

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science and Humanities



**Structure, Teaching Scheme and Syllabus of
B. Sc. (Honours) Biotechnology as per NEP 2020**

Program Code: SC101

With effect from: 2023-24

SEMESTER-III

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Analytical Techniques
Course Code:	13-BIM205-2C
Pre-requisite Course:	Basics Biology up to 12 th Science.

Course Objectives:

- To understand various types of spectroscopies.
- To understand the functions of various types of chromatography
- To understand the fundamental aspects of Electrophoresis and Centrifugation.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	Spectroscopy • Interaction of EM radiation with matter: Overview of Electromagnetic spectrum; physical phenomenon: Absorption, Resonance fluorescence, Emission, Refraction, Diffraction, Scattering, Raman Scattering, Resonance Raman Scattering, Beer-Lambert's Laws. • UV-Vis spectrophotometer: Principle, Instrumentation, working and Application • Atomic spectroscopy: Principles and application of Atomic Absorption/ Emission Spectrometer	11	25%
2	Chromatography • Chromatography: Basic Theory of Chromatography, Partition theory and solvent extraction theory • Introduction to key terms: retention time, retardation factor (R_f), elution • Partition and adsorption chromatography • Different techniques of chromatography: Principle, stationary and Mobile phase, operation, Detection/elution of solute, Application - Planner • Chromatography, (Paper Chromatography, TLC), GC, Ion exchange chromatography, Gel exclusion chromatography, Affinity chromatography, HPLC and FPLC	16	35%
3	Electrophoresis : • Theory & principle of electrophoresis • Agarose electrophoresis of nucleic acid • Electrophoresis of protein- polyacrylamide gel (native and SDS-PAGE), Iso-electric focusing of protein • Overview of 2D Gel Electrophoresis Centrifugation: • Theory of centrifugation and sedimentation, • use and design of different types of rotors • Types of centrifuges: Preparative and analytical centrifugation • Density gradient centrifugation (zonal and isopycnic), differential Centrifugation, Application of centrifugation for preparative and analytical purpose.	18	40%

Text Books: Biophysical chemistry: Principle and techniques by Upadhyay & Nath

Reference Books:

- Principles and techniques of biochemistry & molecular biology by Keith Wilson & John Walker
- Instrumental methods of analysis by B. Sivasankar
- Instrumental methods of analysis by Willard, Merritt, Dean & Settle
- Instrumental analysis by D.A. Skoog, Holler & Crouch
- Physical Biochemistry by David Freifelder
- Instrumental Methods of Chemical Analysis by Chatwal G and Anand, S.
- Chemical analysis and Instrumentation by B. k. Sharma

List of Open Source Software/learning website:

<https://www.youtube.com/watch?v=FX-NiPVsYPM>

<http://www.digimat.in/nptel/courses/video/104105084/L01.html>

www.digimat.in/nptel/courses/video/104105084/L51.html

<http://www.digimat.in/nptel/courses/video/104105084/L41.html>

List of Experiments:

1. Principles of Colorimetry: (i) Verification of Beer's law (ii) To determine maximum absorption spectra of colored solution.
2. Solvent-solvent extraction of plant pigments.
3. Use of paper chromatography for separation of plant pigments
4. Separation of Amino acids by paper chromatography.
5. TLC of Amino acids
6. Demonstration of Ion-exchange chromatography
7. Demonstration of Gel-exclusion chromatography
8. Preparation of the sub-cellular fractions by centrifugation
9. Native gel electrophoresis of proteins

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe basics of spectroscopy	1 Remembering, 2 Understanding
CLO2	Explain available knowledge on Chromatography theory	2 Understanding 4 Analyze
CLO3	Illustrate the various types of chromatographies	3 Applying
CLO4	Learn basic techniques to Electrophoresis	3 Applying, 2 Understanding
CLO5	Analyze the nucleic acid and proteins by Electrophoresis	5, 4 Evaluate, Analyze
CLO6	Discuss the mechanisms involved in various types of centrifugation	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1	2			1	1											3	2	2
CLO2	1	3				3			1				1				3	3	1
CLO3	1	3				1			2								2	3	1
CLO4	1	3				2			1								2	2	3
CLO5	1	3			1	2			2				2				3	2	3
CLO6	1	3			1	3			3				3				1	3	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Central Dogma of Life
Course Code:	13-BIM206-2C
Pre-requisite Course:	Basics Biology

Course Objectives:

- To understand of molecular Biology of prokaryotes and eukaryotes.
- To get complete knowledge on DNA damage and repair in prokaryotes and eukaryotes.
- To understand gene expression and regulation in prokaryotes and eukaryotes.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	Topology DNA, DNA replication. • Genomic organization of prokaryotic and eukaryotic cells. • Experimental evidences: DNA as genetic material, Semi-conservative nature of DNA replication • Concept of central dogma. • Definition: DNA supercoiling, Linking number, role of topoisomerase and its catalytic mechanism • Replication of DNA: Replication in bacteria, Enzymes/ Proteins involved in replication, Eukaryotic replication, ends of linear DNA by telomerase	16	35%
2	Process of transcription and translation • Transcription: Prokaryotic transcription, Eukaryotic transcription, Post transcriptional modification • Genetic code • Translation: Charging of tRNA, Prokaryotic translation, Eukaryotic translation, Post translational modification	17	35%
3	Regulation of gene expression & DNA damage and repair • Regulation of gene expression in prokaryotes: lac operon, trp operon and Immunity operon of bacteriophage Lamda. • Gene regulation in eukaryotes: DNA binding proteins (Activators), yeast galactose utilizing Genes, RNA interference • Causes and types of DNA damage • DNA repair mechanisms	12	30%

Text Books: Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA

Reference Books:

- Lewin B. (2000) Gene VIL IRL Press, Oxford University Press Oxford.
- Watson, J.D., Hopkins, Roberts, Stiez, Weiner. (1987) Molecular Biology of the Gene. (4th Ed) The Benjamin/Cummings Publishing Co. Inc. California.
- T.A. Brown, Genome. • S.B. Primrose Principle of gene manipulation.
- Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

List of Open Source Software/learning website:

<https://www.youtube.com/watch?v=sQgwDgJX2ZQ>

<https://www.visiblebody.com/blog/dna-and-rna-basics-replication-transcription-and-translation>

digimat.in/nptel/courses/video/102106096/L08.html

<http://www.digimat.in/nptel/courses/video/121106008/L20.html>

List of Experiments:

1. To isolate Genomic DNA from Fungi.
2. To isolate Genomic DNA from Bacteria.
3. To perform qualitative analysis of DNA by Agarose Gel Electrophoresis
4. To estimate RNA by orcinol method
5. To estimate DNA by DPA method
6. To discuss and schematically demonstrate the semi-conservative nature of DNA replication
7. To discuss and demonstrate the experimental evidence of DNA as a genetic material.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand DNA topology and DNA replication	2 Understanding
CLO2	Learn prokaryotic DNA transcription	1 Remembering
CLO3	Learn and understand eukaryotic DNA transcription	2 Understanding,
CLO4	Discuss Prokaryotic and Eukaryotic Translation process	3 Applying, 2 Understanding
CLO5	Learn Prokaryotic and Eukaryotic Gene Regulation	5,3, 4 Evaluate,Applying, Analyze
CLO6	Discuss and learn DNA damage and repair mechanism	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1	1	1		1	1											1	1	
CLO2	1	3	1		1	1									2		3	3	3
CLO3	1	3	1		2	2			2						1		3	3	3
CLO4	2	3	1		3	3			3								3	3	3
CLO5	2	3	3		3	3			3						3		3	3	3
CLO6	3	3	3		3	3			3								1	1	2

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Mendelian Genetics
Course Code:	13-BIM207-2C
Pre-requisite Course:	Basic molecular biology

Course Objectives:

- This course is designed to acquire basic knowledge inheritance and to enable students to brush up the concepts of classical genetics.
- To understand sex determination and differentiation.
- To give insight of mutation and human cytogenetics.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	Mendel's work, laws of heredity, Back & Test cross, Complete and Incomplete dominance Linkage: History, Kinds of Linkage, linkage groups, Concept of linkage map, genetic distance Vs physical distance, Determination of linkage map. Types of Crossing over, mechanism of Meiotic Crossing over Introduction of mapping by tetrad analysis, cytological detection of Crossing over, significance of Crossing over. Allelic Variation & Gene function: Multiple allele, Genetic interaction: Epistatic interactions, Non-Epistatic interactions, Pleiotropism	15	33
2	Sex linkage in Drosophila/ Neurospora, Sex-Limited and Sex Influenced Traits Determination of sex and sex differentiation: Genetical controlled of sex determination mechanism Metabolically and hormonally controlled sex determination mechanism Environmentally controlled sex determination Sex differentiation Non-Mendelian/ Cytoplasmic inheritance Eugenics and eugenics, Euphenics	15	33
3	Human cytogenetics: Human karyotype, Banding techniques, , Inborn metabolic disorders, inherited disorders- Autosomal (Klinefelter's syndrome and Turner's Syndrome), Autosomal (Down syndrome and Cri-du chat Syndrome), Pedigree analysis Mutations: Types-Spontaneous and Induced, Mutagen-Physical and Chemical, Mutation at Molecular level, Chromosomal variation in Number & Structure	15	34

Text Books: Cell biology & Genetics: Verma and Agrawal

Reference Books:

- Genetics: principles and analysis. 4 th edition 1998, Denial L. Hartl, Elizabeth tones.
- Principles of genetics: E.J. Gardner.
- Genes 9: Benjamin Levi
- Lehninger Principles of Biochemistry, 5th Edition, Nelson DL and Cox MM (2008),.
- W.H. Freeman and Company, Microbiology Powar and Dagainawala

List of Open Source Software/learning website:

<http://www.digimat.in/nptel/courses/video/121106008/L19.html>

<http://acl.digimat.in/nptel/courses/video/121106008/L17.html>

<http://acl.digimat.in/nptel/courses/video/121106008/L16.html>

<http://www.digimat.in/nptel/courses/video/102104052/L06.html>

<http://acl.digimat.in/nptel/courses/video/121106008/L18.html>

List of Practicals

1. Problem solving of mendelian principles on the basis of monohybrid, dihybrid crosses, codominance and incomplete dominance.
2. Isolation of antibiotic resistant mutant(s) bacterium by direct selection (Gradient Plate Technique)
3. Isolation of antibiotic resistant mutant(s) bacterium by indirect selection (Replica Plate Technique)

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss the Mendelian work and understand mechanism of heredity.	1 Describe
CLO2	List the types of genetic interactions. Discuss Human cytogenetics.	2 Understanding
CLO3	Enabling students to understand types, disadvantages mutagens and inborn metabolic disorders.	3 Applying
CLO4	Development of capacity to understand sex determination and how there is differentiation.	4 Analysing 1 Remembering
CLO5	Learn about chromosomal variations, evaluate syndromes associated with it, identify and compare the numerical and structural variations.	2 Understanding 5Evaluate,
CLO6	Discuss the mechanisms involved in crossing over and Linkage predicts outcomes of it.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1	3	2			3									2		2	3	3
CLO2	1	2				3									2		2	3	3
CLO3	1	3	1			3									2		2	3	3
CLO4	2	3	2		3	3									3		2	3	3
CLO5	2	3	3		3	3									3		2	3	3
CLO6	3	3	3		3	3									3		2	3	3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Microbes in food Industries
Course Code:	13-MDC236-2C
Pre-requisite Course:	Basics of Microbiology

Course Objectives:

- To understand natural flora and source of contamination of foods in general.
- To understand Microbial Spoilage of various Foods and Food borne diseases.
- To understand methods of Food Preservation.
- To understand fermented dairy products.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	A) Foods as a Substrate for Microorganisms ✓ Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general. B) Microbial Spoilage of various Foods ✓ Principles, Spoilage of vegetables, fruits, meat, eggs, milk, bread, canned Foods C) Foodborne diseases (causative agents, foods involved, symptoms and preventive measures) ✓ Food borne intoxications: <i>Staphylococcus aureus</i> & <i>Clostridium botulinum</i> ✓ Food borne infections: <i>Escherichia coli</i> , Salmonellosis, Shigellosis, <i>Campylobacter jejuni</i>	15	34%
2	Principles and Methods of Food Preservation ✓ Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging ✓ Chemical methods of food preservation: salt, sugar, organic acids, SO ₂ , nitrite and nitrates, ethylene oxide, antibiotics	15	33%
3	Fermented Foods ✓ Concept of Starter culture in Dairy Industry. ✓ Fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese ✓ Other fermented foods: dosa, sauerkraut, soy sauce and tempeh ✓ Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market. ✓ An introduction to prebiotic, postbiotics and synbiotic	15	33%

Text Books:

1. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition .Tata McGraw-Hill Publishing Company Ltd, New Delhi, India
2. Michael Pelczar, text book of microbiology, 5thed.

Reference Books:

1. Adams MR and Moss MO.(1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition.CBS Publishers and Distributors, Delhi, India.
3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

List of Open Source Software/learning website:

<https://www.youtube.com/watch?v=shWayTlt4hk>

<http://digimat.in/nptel/courses/video/126105013/L04.html>

digimat.in/nptel/courses/video/126104003/L18.html

<https://www.youtube.com/watch?v=0vmXakqsEOs>

List of Experiment:

1. MBRT of milk samples and their standard plate count.
2. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
3. Isolation of any food borne bacteria from food products.
4. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
5. Preparation of Yogurt/ Dahi.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Enlist and explain factors affect growth and survival of microbes in foods	1 Remember 2 Understanding
CLO2	Discuss causes of microbial Spoilage of various Foods and Food borne infections	1 Remembering 2 Understanding
CLO3	Learn various Physical and Chemical methods of food preservation and apply it.	2 Understanding 3 Applying
CLO4	Acquire and apply the knowledge various Fermented foods and starter culture.	1 Remembering 2 Understanding 3 Apply
CLO5	Understand the concept and advantages of fermented food and Probiotics and analyze its importance in the society.	1 Remembering 2 Understanding 4 Analyze
CLO6	Understanding the concept and formation of Starter culture, fermented food and Probiotics which helps in dairy industry and other food industries.	5 Evaluate 6 Create

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1					2											2		2
CLO2						2											2		2
CLO3			2			3											2		1
CLO4		2	2			3											3		3
CLO5					3	3											3		3
CLO6		2	3		3	3											3		3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Fungi, Lichens and Plant Pathology
Course Code:	13-MDC237-2C
Pre-requisite Course:	Basics Biology up to 12 th Science.

Course Objectives:

- Develop a comprehensive understanding of the diversity, morphology, reproduction, and ecological roles of fungi, particularly within the specified groups.
- Develop a comprehensive understanding of the diversity, morphology, reproduction, and ecological roles of lichens.
- To study general distribution and symptoms of plant diseases.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	General characteristics; Affinities with plants. Thallus organization; Cell wall composition; Nutrition; Classification (Ainsworth). • Phycomycetes: Zygomycetidae: Characteristic features. Thallus organisation; Reproduction; Life cycle and classification with reference to Rhizopus . • Ascomycetes: General characteristics (asexual and sexual fruiting bodies); Life cycle and classification with reference to Claviceps . • Basidiomycetes: General characteristics; Life cycle and Classification with reference to Agaricus	15	33%
2	Allied Fungi: General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies. • Lichens: Occurrence; General characteristics; Classification; Study of thallus (morphological and anatomical), Reproduction; Economic importance. • Mycorrhiza: Ectomycorrhiza, Endomycorrhiza and their significance. • Applied Mycology: Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Medicines (Pharmaceutical preparations); Agriculture (Bio fertilizers).	15	34%
3	Terms and concepts; General symptoms. • Geographical distribution of diseases. Host-Pathogen relationships. • Pathogen, Symptoms, Dissemination, Disease cycle and control measures of following plant diseases: Bacterial diseases – Citrus canker . Fungal diseases – White rust of crucifers, Black rust of wheat .	15	33%

Text Books: Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

Reference Books:

Agrios, G. N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
 Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
 Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

List of Open Source Software/learning website:

<https://www.youtube.com/watch?v=HtNZQ7KmN2M>
<https://www.youtube.com/watch?v=dRfH0zBjAUo>
<https://www.youtube.com/watch?v=TKOv2XWxoeY>
<https://www.youtube.com/watch?v=Bq65kdCCnGU>

List of Experiments:

1. **Rhizopus**: study of asexual stage from temporary mounts and sexual structures through permanent slides/photographs/charts.
2. **Claviceps**: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs/charts.
3. **Agaricus**: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*. Permanent slides/photographs/charts.
4. **Lichens**: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structure (apothecium) through Permanent slides /photographs/charts/specimen.
5. **Mycorrhizae**: Ectomycorrhiza and Endomycorrhiza (Photographs).
6. **Phytopathology**: Study of Plant diseases: Citrus Canker, White rust of crucifers and Black rust of wheat.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.	1 Remembering, 2 Understanding 4 Analyze
CLO2	Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.	2 Understanding 4 Analyze
CLO3	Illustrate the structure of Lichen.	3 Applying
CLO4	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies.	3 Applying, 2 Understanding
CLO5	Identify the common plant diseases according to geographical locations and devise control measures.	5, 4 Evaluate, Analyze
CLO6	Discuss the mechanisms involved in plant pathogenesis.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	1	2			1	1											3	2	2
CLO2	1	3				3			1				1				3	3	1
CLO3	1	3				1			2								2	3	1
CLO4	1	3				2			1								2	2	3
CLO5	1	3			1	2			2				2				3	2	3
CLO6	1	3			1	3			3				3				1	3	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Grammar and Communication Skill-1
Course Code:	13-AEC203-2C
Pre-requisite Course:	Basics English Grammar Basics English up to F.Y.B.Sc.

Course Objectives:

1. To inculcate human values among the students through poems and prose.
2. To create an interest in literature and to develop language skills.
3. The students will become familiar with formal vocabulary that is common in academic texts.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	VOCABULARY&GRAMMARLINK Phrasal Verbs, Antonyms, Synonyms, Misspelled Words , Part Of Speech:- Noun, Pronoun, Verb, Adverb, Articles :- A, An ,The etc.	9	30%
2	SPEAKING Dialogues Writing:- 1.A dialogue between a doctor and a patient 2.A dialogue between a teacher and a student about studies 3.A dialogue between a country child and a town child 4.A dialogue between mother and daughter about studies 5.A dialogue between a shopkeeper and a customer 6.A dialogue between a traffic warden and a taxi driver 7.A dialogue between the two friends about the choice of profession	6	20%
3	READING&WRITING Letter writing (Personal & Business Letters) and invitations, Telegrams and noti Paragraph Writing. Translation:- Translate the Accident/Incident Paragraphs given by your teacher from the English News Papers (Teacher has to give small paragraphs at least 5 to 6 paragraphs or morethan that for the entire semester based on especially from the pages no. 3 & 4 of The Times of India)	6	20%
4	TEXT Glimpses of Life-An Anthology of Short Stories (Orient Black Swan) Lesson 3 to 7	9	30%

Text Books:

1. Glimpses of Life-An Anthology of Short Stories (Orient Black Swan)
2. Easy to learn English grammar by Dr.Jayesh Patel

Reference Books:

1. Very Useful Verbs book (Enka Publication)
2. Contemporary English Grammar Structure & Composition
3. Murphy R. Intermediate English Grammar (New Delhi: Cambridge University)
4. The Art of Public Speaking by Vijay Kumar.
5. The Times of India/The Indian Express
6. Business Correspondence and Report Writing by R. C Sharma & Krishna Mohan.

List of Open Source Software/learning website:

1. englishpage.com
2. epaper.timesofindia.com
3. epaperindianexpress.com
4. <https://www.youtube.com/watch?v=QdAgyD4xhY>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe how public speaking can be used to advocate or create change	1 Remembering
CLO2	Explain the goals and benefits of public speaking	2 Understanding
CLO3	Use parallel structures correctly and effectively.	3 Applying
CLO4	Identify strategies for researching and supporting a speech	4 Analyzing
CLO5	Recognize when to use visual aids	3 Applying
CLO6	Describe how public speaking can be used to advocate or create change	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	2					3					2					3			
CLO2		1			2		1			3		1			2				
CLO3			3					2					2			2			
CLO4		2					2					2							
CLO5					2					2					2				
CLO6	1					1					1					2			

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Title:	Green Chemistry
Course Code:	13-SEC212-2C
Pre-requisite Course:	-

Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about different terms use in green chemistry.
3. To learn about the basic concepts about green chemistry.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	-	-	2	25	25	-	-	50

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction to Green Chemistry Basic Principles of Green Chemistry ; Challenges --pollution control and pollution, Green methods, green products, recycling of waste, International organizations promoting green chemistry, Importance of PTC, Ionic Liquids, Ultrasound assisted reactions.	15	50%
2	Designing Green Synthesis Choice of starting materials, choice of reagents, choice of catalysts, Bio catalysts, polymer supported catalysts, choice of solvents, Synthesis involving basic principles of green chemistry, Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylation, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Knoevenagel Reaction, Reformatsky reaction.	15	50%

Reference Books:

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).

List of Open-Source Software/learning website:

1. <http://onlinelibrary.wiley.com>
2. https://en.wikipedia.org/wiki/Main_Page

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn and understand basic principles of green chemistry	1-Remembering 2-Understanding
CLO2	Learn and understand pollution control and waste management.	1-Remembering 2-Understanding
CLO3	Understand the importance of green products and learn choice appropriate assemblies for synthesis.	1-Remembering 2-Understanding
CLO4	Learn different types of green reactions.	2-Understanding 3-Applying

Mapping of CLOs with Pos

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	2																1		2
CLO2		1			2							2						1	
CLO3								1											
CLO4			1								1						2	1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	Food Fermentation Techniques
Course Code:	13-SEC213-2C
Pre-requisite Course:	Basics of Microbiology

Course Objectives:

- To understand types & health benefits of Fermented Foods
- To understand Milk, Grain & Vegetable Based Fermented foods
- To understand Fermented Meat and Fish
- To understand Probiotics Foods

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	(A) Fermented Foods Definition, types advantages and health benefits (B) Milk Based Fermented Foods Dahi, Yogurt, Buttermilk (Chhachh) and cheese: Preparation of inoculums, types of microorganisms and production process (C) Grain Based Fermented Foods Soy sauce, Bread, Idli and Dosa: Microorganisms and production process	18	60%
2	(A) Vegetable Based Fermented Foods Pickles, Sauerkraut: Microorganisms and production process (B) Fermented Meat and Fish Types, microorganisms involved, fermentation process (C) Probiotics Foods Definition & types, microorganisms and health benefits.	12	40%

Text Books:

1. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition .Tata Mc Graw-Hill Publishing Company Ltd, New Delhi, India
2. Michael Pelczar, text book of microbiology, 5thed.

Reference Books:

1. Hui Y H, Meunier-Goddik L, Josephsen J, Nip W K, Stanfield P S (2004) Handbook of food and fermentation technology, CRC Press
2. Holzapfel W (2014) Advances in Fermented Foods and Beverages, Woodhead Publishing.
3. Yadav JS, Grover, S and Batish VK (1993) A comprehensive dairy microbiology, Metropolitan
4. Jay J M, Loessner MJ ,Golden DA(2005) Modern Food Microbiology, 7th edition. Springer

List of Open Source Software/learning website:

<http://digimat.in/nptel/courses/video/126105013/L04.html>

<http://digimat.in/nptel/courses/video/126104003/L18.html>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss the types & health benefits of Fermented Foods	1 Remembering 2 Understanding
CLO2	Enlist various microbes used in fermentation of various foods.	1 Remembering 2 Understanding
CLO3	Understand the concept and advantages of Milk Based Fermented foods	2 Understanding 3 Applying
CLO4	Acquire and apply the knowledge Grain & Vegetable Based Fermented foods.	1 Remembering 2 Understanding 3 Apply
CLO5	Understand the concept and advantages of fermented food and Probiotics and analyze its importance in the society.	1 Remembering 2 Understanding 4 Analyze
CLO6	Understanding the concept and formation of fermented food and Probiotics Foods	5 Evaluate 6 Create

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1						2											2		2
CLO2						2											2		2
CLO3			2			3											2		1
CLO4		2	2			3											3		3
CLO5					3	3											3		3
CLO6		2	3		3	3											3		3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC101
Course Name:	DNA Damage & Repair
Course Code:	13-SEC214-2C
Pre-requisite Course:	Basic molecular biology

Course Objectives:

- To provide the knowledge of the causes of DNA damage
- To understand effects of DNA damage
- To understand repair mechanism to maintain the integrity of the treasure of life “DNA”.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	-	-	2	25	25	-	-	50

Subject Contents:

Unit	Topic	Total Hours	Weightage (%)
1	Chromosomal Alterations: Structural Alterations, Numerical Alterations Types of Mutations: On the basis of DNA damage: causes and types of DNA damage:	15	50%
2	DNA repair mechanisms: Mismatch DNA repair, nucleotide excision repair, base excision repair, direct DNA repair, SOS response, Photo reactivation, translesion synthesis, recombinational repair, nonhomologous end joining.	15	50%

Text Books: Molecular Biology of the Gene J. D. Watson et. Al.

Reference Books:

- Molecular Biology of Cell: B. Alberts et. al.
- Genes X B. Lewin
- Instant notes on Molecular Biology Turner
- Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition

List of Open Source Software/learning website:

https://www.youtube.com/watch?v=SrEou0y9L_A

<https://www.youtube.com/watch?v=sX6LncNjTFU>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Students will be able to describe types of Mutations.	1 Describe
CLO2	Understanding the DNA damage and repair mechanism	2 Understanding
CLO3	Students could be able to use recombination method.	3 Applying
CLO4	Analysing DNA damage and repair mechanism for find genetic diseases.	4 Analysing 1 Remembering
CLO5	Understanding gene expression, regulation, causes of DNA damage and repair mechanisms to select specific treatments for solving of genetic diseases.	2 Understanding 5 Evaluate,
CLO6	Creating things, which can protect DNA from damaging by various environmental factors.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3
CLO1	2		1			3				3							2	1	3
CLO2	2		2			3				2							2	1	3
CLO3	2		1		1	3				3							3	1	3
CLO4	2		1		2	3				2							2	1	3
CLO5	2		1			3				3							1	1	3
CLO6	2		2			3				3							2	1	3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Biotechnology
Program Code:	SC104
Course Name:	Vedic Mathematics
Course Code:	13-IKS102-2C
Pre-requisite Course:	

Course Objectives:

- To understand the basic concept of Subtraction by Mental Calculation.
- To understand the concept of Multiplication by Mental Calculation.
- To be able to understand the Mental Calculation and Questions of Reasoning.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
-	-	4	2	--	--	25	25	50

Course Contents:

Unit	Topic	Total Hours	Weightage
1	Complement, Subtraction and Multiplication by specific numbers. - Complement of number - Starting Complements from the Middle of the Sum. - Leaving Complements in the middle of the Sum. - Some special and general case of subtraction. - Multiplication by 11 & 12 & 9 Key Words: Subtraction, Complement, Multiplication.	30	50%
2	Multiplication and Working Base Multiplication - Base Multiplication. - Multiplication of Numbers more than the Base. - Multiplication of One more and one less than the base number. - Working Base Multiplication. - Multiplication of 2, 3, 4 Digit number. Key Words: Multiplication, Base, Working base.	30	50%

Reference Books:

- 1) Vedic Mathematics for All Ages by Vandana Singhal: Motilal Banarsidass Publisher private limited- Delhi, 2008.
- 2) Vedic Mathematics by Bharti KrishnaTirthji Maharaj : Motilal Banarsidass Publisher private limited- Delhi, 1965.

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=eyLsbv8E4Kg&list=PLVLoWQFkZbhUFSIAjbWPVv_mlAAX8BBD1
2. <https://www.youtube.com/watch?v=X98-TJRMZRk&pp=ygUzc3VidHJhY3Rpb24gYW5kIG11bHRpcGxpY2F0aW9uIGJ5IHZlZGljIG1hdGhlbWF0aWNz>