Syllabus of 3rd Year B. Sc. Microbiology (Hons.)

As Per National Education Policy 2020 (NEP 2020)

UPL University of Sustainable Technology

SRICT Institute of Science & Research

AY-2024-2025

UPL University of Sustainable Technology, Ankleshwar				
SRICT-Institute of Science and Research (SRICT-ISR)				
B.Sc. - Microbiology (3rd Year)				
SEM	**TYPE OF COURSE**	**COURSE CODE**	**NAME OF SUBJECT**	**Credits**
5	MAJOR	MIM400-3C	Fundamental of Molecular Biology	4
	MAJOR	MIM401-3C	Molecular Genetics	4
	MAJOR	MIM402-3C	Practicals in Microbiology-III	4
	MINOR	MIE400-3C	Bio-Nanotechnology	4
	MINOR	MIE401-3C	Biostatistics and Bioinformatics	4
	SEC	SEC400-3C	Microbial Biotechnology	2
	SEC	SEC401-3C	Advanced Spreadsheet tools	2
	SEC	SEC402-3C	IT skills and Data Analysis	2
			Total Credits	22
6	MAJOR	MIM403-3C	Basics of Industrial microbiology	4
	MAJOR	MIM404-3C	Basics of rDNA Technology	4
	MAJOR	MIM405-3C	Practicals in Microbiology-IV	4
	MINOR	MIE402-3C	Plant and Animal Biotechnology	4
	AEC	AEC400-3C	General Principles of Writing	2
	AEC	AEC401-3C	Business Communications	2
	INT	SEC403-3C	Internship	4
			Total Credits	22

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B.Sc (Hons) - Microbiology
B.Sc. SEM V
Teaching/Exam Scheme
(As per NEP-2020)

w.e.f.: July-2024

No.	Course Code	Category of course	Course title	Hours Per week			Tot. hrs	Cr edit	CCE	SEE	Total Marks
				L	T	P					
1	**MIM400-3C**	Major	Fundamental of molecular biology	4	-	-	4	4	50	50	100
2	**MIM401-3C**	Major	Molecular Genetics	4	-	-	4	4	50	50	100
3	**MIM402-3C**	Major	Practicals in Microbiology-III	-	-	8	8	4	50	50	100
4	**MIE400-3C**	Minor	Bio-Nanotechnology	4	-	-	4	4	50	50	100
5	**MIE401-3C**	Minor	Biostatistics and Bioinformatics	4	-	-	4	4	50	50	100
6	**SEC400-3C**	SEC	Microbial Biotechnology	2	-	-	2	2	25	25	50
	SEC401-3C	SEC	Advanced Spreadsheet tools	2	-	-	2	2	25	25	50
	SEC402-3C	SEC	IT skills and Data Analysis	2	-	-	2	2	25	25	50
			Total	14	-	8	26	22	275	275	550

- CCE - Continuous and Comprehensive Evaluation.
- SEE – Semester End Evaluation.

Skill Enhancement Courses (SEC)	1. SEC400-3C: Microbial Biotechnology 2. SEC401-3C: Advanced Spreadsheet tools 3. SEC402-3C:IT skills and Data Analysis

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM400-3C

Course Name: Fundamental of Molecular Biology

Semester: V

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of Fundamental of molecular biology and its application.

Rationale: At the end of the course, students will have knowledge about coordination chemistry and structure of DNA, DNA Replication, DNA Transcription, Genetic Code, DNA Translation, Gene regulation.

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Chemistry and structure of Nucleic acid** Nature and Structure of DNA and RNA, Organization of DNA in Cell, Difference between Prokaryotic and Eukaryotic RNA, Evidence of DNA as genetic material, Gene concept and Diversity.	**10**
2.	**Mendelian Genetics** Mendelian Genetics, Mendelian experiment, Mendelian laws, Drosophila experiment, Cross mapping.	**10**
3	**DNA Replication** Prokaryotic organisms: Enzymes and its types, Replication Mechanism (Initiation, Elongation, Termination), Model of DNA Replication. Eukaryotic organisms: Enzymes and its types, Replication Mechanism (Initiation, Elongation, Termination), Model of DNA Replication.	**10**

SECTION - B		
4	**DNA Transcription** Gene expression, Central dogma, RNA polymerase and its Types, Initiation, Elongation, Termination, Post transcriptional modification of RNA.	**10**
5	**DNA Translation** Genetic code, Properties of Genetic code, Charging of tRNA, Initiation, Elongation, Termination, Post translation processing protein.	**10**
6	**Gene Regulation** Concept of Operon, Regulation of gene expression: *lac* operon, *trp* operon, *arb* operon, Quorum Sensing.	**10**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levin, R. Losick. Molecular Biology of the Gene. 6th edition. Benjamin Cummings. 2007.
2. M. J. Pelczar, E.C.S. Chan, N. Krieg, Microbiology - Concepts and Applications, International ed, McGraw Hill., 1993.

Reference Books:

1. Brown TA. Genomes. Chapter 7, Understanding a Genome Sequence. 2nd edition. Oxford: Wiley-Liss, Available from: https://www.ncbi.nlm.nih.gov/books/NBK21136/. 2002
2. Benjamin Lewin. Gene IX. Jones and Bartlett Publishers. 2007.
3. R.F. Weaver, Molecular Biology. 4th edition. McGraw Hill, USA. 2007.
4. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter. Molecular Biology of the Cell. 5th edition. Garland Science, New York and London. 2007.
5. J.M. Berg, J.L. Tymoczko, L. Stryer. Biochemistry. 5th edition. W.H. Freeman and Company, USA. 2008.
6. F. M. Ausubel, R. Brent, R.E. Kingston, D. D. Moore, J. A. Smith, K. Struhl. Current Protocols in Molecular Biology. John Wiley and Sons, Inc. 2007.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understanding of Chemical nature and structure of nucleic acid	15
CO-2	Develop the knowledge for basic concept of Mendelian genetics.	20
CO-3	Learn the synthesis of DNA and related enzyme machinery.	18
CO-4	Understand the machinery and mechanism for RNA synthesis.	17
CO-5	Understand the machinery and mechanism for cellular protein synthesis.	15
CO-6	Learn how gene is responsible for expression and regulation of cellular metabolism.	15

UPL University of Sustainable Technology

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM401-3C

Course Name: Molecular Genetics

Semester: V

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of molecular genetics and its application.

Rationale: At the end of the course, students will have knowledge about Mutation and Transposable elements, DNA repair mechanism, Gene transfer mechanisms, Isolation DNA, RNA and other molecules, Importance bacteria as genetic tool, Tools and Techniques in molecular biology

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Mutation & Transposable Elements** Mutation**:** Definition and types of Mutation, Agent for Mutation: Chemical, Physical and Biological, Expression of Mutation, Methods of Detection and isolation of Mutation, HGT. Transposable Elements: Classes and Nomenclature of Transposable Elements, IS elements, Transposons.	**11**
2.	**DNA repair mechanism** Mechanism of DNA repair, Excision repair, Recombination repair, SOS repair, Methylation-directed very short patch repair.	**9**
3	**Gene transfer mechanisms** Introduction of bacterial plasmids and vectors with examples. Gene transfer based on: Conjugation, F factor based mating, Hfr Conjugation, F prime**,** Conjugation, Transformation, Transduction and its types.	**10**

SECTION - B		
4	**Tools and techniques in molecular biology** PCR and its Types, Hybridoma technology, Isolation DNA, RNA and protein**,** Blotting techniques and Types, FISH, RIA, ELISA, cDNA preparation, Gene bank.	**12**
5	**Microbial Genomics** Introduction to genomics, Methods for DNA sequencing, WGS, Functional Genomics, Comparative genomics, Genebank.	**9**
6	**Proteomics, and other omics approach** Introduction to Proteomics, metabolomics, transcriptomics, Methods for Proteomics, and PDB.	**9**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

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C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. Brown TA. Genomes. 2nd edition. Oxford: Wiley-Liss, Chapter 7, Understanding a Genome Sequence. Available from: https://www.ncbi.nlm.nih.gov/books/NBK21136/. 2002

Reference Books:

1. Benjamin Lewin. Gene IX. Jones and Bartlett Publishers. 2007.
2. R.F. Weaver, Molecular Biology. 4th edition. McGraw Hill, USA. 2007.
3. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter. Molecular Biology of the Cell. 5th edition. Garland Science, New York and London. 2007.
4. J.M. Berg, J.L. Tymoczko, L. Stryer. Biochemistry. 5th edition. W.H. Freeman and Company, USA. 2008.
5. F. M. Ausubel, R. Brent, R.E. Kingston, D. D. Moore, J. A. Smith, K. Struhl. Current Protocols in Molecular Biology. John Wiley and Sons, Inc. 2007.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	To learn about the gene mutation mechanisms and its impact on cell.	15
CO-2	Learn about the cellular mechanisms for Repairing the cell mutation.	15
CO-3	Understanding the basic methodology of the DNA transfer in cell.	20
CO-4	Understand the basics tool and techniques required for gene transfer.	20
CO-5	Learn basic bioinformatics techniques related to genomics.	15
CO-6	Enhanced the basic bioinformatics knowledge related to proteomics.	15

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM402-3C

Course Name: Practicals in Microbiology-III

Semester: V

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of Basics practical's related to molecular genetics and DNA molecular biology.

Rationale: At the end of the course, students will have knowledge about how the DNA is play major role in all activities. Even students can learn about Molecular DNA based analysis and estimations.

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
-	-	8	8	50	50	100

Contents:

Sr. No.	Content	Total Hours
	1. Study of various chemical mutagenic agent on bacterial cell. 2. Study of various physical mutagenic agent on bacterial cell. 3. Study of replica plate method. 4. Isolation of lac mutants of *Escherichia coli* using UV radiations as mutagen. 5. Isolation of pigment mutant of *Serratia marcescens* using UV radiations as mutagen. 6. Isolation of streptomycin resistant mutants of *Escherichia coli* by gradient plate method. 7. Study of Auxotrophic resistant mutant. 8. Isolation of RNA from *E. Coli*. 9. Isolation of DNA from *E. Coli*. 10. Isolation of Protein from *E. Coli*. 11. Isolation of Plasmid from *E. Coli*.	**120**

	12. Determination of the plasmid by Gel electrophoresis. 13. Determine the DNA by Gel electrophoresis. 14. Determine the RNA by Gel electrophoresis. 15. Determine the Protein by Gel electrophoresis. 16. Amplification of DNA by PCR. 17. Study the mechanism of Restriction endonuclease activity in lab. 18. Estimation of protein by Folin-Lawary method 19. Estimation of protein by Bradford method 20. Estimation of glucose by Coles method.	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Book and Reference Books:

1. Patel, Rakesh J. and Patel Kiran, R. "Experimental Microbiology Vol. I and Vol. II". Aditya Prakashan, Ahmedabad. 2009
2. M. Gopal Reddy,M., Reddy, M.N., Saigopal, D.V.R. and Mallaiah K.V., "Laboratory Experiments in Microbiology", Himalaya Publishing House, Mumbai. 2007
3. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. 2018
4. Grainger. John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual" The Society for General Microbiology. 2001
5. https://microbenotes.com/introduction-to-antigen-antibody-reactions/
6. https://www.coursesidekick.com/chemistry/3885786
7. https://egyankosh.ac.in/bitstream/123456789/12449/1/Experiment-10.pdf

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the structure and morphology and cultivation strategies for Virus.	20

CO-2	Understand the structure and morphology and cultivation strategies for fungi.	15
CO-3	Estimation of basic polymer by spectroscopic method.	15
CO-4	Learn about the basic techniques for Molecular biology	15
CO-5	Learn how to isolates macromolecules from the cell.	15
CO-6	Learn various mutagenesis agent and their effect on cell.	20

UPL University of Sustainable Technology

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIE400-3C

Course Name: Bio-Nanotechnology

Semester: V

w.e.f July 2025

Type of course: Minor

Prerequisite: Basic knowledge of applications of Nanotechnology in microbiology, biotechnology, and chemistry.

Rationale: This course bridges microbiology and nanotechnology, exploring their applications in healthcare, environment, and industry.

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Introduction to Bio-Nanotechnology** Definition, scope, and importance of bio-nanotechnology, Historical background and major developments, Interdisciplinary nature: Integration of biology, chemistry, and nanotechnology, Applications in microbiology and medicine	**9**
2.	**Nanomaterials in Biological Systems** Classification of nanomaterials: Organic and inorganic nanomaterials, Synthesis of nanoparticles: Physical, chemical, and biological methods, Properties of nanomaterials: Optical, electrical, mechanical, and catalytic properties, Characterization techniques: UV-Vis spectroscopy, SEM, TEM, XRD, DLS	**12**
3	**Biological Synthesis of Nanoparticles** Microbial synthesis of nanoparticles: Bacteria, fungi, and algae-mediated synthesis, Plant-based nanoparticle synthesis, Mechanisms of biological nanoparticle formation, Advantages and limitations of biological methods	**12**

SECTION – B		
4	**Applications of Nanotechnology in Microbiology** Role of nanotechnology in antimicrobial agents, Nanoparticles in drug delivery and targeted therapy, Use of nanomaterials in biosensors and diagnostics, Nanotechnology in water purification and environmental bioremediation.	**9**
5	**Toxicity and Environmental Impact of Nanoparticles** Interaction of nanoparticles with biological systems, Cytotoxicity and genotoxicity of nanoparticles, Risk assessment and biocompatibility of nanomaterials, Environmental fate and degradation of nanoparticles.	**9**
6	**Future Prospects and Ethical Considerations** Recent advancements in bio-nanotechnology, Role of bio-nanotechnology in sustainable development, Ethical and safety concerns in nanotechnology research, Regulatory frameworks for nanomaterial applications.	**9**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. Ratner, M. A., & Ratner, D. Nanotechnology: A gentle introduction to the next big idea. Pearson Education. 2003
2. Kumar, C. S. S. R. (Ed.). Nanomaterials for medical diagnosis and therapy. Wiley-VCH. 2006
3. Niemeyer, C. M., & Mirkin, C. A. (Eds.). Nanobiotechnology: Concepts, applications, and perspectives. Wiley-VCH. 2004

Reference Books:

1. Bhushan, B. Handbook of nanotechnology. Springer. 2017
2. Jain, K. K. The handbook of nanomedicine (2nd ed.). Springer. 2012
3. Rai, M., Duran, N., & Field, D. Metal nanoparticles in microbiology. Springer. 2012
4. Sahoo, S. K. (Ed.). Nanotechnology in drug delivery. CRC Press. 2012

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the definition, scope, historical background, and interdisciplinary nature of bio-nanotechnology.	15%
CO-2	Classify different types of nanomaterials and explain their physical, chemical, and biological synthesis approaches.	20%
CO-3	Explore microbial and plant-based synthesis of nanoparticles and their underlying mechanisms.	15%
CO-4	Discuss the role of nanotechnology in antimicrobial agents, drug delivery, biosensors, and environmental bioremediation.	20%
CO-5	Understand the interactions of nanoparticles with biological systems, their potential risks, and environmental fate.	15%
CO-6	Analyze recent advancements, ethical concerns, safety regulations, and sustainability aspects of nanotechnology applications.	15%

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIE401-3C

Course Name: Bioinformatics and Biostatistics

Semester: V

w.e.f July 2025

Type of course: Minor

Prerequisite: Should have underlying knowledge of various application of computational science and mathematical sciences.

Rationale: At the end of the course, students will have a fundamental knowledge regarding various aspects of use of mathematical science and computational science in applied life science.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Introduction to bioinformatics** Bioinformatics definition, Concept, History, Scope and Applications. Internet Basics: Connecting to the Internet, E-mail, FTP, WWW, Difference between WWW and Internet. Bioinformatics web portals: NCBI, EBI, ExPASy.	**9**
2.	**Databases** Classification of databases, Primary (Genbank), Secondary (PIR) and Tertiary or Composite (KEGG) databases. Sequence databases - DNA sequence databases (ENA, DDBJ). Protein sequence databases (PDB, Swissprot, PROSITE).	**12**
3	**Sequence alignment** Basics of sequence alignment - match, mismatch, gaps, gap penalties, scoring alignment, Types of sequence alignment - pairwise and multiple alignment, local	**9**

	and global alignment, Dot matrix comparison of sequences. Scoring matrices - PAM and BLOSUM, Pairwise sequence similarity search by BLAST and FASTA, Concepts of phylogeny - Distance based (NJ method) and character based (ML method) tree construction methods	
SECTION - B		
4	**Basic concepts in biostatistics** Introduction to Biostatistics, kinds of data and variables - based on nature (numerical-discrete and continuous, categorical-ordinal and nominal) - based on source (primary and secondary data), sample size, sampling methods and sampling errors, Data tabulation and representation methods: graphical methods– stem and leaf plot, line diagram, bar graphs, histogram, frequency polygon, frequency curves, diagrammatic method- pie diagram.	**12**
5	**Calculations and Measurement** Calculations of mean, median, mode, variance, standard deviation, Concepts of coefficient of variation**,** Measure of central tendency, with computation and their application in biostatistics.	**9**
6	**Tests of significance** Normal distribution curve, characteristics and uses with computation. One and two sample tests, Z-test, t-test, F-test and Chi-square test and their applications.	**9**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate

C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. Lesk, A. M. *Introduction to bioinformatics* (5th ed.). Oxford University Press. 2019
2. Holmes, S., & Huber, W. *Modern statistics for modern biology*. Cambridge University Press. 2019

Reference Books:

1. Mount, D. W. Bioinformatics: Sequence and genome analysis (2nd ed.). Cold Spring Harbor Laboratory Press. 2004

2. Pevsner, J. Bioinformatics and functional genomics (3rd ed.). Wiley-Blackwell. 2015
3. Daniel, W. W., & Cross, C. L. *Biostatistics: A foundation for analysis in the health sciences* (11th ed.). Wiley. 2018
4. Ussery, D. W., Wassenaar, T. M., & Borini, S. *Computing for comparative microbial genomics: Bioinformatics for microbiologists*. Springer. 2009

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the definition, scope, and applications of bioinformatics.	15%
CO-2	Utilize databases for DNA and protein sequence retrieval, analysis, and interpretation.	20%
CO-3	Perform various alignment, apply scoring matrices and construct phylogenetic trees.	15%
CO-4	Describe types of data, sampling methods, and graphical representation techniques for biological data analysis.	20%
CO-5	Compute mean, median, mode, standard deviation, and variance to analyze biological datasets and interpret results.	15%
CO-6	Apply Z-test, t-test, F-test, and Chi-square test to assess the significance of biological data in research studies.	15%

UPL University of Sustainable Technology

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: SEC400-3C

Course Name: Microbial Biotechnology

Semester: V

w.e.f.- July 2025

Type of Course: SEC Course

Prerequisite: Understanding of role of biotechnology in Microbiology.

Rationale: Learn about the various applications of biotechnology in production of microbial metabolites.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
2	-	-	2	25	25	50

Contents:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Commercial Production of Microorganisms** Industrial Fermenters, Single cell Protein, Single cell oil, Amino acids, Vitamins, Steroids, Metabolites, Enzymes, Antibiotics.	**7**
2	**Bioconversions** Biomining and bioleaching of ores (Use of thermophilic microorganisms In industrial microbiology, Biogas, Bioleaching, Biodiesel, Biofuel.	**8**
	SECTION-B	
3	**Microorganisms & Agriculture** Microorganisms in Agricultural Waste water treatment, Microbial Plant growth promoting substances and its important, Vermiculture, Microbial pesticides, Biofertilizer.	**7**
4	**Bioremediation** Basic concept of bioremediation, strategies for bioremediation, mechaanisms for bioremediation, Petroleum prospecting and formation of oil spills, Wastewater treatment, chemical degradation, heavy metals, pesticides.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

References:

1. Casida, L. E. Industrial microbiology (2nd ed.). New Delhi: Wiley Eastern Limited. 1991
2. Patel, A. H. Industrial microbiology (2nd ed.). New Delhi: Macmillan India Limited. 2004
3. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. Prescott's microbiology (10th ed.). New York, NY: McGraw-Hill Education. 2017
4. Waites, M. J., Morgan, N. L., Rockey, J. S., & Higton, G. Industrial microbiology: An introduction. Oxford, UK: Wiley-Blackwell. 2001
5. Maier, R. M., Pepper, I. L., & Gerba, C. P. Environmental microbiology (3rd ed.). San Diego, CA: Academic Press. 2015
6. Rangaswami, G., & Bagyaraj, D. J. Agricultural microbiology (2nd ed.). New Delhi: PHI Learning Pvt. Ltd. 2004
7. Glazer, A. N., & Nikaido, H. Microbial biotechnology: Fundamentals of applied microbiology (2nd ed.). Cambridge, UK: Cambridge University Press. 2007
8. Shuler, M. L., & Kargi, F. Bioprocess engineering: Basic concepts (2nd ed.). Upper Saddle River, NJ: Prentice Hall. 2002

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	To introduce the students to the use of microorganisms in biotechnology based process and industries.	20%
CO-2	Develop knowledge regarding the mechanism and stretegies for the production of various microbial metabolites for society.	15%
CO-3	Understand the production of various energy resources.	15%
CO-4	Understand the use of microbes in agriculture biotechnology.	20%
CO-5	To develop a keen insight in the students for bioremediation of various environmental pollution using microbes	10%
CO-6	To explore the microbes for management of human need and balance the environment.	20%

UPL University of Sustainable Technology

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: SEC401-3C

Course Name: Advanced Spreadsheet Tools

Semester: V

w.e.f.: July 2025

Type of Course: SEC Course

Prerequisite: Basic knowledge of spreadsheets, including data entry, simple formulas, and basic formatting.

Rationale:

The course equips learners with essential skills for efficient data management, analysis, and visualization. It bridges the skill gap by covering advanced functions, automation techniques, and reporting tools to enhance productivity. The course emphasizes hands-on learning to improve accuracy, decision-making, and efficiency. By mastering these tools, learners become more proficient in handling real-world data challenges across various industries.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
2	-	-	2	25	25	50

Contents:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Dealing with Data** Data Entry and Formatting: Using Excel Tables Formatting Cells, Rows, and Columns Custom Number Formatting. Sorting and Filtering Data: Sorting Data (Single & Multiple Levels) Applying Filters for Quick Data Analysis Using Advanced Filters. Data Validation and Cleaning: Setting Up Data Validation (Drop-down lists, Rules) Removing Duplicates and Handling Empty Cells Text-to-Columns and Flash Fill.	**7**
2	**Functions and Formulas** Logical Functions: IF, AND, OR, NOT Functions Nested IF Statements Using	**8**

	IFERROR for Error Handling. Lookup and Reference Functions: VLOOKUP and HLOOKUP INDEX and MATCH XLOOKUP (for newer Excel versions). Essential Math and Statistical Functions: SUM, AVERAGE, COUNT, COUNTA, ROUND, INT, MOD, MIN, MAX, MEDIAN.	
SECTION-B		
3	**Data Analysis and Visualization** Pivot Tables and Charts: Creating Pivot Tables, Filtering Data. Charts and Graphs: Creating Basic Charts (Bar, Line, and Pie). Customizing Charts for Better Visualization. What-If Analysis: Goal Seek, Scenario Manager, Data Tables.	**7**
4	**Basic Productivity and Time-Saving Tools** Keyboard Shortcuts and Quick Access Tools, Essential Excel keyboard shortcuts, Customizing the Quick Access Toolbar. Basic Data Entry Automation, AutoFill and Flash Fill, Using Named Ranges for quick referencing. Page Setup and Printing, Setting up print areas and page breaks, Printing headers and footers.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate

C: Create and above Levels (Revised Bloom's Taxonomy)

References:

1. Microsoft Excel 2019 Bible – John Walkenbach, Wiley Publications
2. Excel Formulas & Functions For Dummies – Ken Bluttman, Wiley Publications
3. Data Analysis with Microsoft Excel – Kenneth N. Berk, Patrick Carey
4. Advanced Excel Reporting for Management Accountants – Neale Blackwood, Wiley
5. Online Microsoft Documentation: https://support.microsoft.com/excel

Course Outcomes:

After completing this course, student will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Organize, format, and manage large datasets using tables, sorting, filtering, and data validation techniques.	20%

CO-2	Master logical, lookup, and statistical functions for advanced data calculations and analysis.	15%
CO-3	Create Pivot Tables, Charts, and use What-If Analysis tools to extract insights from data.	15%
CO-4	Use automation features like AutoFill, Flash Fill, and Quick Access Toolbar for efficient workflow.	20%
CO-5	Set up print areas, manage page layouts, and create structured, printable reports.	10%
CO-6	Apply advanced spreadsheet tools confidently in real-world scenarios.	20%

List of Open Source Software/learning website:

1. **Open-Source Spreadsheet Software:**
   - LibreOffice Calc (https://www.libreoffice.org/)
   - Apache OpenOffice Calc (https://www.openoffice.org/)
   - Gnumeric (http://www.gnumeric.org/)
2. **Learning Platforms for Excel and Data Analysis:**
   - NPTEL Online Courses: https://archive.nptel.ac.in/courses/
   - Khan Academy: https://www.khanacademy.org/
   - Coursera Free Courses: https://www.coursera.org/
   - Udemy Free Courses: https://www.udemy.com/
   - Microsoft Learn: https://learn.microsoft.com/en-us/training/

UPL University of Sustainable Technology

SRICT Institute of Science & Research

As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: SEC402-3C

Course Name: IT skills and Data Analysis

Semester: V

w.e.f.: July 2025

Type of Course: SEC Course

Prerequisite: Basic knowledge of data analysis, modeling, visualization and data coding.

Rationale:

Familiarise the student with the quantitative skills required for representing and Interpreting data for the purpose of decision making. Enable the student to analyse data and problem situations using relevant IT tools.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
2	-	-	2	25	25	50

Contents:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Data Analysis Tool – Power BI** Class Introduction (BI Basics), Class Introduction (Power BI Desktop Overview), Data Discovery with Power BI Desktop. Transforming Data (Basic Transforms), Transforming Data (Add Column From Example), Transforming Data (Appending Queries), Transforming Data (Merging Queries). Transforming Data (Combine Files), Transforming Data (M Query Basics), Transforming Data (Parameters and Templates), Transforming Data (Other Query Features).	**7**
2	**Introduction to Modeling Data** Creating the Data Model (Modeling Basics), Creating the Data Model (Model Enhancements), Creating the Data Model (What If Parameters). Creating Calculated Columns and Tables (DAX Basics), Creating Calculated Columns and Tables (Navigation Function), Creating Calculated Columns and Tables (Calculated Tables).	**8**

	Creating Calculated Measures (Measure Basics), Creating Calculated Measures (Time Intelligence Functions).	
SECTION-B		
3	**Introduction to Visualizing Data** Creating Basic Reports with the Power BI Desktop, Creating Interactive Reports (Adding Slicers for Filters), Creating Interactive Reports (Visualizing Tabular Data), Creating Interactive Reports (Visualizing Categorical Data). Creating Interactive Reports (Visualizing Data Trends), Creating Interactive Reports (Visualizing Categorical and Trend Data Together), Creating Interactive Reports (Visualizing Geographical Data with Maps), Creating Interactive Reports (Visualizing Goal Tracking). Creating Interactive Reports (Using Custom Visuals), Creating Interactive Reports (Digital Storytelling), Creating Interactive Reports (Other Features).	**7**
4	**Introduction to DAX Coding** Data Modeling Basics (Overview), Data Modeling Basics (Tabular), What is DAX (Overview), What is DAX (Tabular), Creating Calculated Columns (Basics). Creating Calculated Columns (Basics Continued), Navigation Functions, Conditional and Logical Functions, Creating Calculated Measures. Time Intelligence (Overview), Time Intelligence (Time Intelligence Functions), Using X-Functions and A-Functions, Table Functions, DAX as a Query Language.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

References:

1. Alberto Ferrari ,Marco Russo, Introducing Microsoft Power BI
2. Devin Knight, Brian Knight, and Mitchell Pearson, Microsoft Power BI Quick Start Guide.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Represent and interpret data in tabular and graphical forms	20%
CO-2	Understand and interpret the measures of central tendency and dispersion.	15%
CO-3	Use IT tools such as Power BI to visualise and analyse data.	15%
CO-4	Equip the student with some fundamental concepts, which play a critical role in Understanding and visualizing real world data.	20%
CO-5	Relevant concepts will be introduced which will be supplemented by hands-on activities enabled by the use of Power BI	10%
CO-6	Students learn about the concept of datasets and Different type of Variables Distinction between primary and secondary sources of data	20%

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL

- https://learn.microsoft.com/en-us/power-bi/connect-data/desktop-data-sources
- https://community.powerbi.com/t5/Desktop/How-to-reference-a-table-column-within-an-API-url/td-p/2244511
- https://community.powerbi.com/t5/Power-Query/Query-references-other-queries-or-steps-so-it-may-not-directly/td-p/2836287
- https://learn.microsoft.com/en-us/power-bi/collaborate-share/service-url-filters

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SRICT Institute of Science & Research

B.Sc (Hons) - Microbiology
B.Sc. SEM VI
Teaching/Exam Scheme
(As per NEP-2020)

w.e.f.: July-2025

No.	Course Code	Category of course	Course title	Hours Per week			Tot. hrs	Credit	CCE	SEE	Total Marks
				L	T	P					
1	MIM403-3C	Major	Basics of Industrial Microbiology	4	-	-	4	4	50	50	100
2	MIM404-3C	Major	Basics of rDNA Technology	4	-	-	4	4	50	50	100
3	MIM405-3C	Major	Practicals in Microbiology-IV	-	-	8	8	4	50	50	100
4	MIE402-3C	Minor	Plant and Animal Biotechnology	4	-	-	4	4	50	50	100
5	AEC400-3C	AEC	General Principles of Writing	2	-	-	2	2	25	25	50
	AEC401-3C	AEC	Business Communications	2	-	-	2	2	25	25	50
6	SEC403-3C	INT	Internship *	-	-	-	*	4	50	50	100
			Total	14	-	8	22	22	275	275	550

s

- CCE - Continuous and Comprehensive Evaluation.
- SEE – Semester End Evaluation.

Ability Enhance Course (AEC)	1. AEC400-3C: General Principles of Writing 2. AEC401-3C: Business Communications

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SRICT Institute of Science & Research

As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM403-3C

Course Name: Basics of Industrial Microbiology

Semester: VI

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of Basics of Industrial microbiology and its application.

Rationale: At the end of the course, students will have knowledge about Fermentation Design and type, Medium sterilization and inoculum development, Up-stream Processing, Downstream processing, Immobilization and post modification, Production of fermentative /industrial products.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Fermentation Design and type** Fundamental concepts of fermentation, Chronological development in industrial microbiology, Introduction to the component parts of fermentation process, Stirred tank bioreactor, Body construction and design, Devices of aeration and agitation, Devices for monitoring pH, temperature, foam and dissolved oxygen, Air-lift fermenter, Tower fermenter, Cyclone fermenter, Bio-catalyst reactors.	**10**
2	**Medium sterilization and inoculum development** Characteristics of an industrially ideal organism, Principles of media formulation, Media ingredients: water, carbon sources, nitrogen sources, minerals, growth factors, buffers, chelators, precursors, inducers, inhibitors, antifoam agents. Sterilization of media: Use of high pressure steam: principle, batch and continuous sterilization process. Inoculum development: general principles for	**10**

	development of seed culture for bacterial, yeast and fungal processes. Strain improvement, Strain improvement for modifications of properties other than yield.	
3	**Fermenter operation and scale up** Modes of operation: surface culture fermentation, submerged fermentation (batch, fed-batch and continuous fermentations), solid substrate fermentation Operating parameters and their control: aseptic operation, mass transfer of oxygen, foam, pH, temperature. Safety procedures: Containment, Clean room environment.	**10**
SECTION - B		
4	**Downstream processing** Introduction to Downstream processing, Removal of microbial cells and suspended solids: Foam separation, Precipitation, Filtration, Centrifugation Cell disruption methods: Physico-mechanical methods, Chemical methods. Product concentration and purification: Liquid-liquid extraction, Membrane processes Finishing stages: Drying, Crystallization, Effluent treatment, Immobilization and post modification.	**10**
5	**Product analysis and fermentation economics** Detection and assay of fermentation products. Physical assays: Titration and gravimetric analysis, turbidity and cell yield determination. Chemical assays: Chromatography, Spectrophotometry. Biological assays: Microbial assay Microbial quality assurance: Sterility testing, Sterility testing. Introduction to fermentation economics.	**10**
6	**Production of fermentative/industrial products** Protease, Amylase, Lipase, Butanol, Acetic acid, Citric acid, Penicillin, Ethanol, Lysine.	**10**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. P. Stanbury, A. Whitaker, S. Hall. Principles of Fermentation Technology. 3rd edition. Butterworth-Heinemann. 2016.

Reference Books:

1. M. L. Shuler, F. Kargi, Bioprocess Engineering: Basic Concepts 2nd edition. Pearson Education India. 2015.
2. N. Okafor. Modern Industrial Microbiology & Biotechnology. 1st edition. CRC Press, USA. 2007.
3. E.M.T. El-Mansi, C.F. Bryce, A.L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. 3rd edition. CRC Press. 2012.
4. A.N. Glazer, H. Nikaido. Microbial Biotechnology: Fundamentals of Applied Microbiology. 2nd edition. Cambridge University Press. 2007.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understanding the various types of fermenter and their applications.	15
CO-2	Learn how media is prepared and sterilized for industrial fermentation process.	20
CO-3	Understand the various parameters need to be control during the fermentation process and its scale up study.	15
CO-4	Learn about the various steps for downstream processing.	15
CO-5	Analyzed the synthesized products in term of quality and quantity and fermentation economics.	15
CO-6	Learn how various products has been synthesized in industries.	20

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SRICT Institute of Science & Research

As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM404-3C

Course Name: Basics of rDNA Technology

Semester: VI

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of Basics of rDNA technology and its application.

Rationale: At the end of the course, students will have knowledge about introduction and History of rDNA Technology, Enzymes in rDNA Technology, Vectors and Plasmids, Methods for rDNA Technology, genetically modified microorganisms, Applications of rDNA technology.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Introduction and History of rDNA Technology** Concept of gene cloning, History of rDNA Technology, Strategies for rDNA Technology, Future of rDNA Technology.	**9**
2.	**Enzymes in rDNA Technology** Restriction endonuclease enzymes and their classification, Ligases, Linkers, Adaptors, Homo-Polymer Tail, Formation of DNA fragment.	**9**
3	**Vectors and Plasmids** Define vector and plasmid, Bacteriophage, Cosmid, Phasmid, Shuttle vector, Ti-plasmid, Artificial plasmid. Selection of marker gene and clone by colony hybridization, Plaque hybridization, Blotting technique.	**12**

SECTION - B		
4	**Methods for rDNA Technology** Gene cloning in prokaryotic and eukaryotic method, DNA Fingerprinting, Hybridization, Isolating and cutting DNA, Joining DNA fragments, Inserting DNA into a host cell, Selecting transformed cells, PCR, cDNA, CRISPR-Cas9.	**9**
5	**Genetically modified organisms** Definition, Mechanism and examples: Genetically modified plant, Genetically modified animal, Genetically modified bacteria, Genetically modified insect.	**9**
6	**Applications of rDNA Technology** Production of pharmaceutical products: Human hormone, Insulin, Vaccines. Diagnosis of disease: DNA Probe and PCR in diagnosis. Agriculture industry: Pesticides (Bacterial and Virus), insecticides, Transgenic plant. Environmental: Control the pollution by superbug or GMO.	**12**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. J. Watson, T. Baker, S. Bell, A. Gann, M. Levine, R. Losick. Molecular Biology of the Gene. 7th edition. Pearson. 2014.

Reference Books:

1. Benjamin Lewin. Gene IX. Jones and Bartlett Publishers. 2007.
2. R.F. Weaver, Molecular Biology. 4th edition. McGraw Hill, USA. 2007.
3. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter. Molecular Biology of the Cell. 5th edition. Garland Science, New York and London. 2007.
4. J.M. Berg, J.L. Tymoczko, L. Stryer. Biochemistry. 5th edition. W.H. Freeman and Company, USA. 2008.
5. F. M. Ausubel, R. Brent, R.E. Kingston, D. D. Moore, J. A. Smith, K. Struhl. Current Protocols in Molecular Biolog.y John Wiley and Sons, Inc. 2007.
6. D.P. Clarke, N. Pazdernik. Molecular Biology. 2nd edition. Academic Press. 2012.

7. T.A. Brown. Gene Cloning and DNA Analysis: An Introduction. 7th edition. Wiley Blackwell Publishers. 2016.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basics knowledge and history of rDNA technology.	15
CO-2	Learn various enzymatic machinery used for rDNA technology.	20
CO-3	Understand the various structure of plasmid and vectors, its types and utility for rDNA technology.	15
CO-4	Learn various tools and techniques used in rDNA technology.	20
CO-5	Analyze the development of GMP, GMA, and other related MOs.	15
CO-6	Develop knowledge for implications of GMO/Products for various industrial purpose.	15

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIM405-3C

Course Name: Practicals in Microbiology-IV

Semester: VI

w.e.f.: July 2025

Type of course: Major Course

Prerequisite: Should have underlying knowledge of production of fermentative products.

Rationale: At the end of the course, students will have knowledge about Fermentation of primary and secondary metabolites.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
-	-	-	8	50	50	100

Contents:

Sr. No.	Content	Total Hours
	1. Immobilization of cell and enzyme. 2. Estimation of glucose by Nelson-Somogy and DNSA method 3. Development of bacterial and fungal inoculum for fermentation. 4. Production and estimation of Protease by SmF. 5. Production and estimation of amylase by SmF. 6. Production and estimation of Protease by SSF. 7. Production and estimation of amylase by SSF. 8. Quantification of amylase by Iodine method. 9. Estimation of glucose by DNSA method. 10. Study the effect of pH on enzyme production. 11. Study the effect of Temperature on enzyme production. 12. Study the effect of various Carbon source on enzyme production. 13. Study the effect of various Nitrogen source on enzyme production. 14. Study the effect of inoculum volume on enzyme production 15. Sterility testing of pharmaceutical products.	**120**

	16. Study the size of DNA by Gel electrophoresis 17. Determination of OTR under static and shake flask condition by sulfite oxidation method. 18. Production and estimation of ethanol. 19. Purification of enzymes by ammonium sulphate method. 20. Purification of enzymes by dialysis.	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Patel, Rakesh J. and Patel Kiran, R. Experimental Microbiology Vol. I and Vol. II. Aditya Prakashan, Ahmedabad. 2009
2. M. Gopal Reddy, M. Reddy, M.N., Saigopal, D.V.R. and Mallaiah K.V., Laboratory Experiments in Microbiology, Himalaya Publishing House, Mumbai. 2007
3. Aneja, K. R., Laboratory Manual of Microbiology and Biotechnology. 2 Edition, Meditech Scientific International. 2018
4. Grainger. John, Hurst. Janet and Burdass. Dariel, Basic Practical Microbiology: A Manual. The Society for General Microbiology. 2001

Course Outcomes:
After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Learn about the production of secondary metabolites by fermentation.	20
CO-2	Understand the methods for the estimation of Macromolecules.	20
CO-3	Understand the Role and mode of action of antibiotic.	15
CO-4	Learn the methods for immobilization of cell and other metabolites.	15
CO-5	Estimate the various component of blood.	20
CO-6	Learn about the basic practical of rDNA technology.	10

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: MIE402-3C

Course Name: Plant and Animal Biotechnology

Semester: VI

w.e.f July 2025

Type of course: Minor

Prerequisite: Basic knowledge of cell biology, genetics, microbiology, and molecular biology is required.

Rationale: This course explores genetic manipulation, tissue culture, and industrial applications of plant and animal biotechnology for advancements in agriculture, medicine, and environmental sustainability.

Teaching and Examination Scheme:

Credits				Examination Marks		Total Marks
L	T	P	Total	CCE Marks	SSE Marks	
4	-	-	4	50	50	100

Contents:

Sr. No.	Content	Total Hours
	SECTION - A	
1	**Introduction to Plant and Animal Biotechnology** Definition, scope, and applications of biotechnology. Historical developments in plant and animal biotechnology. Ethical, social, and legal aspects of biotechnology. Tools and techniques in biotechnology: restriction enzymes, vectors, and gene transfer methods.	**9**
2.	**Plant Tissue Culture and Genetic Engineering** Basics of plant tissue culture: callus culture, organogenesis, somatic embryogenesis. Micropropagation techniques and applications. Protoplast fusion and hybridization. Genetic engineering in plants: Agrobacterium-mediated transformation, gene gun method. Genetically modified (GM) crops and their	**12**

	applications.	
3	**Animal Cell Culture and Genetic Engineering** Introduction to animal cell culture: primary culture, secondary culture, and cell lines. Culture media and growth requirements. Stem cell technology: types, applications, and challenges. Animal cloning: techniques and applications. Genetically modified animals and transgenic technology.	**9**
SECTION - B		
4	**Applications of Plant Biotechnology** Production of secondary metabolites using plant cell culture. Biopesticides and biofertilizers: role in sustainable agriculture. Stress tolerance in plants (drought, salinity, pest resistance). Edible vaccines and nutraceuticals. CRISPR and genome editing in plants.	**12**
5	**Applications of Animal Biotechnology** Recombinant vaccines and monoclonal antibodies. Production of therapeutic proteins in animals. Gene therapy: methods and applications. In-vitro fertilization (IVF) and embryo transfer technology. Xenotransplantation and organ regeneration.	**9**
6	**Industrial and Environmental Applications** Use of genetically modified plants and animals in industry, Bioreactors and large-scale production of biotech products. Bioremediation using genetically engineered plants and microbes. Animal biotechnology in pharmaceuticals and diagnostics, Future perspectives in plant and animal biotechnology.	**9**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**30**	**10**	**15**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. Bhojwani, S. S., & Razdan, M. K. Plant tissue culture: Theory and practice. Elsevier. 1996
2. Chawla, H. S. Introduction to plant biotechnology (3rd ed.). CRC Press. 2009
3. Freshney, R. I. Culture of animal cells: A manual of basic technique and specialized

applications (7th ed.). Wiley-Blackwell. 2015

Reference Books:

1. Brown, T. A. Gene cloning and DNA analysis: An introduction (7th ed.). Wiley-Blackwell. 2016
2. Glick, B. R., & Patten, C. L. Molecular biotechnology: Principles and applications of recombinant DNA (5th ed.). ASM Press. 2017
3. Singh, B. D.. Biotechnology: Expanding horizons (4th ed.). Kalyani Publishers. 2015

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the fundamental concepts, scope, and applications of plant and animal biotechnology.	15%
CO-2	Demonstrate knowledge of plant tissue culture methods.	20%
CO-3	Describe animal cell culture techniques, for biomedical applications.	15%
CO-4	Evaluate the role of GM crops, biofertilizers, biopesticides, and genome editing technologies.	20%
CO-5	Explain the use of recombinant vaccines, gene therapy, MAbs and cloning in medical biotechnology.	15%
CO-6	Assess the industrial-scale applications of GMP and animals, bioreactors, and bioremediation.	15%

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SRICT Institute of Science & Research

As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: AEC400-3C

Course Name: General Principles of Writing

Semester: VI

Type of Course: Ability Enhance Course

Prerequisite: Basic Knowledge of English

Rationale: At the end of the course, students will have knowledge of English language. It also targets the understanding of grammar, focusing on comprehension, and writing skills.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
L	T	P	C	CCE Marks	SSE Marks	
2	-	-	2	25	25	50

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**General Writing** Process of writing, First draft of Writing, Analyzing the errors and preparing the final draft, Paragraph writing, Email Writing, Essay Writing (Composition).	7
2	**Letter Writing** Types of letter writing - formal and Informal, Format of a formal letter writing **Official Letters** Official Letters lodging complaints with - the Police Commissioner, the Municipal Commissioner and the Post Master.	7
	SECTION-B	
3	**Report Writing** Types of Report – Formal (Business, Feasibility and Progress), Format of report writing **Suggested topics** Accidental, Natural Calamities, Celebration of festivals, and Progress of a product	8

	and, Launching of a product in the market.	
4	**Formal Writing :** Job Application Types of Resumes Resume Writing	**8**

Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E:Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. David Green: Contemporary English Grammar Structure and Usage
2. M L Tickoo and Subramanian: Intermediate Grammar, Usage and Composition
3. Wren and Martin – High School English Grammar and Composition
4. Murphy, R. (2019). English Grammar in Use (5th ed., p. 80) Cambridge: Cambridge University Press.
5. Advance Writing Skill by D.S Paul.

Course Outcomes: After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Use English in day-to-day communication	20%
CO-2	Use various forms of vocabulary in varied situations in oral and written communication.	20%
CO-3	Comprehend the dynamics of various rules of grammar and check its validation in writing various documents.	20%
CO-4	Use grammar effectively for improving professional writing.	10%
CO-5	Write various formal and informal documents of day to day life	20%
CO-6	Prepare for lifelong learning and enhance writing in English for day to day communication.	10%

List of Open Source Software/learning website:

- http://www.english-online.org.uk/
- http://www.learnenglish.de/

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As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code: AEC401-3C

Course Name: Business Communication

Semester: VI

w.e.f.: July 2025

Type of Course: Ability Enhance Course

Prerequisite: Basic Knowledge of English

Rationale: At the end of the course, it will enhance communication skills of the students and make them well equipped for business communication with regard to various corporate sectors.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
L	T	P	C	CCE Marks	SSE Marks	
2	-	-	2	25	25	50

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Interview Preparation** Meaning and Types of Interviews [Face to Face, Telephonic, Video], Interview procedure [Opening, Listening, Closure], Preparation for Interview, Types of questions generally asked at interviews, Importance of non - verbal aspects, Resume Writing.	8
2	**Group Discussion (GD)** Meaning and Definitions of Group Discussion, Types of Group Discussion, Procedure of Group Discussion, Group discussion common mistakes, Importance of Group Discussions, Skills Evaluated in Group Discussions.	8
	SECTION-B	
3	**Effective Presentation Strategies** Introduction, Purpose of Presentation, Analyzing audience Locale, Organizing content (Introduction, Main body, Conclusion), Use of Visual Aids, Modes of	8

	delivery (Extemporaneous, Manuscript, Impromptu, Memorization).	
4	**Leadership skills and Team work** Role of an effective leader, Qualities of a leader, Importance of team work,Team work as an employability skills, Significance of team spirit.	**8**

Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance, U: Understanding, A: Application, N: Analyze and E:Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Book:

1. Soft Skills & Employability Skills (Cambridge) By: Pillai Sabina, Fernandez Agna. New Delhi: Cambridge University Press, 2019 (Reprint)

Reference Books:

1. Paul Emmerson. Business English –Handbook Advanced.India:Macmillan Publishers,2007.
2. Norman Whitby. Business Benchmark (Cambridge English). Cambridge University Press, 2014
3. G. Damodar .English for Communication:Cambridge University Press,2021.
4. Sanjay, Kumar.,Pushp, Lata., Communication Skills Oxford Higher Education,2nd Ed. OUP,2015.
5. Kaul. Effective Business Communication, Pentice Hall:New Delhi.
6. Robinson, Netrakanil and Shintre . Communication Competence in Business English, Orient Longman: Hyderabad
7. Tengse,Ajay. Sodt-Skills -A Textbook for Undergtraduates.Orient Blackswan 2015.
8. Dhanvel,S.P. English and Soft -skills Orient Blackswan 2021.
9. Jungeja, Om. Mujumdar Aarati. Business Communication. Orient Blackswan 2010.
10. .Parikh, J. P. Surve, Anshu. Swarnabharati, Behrinnwala, Asma. Business Communication (Basic Concepts and Skills) Orient Blackswan.2011.
11. Samson, T. Alexander, Susan. Thomas Mary Sowmya. Effective Business Communication, Cambridge, 2020.

Course Outcomes: After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Students will be able to know the importance and need of communication skills for better employment and performance in industry	20%
CO-2	Students will be able utilize and implement the presentation skills along with collegiality skills in their day to day tasks at the workplace.	20%
CO-3	Relate themselves orally using business English.	20%
CO-4	Narrate to various situations through the fictional presentation of ideas.	10%
CO-5	Using and apprehending the business skills efficiently	20%
CO-6	Students will be able to inculcate employability skills ensuring their extraordinary achievement in a corporate setting and beyond.	10%

List of Open Source Software/learning website:

- http://www.english-online.org.uk/
- http://www.learnenglish.de/

UPL University of Sustainable Technology

SRICT Institute of Science & Research

As Per National Education Policy 2020 (NEP 2020)

Bachelor of Science

Course Code:

Course Name: Internship

Semester: VI

w.e.f.: July 2025

Type of Course: Major

Prerequisite: Basic Knowledge of microbial processes and operations.

Rationale: To provide students with practical, real-world experience, focusing on work experience, professional activities, or cooperative education, at the end of the course, students will learn about the application of microbiology concepts in modern biochemical industries. This will also provide the students an opportunity to practically use their biological science-based skills in a life-science industry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
L	T	P	C	CCE Marks	SSE Marks	
-	-	-	4	50	50	100

Content:

Sr. No.	Content	Total Hrs.
1	The students shall carry out 02 weeks internship in an industry of national/international repute. They must prepare an internship report on a specific template provided by the University. Upon completion of the internship, students are required to present their work before the expert committee. Students must submit 01copy of their spiral internship report to the department.	**120**