WBC in blood sample. • Preparation of a blood smear and differential blood count. • To separate serum from the given blood sample. • To determine Albumin Globulin ratio in given serum sample. • Estimation of serum protein by Folin Lowry test. • Isolation of Immunoglobulin. • Separation of serum protein by SDS PAGE. • Detection of class specific Antibody by Double Diffusion method. • Observe Ag-Ab interaction by Immunoelectrophoresis. • Observe Ag-Ab interaction by counter current Immunoelectrophoresis. • Study of Agglutination reaction • Study of ELISA technique. • Immuno diffusion test. • Blood group determination by slide agglutination reaction.	30	
Keywords	Immunology, Antigen–Antibody Interaction, Immunodiagnostics, Serum Proteins, ELISA and Agglutination		

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
• Practical Immunology, Author: Frank C. Hay and Olwyn M. R. Westwood, 4th Edition, 2002, Publisher: Blackwell Science. • Laboratory Manual and Workbook in Microbiology: Applications to Patient Care, Authors: Anne M. Van Leeuwen and Mickey L. Bladh, 8th Edition, 2021, Publisher: Elsevier. • Basic and Clinical Immunology Laboratory Manual, Authors: Daniel P. Stites and colleagues, Latest Edition, Publisher: McGraw-Hill Education. • Practical Immunology: A Laboratory Manual, Author: John R. W. Masters, 2015 Edition, Publisher: Wiley-Blackwell. • Manual of Clinical Laboratory Immunology, Editors: Barbara Detrick, Robert G. Hamilton and John D. Folds, 8th Edition, 2016, Publisher: ASM Press.	

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 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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Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Bioprocessing	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Explain principles of microbial growth and industrial bioprocess operations. • Select suitable microorganisms, media, and bioreactors for fermentation processes. • Analyze operational parameters affecting fermentation performance and productivity. • Apply downstream processing techniques for recovery and purification of bioproducts. • Evaluate industrial applications of bioprocess technology in biotechnology sectors.	
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	Fundamentals of Bioprocess Engineering • Introduction to Bioprocess Engineering and Industrial Biotechnology • Microbial Growth Kinetics and Growth Models • Microbial Death Kinetics and Process Dynamics • Isolation, Screening and Selection of Industrial Microorganisms • Preservation and Maintenance of Industrial Microbial Cultures • Fermentation Media Design, Optimization and Sterilization	12 (12 Hrs)
II	Bioreactors and Fermentation Technology • Principles and Types of Fermentation Processes • Batch, Fed-Batch and Continuous Fermentation Systems • Stirred Tank Bioreactors: Design and Operation • Specialized Bioreactors: Fluidized Bed and Photobioreactors • Aeration, Agitation and Oxygen Transfer in Bioprocesses	11 (11 Hrs)

	Monitoring and Control of Fermentation Parameters	
III	Downstream Processing and Product Recovery - Principles and Strategies of Downstream Processing - Removal of Microbial Cells and Solid Matter - Cell Disruption and Release of Intracellular Products - Product Concentration and Purification Techniques - Chromatographic Methods in Bioprocessing - Product Formulation, Quality Control and Process Economics	11 (11 Hrs)
IV	Industrial Applications of Bioprocess Engineering - Industrial Production of Ethanol and Organic Acids - Production of Citric Acid, Amino Acids and Antibiotics - Single Cell Protein: Production and Industrial Applications - Bioprocess Applications in Bioenergy Production - Microbial Technologies for Waste Management and Bioremediation - Recent Advances and Emerging Trends in Industrial Biotechnology	11 (11 Hrs)
Keywords	Bioprocess Engineering, Fermentation Technology, Bioreactor Design Downstream Processing, Industrial Biotechnology	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
Bioprocess Engineering: Basic Concepts, Authors: Michael L. Shuler and Fikret Kargi, Edition/Year: 3rd Edition, 2017, Publisher: Pearson Education Bioprocess Engineering Principles, Author: Pauline M. Doran, Edition/Year: 2nd Edition, 2013, Publisher: Academic Press (Elsevier) Principles of Fermentation Technology, Authors: Peter F. Stanbury, Allan Whitaker and Stephen J. Hall, Edition/Year: 3rd Edition, 2017, Publisher: Butterworth-Heinemann (Elsevier) Biotechnology: A Textbook of Industrial Microbiology, Authors: Wulf Crueger and Anneliese Crueger, Edition/Year: 3rd Edition, 2019 Reprint, Publisher: Panima Publishing Corporation Industrial Microbiology, Author: A. H. Patel, Edition/Year: 3rd Edition, 2020, Publisher: Macmillan Publishers India Industrial Microbiology: An Introduction, Author: Michael J. Waites, Edition/Year: 2nd Edition, 2013, Publisher: Wiley-Blackwell Comprehensive Biotechnology, Editors: Murray Moo-Young, Edition/Year: 3rd Edition, 2019, Publisher: Elsevier Biochemical Engineering Fundamentals, Author: James E. Bailey and David F. Ollis, Edition/Year: 2nd Edition, Reprint 2017, Publisher: McGraw-Hill Education Fermentation Microbiology and Biotechnology, Authors: E. M. T. El-Mansi, C. F. A. Bryce, A. L. Demain and A. R. Allman, Edition/Year: 4th Edition, 2019, Publisher: CRC Press Manual of Industrial Microbiology and Biotechnology, Editors: Richard H. Baltz, Arnold L. Demain and Julian E. Davies, Edition/Year: 4th Edition, 2010, Publisher: ASM Press - NPTel – Principles of Downstream Techniques in Bioprocess, , https://nptel.ac.in/courses/102106022 - SWAYAM – Fundamentals of Bioprocess Engineering, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_bt95

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: I Sem (1YR)	Session:2026-2027
1	Course Code	BT/DSC-1C-PR	
2	Course Title	Bioprocessing	
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 – • Isolate and characterize industrially important microorganisms from environmental samples. • Analyze microbial growth kinetics and thermal death parameters. • Perform fermentation processes for production of organic acids, enzymes and bioethanol. • Evaluate enzyme activity and kinetic parameters using standard assays. • Apply solid-state and submerged fermentation techniques for industrial biotechnology applications.	
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	• Isolation and Identification of Microorganisms from Industrial Wastewater using selective media and biochemical characterization. • Enumeration of Microbial Population in Industrial Effluents by serial dilution and plate count methods. • Determination of Thermal Death Point (TDP) of Bacteria and Fungi. • Determination of Thermal Death Time (TDT) of Microorganisms under controlled temperature conditions. • Study of Bacterial Growth Curve using spectrophotometric and viable count methods. • Study of Fungal Growth Curve by dry weight measurement or biomass estimation. • Preparation and Optimization of Fermentation Media for microbial growth and product formation. • Production of Citric Acid by <i>Aspergillus niger</i> under submerged fermentation conditions. • Bioethanol Production from Carbohydrate Sources using yeast fermentation.		30

	• Estimation of Ethanol Yield by specific gravity, distillation or chemical methods. • Production of Industrial Enzymes from Microbial Sources (e.g., amylase, protease or cellulase). • Determination of Enzyme Kinetics (K_m and V_{max}) using Michaelis–Menten analysis. • Solid-State Fermentation (SSF) for production of enzymes or organic acids using agro-industrial residues.	
Keywords	Fermentation Technology, Industrial Microorganisms, Enzyme Production Bioethanol, Bioprocess Engineering	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Experiments in Microbiology, Plant Pathology and Biotechnology, Author: K. R. Aneja, 5th Edition, 2017, Publisher: New Age International Publishers. • Biochemical Engineering Fundamentals, Author: James E. Bailey and David F. Ollis, 2nd Edition, 2010 Reprint, Publisher: McGraw-Hill Education. • Laboratory Manual in Industrial Biotechnology, Author: P. Gunasekaran, 2019 Edition, Publisher: New Age International Publishers. • Practical Biotechnology, Author: R. C. Dubey, 2022 Edition, Publisher: S. Chand Publishing.

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: G. On spot Assessment - 20 H. Spotting based on tools & technology (written) – 10 Marks I. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-3C-TH	
2	Course Title	Biotechnology for Environment	
3	Course Type	Elective Course - Theory	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Explain environmental pollution sources, impacts and monitoring methods. Evaluate physical, chemical and biological wastewater treatment technologies. Apply bioremediation approaches for management of environmental contaminants. Assess treatment strategies for industrial and municipal waste streams. Utilize biotechnological tools for sustainable environmental management and resource recovery.	
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	Environment, Pollution and Environmental Monitoring Environment: Concepts, Components and Ecosystem Functions Environmental Issues and Sustainable Development Environmental Pollution: Types, Sources and Impacts Air Pollution: Sources, Pollutants and Environmental Effects Methods for Measurement and Monitoring of Environmental Pollution Biotechnological Approaches for Air Pollution Control and Mitigation	12 (12 Hrs)
II	Water Pollution and Wastewater Treatment Technologies Water Pollution: Sources, Types and Environmental Consequences Physico-Chemical and Biological Assessment of Water Quality Wastewater Treatment: Physical, Chemical and Biological Processes Microbiology of Wastewater Treatment Systems Aerobic Treatment Processes: Activated Sludge, Trickling Filters and Oxidation Ponds Anaerobic Treatment Processes: Anaerobic Digesters, Filters and Sludge	11 (11 Hrs)

	Treatment	
III	Bioremediation and Industrial Waste Management Characteristics and Treatment of Industrial Wastewaters Wastewater Treatment in Dairy, Distillery, Tannery, Sugar and Antibiotic Industries Principles and Applications of Bioremediation Xenobiotics in the Environment: Sources, Fate and Biodegradation Environmental Issues Related to Oil Spills, Surfactants and Pesticides Electronic Waste (E-Waste), Resource Recovery and Regional Issues of Arsenic and Fluoride Pollution	11 (11 Hrs)
IV	Sustainable Environmental Biotechnology Biopesticides and Their Role in Integrated Pest Management (IPM) Sources, Characteristics and Classification of Solid Wastes Composting and Vermicomposting Technologies for Waste Management Biomethanation and Methane Production from Organic Wastes Phytotechnology and Phytoremediation for Environmental Cleanup Emerging Trends in Environmental Biotechnology and Circular Bioeconomy	11 (11 Hrs)
Keywords	Environmental Pollution, Wastewater Treatment, Bioremediation, Solid Waste Management, Biopesticides	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Environmental Biotechnology: Principles and Applications, Authors: Bruce E. Rittmann and Perry L. McCarty, Edition/Year: 2nd Edition, 2020, Publisher: McGraw-Hill Education • Environmental Biotechnology, Authors: Indu Shekhar Thakur, Edition/Year: 3rd Edition, 2021, Publisher: I.K. International Publishing House • Environmental Microbiology, Authors: Ian L. Pepper, Charles P. Gerba and Terry J. Gentry, Edition/Year: 4th Edition, 2022, Publisher: Academic Press • Wastewater Engineering: Treatment and Resource Recovery, Authors: Metcalf & Eddy, AECOM, Edition/Year: 5th Edition, 2014, Publisher: McGraw-Hill Education • Biotechnology: Environmental Processes I & II, Editors: Hans-Jürgen Rehm and Gerald Reed, Edition/Year: Reprint Edition, Publisher: Wiley-VCH • Environmental Biotechnology and Cleaner Bioprocesses, Authors: Olgica N. Bakish and Rakesh Sharma, Edition/Year: 2020, Publisher: CRC Press • Introduction to Environmental Engineering and Science, Authors: Gilbert M. Masters and Wendell P. Ela, Edition/Year: 3rd Edition, 2017, Publisher: Pearson • Bioremediation and Natural Attenuation, Authors: Pedro J. Alvarez and Walter A. Illman, Edition/Year: 2nd Edition, 2018, Publisher: Wiley • Environmental Chemistry, Authors: A. K. De, Edition/Year: 9th Edition, 2022, Publisher: New Age International • NPTEL – Environmental Biotechnology, https://nptel.ac.in/courses/102105088 • SWAYAM - Basic Environmental Engineering and Pollution Abatement, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ch73

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-1C-PR	
2	Course Title	Biotechnology for Environment	
3	Course Type	Elective 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 – • Isolate, culture, and characterize environmentally important microorganisms involved in biodegradation and nutrient cycling. • Apply microbial biotechnology for composting, biofertilizer production, biopesticide development, and waste management. • Demonstrate the principles and applications of bioremediation, phytoremediation, and bioenergy production. • Evaluate the role of microorganisms in environmental sustainability and pollution control. • Apply environmental biotechnology techniques to address industrial, agricultural, and ecological challenges.	
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	• Isolation and enumeration of microorganisms from contaminated soil, compost, and industrial waste samples. • Isolation and screening of hydrocarbon-degrading microorganisms from oil-contaminated soil. • Isolation and screening of cellulolytic microorganisms using cellulose agar medium. • Isolation and screening of phosphate-solubilizing microorganisms. • Isolation and screening of nitrogen-fixing microorganisms from rhizosphere soil. • Production and evaluation of biofertilizers using selected microbial cultures. • Preparation and evaluation of biopesticides using Bacillus or fungal biocontrol agents (demonstration). • To screen the antagonism between Trichoderma sp. and Curvularia sp. • Determination of effect of fungicide on the growth of fungi (Trichoderma sp.). • Effect of fungicide on the antagonism between Trichoderma sp. and	30	

	Curvularia sp. • Microbial tolerance of heavy metals • Effect of xenobiotics on growth of microorganisms. • Vermicomposting and assessment of vermicompost quality. • Demonstration of biogas (methane) production using anaerobic digestion. • Demonstration of phytoremediation using suitable aquatic or terrestrial plants for pollutant removal.	
Keywords	Bioremediation, Biofertilizers, Biopesticides, Composting, Environmental Microbiology	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Pepper, I. L., Gerba, C. P., & Gentry, T. J. (2015). Environmental Microbiology (3rd Edition). Academic Press. • Maier, R. M., Pepper, I. L., & Gerba, C. P. (2009). Environmental Microbiology (2nd Edition). Academic Press. • Alexander, M. (1999). Biodegradation and Bioremediation (2nd Edition). Academic Press. • Kumar, H. D. (2010). A Textbook of Environmental Biotechnology. Affiliated East-West Press. • Aneja, K. R. (2017). Experiments in Microbiology, Plant Pathology and Biotechnology (5th Edition). New Age International Publishers.

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

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session:2026-27
1	Course Code	BT/DSE-3C-TH	
2	Course Title	Industrial Products of Biotechnology	
3	Course Type	Elective Course - Theory	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Explain industrial production processes for microbial biotechnology products. Describe fermentation strategies for acids, alcohols and solvents. Evaluate production and applications of enzymes, amino acids and SCP. Analyze industrial manufacturing of antibiotics, vaccines and biopharmaceuticals. Assess emerging biotechnology products for sustainable industrial development	
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	Industrial Microorganisms and Fermentation Products Introduction to Industrial Biotechnology and Fermentation Industries Industrially Important Microorganisms and Strain Improvement Fermentation Processes for Industrial Product Formation Production of Organic Acids: Citric Acid, Lactic Acid and Acetic Acid Production of Alcohols and Solvents: Ethanol, Butanol and Acetone Recovery, Purification and Quality Control of Fermentation Products	12 (12 Hrs)
II	Industrial Production of Biomolecules Industrial Production of Amino Acids: Glutamic Acid, Lysine and Tryptophan Production and Applications of Industrial Enzymes Microbial Production of Vitamins and Nutraceuticals Single Cell Protein (SCP): Sources, Production and Applications Microbial Polysaccharides and Biopolymers Commercial Production of Bioactive Metabolites and Value-Added Products	11 (11 Hrs)
III	Antibiotics, Vaccines and Biopharmaceuticals Antibiotics: Types, Production and Industrial Applications	11 (11 Hrs)

	Industrial Production of Penicillin, Streptomycin and Other Antibiotics Vaccines: Types, Production and Quality Assurance Recombinant Vaccines and Modern Vaccine Technologies Therapeutic Proteins, Hormones and Monoclonal Antibodies Regulatory and Biosafety Aspects of Biopharmaceutical Production	
IV	Emerging Industrial Biotechnology Products Biofertilizers and Biopesticides: Production and Applications Bioplastics and Biodegradable Polymers Biofuels: Bioethanol, Biodiesel and Biogas Production Plant Secondary Metabolites and Industrial Products Industrial Biotechnology in Agriculture, Healthcare and Environment Recent Advances and Future Prospects of Industrial Biotechnology Products	11 (11 Hrs)
Keywords	Industrial Biotechnology, Fermentation Products, Antibiotics and Vaccines Industrial Enzymes, Single Cell Protein (SCP)	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
• Biotechnology: A Textbook of Industrial Microbiology, Authors: Wulf Crueger and Anneliese Crueger, 3rd Edition, 2000, Publisher: Panima Publishing Corporation • Principles of Fermentation Technology, Authors: Peter F. Stanbury, Allan Whitaker and Stephen J. Hall, 3rd Edition, 2017, Publisher: Butterworth-Heinemann (Elsevier) • Industrial Microbiology, Author: A. H. Patel, 3rd Edition, 2020, Publisher: Macmillan Publishers India • Industrial Microbiology: An Introduction, Authors: Michael J. Waite, Neil L. Morgan, John S. Rockey and Gary Higton, 2nd Edition, 2013, Publisher: Wiley-Blackwell • Fermentation Microbiology and Biotechnology, Authors: E. M. T. El-Mansi, C. F. A. Bryce, A. L. Demain and A. R. Allman, 4th Edition, 2019, Publisher: CRC Press • Manual of Industrial Microbiology and Biotechnology, Editors: Richard H. Baltz, Arnold L. Demain and Julian E. Davies, 4th Edition, 2010, Publisher: ASM Press • Bioprocess Engineering Principles, Author: Pauline M. Doran, 2nd Edition, 2013, Publisher: Academic Press (Elsevier) • Bioprocess Engineering: Basic Concepts, Authors: Michael L. Shuler and Fikret Kargi, 3rd Edition, 2017, Publisher: Pearson Education • Comprehensive Biotechnology, Editor: Murray Moo-Young, 3rd Edition, 2019, Publisher: Elsevier • Biochemical Engineering Fundamentals, Authors: James E. Bailey and David F. Ollis, 2nd Edition, Reprint 2017, Publisher: McGraw-Hill Education • NPTEL – Industrial Biotechnology, https://nptel.ac.in/courses/102105058	

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-1C-PR	
2	Course Title	Industrial Products of Biotechnology	
3	Course Type	Elective 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 – • Perform microbial fermentation for the production of industrially important biomolecules. • Produce and evaluate industrial biotechnology products, including alcohols, organic acids, enzymes, antibiotics, amino acids, and single-cell protein. • Apply downstream processing techniques for recovery and partial purification of fermentation products. • Monitor fermentation processes and evaluate product quality using biochemical and microbiological methods. • Understand the industrial applications and commercialization of biotechnology-derived products.	
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	• Laboratory safety, sterilization techniques, and preparation of fermentation media for industrial microorganisms. • Isolation and maintenance of industrially important microorganisms from natural sources. • Production and estimation of ethanol by yeast fermentation. • Production and qualitative estimation of citric acid using <i>Aspergillus niger</i>. • Production of lactic acid by lactic acid bacteria. • Production and estimation of α-amylase from microbial cultures. • Production and assay of protease from bacterial or fungal cultures. • Production of single-cell protein (SCP) using yeast or bacterial cultures. • Production and qualitative estimation of amino acids (e.g., glutamic acid) by microbial fermentation. • Production and screening of antibiotics from <i>Streptomyces</i> spp. using agar diffusion assay. • Production of biofertilizers using nitrogen-fixing or phosphate-	30	

	solubilizing microorganisms. • Preparation and evaluation of probiotic cultures and assessment of cell viability. • Recovery and partial purification of fermentation products by filtration, centrifugation, and solvent precipitation. • Determination of fermentation kinetics by monitoring microbial growth, pH, substrate utilization, and product formation. • Industrial visit or case study on the commercial production of antibiotics, vaccines, enzymes, organic acids, alcohols, amino acids, probiotics, or biopharmaceuticals.	
Keywords	Industrial Fermentation, Bioproducts, Enzyme Production, Antibiotics Downstream Processing	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
- Patel, A. H. (2018). Industrial Microbiology (2nd Edition). Macmillan Publishers India. - Crueger, W., & Crueger, A. (2000). Biotechnology: A Textbook of Industrial Microbiology (2nd Edition). Panima Publishing. - Stanbury, P. F., Whitaker, A., & Hall, S. J. (2017). Principles of Fermentation Technology (3rd Edition). Butterworth-Heinemann. - Aneja, K. R. (2017). Experiments in Microbiology, Plant Pathology and Biotechnology (5th Edition). New Age International Publishers. - Glazer, A. N., & Nikaido, H. (2007). Microbial Biotechnology: Fundamentals of Applied Microbiology (2nd Edition). Cambridge University Press.

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: M. On spot Assessment - 20 N. Spotting based on tools & technology (written) – 10 Marks O. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session:2026-27
1	Course Code	BT/MDC-4C-TH	
2	Course Title	Intellectual Property Rights and Bioethics in Biotechnology	
3	Course Type	Multi-Disciplinary	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Explain intellectual property concepts relevant to biotechnology innovations. Evaluate patenting procedures and protection of biological inventions. Analyze ethical issues in biomedical and biotechnological research. Assess societal and legal implications of emerging biotechnologies. Apply principles of research ethics and responsible scientific conduct.	
6	Credit Value	04 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)- 60 Periods (60 Hours)		
Unit	Topic (Course content)	No. of Period
I	Fundamentals of Intellectual Property Rights Introduction to Intellectual Property Rights (IPR): Concepts, Scope and Importance Types of Intellectual Property: Patents, Copyrights, Trademarks, Industrial Designs and Geographical Indications Intellectual Property Rights in Biotechnology and Life Sciences Patent System: Criteria for Patentability and Patent Specification Patent Filing Procedure and Patent Search Techniques National and International IPR Frameworks: WIPO, WTO and TRIPS Agreement	15 (15 Hrs)
II	Biotechnology Patents and Protection of Biological Resources Patenting in Biotechnology: Products, Processes and Microorganisms Patentability of Genes, DNA Sequences, Cell Lines and Biotechnological Inventions Plant Variety Protection and Farmers' Rights Protection of Traditional Knowledge and Indigenous Biological Resources Biodiversity, Bioprospecting and Benefit-Sharing Mechanisms	15 (15 Hrs)

	Biopiracy, Traditional Knowledge Digital Library (TKDL) and Case Studies	
III	Bioethics in Biotechnology and Biomedical Research Introduction to Bioethics: Principles, Scope and Historical Development Ethical Theories and Decision-Making in Life Sciences Ethics in Human and Animal Research Informed Consent, Privacy and Confidentiality in Biological Research Ethical Issues in Clinical Trials and Biomedical Investigations Research Integrity, Scientific Misconduct and Plagiarism	15 (15 Hrs)
IV	Emerging Ethical Issues and Societal Implications of Biotechnology Ethical Issues in Genetic Engineering and Recombinant DNA Technology Bioethical Concerns in Genome Editing and CRISPR Technologies Ethical Aspects of Stem Cell Research and Cloning Ethical, Legal and Social Implications (ELSI) of Biotechnology Bioethics in Agricultural Biotechnology and Genetically Modified Crops Responsible Innovation, Public Engagement and Future Challenges in Biotechnology	15 (15 Hrs)
Keywords	Intellectual Property Rights (IPR), Biotechnology Patents, Bioethics Traditional Knowledge, Research Ethics	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology, Author: Padma Nambisan, 2nd Edition, 2017, Publisher: Academic Press • Intellectual Property Rights: Unleashing the Knowledge Economy, Author: Prabuddha Ganguli, 2001, Publisher: Tata McGraw-Hill • Intellectual Property Rights, Author: Neeraj Pandey, 2nd Edition, 2021, Publisher: PHI Learning • Biotechnology and Intellectual Property Rights: Legal and Social Implications, Authors: Kankanala C. et al., 2007, Publisher: Oxford & IBH Publishing • Bioethics: Principles, Issues and Cases, Author: Lewis Vaughn, 5th Edition, 2022, Publisher: Oxford University Press • Medical Ethics and Bioethics, Author: B. K. Mahajan and M. C. Gupta, 5th Edition, 2021, Publisher: Jaypee Brothers Medical Publishers • Research Ethics and Scientific Integrity, Authors: Ana Smith Iltis and Michael Dougherty, 2019, Publisher: Springer • Ethics in Biotechnology, Author: V. S. Sree Krishna, 2018, Publisher: New India Publishing Agency • The Oxford Handbook of Bioethics, Editor: Bonnie Steinbock, 2009, Publisher: Oxford University Press • Biodiversity, Traditional Knowledge and Intellectual Property, Authors: Graham Dutfield and Uma Suthersanen, 2008, Publisher: Edward Elgar Publishing • NPTEL - Intellectual Property Rights and Competition Law, https://nptel.ac.in/courses/110105139 • SWAYAM - Intellectual Property Rights, https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed22

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

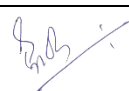
SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction		
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: I Sem (1YR) Session: 2026-27
1	Course Code	BT/PC-4C-PR
2	Course Title	Water Quality: Analysis and Improvement
3	Course Type	Practical Course
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 – • Collect, preserve, and analyze water samples using standard physicochemical and microbiological methods. • Evaluate drinking water and wastewater quality based on national and international standards. • Perform microbiological analysis of water and assess microbial contamination. • Understand biological wastewater treatment processes and evaluate their efficiency. • Interpret water quality data and prepare scientific reports for environmental monitoring and water resource management.
6	Credit Value	04 Credits Credit =120 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 100 Min Passing Marks: 20
Part B: Content of Course		
Total No. of learning-Training/performance Periods: 60 Periods (120 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Laboratory safety, biosafety, and standard methods for water analysis. • Collection, preservation, labeling, and transportation of water samples. • Determination of colour, odour, taste, and turbidity of water samples. • Determination of water temperature and pH. • Determination of electrical conductivity (EC) and total dissolved solids (TDS). • Determination of total suspended solids (TSS). • Determination of total solids (TS), fixed solids, and volatile solids. • Determination of dissolved oxygen (DO) by Winkler's method. • Determination of biochemical oxygen demand (BOD). • Determination of chemical oxygen demand (COD). • Determination of total alkalinity of water. • Determination of total hardness (calcium and magnesium hardness). • Estimation of chloride content in water. • Estimation of sulphate content in water.	60

	• Estimation of nitrate and nitrite content in water. • Estimation of phosphate concentration in water. • Determination of fluoride concentration in water. • Determination of residual chlorine in drinking water. • Determination of iron concentration in water. • Estimation of heavy metals (lead, arsenic, cadmium, chromium) by demonstration using AAS/ICP-OES. • Enumeration of total coliforms by the Most Probable Number (MPN) method. • Isolation and identification of microorganisms from drinking water and wastewater. • Enumeration of heterotrophic bacteria by standard plate count. • Gram staining and biochemical characterization of waterborne bacteria. • Assessment of wastewater treatment efficiency by comparing influent and effluent characteristics. • Study of activated sludge and microscopic examination of sludge microorganisms. • Demonstration of aerobic wastewater treatment processes (activated sludge, trickling filter, oxidation pond). • Demonstration of anaerobic wastewater treatment and biogas production. • Calculation and interpretation of the Water Quality Index (WQI) using analytical data. • Preparation of a comprehensive water quality monitoring report with statistical analysis, graphical presentation, and management recommendations.	
Keywords	Water Quality, Wastewater Treatment, Physicochemical Analysis, Water Microbiology, Water Quality Index	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• APHA, AWWA & WEF (2023). Standard Methods for the Examination of Water and Wastewater (24th Edition). American Public Health Association. • Sawyer, C. N., McCarty, P. L., & Parkin, G. F. (2003). Chemistry for Environmental Engineering and Science (5th Edition). McGraw-Hill. • Pepper, I. L., Gerba, C. P., & Gentry, T. J. (2015). Environmental Microbiology (3rd Edition). Academic Press. • Aneja, K. R. (2017). Experiments in Microbiology, Plant Pathology and Biotechnology (5th Edition). New Age International Publishers. • Trivedy, R. K., & Goel, P. K. (1986). Chemical and Biological Methods for Water Pollution Studies. Environmental Publications.

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 + Attendance- 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):	Laboratory / Field Skill Performance: P. On spot Assessment - 40 Q. Spotting based on tools & technology (written) – 20 Marks R. Viva-voce (based on principle/technology) - 10 Marks	Managed by course teacher as per lab status

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Bachelor in Life Sciences (Certificate/Diploma/Degree/Honors)		Semester: I Sem (1YR)	Session: 2026-27
1	Course Code	BT/SEC-2C-TH	
2	Course Title	Entrepreneurship in Biotechnology	
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 - Explain entrepreneurship concepts and opportunities in biotechnology sectors. Develop business plans for biotechnology-based products and services. Evaluate funding, commercialization and intellectual property strategies. Analyze regulatory and ethical requirements for biotechnology enterprises. Design sustainable startup models in biotechnology and life sciences..	
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	Fundamentals of Entrepreneurship and Biotechnology Business Introduction to Entrepreneurship: Concepts, Characteristics and Types of Entrepreneurs Entrepreneurship Opportunities in Biotechnology and Life Sciences Biotechnology Industry: Structure, Sectors and Market Trends Innovation, Creativity and Business Idea Generation in Biotechnology Biotechnology Venture Creation and Business Planning Identification and Evaluation of Biotechnology Business Opportunities Business Model Development and Business Plan Preparation Funding Sources: Venture Capital, Angel Investors, Government Schemes and Start-up Grants Technology Commercialization and Product Development Strategies Intellectual Property and Regulatory Affairs	15

	Intellectual Property Rights (IPR) and Patents in Biotechnology Technology Transfer, Licensing and Commercialization of Biotechnological Innovations Regulatory Frameworks for Biopharmaceuticals, Agricultural and Industrial Biotechnology Products Biosafety, Bioethics and Quality Assurance in Biotechnology Enterprises Biotechnology Enterprise Management and Startup Ecosystem Establishment and Management of Biotechnology Startups and Enterprises Incubation Centers, Biotechnology Parks and Startup Support Systems in India Case Studies of Successful Biotechnology Entrepreneurs and Emerging Opportunities	
Lab/Field Training Contents	• Identification of Biotechnology Business Opportunities based on current market needs and emerging technologies. • Preparation of a Biotechnology Startup Idea Canvas describing problem, solution and value proposition. • Market Survey and Demand Analysis for a biotechnology-based product or service. • Business Model Canvas Development for a biotechnology startup. • Preparation of a Detailed Business Plan including technical, financial and marketing aspects. • Cost Analysis and Pricing Strategy for biotechnology products such as biofertilizers, enzymes, probiotics or diagnostics. • SWOT Analysis of a biotechnology enterprise or startup. • Patent Search Exercise using patent databases such as Google Patents, WIPO Patentscope and Indian Patent Database. • Case Study Analysis of Successful Biotechnology Startups in India and abroad. • Preparation of a Technology Commercialization Plan for a laboratory-developed biotechnology product. • Development of a Funding Proposal for submission to government agencies (BIRAC, DST, DBT, MSME, Startup India). • Preparation of a Pitch Deck and Investor Presentation for a biotechnology startup. • Regulatory Requirement Mapping for biotechnology products such as vaccines, diagnostics, biofertilizers or food products. • Branding and Digital Marketing Exercise for a biotechnology product using online platforms and social media tools. • Visit to Biotechnology Incubator, Startup, Biotech Park or Industry and preparation of an observational report.	30
Keywords	Biotechnology Entrepreneurship, Biotechnology Startup, Innovation Management, Technology Commercialization, Intellectual Property Rights	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
• Biotechnology Entrepreneurship: Starting, Managing and Leading Biotech Companies, Authors: Craig Shimasaki, 2nd Edition, 2021, Publisher: Academic Press • Entrepreneurship Development, Authors: S. S. Khanka, 3rd Edition, 2018, Publisher: S. Chand Publishing • Innovation and Entrepreneurship, Author: Peter F. Drucker, 2014 Edition, Publisher: Routledge • Technology Entrepreneurship: Creating, Capturing and Protecting Value, Authors: Thomas N. Duening and Robert A. Hisrich, 3rd Edition, 2019, Publisher: Academic Press	

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 S. Performed the task based on learned skill - 20 Marks T. Spotting based on tools (written) – 10 Marks U. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

Department of Biotechnology
Semester II
Scheme of Examination

Paper Code	Title of Theory/Practical Paper	Marks Theory		Marks Practical	
DSC-I	Bioinformatics	70	30	35	15
DSC-II	Biotechnology tools	70	30	35	15
DSC-III	Human Genomics and Proteomics	70	30	35	15
DSE - I	Animal Cell Culture and Applications	70	30	35	15
DSE - II	Research Methodology	70	30	35	15
MDC	Food Biotechnology	70	30	NA	NA
PC	Biological Database management and Drug Discovery	70	30	NA	NA
VAC	Nano-Biotechnology	35	15	NA	NA

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Bioinformatics	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Describe fundamental concepts, scope, and applications of bioinformatics. • Access, retrieve, and manage biological data from public databases. • Analyze genomic, transcriptomic, and structural biological information. • Utilize bioinformatics tools for sequence analysis and annotation. • Evaluate bioinformatics applications in drug discovery and personalized medicine.	
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	Fundamentals of Bioinformatics • Introduction, History and Scope of Bioinformatics • Relationship Between Biotechnology and Bioinformatics • Bioinformatics Infrastructure and Resources in India (BTIS Network) • Biological Data Types and Sequence Nomenclature • Bioinformatics Tools and Software Resources • Applications of Bioinformatics in Life Sciences and Biotechnology	12 (12 Hrs)
II	Biological Sequences and Databases • Biological Sequences: Genomic DNA, cDNA and Organelle DNA • Sequence Formats, Retrieval and Data Management • Biological Databases: Concepts, Classification and Organization • Primary, Secondary and Specialized Biological Databases • International Nucleotide Sequence Databases: NCBI, EMBL and DDBJ • GenBank and Other Major Biological Information Resources	11 (11 Hrs)

III	Genome Informatics and Biological Data Resources • Genome Annotation and Functional Genomics Resources • Protein Sequence and Structure Databases • Molecular Modeling and Structural Biology Databases • Taxonomy Databases and Biological Classification Systems • Human Genome Project: Objectives, Achievements and Applications • Data Mining and Information Retrieval in Bioinformatics	11 (11 Hrs)
IV	Applied Bioinformatics and Drug Discovery • Introduction to Cheminformatics and Chemical Databases • Pharmacogenomics and Personalized Medicine • Computer-Aided Drug Design and Virtual Screening • Sanjeevini Module: Components and Applications in Drug Discovery • Bioinformatics Approaches in Genomics, Proteomics and Systems Biology • Emerging Trends and Applications of Bioinformatics in Biotechnology	11 (11 Hrs)
Keywords	Bioinformatics, Biological Databases, Sequence Analysis, Cheminformatics Pharmacogenomics	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Bioinformatics: Sequence and Genome Analysis, Author: David W. Mount, Edition/Year: 2nd Edition, 2004 (Reprint editions available), Publisher: Cold Spring Harbor Laboratory Press • Bioinformatics and Functional Genomics, Author: Jonathan Pevsner, Edition/Year: 4th Edition, 2023, Publisher: Wiley-Blackwell • Introduction to Bioinformatics, Authors: Arthur M. Lesk, Edition/Year: 6th Edition, 2023, Publisher: Oxford University Press • Essential Bioinformatics, Authors: Jin Xiong, Edition/Year: 2006 (Reprint editions available), Publisher: Cambridge University Press • Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Editors: Andreas D. Baxevanis and B. F. Francis Ouellette, Edition/Year: 4th Edition, 2020, Publisher: Wiley-Interscience • Fundamental Concepts of Bioinformatics, Authors: Dan E. Krane and Michael L. Raymer, Edition/Year: 2003 (Reprint editions available), Publisher: Benjamin Cummings • Structural Bioinformatics, Editors: Philip E. Bourne and Helge Weissig, Edition/Year: 2nd Edition, 2010, Publisher: Wiley-Blackwell • Introduction to Computational Biology and Bioinformatics, Authors: John M. Hancock and Marketa J. Zvelebil, Edition/Year: 2018, Publisher: Garland Science • Cheminformatics: Concepts, Methods and Tools for Drug Discovery, Authors: Jürgen Bajorath, Edition/Year: 2004, Publisher: Humana Press • Principles of Genome Analysis and Genomics, Authors: Sandy B. Primrose and Richard Twyman, Edition/Year: 8th Edition, 2023, Publisher: Wiley-Blackwell • NPTEL – Bioinformatics: Algorithms and Applications, https://nptel.ac.in/courses/102106065 • SWAYAM – Bioinformatics for Biologists, https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_bt02

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction		
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)
		Session: 2026-2027
1	Course Code	BT/DSC-1C-PR
2	Course Title	Bioinformatics
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 – • Retrieve and analyze biological data from major bioinformatics databases. • Perform sequence similarity searches and primer design using computational tools. • Analyze microbial genomes and protein structures using online resources. • Predict protein active sites and study protein–ligand interactions through molecular modeling. • Synthesize nanoparticles and evaluate their antimicrobial applications
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	• Retrieval of Protein and Nucleotide Sequences from NCBI Databases (GenBank, RefSeq and Protein Database). • Database Searching and Sequence Analysis Using BLAST for identification of homologous genes and proteins. • Comparative Analysis of BLAST Results and study of its applications in biotechnology research. • Primer Design (Forward and Reverse Primers) from given nucleotide sequences using bioinformatics tools. • Whole Genome Analysis of a Microorganism using NCBI Genome and related databases. • Protein Sequence Retrieval and Functional Annotation using UniProt and NCBI resources. • Study of Protein Structure Using Protein Data Bank (PDB) and structural visualization tools. • Three-Dimensional Molecular Modeling of Proteins using Swiss-PDB	30

	Viewer, PyMOL or Chimera. • Prediction of Protein Active Sites and Ligand Binding Regions using the Sanjeevini Module and related software. • Molecular Docking and Protein–Ligand Interaction Analysis using Sanjeevini or other docking platforms.	
Keywords	Bioinformatics, BLAST Analysis, Genome Analysis, Molecular Modeling	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Bioinformatics: Sequence and Genome Analysis, Author: David W. Mount, 2nd Edition, 2004, Publisher: Cold Spring Harbor Laboratory Press. • Essential Bioinformatics, Authors: Jin Xiong, 2006, Publisher: Cambridge University Press. • Bioinformatics and Functional Genomics, Author: Jonathan Pevsner, 3rd Edition, 2015, Publisher: Wiley-Blackwell. • Practical Bioinformatics, Author: Michael Agostino, 2022, Publisher: Garland Science. • Nanobiotechnology: Principles and Applications, Authors: Christof M. Niemeyer and Chad A. Mirkin, 2011, Publisher: Wiley.

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: V. On spot Assessment - 20 W. Spotting based on tools & technology (written) – 10 Marks X. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Biotechnology Tools	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Explain principles and applications of modern analytical biotechnology instruments. • Apply electrophoretic, spectroscopic and chromatographic techniques for biomolecule analysis. • Interpret data generated from microscopy, sequencing and structural biology tools. • Utilize molecular diagnostic techniques for nucleic acid and protein analysis. • Evaluate applications of biosensors and advanced bioanalytical technologies.	
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	Analytical and Immunological Techniques • Principles, Types and Applications of Electrophoresis • Agarose Gel and Polyacrylamide Gel Electrophoresis (PAGE) • Principles and Applications of Spectrophotometry • Atomic Absorption Spectroscopy (AAS) and FT-IR Spectroscopy • Radioisotope Techniques: Radioimmunoassay (RIA) and Autoradiography • Enzyme-Linked Immunosorbent Assay (ELISA): Types and Applications	12 (12 Hrs)
II	Advanced Imaging and Molecular Analysis Techniques • Principles and Applications of Advanced Microscopy • Confocal Microscopy: Instrumentation and Applications • Scanning and Transmission Electron Microscopy (SEM and TEM)	11 (11 Hrs)

	• DNA Sequencing Technologies: Components, Types and Applications • Polymerase Chain Reaction (PCR): Principles, Types and Applications • Thermocyclers and Automated Nucleic Acid Analysis Systems	
III	Separation and Structural Characterization Techniques • Principles and Applications of Chromatographic Techniques • High-Performance Liquid Chromatography (HPLC) and HPTLC • Gas Chromatography–Mass Spectrometry (GC-MS) and Liquid Chromatography–Mass Spectrometry (LC-MS) • Nuclear Magnetic Resonance (NMR) Spectroscopy • X-Ray Diffraction and Structure Determination of Biomolecules • Applications of Chromatographic and Spectroscopic Techniques in Biotechnology	11 (11 Hrs)
IV	Molecular Diagnostic and Biosensing Technologies • DNA Microarray Technology: Principles and Applications • Flow Cytometry: Instrumentation, Cell Sorting and Applications • Southern, Northern and Western Blotting Techniques • Biosensors: Principles, Components and Classification • Types of Biosensors and Their Applications in Biotechnology • Emerging Trends in Molecular Diagnostics and Biosensor Technology	11 (11 Hrs)
Keywords	Electrophoresis and Spectroscopy, Microscopy and Imaging, Chromatography and Structural Analysis, Molecular Diagnostics, Biosensors and Bioanalytical Techniques	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Principles and Techniques of Biochemistry and Molecular Biology, Authors: Keith Wilson and John Walker, Edition/Year: 8th Edition, 2018, Publisher: Cambridge University Press • Physical Biochemistry: Principles and Applications, Authors: David Sheehan, Edition/Year: 3rd Edition, 2020, Publisher: Wiley-Blackwell • Biophysical Chemistry: Techniques and Applications, Author: Upadhyay, Upadhyay and Nath, Edition/Year: Revised Edition, 2019, Publisher: Himalaya Publishing House • Instrumental Methods of Chemical Analysis, Authors: Gurdeep R. Chatwal and Sham K. Anand, Edition/Year: 6th Edition, 2021, Publisher: Himalaya Publishing House • Analytical Biochemistry, Authors: David J. Holme and Hazel Peck, Edition/Year: 4th Edition, Reprint 2017, Publisher: Pearson Education • Molecular Cloning: A Laboratory Manual, Authors: Michael R. Green and Joseph Sambrook, Edition/Year: 4th Edition, 2012, Publisher: Cold Spring Harbor Laboratory Press • Molecular Biotechnology: Principles and Applications of Recombinant DNA, Authors: Bernard R. Glick, Jack J. Pasternak and Cheryl L. Patten, Edition/Year: 5th Edition, 2017, Publisher: ASM Press • Introduction to Spectroscopy, Authors: Donald L. Pavia, Gary M. Lampman, George S. Kriz and James A. Vyvyan, Edition/Year: 5th Edition, 2014, Publisher: Cengage Learning

- **Bioinstrumentation**, Author: Leslie Cromwell, Edition/Year: 2nd Edition, Reprint 2018, Publisher: Pearson Education
- **Handbook of Instrumental Techniques for Analytical Chemistry**, Editor: Frank A. Settle Jr., Edition/Year: Reprint Edition, 2017, Publisher: Pearson/Prentice Hall
- NPTEL – Bioanalytical Techniques and Bioinformatics, <https://nptel.ac.in/courses/102103044>

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-2027
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Biotechnology tools	
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 – • Operate and apply common laboratory instruments used in biotechnology. • Perform microbial cultivation and pure culture isolation techniques. • Utilize chromatographic, spectrophotometric and electrophoretic methods for biomolecule analysis. • Apply advanced molecular and immunological techniques such as PCR and ELISA. • Interpret experimental data generated using modern biotechnology tools and 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	• Operation and Calibration of Basic Biotechnology Laboratory Instruments (micropipettes, pH meter, analytical balance and centrifuge). • Centrifugation Techniques for separation of cellular components and biomolecules. • Spectrophotometric Analysis for estimation of DNA, RNA and proteins. • Chromatographic Separation of Biomolecules using paper chromatography and thin-layer chromatography (TLC). • Ion Exchange or Gel Filtration Chromatography for purification of biomolecules. • Preparation and Sterilization of Culture Media for microbial cultivation. • Isolation of Pure Microbial Cultures using streak plate, spread plate and pour plate techniques. • Microscopic Examination and Staining of Microorganisms using simple and Gram staining methods. • Agarose Gel Electrophoresis of DNA and analysis of nucleic acid	30	

	samples. • Polymerase Chain Reaction (PCR) amplification of target DNA and analysis of PCR products. • Enzyme-Linked Immunosorbent Assay (ELISA) for detection of antigens or antibodies. • Demonstration of Southern Blotting Technique for detection and analysis of specific DNA sequences	
Keywords	Biotechnology Tools, Spectrophotometry, Chromatography, PCR ELISA	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
	• Principles and Techniques of Biochemistry and Molecular Biology, Authors: Keith Wilson and John Walker, 8th Edition, 2018, Publisher: Cambridge University Press. • Molecular Cloning: A Laboratory Manual, Authors: Michael R. Green and Joseph Sambrook, 4th Edition, 2012, Publisher: Cold Spring Harbor Laboratory Press. • Biochemistry Laboratory: Modern Theory and Techniques, Author: Rodney F. Boyer, 2nd Edition, 2009, Publisher: Pearson Education. • Laboratory Manual in Biotechnology, Author: P. Gunasekaran, 2019 Edition, Publisher: New Age International Publishers. • Experiments in Microbiology, Plant Pathology and Biotechnology, Author: K. R. Aneja, 5th Edition, 2017, Publisher: New Age International Publishers.

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: Y. On spot Assessment - 20 Z. Spotting based on tools & technology (written) – 10 Marks AA. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-3C-TH	
2	Course Title	Human Genomics and Proteomics	
3	Course Type	Core Course	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: • Explain principles, tools and applications of genomics and proteomics. • Analyze genome organization, sequencing methods and comparative genomic data. • Interpret protein structure, function and proteomic datasets. • Apply computational approaches for protein modeling and interaction studies. • Evaluate applications of systems biology in biotechnology and medicine.	
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	Fundamentals of Genomics • Introduction, Scope and Historical Development of Genomics • Types of Genomics: Structural, Functional and Comparative Genomics • Genome Organization and Genome Complexity • Genome Mapping: Genetic and Physical Mapping Approaches • Genome Sequencing Technologies and Strategies • Plant Genomics: Concepts, Resources and Applications • Genomics in Medicine: Gene-Based Diagnosis and Therapeutics • Disease Models and Future Perspectives of Genomics	12 (12 Hrs)
II	Genome Projects and Comparative Genomics • Genome Projects: Objectives, Strategies and Achievements • Human Genome Project: Organization, Outcomes and Applications • ENCODE Project and Functional Annotation of the Genome	11 (11 Hrs)

	• Gene Sequencing Methods: EST and Random Shotgun Sequencing • Whole Genome Shotgun Sequencing and Next-Generation Approaches • Single Nucleotide Polymorphisms (SNPs) and Genetic Variation • Comparative Genomics in Bacteria, Eukaryotes and Organelles • Sequence Analysis and Evolutionary Applications of Comparative Genomics	
III	Fundamentals of Proteomics and Protein Structure Analysis • Introduction, Scope and Importance of Proteomics • Relationship Between Genomics and Proteomics • Protein Structure, Function and Classification • Methods for Protein Isolation, Separation and Identification • Structural Proteomics and Protein Structure Determination • Computational Approaches in Protein Structure Analysis • Homology Modeling and Ab-initio Protein Structure Prediction • Applications of Structural Proteomics in Biological Research	11 (11 Hrs)
IV	Molecular Diagnostic and Biosensing Technologies • DNA Microarray Technology: Principles and Applications • Flow Cytometry: Instrumentation, Cell Sorting and Applications • Southern, Northern and Western Blotting Techniques • Biosensors: Principles, Components and Classification • Types of Biosensors and Their Applications in Biotechnology • Emerging Trends in Molecular Diagnostics and Biosensor Technology	11 (11 Hrs)
Keywords	Genomics, Comparative Genomics, Proteomics, Protein Structure Analysis Systems Biology	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Introduction to Genomics, Authors: Arthur M. Lesk, Edition/Year: 3rd Edition, 2017, Publisher: Oxford University Press • Principles of Genome Analysis and Genomics, Authors: Sandy B. Primrose and Richard Twyman, Edition/Year: 8th Edition, 2023, Publisher: Wiley-Blackwell • Genomes 4, Author: Terry A. Brown, Edition/Year: 2017, Publisher: Garland Science • Bioinformatics and Functional Genomics, Author: Jonathan Pevsner, Edition/Year: 4th Edition, 2023, Publisher: Wiley-Blackwell • Introduction to Proteomics: Principles and Applications, Authors: Nawin C. Mishra, Edition/Year: 2010, Publisher: Wiley-Interscience • Proteomics: From Protein Sequence to Function, Authors: S. R. Pennington and M. J. Dunn, Edition/Year: 2nd Edition, 2009, Publisher: Garland Science • Proteomics for Biological Discovery, Authors: Timothy D. Veenstra and John R. Yates III, Edition/Year: 2006, Publisher: Wiley-Liss • Structural Bioinformatics, Editors: Philip E. Bourne and Helge Weissig, Edition/Year: 2nd Edition, 2010, Publisher: Wiley-Blackwell • Systems Biology: A Textbook, Authors: Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald and Hans Lehrach, Edition/Year: 2nd Edition, 2016, Publisher:

Wiley-VCH

- Systems Biology and Biotechnology of Escherichia coli, Editors: Sang Yup Lee, Edition/Year: 2009, Publisher: Springer
- NPTEL – Functional Genomics, <https://nptel.ac.in/courses/102104056>
- SWAYAM - Introduction to Proteogenomics, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_bt72

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
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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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Approval of the Board of Studies

Date: 03-09-2026

Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

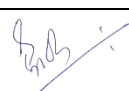
SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSC-1C-PR	
2	Course Title	Human Genomics and Proteomics	
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 – • Retrieve, analyze and interpret genomic and proteomic data from biological databases. • Perform genome annotation, comparative genomics and sequence analysis. • Analyze protein sequences, structures and functional domains using bioinformatics tools. • Evaluate protein–protein interactions and proteome-wide datasets. • Apply computational approaches for genomics and proteomics research in biotechnology	
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	• Retrieval of Genome Sequences from Public Databases (NCBI, Ensembl, UCSC Genome Browser). • Genome Annotation and Gene Prediction using bioinformatics tools. • Comparative Genomics Analysis of selected microbial or eukaryotic genomes. • Identification and Analysis of Single Nucleotide Polymorphisms (SNPs) from genomic datasets. • Sequence Alignment and Phylogenetic Tree Construction using DNA and protein sequences. • Analysis of Human Genome and ENCODE Project Resources using online databases. • Protein Sequence Retrieval and Functional Annotation using UniProt and related databases. • Protein Structure Prediction by Homology Modeling using SWISS-MODEL or similar tools. • Three-Dimensional Visualization of Protein Structures using Protein	30	

	Data Bank (PDB), PyMOL or Chimera. • Proteome Analysis and Protein Identification using ExPASy and proteomic databases. • Protein–Protein Interaction Network Analysis using STRING database and Cytoscape. • Two-Dimensional Gel Electrophoresis (2D-PAGE) and Protein Profile Analysis (demonstration or hands-on exercise)	
Keywords	Genomics, Proteomics, Genome Annotation, Protein Structure, Bioinformatics	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
- Bioinformatics and Functional Genomics – Jonathan Pevsner, 3rd Edition, 2015, Wiley-Blackwell. - Introduction to Bioinformatics – Arthur M. Lesk, 5th Edition, 2019, Oxford University Press. - Proteomics: From Protein Sequence to Function – S. R. Pennington and Michael J. Dunn, 2nd Edition, 2012, Garland Science. - Principles of Genome Analysis and Genomics – Sandy B. Primrose and Richard Twyman, 8th Edition, 2020, Wiley-Blackwell. - Practical Bioinformatics – Michael Agostino, 2022, Garland Science.

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: BB. On spot Assessment - 20 CC. Spotting based on tools & technology (written) – 10 Marks DD. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-3C-TH	
2	Course Title	Animal Cell Culture and Applications	
3	Course Type	Elective Course - Theory	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Demonstrate principles and techniques of animal cell culture. Establish, maintain and preserve animal cell lines under aseptic conditions. Apply stem cell and transgenic animal technologies in biotechnology. Evaluate hybridoma, vaccine and biopharmaceutical production systems. Assess applications of tissue engineering and regenerative medicine.	
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	Fundamentals of Animal Cell and Tissue Culture Introduction, History and Principles of Animal Cell and Tissue Culture Laboratory Design, Aseptic Techniques and Biosafety Practices Essential Equipment, Consumables and Culture Facilities Culture Media: Composition, Preparation, Types of Animal Cell Culture Media Culture Conditions: pH, Temperature, CO ₂ and Nutritional Requirements Applications of Animal Cell Culture in Biotechnology, Medicine and Research	12 (12 Hrs)
II	Culture Techniques and Cell Line Management Primary Cell Culture and Established Cell Lines Cell Disaggregation Methods: Mechanical and Enzymatic Techniques Suspension Culture and Monolayer Culture Systems Cell Line Development, Maintenance and Continuous Cell Lines Biology of Cultured Cells: Cell Adhesion, Growth, Proliferation and Differentiation Cell Senescence, Transformation and Growth Characteristics of Cultured Cells	11 (11 Hrs)

	Sources, Types and Control of Cell Culture Contamination Cell Line Banking, Cryopreservation and Cell Viability Assessment	
III	Stem Cell Technology and Animal Biotechnology Stem Cells: Types, Characteristics and Culture Techniques Embryonic, Adult and Induced Pluripotent Stem Cells (iPSCs) Applications of Stem Cells in Regenerative Medicine and Biotechnology Transgenic Animals: Principles and Methods of Production Applications of Transgenic Animals in Agriculture, Medicine and Research Ethical and Regulatory Aspects of Animal Biotechnology	11 (11 Hrs)
IV	Advanced Applications of Animal Cell Culture Hybridoma Technology and Monoclonal Antibody Production Cell Culture-Based Vaccine Production for Human and Veterinary Use Recombinant Protein and Biopharmaceutical Production Using Animal Cells Tissue Engineering: Principles, Scaffolds and Cell-Based Approaches Applications of Tissue Engineering in Regenerative Medicine Emerging Trends in Animal Cell Culture and Cell-Based Therapeutics	11 (11 Hrs)
Keywords	Animal Cell Culture, Cell Lines, Stem Cells, Monoclonal Antibodies Tissue Engineering	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
• Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, Author: R. Ian Freshney, 8th Edition, 2021, Publisher: Wiley-Blackwell • Animal Cell Culture and Virology, Author: S. N. Jogdand, 3rd Edition, 2017, Publisher: Himalaya Publishing House • Basic Cell Culture Protocols, Editors: Cheryl D. Helgason and Cindy L. Miller, 5th Edition, 2013, Publisher: Humana Press • Animal Cell Biotechnology: Methods and Protocols, Editors: Nigel Jenkins, 4th Edition, 2018, Publisher: Humana Press • Essential Cell Biology, Authors: Bruce Alberts et al., 6th Edition, 2023, Publisher: Garland Science • Molecular Biotechnology: Principles and Applications of Recombinant DNA, Authors: Bernard R. Glick, Jack J. Pasternak and Cheryl L. Patten, 5th Edition, 2017, Publisher: ASM Press • Stem Cells: Scientific Facts and Fiction, Authors: Christine Mummery et al., 3rd Edition, 2020, Publisher: Academic Press • Principles of Tissue Engineering, Editors: Robert Lanza, Robert Langer and Joseph Vacanti, 5th Edition, 2020, Publisher: Academic Press • Monoclonal Antibodies: Principles and Practice, Author: James W. Goding, 3rd Edition, Reprint 2017, Publisher: Academic Press • Animal Biotechnology, Authors: M. M. Ranga and S. C. Sharma, Revised Edition, 2019, Publisher: Agrobios (India) • NPTEL – Animal Transgenesis: Principles and Methods, https://nptel.ac.in/courses/102106821 • SWAYAM - Animal Biotechnology, https://onlinecourses.swayam2.ac.in/e-learning/preview/cec26_ma06	

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

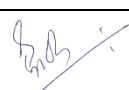
SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction		
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR) Session: 2026-27
1	Course Code	BT/DSE-1C-PR
2	Course Title	Animal Cell Culture and Applications
3	Course Type	Elective 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 – • Demonstrate aseptic laboratory practices and perform basic animal biotechnology techniques. • Process animal blood and tissues for serum, plasma, cellular, and genomic DNA analysis. • Isolate, quantify, and evaluate the quality of genomic DNA from different animal tissues. • Assess cell viability and perform basic cell culture-related laboratory procedures. • Apply molecular and immunological techniques in biomedical, veterinary, pharmaceutical, and animal biotechnology research.
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	•Laboratory safety, biosafety, aseptic techniques, and maintenance of an animal cell culture laboratory. •Preparation of animal cell culture media and sterilization of laboratory materials. •Separation of serum and plasma from whole blood. •Preparation of blood smear and staining for differential blood cell observation. •Enumeration of blood cells using a haemocytometer (demonstration). •Cell viability test using Trypan Blue dye exclusion method. •Isolation and maintenance of primary animal cells (demonstration). •Cryopreservation and revival of animal cells (demonstration). •Extraction and estimation of genomic DNA from blood. •Extraction and estimation of genomic DNA from spleen tissue. •Extraction and estimation of genomic DNA from muscle tissue. •Quality assessment of isolated DNA by agarose gel electrophoresis and	30

	spectrophotometry. • Demonstration of PCR amplification using animal genomic DNA. • Demonstration of ELISA or immunological assays used in animal biotechnology. • Study of stem cell culture, hybridoma technology, transgenic animals, and cell culture-based vaccine production through demonstrations, videos, or case studies.	
Keywords	Animal Cell Culture, Genomic DNA, Cell Viability, Blood Cell Analysis Molecular Biotechnology	

• Part C - Learning Resource	
Text Books, Reference Books, Other Resources -	
	• Freshney, R. I. (2021). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications (8th Edition). Wiley-Blackwell. • Doyle, A., & Griffiths, J. B. (2000). Cell and Tissue Culture: Laboratory Procedures. John Wiley & Sons. • Masters, J. R. W. (2000). Animal Cell Culture: A Practical Approach (3rd Edition). Oxford University Press. • Wilson, K., & Walker, J. (2018). Principles and Techniques of Biochemistry and Molecular Biology (8th Edition). Cambridge University Press. • Sambrook, J., & Russell, D. W. (2001). Molecular Cloning: A Laboratory Manual (3rd Edition). Cold Spring Harbor Laboratory Press.

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: EE. On spot Assessment - 20 FF. Spotting based on tools & technology (written) – 10 Marks GG. Viva-voce (based on principle/technology) - 05 Marks		Managed by course teacher as per lab status

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-3C-TH	
2	Course Title	Research Methodology	
3	Course Type	Elective Course - Theory	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Identify research problems and formulate scientifically relevant research objectives. Design research studies and apply appropriate statistical analysis methods. Prepare scientific reports, dissertations and research manuscripts effectively. Utilize reference management and scientific communication tools efficiently. Evaluate research quality using publication metrics and indexing databases	
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	Foundations of Research Methodology Introduction to Research: Meaning, Objectives and Types of Research Research Process and Scientific Method Identification of Research Problems and Research Gap Analysis Formulation of Research Questions, Objectives and Hypotheses Research Planning and Conceptualization of Research Projects Components and Selection of Research Problems Literature Collection: Sources and Types of Scientific Literature Digital Information Resources and UGC Library Tools for Literature Search	12 (12 Hrs)
II	Research Design and Data Analysis Research Design: Concepts, Types and Applications Study Area Selection and Sampling Techniques Research Methodology, Resource Planning and Experimental Design Data Collection, Compilation and Organization Descriptive Statistics: Mean, Median, Mode and Measures of Dispersion	11 (11 Hrs)

	Correlation and Regression Analysis in Research Hypothesis Formulation and Testing Statistical Significance Tests: Student's t-Test and Chi-Square Test	
III	Scientific Writing and Research Reporting Scientific Writing: Principles and Structure of Research Documents Types of Research Reports, Dissertations and Thesis Writing Components of Research Reports and Scientific Papers Data Presentation: Tables, Figures, Graphs and Illustrations Citation Styles, Bibliography and Reference Management Reference Management Tools: EndNote and Mendeley Digital Tools for Scientific Communication: Canva and Photoshop Ethics in Scientific Writing, Plagiarism and Academic Integrity	11 (11 Hrs)
IV	Research Publications, Quality Assessment and Academic Networking Research Publications: Books, Journals, Patents and Conference Proceedings Journal Quality Assessment and Journal Selection Strategies Indexing Databases: Web of Science, Scopus, SCI and DOAJ Citation Analysis and Research Metrics H-Index, i10-Index, CiteScore and Journal Impact Factor Researcher Profiles and Academic Visibility through Google Scholar Academic and Professional Networking Platforms: ResearchGate, LinkedIn and ORCID Emerging Trends in Research Communication, Open Access Publishing and Research Evaluation	11 (11 Hrs)
Keywords	Research Methodology, Scientific Writing, Research Design, Bibliometrics Academic Publishing	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
- Research Methodology: Methods and Techniques, Author: C. R. Kothari and Gaurav Garg, 4th Edition, 2019, Publisher: New Age International Publishers - Research Methodology: A Step-by-Step Guide for Beginners, Author: Ranjit Kumar, 5th Edition, 2019, Publisher: Sage Publications - Scientific Writing and Communication: Papers, Proposals and Presentations, Authors: Angelika H. Hofmann, 4th Edition, 2019, Publisher: Oxford University Press - The Craft of Research, Authors: Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams et al., 5th Edition, 2024, Publisher: University of Chicago Press - Practical Research: Planning and Design, Authors: Paul D. Leedy and Jeanne Ellis Ormrod, 12th Edition, 2019, Publisher: Pearson Education - Statistics for Research, Author: George Argyrous, 4th Edition, 2018, Publisher: Sage Publications - Biostatistics: A Foundation for Analysis in the Health Sciences, Authors: Wayne W. Daniel and Chad L. Cross, 11th Edition, 2018, Publisher: Wiley - Writing Scientific Research Articles: Strategy and Steps, Authors: Margaret Cargill and Patrick O'Connor, 3rd Edition, 2021, Publisher: Wiley-Blackwell - Academic Writing for Graduate Students, Authors: John M. Swales and Christine B.

Feak, 4th Edition, 2020, Publisher: University of Michigan Press

- Publication Manual of the American Psychological Association (APA), 7th Edition, 2020, Publisher: American Psychological Association
- NPTEL – User Research Methods, <https://nptel.ac.in/courses/107103001>
- SWAYAM - Development Research Methods, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_hs253

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
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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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Approval of the Board of Studies

Date: 03-09-2026

Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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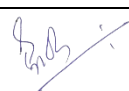
SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/DSE-1C-PR	
2	Course Title	Research Methodology	
3	Course Type	Elective 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 – • Formulate research problems, hypotheses, and experimental designs for biotechnology research. • Retrieve, organize, and critically analyze scientific literature using online databases and reference management software. • Apply appropriate statistical methods for data analysis and interpretation of biotechnology experiments. • Prepare research proposals, scientific manuscripts, reports, posters, and presentations following ethical and publication standards. • Select appropriate journals, evaluate publication quality, and effectively communicate scientific research in biotechnology.	
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	• Identification of a research problem, formulation of research objectives, hypothesis, and research questions in biotechnology. • Literature search using Google Scholar, PubMed, Scopus, Web of Science, NCBI, ScienceDirect, SpringerLink, and DOAJ. • Collection, organization, and review of scientific literature using Mendeley and EndNote. • Preparation of a research proposal including title, objectives, methodology, expected outcomes, and work plan. • Design of biotechnology experiments, selection of controls, variables, replication, and sampling methods. • Data entry and statistical analysis using Microsoft Excel, SPSS, or R (mean, median, mode, standard deviation, variance, and graphical presentation). • Application of hypothesis testing using t-test, Chi-square test, ANOVA, and correlation analysis. • Preparation of tables, graphs, charts, and scientific illustrations using Excel, GraphPad Prism, Canva, or BioRender.		30

	•Reference formatting and citation styles (APA, Vancouver, Harvard, and journal-specific formats). •Preparation of a scientific manuscript (title, abstract, introduction, materials & methods, results, discussion, references). •Identification of suitable journals using indexing databases (Scopus, Web of Science, SCI, ESCI, DOAJ) and evaluation of journal quality (Impact Factor, CiteScore, H-index, Quartiles). •Preparation and presentation of a research seminar	
Keywords	Research Design, Scientific Writing, Biostatistics, Reference Management Research Ethics	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques (4th Edition). New Age International Publishers. • Montgomery, D. C. (2019). Design and Analysis of Experiments (10th Edition). John Wiley & Sons. • Day, R. A., & Gastel, B. (2022). How to Write and Publish a Scientific Paper (9th Edition). Cambridge University Press. • Gerstman, B. B. (2015). Basic Biostatistics: Statistics for Public Health Practice (2nd Edition). Jones & Bartlett Learning.

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: HH. On spot Assessment - 20 II. Spotting based on tools & technology (written) – 10 Marks JJ. Viva-voce (based on principle/technology) - 05 Marks	Managed by course teacher as per lab status

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

Affiliated with Hemchand Yadav Vishwavidyalaya Durg (C.G.)

SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/MDC-4C-TH	
2	Course Title	Food Biotechnology	
3	Course Type	Multi-Disciplinary	
4	Pre-requisite (if any)	As per program	
6	Course Learning Outcomes (CLO)	Upon successful completion of this course, students will be able to: Explain principles and applications of biotechnology in food production. Evaluate microbial processes involved in fermented food manufacturing. Analyze the role of enzymes and biomolecules in food processing. Assess food quality, safety and regulatory requirements. Apply biotechnology approaches for development of value-added foods.	
6	Credit Value	04 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)- 60 Periods (60 Hours)		
Unit	Topic (Course content)	No. of Period
I	Fundamentals of Food Biotechnology Introduction, History and Scope of Food Biotechnology Food Composition and Nutritional Components Microorganisms Used in Food Biotechnology Principles of Food Fermentation and Bioprocessing Food Quality, Safety and Hygiene Standards Biotechnology in Food Preservation and Shelf-Life Enhancement	15 (15 Hrs)
II	Fermented Foods and Functional Foods Fermented Dairy Products: Curd, Yogurt and Cheese Fermented Cereal and Traditional Foods of India Production of Fermented Beverages and Vinegar Probiotics, Prebiotics and Synbiotics Functional Foods and Nutraceuticals Microbial Production of Food Additives, Flavors and Pigments	15 (15 Hrs)
III	Food Processing and Product Development	15 (15 Hrs)

	Enzymes in Food Processing and Biotechnology Biotechnology of Bakery, Beverage and Dairy Industries Single Cell Protein (SCP) and Alternative Protein Sources Production of Organic Acids, Amino Acids and Vitamins for Food Applications Food Packaging Technologies and Biodegradable Packaging Materials Quality Control and Biotechnological Tools in Food Analysis	
IV	Advanced Food Biotechnology and Food Safety Genetically Modified Foods: Development and Applications Molecular Techniques for Food Authentication and Traceability Foodborne Pathogens and Rapid Detection Methods Food Safety Regulations, Risk Assessment and Quality Assurance Biofortification and Nutritional Enhancement of Food Crops Emerging Trends in Food Biotechnology and Future Perspectives	15 (15 Hrs)
Keywords	Food Biotechnology, Food Fermentation, Functional Foods, Probiotics Food Safety	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
• Food Biotechnology, Authors: Kalidas Shetty, Gopinadhan Paliyath, Alan Pometto, Robert Levin and Rosane Thomas, 2nd Edition, 2018, Publisher: CRC Press • Food Biotechnology: Principles and Applications, Authors: Jeffrey H. Dorfman and W. H. Holzapfel, 2016, Publisher: Wiley-Blackwell • Fundamentals of Food Biotechnology, Authors: P. F. Stanbury and A. Whitaker, 2017, Publisher: Elsevier • Food Microbiology, Authors: William C. Frazier and Dennis C. Westhoff, 5th Edition, 2017, Publisher: McGraw-Hill Education • Modern Food Biotechnology, Authors: N. K. Farkye and R. F. Mathews, 2019, Publisher: Springer • Food Science and Technology, Author: Geoffrey Campbell-Platt, 2nd Edition, 2017, Publisher: Wiley-Blackwell • Essentials of Food Biotechnology, Author: J. P. Cherry, 2018, Publisher: Springer • Food Biochemistry and Food Processing, Editors: Y. H. Hui and E. Özgül Evranuz, 3rd Edition, 2024, Publisher: Wiley-Blackwell • Food Microbiology: An Introduction, Author: Thomas J. Montville and Karl R. Matthews, 4th Edition, 2022, Publisher: ASM Press • Biotechnology in Functional Foods and Nutraceuticals, Author: Debasis Bagchi, 2021, Publisher: CRC Press • NPTEL - Food Packaging Technology, https://nptel.ac.in/courses/127106237 • SWAYAM - Fundamentals of Food Process Engineering, https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ag25

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	

Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction		
Program: Master in Life Sciences (Diploma/Degree/Honors)		Semester: II Sem (1YR) Session: 2026-27
1	Course Code	BT/PC-4C-PR
2	Course Title	Biological Database Management and Drug Discovery
3	Course Type	Practical Course
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 – • Retrieve, organize, and manage biological information from major public databases. • Perform sequence, genome, protein, and pathway analyses using bioinformatics resources. • Interpret biological data through comparative analysis and functional annotation. • Utilize biological databases for molecular biology, genomics, proteomics, and biotechnology research. • Prepare scientific reports integrating information from multiple biological databases.
6	Credit Value	04 Credits Credit =120 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 100 Min Passing Marks: 20
Part B: Content of Course		
Total No. of learning-Training/performance Periods: 60 Periods (120 Hours)		
Module	Topic (Course content)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Introduction to biological databases and data management in biotechnology. • Classification of biological databases: primary, secondary, and specialized databases. • Retrieval of nucleotide sequences from NCBI GenBank. • Retrieval of protein sequences from NCBI Protein database. • Searching and downloading literature from PubMed. • Retrieval of genome information using NCBI Genome database. • Gene sequence retrieval using Ensembl Genome Browser. • Genome visualization using the UCSC Genome Browser. • Sequence similarity search using NCBI BLAST (blastn and blastp). • Protein domain analysis using Pfam and InterPro databases. • Identification of conserved domains using the NCBI Conserved Domain Database (CDD). • Multiple sequence alignment using Clustal Omega.	60

	• Multiple sequence alignment using MEGA software. • Construction and interpretation of phylogenetic trees using MEGA. • Retrieval of protein three-dimensional structures from the Protein Data Bank (PDB). • Visualization and analysis of protein structures using PyMOL. • Visualization of biomolecular structures using UCSF Chimera. • Identification of protein active sites using CASTp or similar tools. • Primer designing using Primer3 and Primer-BLAST. • Restriction enzyme mapping using NEBcutter. • Analysis of gene expression datasets using the NCBI Gene Expression Omnibus (GEO). • Retrieval of metabolic pathways using the KEGG database. • Retrieval of enzyme information from the BRENDA Enzyme Database. • Retrieval of protein information using UniProtKB. • Identification of protein families using PROSITE and SMART databases. • Retrieval and analysis of SNP information using dbSNP. • Management of scientific references using Mendeley and EndNote. • Preparation of a biological database report with sequence annotations and database citations. • Comparative analysis of biological databases for a selected gene or protein. • Identification and retrieval of disease target proteins from biological databases (NCBI, UniProt, and Protein Data Bank). • Three-dimensional structure visualization and active site prediction of target proteins using PyMOL, UCSF Chimera, and CASTp. • Virtual screening and molecular docking of bioactive compounds against target proteins using AutoDock Vina, PyRx, or CB-Dock. • Prediction of pharmacokinetic (ADMET) properties and drug-likeness of lead compounds using SwissADME, pkCSM, and ProTox3. • Molecular dynamics simulation and binding interaction analysis of protein–ligand complexes using GROMACS, Desmond, or CABS-flex to evaluate complex stability. • Mini-project: Integrated retrieval, analysis, documentation, and presentation of a gene/protein using multiple biological databases.	
Keywords	Biological Databases, Bioinformatics, Genomics, Proteomics Sequence Analysis	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -

- Mount, D. W. (2021). Bioinformatics: Sequence and Genome Analysis (3rd Edition). Cold Spring Harbor Laboratory Press.
- Pevsner, J. (2023). Bioinformatics and Functional Genomics (4th Edition). Wiley-Blackwell.
- Lesk, A. M. (2019). Introduction to Bioinformatics (5th Edition). Oxford University Press.
- Xiong, J. (2017). Essential Bioinformatics (2nd Edition). Cambridge University Press.
- Baxevanis, A. D., & Ouellette, B. F. F. (2020). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (4th Edition). Wiley.

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	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar + Attendance-	10	
	Total Marks -	30	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: KK. On spot Assessment - 40 LL. Spotting based on tools & technology (written) – 20 Marks MM. Viva-voce (based on principle/technology) - 10 Marks		Managed by course teacher as per lab status

Approval of the Board of Studies

Date: 03-09-2026

Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
Signature	Joined by Google Meet on 03-09-2026 https://meet.google.com/uyr-ryry-ihm					

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SYLLABUS FOR THE ONE YEAR POSTGRADUATE PROGRAMME

Part A: Introduction			
Program: MSc in Life Sciences (Degree/Honors)		Semester: II Sem (1YR)	Session: 2026-27
1	Course Code	BT/VAC-2C-TH	
2	Course Title	Nano-Biotechnology	
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 - Explain principles, synthesis and characterization of nanomaterials. Evaluate interactions between nanomaterials and biological systems. Analyze nanotechnology applications in diagnostics and therapeutics. Assess agricultural and environmental applications of nanobiotechnology. Examine safety, ethical and regulatory aspects of nanotechnology.	
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	Fundamentals of Nanobiotechnology Introduction to Nanotechnology and Nanobiotechnology: Concepts, Scope and Applications Nanomaterials: Classification, Properties and Biological Interactions Synthesis of Nanomaterials: Physical, Chemical and Biological Approaches Characterization of Nanomaterials: UV-Visible Spectroscopy, DLS, SEM, TEM and AFM		08 (08 Hrs)
II	Nanomaterials in Biological Systems Nanoparticles for Drug Delivery: Principles and Mechanisms Liposomes, Polymeric Nanoparticles and Dendrimers Nanobiomaterials and Their Interactions with Cells and Tissues Nanotoxicology and Safety Assessment of Nanomaterials		07 (07 Hrs)
III	Diagnostic and Therapeutic Applications of Nanobiotechnology Nanobiosensors: Principles, Types and Applications Nanotechnology in Molecular Diagnostics and Imaging Targeted Drug Delivery and Controlled Release Systems Nanomedicine: Applications in Cancer Therapy and Regenerative Medicine		08 (08 Hrs)

IV	Agricultural, Environmental and Industrial Applications of Nanobiotechnology Nanobiotechnology in Agriculture: Nanofertilizers, Nanopesticides and Crop Improvement Environmental Applications: Bioremediation, Water Purification and Pollution Monitoring Industrial Applications of Nanobiotechnology: Enzymes, Biomaterials and Bioprocesses Ethical, Regulatory and Future Perspectives of Nanobiotechnology	07 (07 Hrs)
Keywords	Nanobiotechnology, Nanoparticles, Nanobiosensors, Nanomedicine, Nanotoxicology	

• Part C - Learning Resource
Text Books, Reference Books, Other Resources -
- Nanobiotechnology: Concepts, Applications and Perspectives, Author: Christof M. Niemeyer and Chad A. Mirkin, 2004, Publisher: Wiley-VCH - Introduction to Nanobiotechnology, Author: Vinod Labhasetwar and Diandra Leslie-Pelecky, 2007, Publisher: John Wiley & Sons - Nanobiotechnology: Principles and Applications, Author: C. M. Niemeyer and C. A. Mirkin, 2011, Publisher: Wiley - Nanotechnology in Biology and Medicine: Methods, Devices and Applications, Author: Tuan Vo-Dinh, 2017, Publisher: CRC Press - Nanobiotechnology: Bioinspired Devices and Materials of the Future, Author: Oded Shoseyov and Ilan Levy, 2008, Publisher: Humana Press - Biomedical Nanotechnology, Authors: Neelina H. Malsch, 2015, Publisher: CRC Press - Nanotechnology: Principles and Practices, Author: Sulabha K. Kulkarni, 5th Edition, 2019, Publisher: Springer - Nanotechnology and Nanomaterials in the Treatment of Life-Threatening Diseases, Editors: Kewal K. Jain and Vinod Labhasetwar, 2020, Publisher: Elsevier

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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Approval of the Board of Studies						
Date: 03-09-2026						
Name	Prof. S. K. Jadhav	Sabiha Naz	Dr. Shubha Diwan	Shri Sanjay Bhagwat	Ku. Varsha Meshram	Dr. Pramod Kumar Mahish
Designation	VC Nominee	Subject Expert	Subject Expert	Employment/ Industrial Member	Merit Alumni	Chairman/ HOD
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