

SANKALCHAND PATEL UNIVERSITY
VISNAGAR

Faculty of Science and Humanities



Structure, Teaching Scheme and Syllabus of
Bachelor of Science (Microbiology)

Program Code: SC102

With effect from: 2023-24

Semester- II

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Microbial Physiology & Metabolism
Course Code:	12-MIM203-1C
Pre-requisite Course:	

Course Objective:

- To learn the basic and fundamental aspects of Physiology and Metabolism
- To understand the nutritional requirements of various microbes and effects of various chemical and physical conditions on bacterial cell
- To understand the nutritional uptake and transport mechanisms of microbes
- To understand the metabolic pathways of the microorganisms on the basis of their source of energy and nutrition

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	Content	Total Hours	Weightage
1	Microbial Growth and Effect of Environment on Microbial Growth: Definitions of Microbial Growth, Mathematical Expressions of Microbial Growth, Steps in the Cell Division Process of <i>E.coli</i>, Normal Growth Cycle of Bacteria, Methods for the Measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curves Microbial growth in response to environment-<i>Temperature</i> (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), <i>pH</i> (acidophiles, alkaliphiles), <i>solute and water activity</i> (halophiles, xerophiles, osmophilic), <i>Oxygen</i> (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe) Microbial growth in response to nutrition and energy– Autotrophy & Heterotrophy, Basic Concepts of Chemotrophy and Phototrophy with suitable examples.	15	34%
2	A) Chemo heterotrophic Metabolism-Aerobic Respiration Concept of aerobic respiration, anaerobic respiration and fermentation Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway TCA cycle Electron transport chain: components of respiratory chain B) Chemo heterotrophic Metabolism- Anaerobic respiration & fermentation Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate /nitrite and nitrate /ammonia respiration; fermentative nitrate reduction), Fermentation-Alcohol fermentation and Pasteur effect; Lactate fermentation (homo fermentative and hetero fermentative pathways)	15	33%

3	(A) Chemo lithotrophic and Phototrophic Metabolism Introduction to aerobic and anaerobic chemolithotrophy with an example each. Hydrogen oxidation (definition and reaction), Methanogenesis (definition and reaction), Introduction to phototrophic metabolism-groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria. (B) Nutrient uptake and Transport Passive and facilitated diffusion Primary and secondary active transport, concept of uniport, symport and antiport Group translocation	15	33%
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List of Experiments

1. Study and plot the growth curve of *E.coli* and Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data,
2. Enumeration of bacteria by Standard Plate Count
3. Effect of temperature on growth of *E.coli*
4. Effect of pH on growth of *E.coli*
5. Effect of carbon and nitrogen sources on growth of *E.coli*
6. Effect of salt on growth of *E.coli*
7. Demonstration of the thermal death time and decimal reduction time of *E.coli*

Text Books:

1. Michael Pelczar, text book of microbiology, 5th ed.
2. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

Reference Books:

1. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
2. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
3. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag
4. Stanier RY, Ingraham JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.

List of Open Source Software/learning website:

<https://onlinecourses.swayam2.ac.in>
<https://archive.nptel.ac.in/courses>
<https://onlinecourses.nptel.ac.in>
<https://www.coursera.org>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the growth pattern of bacteria isolated from different environment and understand the effects of various cultivation conditions on bacterial growth.	1 Remembering 2 Understanding
CLO2	Measure the microbial growth with direct and indirect methods.	1 Remembering 2 Understanding 3 Applying
CLO3	Classify the microorganisms by comparing their physical and nutritional requirements.	2 Understanding 4 Analyze
CLO4	Understand and discuss various mechanisms for regulation of biochemical pathways and transport mechanisms so that it can be applied.	1 Remembering 2 Understanding 3 Apply
CLO5	Understand nutrition uptake and transport mechanisms in the microorganisms and different nutritional requirements so that student can justify the diversity of microbes in various habitats.	1 Remembering 2 Understanding 5 Evaluate
CLO6	Understand the various metabolic pathways in different organisms like chemolithotrophy, chemoheterotrophy and phototrophy and extremophiles so that its knowledge can be applied for finding solutions for environmental problems and bioenergy generation and enzyme technology etc.	2 Understanding 3 Applying 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
CLO1	1	1			1												3	1
CLO2	2	2			1												3	2
CLO3		3			2												3	3
CLO4	3	3			2												3	3
CLO5	2	2			3	2											3	3
CLO6	3	3	1	1	3	3			3				1				3	3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Environmental Microbiology
Course Code:	12-MIM204-1C
Pre-requisite Course:	

Course Objective:

- To understand the abundance and diversity of microorganisms in different habitats.
- To understand interactions of microbes with the environment and to understand the negative and positive interactions of microbes with different host.
- To understand the role of microorganisms in remediation of solid and liquid waste

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	Content	Total Hours	Weightage
1	Microorganisms and their Habitats • Structure and function of ecosystem, • Terrestrial Environment: Soil profile and soil microflora • Aquatic Environment: Microflora of fresh water and Marine habitats • Atmosphere: Aeromicroflora and dispersal of microbes • Animal Environment: Microbes in/ on human body (Microbiomics) & animal (ruminants) body. • Extreme Habitats: Extremophiles: Microbes thriving at high & low temperature, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.	15	33%
2	A) Microbial Interactions • Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation • Microbe-Plant interaction: Symbiotic and non-symbiotic interactions • Microbe-animal interaction: Microbes in ruminants • Hematophagous fungi and Symbiotic Luminescent bacteria B) Biogeochemical Cycling • Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin • Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification, and nitrate reduction. • Phosphorus cycle: Phosphate immobilization and solubilization • Sulphur cycle: Microbes involved in Sulphur cycle • Other elemental cycles: Iron and manganese	15	34%

3	A) Water Potability • Treatment and safety of drinking (potable) water, • Methods to detect potability of water samples: (a) Standard qualitative procedures: presumptive test, confirmed and completed tests for detection of fecal coliforms (b) Standard Quantitative Procedures: SPC & MPN, (c) Membrane filtration technique & (d) Presence/absence tests. • Wastewater treatment (B) Waste Management • Solid Waste management: Sources and types of solid waste • Methods of solid waste disposal (composting and sanitary landfill)	15	33%
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List of Experiments

1. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C). (study of morphological and colony characters.)
2. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane (study of morphological and colony characters.)
3. Isolation of Actinomycetes from soil sample
4. Determination of BOD of wastewater sample.
5. Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
6. Isolation of Rhizobium from root nodules.

Text Books:

1. Michael Pelczar, text book of microbiology, 5th ed.
2. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

Reference Books:

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko J M and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. Singh A, Kuhad, R C & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Heidelberg.
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
9. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
10. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.
11. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.

List of Open Source Software/learning website:

<https://onlinecourses.swayam2.ac.in>
<https://archive.nptel.ac.in/courses>
<https://onlinecourses.nptel.ac.in>
<https://www.coursera.org>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Know about the microbial ecology and microflora in various ecosystems and microorganisms in extreme environment and diversity among them.	1 Remembering 2 Understanding
CLO2	Know the interactions of microorganisms with host i.e. plant, animal which would be useful in justifying diversity of microbes in different rhizosphere.	1 Remembering 2 Understanding 3 Evaluate
CLO3	Study various mechanisms by which microbes can thrive in hostile conditions.	1 Remembering 2 Understanding
CLO4	Illustrate various biogeochemical cycles which maintains the balance of various vital elements in ecosphere and illustrate them.	1 Remembering 2 Understanding 4 Analyze
CLO5	To study drinking water treatment and techniques to evaluate the water quality	3 Applying 4 Evaluate
CLO6	Know the applied aspect of microbiology i.e. Solid waste management which helps to design the treatment procedure	3 Applying 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
CLO1	1	1			1				1								3	1
CLO2	1	2			1												3	2
CLO3	1	3			2												3	3
CLO4	1	3			2												3	3
CLO5	1	2	1		3	2											3	3
CLO6	1	3	1	1	3	3			3				1				3	3

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Metabolic Pathways of cell
Course Code:	12-BIE203-1C
Pre-requisite Course:	Basics Biotechnology up to 12 th Science.

Course Objectives:

- To understand the comprehensive action and performance of the enzyme and cell constituents of prokaryotes and eukaryotes.
- To get complete knowledge on types, function and control of enzymes.
- To understand metabolism of biomolecules like lipid, carbohydrate, amino acids.

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	Content	Total Hours	Weightage
1	Glucose Metabolism: Glycolysis and fate of pyruvate (Alcohol and lactic acid fermentation), TCA cycle, Pentose phosphate pathway, Gluconeogenesis. ETC & Oxidative phosphorylation: ETC of mitochondria, electron carriers, complexes of ETC, ATP generation coupled to electron transport	15	33%
2	Lipid metabolism: Lipid oxidation (Beta Oxidation), Fatty acid biosynthesis Amino acid metabolism: transamination, Deamination, Urea cycle Photosynthesis: Photophosphorylation in plant (Light reaction), Carbohydrate synthesis coupled to photophosphorylation (Dark reaction or C3 cycle or Calvin cycle), C4 cycle	15	34%
3	Basics of Enzyme: Enzyme as a biocatalyst, coenzyme, cofactor, Nomenclature and Classification of enzyme, Basic concept of enzyme substrate reaction. Factor affecting on enzyme catalyze reaction Overview of catalytic mechanisms of enzyme Enzyme kinetics: M-M equation, Double reciprocal plot Inhibition of enzyme Regulations of enzymes-allosteric and Covalent regulation	15	33%

Text Books: Lehninger Principles of Biochemistry, 4th Edition (Unit-2&3)
Understanding Enzymes: Trevor Palmer (Unit-1)

Reference Books:

Biochemistry, U Satyanarayan
Biochemistry, D. Voet and J.G. Voet.
Biochemistry, Jain & Jain
Enzymology, T. Devsena

List of Open Source Software/learning website:

<https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-bt17/>
<https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-bt18/>
https://archive.nptel.ac.in/courses/102/103/102103_091/
<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>

List of Experiments:

- Estimation of Protein & Sugar
 - ✓ Quantification of protein using Biuret method/ Folin-Lowary assay/ Bradford's method
 - ✓ Estimation of Reducing Sugar by DNSA method/ Anthrone method
 - ✓ Estimation of blood glucose by glucose oxidase method
- To study activity of any enzyme under optimum conditions (Assaying of various enzymes):
 - ✓ Amylases
 - ✓ Phosphatases
 - ✓ Invertase
- Enzyme Kinetics: (Salivary amylase or other)
 - ✓ Effect of Substrate concentration (Determination of K_m and V_{max})
 - ✓ Determine temperature optimum of the enzyme
 - ✓ Effect of pH on enzyme activity

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss on biosynthesis and degradation of Biomolecules in different organisms.	2 Understanding
CLO2	Describe structure, function of biomolecules.	1 Remembering
CLO3	Understanding of enzyme kinetics to apply for quantitative estimation of biomolecules.	2 Understanding,
CLO4	Compare between protein and lipid synthesis.	3 Applying, 2 Understanding
CLO5	Discuss photosynthesis and evaluate carbohydrate synthesis by it.	3 Applying, 4 Analyze 5 Evaluate
CLO6	Design the mechanism involved in biomolecule synthesis.	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
CLO1	2	2	1		1												3	2
CLO2	1	3	1		1	1											3	3
CLO3	2	3	2		2	2			2						1		2	3
CLO4	1	3	1		1	1			1						1		2	2
CLO5		3	2		2	2			2						2		3	2
CLO6	3	3	3		3	3			3						3		1	3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Title:	Basics of Botany
Course Code:	12-BIE205-1C
Pre-requisite Course:	Fundamentals of biology up to B.Sc. semester-I

Course Objectives:

- To gain basic knowledge of biomolecules such as Carbohydrate, Lipids ,protein etc.
- To differentiate the prokaryotic and eukaryotic cell structure.
- To gain knowledge of various cell structures and cell organelles

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

Course Contents:

Unit	Content	Total Hours	Weightage
1	Biomolecules- I · Brief account and importance of: pH and buffers. · Carbohydrates: Definition, classification and significance Structure and functions of Monosaccharides (trioses, pentoses and hexoses), Structure and functions of Disaccharides (maltose, lactose and sucrose) and Structure and functions of Polysaccharides (starch and cellulose). · Lipids: Definition, classification and significance Structure and functions of Fatty acids: Saturated and unsaturated Essential fatty acids Simple and Conjugated Lipids: Structure and functions of Triglycerides and waxes. Conjugated lipids with examples.	15	25%
2	Biomolecules - II Amino acids: Definition and classification (based on polarity) Properties of amino acids. Peptide bond, Dipeptide and polypeptide. Proteins: Definition, classification and significance General (Physical) properties of Proteins. Levels of protein structure- primary,secondary, tertiary and quaternary; Protein denaturation. Enzymes: Classification and Functions Nucleic acids: Definition, classification and significance. Structure of nitrogenous bases; Structure and function of nucleotides. Types of nucleic acids; Structure of DNA (Watson and Crick's model); Types of RNA; Structure of tRNA.	15	25%

3	Cell Biology – I · Cell as a basic unit of structure and function, Characteristics and comparison of Prokaryotic and Eukaryotic cell. · Cell wall: Ultrastructure, chemical composition and functions · Plasma membrane: Ultrastructure, chemical composition and functions, fluid mosaic model, Membrane transport – Passive, active and facilitated transport. · Nucleus: Structure-nuclear envelope, nuclear lamina, molecular organization of chromatin; nucleolus.	15	25%
4	Cell Biology – II Chloroplast: Structural organization and Functions Mitochondria: Structural organization and Functions Introduction and functions of: Endoplasmic Reticulum, Golgi apparatus and Lysosomes Cell division: Eukaryotic Cell Cycle, Mitosis, meiosis and their significance	15	25%

Reference Books:

List of Reference Books:

1. Campbell, M.K. (2012). Biochemistry, 7th ed., Published by Cengage Learning.
2. Campbell, P.N. and Smith, A.D. (2011). Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone.
3. Tymoczko, J.L., Berg, J.M. and Stryer, L. (2012). Biochemistry: A short course, 2nd ed., W.H. Freeman.
4. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011). Biochemistry, W.H. Freeman and Company.
5. Nelson, D.L. and Cox, M.M. (2008). Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. (2009). The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

List of Open-Source Software/learning website:

https://www.gresham.ac.uk/watch-now?utm_source=google&utm_medium=cpc&utm_campaign=19981604831&utm_content=148497108936&utm_term=university%20lectures%20online&gclid=Cj0KCQjwmN2iBhCrARIsAG_G2i6cCJUMQsrCHnHS4bIhkSKJNNPC_YCvj7ngxLfNjlvHFM9mspwFebwaAkkvEALw_wcB
https://www.govtsciencecollegedurg.ac.in/onlinevideo_lect.aspx?page=Botany
<https://www.youtube.com/watch?v=jfNt3ziQJV0>
<https://www.youtube.com/watch?v=lf9uajt628o>

List of Experiments:

- 1) Preparation of solutions and plant juices to determine their pH using Universal indicator/pH meter.
- 2) To determine isoelectric point of Protein (Casein).
- 3) Estimation of Free Fatty acids by titration method.

- 4) Bio-Molecules: Tests for detection of Carbohydrates: The following tests are to be performed to detect the nature of carbohydrates available in the supplied sample (Glucose, Fructose, Maltose, Sucrose and Starch).
1. Molisch's test, 2. Benedict's test, 3. Barfoed's test, 4. Seliwanoff's test,
 5. Iodine test, 6. Cobalt chloride test.
- 5) Tests for detection of Lipids i.e., Fats and oils: Micro-chemical tests on sections of Plant materials- Sudan III stain, Solubility test.
- 6) Tests for detection of Proteins: Biuret test/Xanthoprotic test.
- 7) Akaryota - Bacteriophage, Prokaryota - Cyanophycean cell & Eukaryota - typical Animal & Plant cell.
- 8) To study the various types of cell organelles through micrographs / charts (As per theory syllabus).
- 9) Study of mitosis from onion root tip using squash method.
- 10) Study of different stages of meiosis (Chart/Permanent Slides).

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe basics of Biomolecules and cell biology	1 Remembering, 2 Understanding
CLO2	Explain available knowledge on carbohydrate, amino acids, proteins and lipids.	2 Understanding 4 Analyze
CLO3	Illustrate the structure of biomolecules and learn basic techniques to identify and interpret structures of biomolecules and nucleic acids.	3 Applying
CLO4	Discuss the basics of Cell and cell organelles	3 Applying, 2 Understanding
CLO5	Understand the transport of molecules through cell membrane	4 Analyze 5 Evaluate,
CLO6	To study and understand the cell cycle and its control so that the knowledge can be applied to find diagnostic and treatment for cancer.	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
CLO1	1				1												1	
CLO2	1				1													
CLO3	2	2			3	1												
CLO4	2	1			1												1	
CLO5	3	2	2		2	2												
CLO6	3	3	3		3	3											1	3

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Digital Marketing
Course Code:	12-MDC226-1C
Pre-requisite Course:	

Course Objectives:

- To understand the basic concept of Digital Marketing.
- To understand the concept of Web Design.
- To know about Domain Registration and Hosting

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	Content	Total Hours	Weightage
1	Introduction to Digital Marketing. • What is marketing? • What is digital marketing? • Why are people going online? • Key concepts of digital marketing • Benefits of digital marketing • How digital marketing evolved • Who's using digital marketing? • How traditional and digital media differ? • Understand the future of digital marketing • What is search engine? • Types of search engine • How search engine works? • Why is google the world's best search engine? • Tools required in digital marketing • What is advertising? • What is online advertising? • What is Ad Words? • Career scope in Digital Marketing	11	25%
2	Website Design Guidelines. • What is Website? • What is www? • What are the different types of website? • Web page vs website • Difference between blog vs website • Components of website • Purpose of creating websites • How to build a web page? • Web design vs web development • What makes a website user-friendly? • Dynamic vs Static website	11	25%

	• What are responsive websites? Domain Registration and Hosting • What is domain & sub domain name? • Parts of domain name • How to choose a domain name? • What is Protocol? • What is IP address • What is web hosting? • How to buy domain and hosting? • Costs of a domain name Word Press Website Creation • What is Word Press? • Understanding Word Press and it's functioning? • Features of Word Press • Sites built with Word Press		
3	Search Engine Optimization • Introduction and Understanding of SEO? • How Search Engine works? • Basics of SEO • On-Page SEO vs Off-Page SEO • What is the main purpose of using keyword in SEO? • Some important SEO tools • What is google my business? Keyword Research and Planning • What is Keywords? • Types of Keywords • Why is keyword research important? • Understanding your target market • What is Keyword Density, and does it matter? • Know what your people want • How to use google keyword planner? • How to do the business analysis?	11	25%
4	Google Analytics • Introduction of Google Analytics • Data Analysing with Google Analytics • Checking User Behavior • Tracking Traffic from Different Source • Using Analytics Date for Retargeting Google AdSense • Money Making with AdSense • Easy Steps for AdSense • How to Approve AdSense Account • Placing Ads to Website	12	25%

Reference /Readings Books:

1. Digital Marketing; by Vandana Ahuja; Oxford University Press
2. Internet Marketing and e-Commerce; by Ward Hanson; Cengage
3. Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World; by Chuck Hemann
Ken Burbary; Que Publishing
4. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable
Online Campaigns; by Ian Dodson; Wiley publication

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=evRg1B9ya94>
2. https://www.youtube.com/watch?v=ghZZB_7HFS8
3. https://www.youtube.com/watch?v=spf_AhwMT_k
4. <https://www.youtube.com/watch?v=TP-fvp1REls>

List of Experiments:

Note: The experiment list provided beneath is for reference only. The course teacher may change/formulate it as per his/her methodology and requirement.

1. Domain registration and hosting.
2. Design and development of word press website.
3. SEO tools.
4. Keyword planner tools.
5. Google analytics tools.
6. Google AdSense.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe digital marketing.	1 Remembering
CLO2	Discuss the knowledge on the different types of website.	2 Understanding
CLO3	Use Data Analysing with Google Analytics.	3 Applying
CLO4	Explain Tracking Traffic from Different Source.	4 Analysing
CLO5	To know Google AdSense to Justify the application of its.	5 Evaluating
CLO6	Create website for digital marketing.	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
CLO1		2		1	3				2	1			3					
CLO2		2	2	2	1		1	2	2	1			2					
CLO3		2			3					2								
CLO4		1		2	1					2						2		
CLO5	2	2			1	2			3	1								
CLO6		2	2	2	1		1	2	2	1			2					

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Cyber Security-II
Course Code:	12-MDC227-1C
Pre-requisite Course:	Basics of computer

Course Objectives:

- Graduates will have solid basics in Mathematics, Programming, Computer Network, Network, Security, Cyber Security fundamentals and advancements to solve technical problems.
- To be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.
- To be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

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	E-Commerce and Digital Payments Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act, 2007.	18	50%
2	Digital Devices Security , Tools and Technologies for Cyber Security End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Anti-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	18	50%

Reference Books:

1. "Cyber Security (with CD): Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" by Nina Godbole, Sunit Belapure.
2. "Cyber Laws & Information Technology" by Dr. Jyoti Rattan
3. Cyber Crimes & laws by Taxman and Technology decoded by N.S.Nappani.
4. Avi Silberschatz, Greg Gagne, and Peter Baer Galvin Operating System Concepts John Wiley & Sons, Inc.
5. Computer Forensics: Computer Crime Scene Investigation by John R. Vacca.
6. Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004.

List of Open-Source Software/learning website:

1. <https://swayam.gov.in>
2. <https://nptel.ac.in>
3. https://en.wikipedia.org/wiki/Main_Page

List of Experiment

Sr. No	Experiments
1	Configuring security settings in Mobile Wallets and UPIs.
2	Checklist for secure net banking.
3	Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
4	Setting and configuring two factor authentication in the Mobile phone.
5	Security patches management and updates in Computer and Mobiles.
5	Managing Application permissions in Mobile phone.
6	Installation and configuration of computer Anti-virus.
7	Installation and configuration of Computer Host Firewall.
8.	Wi-Fi security management in computer and mobile.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the broad set of technical, social & political aspects of Cyber Security.	2 Understanding
CLO2	Appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states tonational infrastructure.	2 Understanding
CLO3	Understand the importance of ethical hacking tool.	2 Understanding
CLO4	Implementing ethical hacking tools in an organization.	3Applying
CLO5	Apply security principles to system design.	3 Applying
CLO6	Apply methods for authentication, access control, intrusion detection and prevention andconduct research in Cyber Security	3 Applying 4 Analysing

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
CLO1	1	1	1		2				1	2						2		
CLO2		2				2			2		1	1			1			
CLO3			1						1	2						2		
CLO4		1	2			1	2		2				1		2			
CLO5	1	1			2	1		2							1			
CLO6	1				1	1	2	2							1			

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Title:	Reaction of Organic Chemistry-II
Course Code:	12-MDC230-1C
Pre-requisite Course:	Basic Chemistry up to 12 science

Course Objectives:

- The capacity to job effectively and safely in a laboratory environment.
- Opportunities for student and faculty to interact with alumni and with professional chemists.
- To develop the fundamental analytical and industrial skills to work effectively in the different fields of chemistry.
- To develop idea for the new way of organic 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	
3	--	2	4	50	25	--	25	100

Course Contents:

Unit	Content	Total Hours	Weightage
1	HALONITROARENES Reactivity, Structure and nomenclature of amines, physical properties, Separation of a mixture of primary, secondary, tertiary amines, Structure feature effecting basicity of amines, Preparation of alkyl and arylamines (reduction of nitro compound, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction.	18	34
2	REACTION MECHANISM Fission of Co-Valent bond (With atleast one example of each intermediates), Types of reagents, Types of organic reaction with mechanism. Substitution reactions (Nucleophilic & Electrophilic), Addition reactions (Nucleophilic & Electrophilic), Elimination reactions (E1 & E2)	12	33
3	AROMATIC HYDROCARBONS Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: Effect of substituent groups, Determination of orientation, Classification of substituent groups, Orientation in disubstituted benzenes, halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acetylation with their mechanism. Directing effects of the groups.	12	25

Reference Books:

1. Organic reaction and mechanism, P.S.Kalsi, New Age international Publishers.
2. Text book of organic Chemistry, P.S.Kalsi, New Age international Publishers.
3. Organic Chemistry Vol. I & II, S.M.Mukherji, S.P.Singh, R.P.Kapoor.
4. Reaction mechanism in Organic Chemistry, S.M.Mukherji, S.P.Singh. 3rdedn, Macmillan.

5. Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4thedn, Himalaya Publication House.
6. Organic Chemistry, T.W.Graham Solomons, 4thedn, John Wiley, 1998.

Chemistry Practical

List of Experiments:

1.	Organic Chemistry 1) Identification of an organic compound through the functional group analysis, Determination of melting point and boiling point, Preparation of suitable derivative. 2) Candidate should perform the analysis of at least 05 compounds.
2.	Volumetric Titrations 1) To determine the Normality, gram/liter and molarities of $H_2C_2O_4$, $2H_2O$ and H_2SO_4 present in the solution mixture of $H_2C_2O_4$, $2H_2O$ & H_2SO_4 by using X N NaOH and Y N $KMnO_4$ solutions. 2) To determine the Normality, gram/liter and molarity of $H_2C_2O_4$, $2H_2O$ and $K_2C_2O_4$ present in the solution mixture of $H_2C_2O_4$, $2H_2O$ & $K_2C_2O_4$ by using X N NaOH and Y N $KMnO_4$ solutions.

Reference Books:

1. Vogel's textbook of quantitative chemical analysis, 6th Edition, J Mendham, R C Denney, J D Barnes, M J K Thomas.
2. Practical Chemistry, O P Pandey, D N Bajpai, S Giri.
3. An Advanced course in Practical Chemistry, Ghoshal, Mahapatra, Nad.

List of Open-Source Software/learning website:

1. <https://www.organic-chemistry.org>
2. <https://swayam.gov.in>
3. <https://nptel.ac.in>
4. <http://onlinelibrary.wiley.com>
5. 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 about reactivity, structure, nomenclature and properties of halonitroarenes.	1Remembering 2Understanding
CLO2	Learn and understand about reaction mechanism, intermediates and nucleophilic substitution reaction.	1Remembering 2Understanding
CLO3	Learn and understand about aromaticity in organic molecules.	1Remembering 2Understanding
CLO4	Learn, understand and perform the organic spotting of unknown organic compound and volumetric titrations.	2Understanding 3Applying

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
CLO1	2																	
CLO2		1			3							2						
CLO3								2										
CLO4			2								1							

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Basic English – II
Course Code:	12-AEC202-1C
Pre-requisite Course:	Basics English Grammar and Composition up to 12 th Science.

Course Objectives:

- To inculcate human values among the students through poems and prose.
- To create an interest in literature and to develop language skills.
- 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	Content	Total Hours	Weightage
1	VOCABULARY&GRAMMARLINK Regular Verbs' meanings with past and past participle forms, One Word Substitutes, Modal Auxiliaries, Imperatives, Antonyms, Synonyms.	9	30%
2	SPEAKING Public Speaking: (Teacher has to give Tips to the students about How to deliver speech in front of public) Speeches: Reservation System in India, Elections, Importance of Reading, Science& Technology, Indian culture & Western culture (or more than these topics)	6	20%
3	READING&WRITING 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 more than that for the entire semester based on especially from the pages no. 3 & 4 of The Times of India)	6	20%
4	TEXT Fantasy a collection of short stories edited by V Sasikumar (Orient Black Swan) Lesson 6 to10	9	30%

Text Books:

- Fantasy a collection of short stories edited by V Sasikumar(Orient Black Swan)
- Easy to learn English grammar by Dr.Jayesh Patel

Reference Books:

- Very Useful Verbs book (Enka Publication)
- Contemporary English Grammar Structure & Composition
- Murphy R. Intermediate English Grammar(New Delhi: Cambridge University)
- The Art of Public Speaking by Vijay Kumar.
- The Times of India/The Indian Express
- 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	Use context clues to find the meaning of a word and/or phrase in a reading text	1 Remembering
CLO2	Express their ideas in group discussions.	2 Understanding
CLO3	Use appropriate note-taking styles for reading and listening texts.	3 Applying
CLO4	Identify the types of words in the sentence.	4 Analysing
CLO5	Explain sentences using collocation words.	2 Understanding
CLO6	Use cohesion mechanisms to distinguish different ideas.	3 Applying

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
CLO1	3					2					2					3		
CLO2		2			2		1			2		1			2			
CLO3			3					1					3			2		
CLO4		2					3					2						
CLO5					2					2					3			
CLO6	1					1					1					2		

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	National Service Scheme
Course Code:	12-VAC101-1C
Pre-requisite Course:	

Course Objectives:

- To understand the basic concept of NSS Regular Activities.
- To understand the Important of Soft Skills .
- To be able to understand the Leadership Skill, Communication Skill And Report Writing Skills.

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

Subject Contents:

Unit	Content	Total Hours	Weightage
1	NSS Regular Activities and Special Camping Programme • NSS Regular Activities – A Detailed Study • Adoption of villages, Contracting Village / Area Leader, Identification of Problems • Adoption of Slums, NSS Volunteers for Slums Work • Some Suggestions For Selecting of Slums • Objective and Contribution of the Special Camping Programs • Suggestive List of Activities During Special Camping • Environment Enrichment and Conservation • Health, Family and Nutrition Program, Social Service program	30	50%
2	NSS Programmes and Soft Skills • Soft Skills – Basic Concepts • Importance of Soft Skills • Leadership Skills, Communication Skills and Writing Skills as Part of Soft Skills Development • Report Writing On the Basis of Your Institutional Activities • Basic Concepts and Components • Various NSS Programmes and Activities • National Calamities and National Emergencies, Urban Projects and Rural Projects • Institutional Work Campus Work , Orientation of NSS Volunteers	30	50%

Reference Books:

- 1) National Service Scheme manual – 1998 and 2006
- 2) Principles and Practices of Management by L.M. Prasad

List of Open Source Software/learning website:

1. <https://nss.nic.in>

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Instrumentation Measurement & analysis
Course Code:	12-SEC206-1C
Pre-requisite Course:	Basics Physics up to 12 th Science.

Course Objectives:

- To know application of various measurement instruments.
- To understand the working of practical appliances.
- To be able to know use various appliances in physics practical.

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	Vernier Callipers : Introduction, Theory, Figure, Description of the instrument, Detail study of Least count, Errors, Positive Error, Negative Error, Determination of Magnitude of Positive and Negative Errors. Micrometre Screw : Introduction, Theory, Figure, Description of the instrument, Definition of pitch and its Determination, study of least count, Meaning of the Error and explanation of positive and negative Errors, Determination of positive and Negative Errors, Method of taking observation with the help of micrometre screw. Spherometer : Introduction, Theory, Figure, Description of the instrument, to determine the pitch of the screw, To Determine the Least count of the Spherometer, Zero Error, Derivation of Formula for the Radius of Curvature Of Curved Surface.	15	50%
2	Wheatstone Bridge : Introduction, Theory with Figure, The Figure of Meter Bridge used in Laboratory, Construction of Meter Bridge. Construction of Galvanometer : Introduction, Theory, Sensitivity and Figure of merit of Galvanometer. Ammeter, Voltmeter, and Ohmmeter: Understanding the structure of the ammeter, voltmeter, and ohmmeter. Learning how to use those meters and using them to measure the current, voltage, and resistance of an electric circuit.	15	50%

Text Books:

- Experimental book for Physics.

Reference Books:

- Experimental book for Physics.

List of Open Source Software/learning website:

- http://www.allaboutcircuits.com/vol_1/chpt_8/1.html

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the instruments used in physics practicals.	1 Remembering
CLO2	Discuss the construction of various measuring devices.	2 Understanding
CLO3	Compare the vernier calipers, Micrometer screw and Spherometer	3 Applying
CLO4	Explain the various measuring devices.	4 Analyzing
CLO5	Discuss the working of various measuring devices.	2 Understanding
CLO6	Usage of the various meters in laboratory.	3 Applying

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
CLO1	2																	
CLO2			2															
CLO3			3															
CLO4	1																	
CLO5					2													
CLO6					1													

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Title:	Chemistry of cosmetics and Hygiene products
Course Code:	12-SEC207-1C
Pre-requisite Course:	-

Course Objectives:

- The capacity to job effectively and safely in a laboratory environment.
- Opportunities for student and faculty to interact with alumni and with professional chemists.
- To develop the fundamental analytical and industrial skills to work effectively in the different fields of chemistry.
- To develop idea for the new way of green synthesis.

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	Content	Total Hours	Weightage
1	Introduction of cosmetics & Hygiene products Introduction, requirements/function and characteristics of the following products: Shampoo, Anti-sunburn lotion, Face-powders, Lipsticks, Talcum powder, Cold-creams, Hair dyes, .Essential oils	15	50%
2	Chemistry of cosmetics Chemical synthesis of : Shampoo, Anti-sunburn lotion, Face-powders, Lipsticks, Talcum powder, Cold-creams, Hair dyes.	15	50%

Reference Books:Pharmaceutics and cosmetics by Gupta-Gupta (A Pragati Edition)

1. Text book of cosmetics Garud-Sharma-Garud (A Pragati Edition)

List of Open-Source Software/learning website:

1. <http://www.chemistryexplained.com/Co-Di/Cosmetic-Chemistry.html>
2. <https://www.slideshare.net/tanujanautiyal/cosmetics-chemistry-by-dr-tanuja-nautiyal>
3. <https://www.tutorialsduniya.com/notes/chemistry-of-cosmetics-perfumes-notes/>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Introduction and the importance of cosmetics.	2 Understanding
CLO2	Requirements and uses of cosmetics and essential oils.	2 Understanding
CLO3	Industrial synthesis of cosmetics.	3Applying 2 understanding

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)																PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2
CLO1	1				2													
CLO2			2								1							
CLO3	2						1											

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Microbiology
Program Code:	SC102
Course Name:	Biocomputing
Course Code:	12-SEC208-1C
Pre-requisite Course:	Basics Biology up to 12 th Science.

Course Objectives:

- To understand basics of computer and roll of computer in scientific educations well as in daily life.
- To understand applications of computer in learning like ICT, report writing and research writing.
- To understand the components of computer to enhance students' knowledge and interest to deal with many aspects of computer related finding job.

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	Content	Total Hours	Weightage
1	- History, development and types of computers: General awareness of computer systems – hardware and software (CPU and other peripheral devices, computer arithmetic, computer logic) - Programming languages – machine language, assembly language, higher level languages graphics, statistical packages – MINITAB, MATLAB etc	15	50%
2	- Concepts of internet. - Applications of internet in society - Concept of HTML, HTTP, URL, Domain, Search engine - Computer and Internet in Biotechnology	15	50%

Reference Books:

- Computers Today: D. H. Sanders
- Developing Bioinformatics Computer Skills C. Gibas and P. Jamback.

List of Open Source Software/learning website:

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss history of computer.	2 Understanding
CLO2	Describe and compare hardware components and software components of computer.	1 Remembering 4 Analyze
CLO3	Categorize and Illustrate internet concept, its components.	3 Applying 4 Analyze
CLO4	Use basic knowledge of computer and utilize it in improving education.	3 Applying,
CLO5	Evaluate available programming languages and statistical software and createnewsoftware for statistical analysis.	5 Evaluate, 6 Creating
CLO6	Design software which can help in understanding structure of biomolecules.	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
CLO1		1								1								
CLO2	1	1								2								
CLO3	1									2								
CLO4	1	2			1					3								
CLO5	2	3	2		2	1				3								
CLO6	3	3	3		2	3				3								

3: High, 2: Medium, 1: Low