

SANKALCHAND PATEL UNIVERSITY VISNAGAR

Faculty of Science and Humanities



Structure, Teaching Scheme and Syllabus of

B. Sc. Honours (Chemistry)

Program Code: SC103

With effect from: 2023-24

SEMESTER-I

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Organic Chemistry-I
Course Code:	11-CHM201-1C
Pre-requisite Course:	Basic Chemistry up to 12 science

Course Objectives:

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

Course Contents:

Unit	Topic	Total Hours	Weightage
1	STRUCTURE AND PROPERTIES Factors affecting to the properties of organic molecule Intramolecular forces (dipole-dipole interaction, Vanderhalls forces), Electrometric effect, Inductive effect, Resonance effect (draw resonating structures of Nitro benzene, Chlorobenzene, Phenoxide ion, Anillinium ion, Acetate ion), Hyperconjugation (o,p-directing effect of Alkyl group, Stability of Carbonium ion and Free radicals).	15	34%
2	NAME REACTIONS AND MECHANISM Aldol Condensation, Baeyer-Villiger Oxidation, Benzoin Condensation, Birch Reduction, Claisen Condensation, Claisen Rearrangement, Cope Elimination, Curtius Rearrangement, Dakin Reaction, Favorskii Reaction, Hofmann Elimination, Pinacol Rearrangement.	15	33%
3	INTRODUCTION OF GREEN CHEMISTRY What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals –different basic approaches to do so.	15	33%

Text Books:

1. Textbook of Chemistry paper -101, Nirav Publication

Reference Books:

Organic Chemistry

- 1.'Organic reaction and mechanism, P.S.Kalsi, New Age international Publishers.

2. Reaction mechanism in Organic Chemistry, S.M.Mukhergi, S.P.Singh. 3rd edn, Macmillan.
3. Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4th edn, Himalaya Publication House.
4. Text book of Organic Chemistry, Arun Bahal, S. Chand.

Green Chemistry

- 1 A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
- 2 M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

List of Open-Source Software/learning website:

1. <https://swayam.gov.in>
2. <https://nptel.ac.in>
3. <http://onlinelibrary.wiley.com>
4. https://en.wikipedia.org/wiki/Main_Page

List of Experiments:

Sr. No	Practical Exercise
1.	Demonstrations Preparation of standard stock solution by/v method and their different dilutions. Preparation of standard stock solution of HCl by v/v method and their different dilutions. (Any 5 solution preparation)
2.	Melting point and Boiling point of an organic compound. Identify the types of organic compound. (Any 10 compounds)

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understanding the different effects in organic compounds	2 Understanding
CLO2	Understand the resonance effect in organic chemistry	2 Understanding
CLO3	Use and explain of reaction mechanism	3Applying 2 understanding
CLO4	Understand the name reaction and their application	2 understanding 3 Applying
CLO5	Explain basics of the green chemistry.	2 understanding
CLO6	To prepare standard solution.	3 Applying

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

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Inorganic & Physical Chemistry-I
Course Code:	11-CHM202-1C
Pre-requisite Course:	Basic chemistry up to B.Sc. semester-I

Course Objectives:

1. The ability to work effectively and safely in a laboratory environment.
2. Opportunities for student and faculty to interact with alumni and with professional chemists.
3. The basic analytical and technical skills to work effectively in the various fields of chemistry.
4. The ability to synthesize, separate and characterize compounds using published reactions, protocols, standard laboratory equipment, and modern instrumentation.

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	Topic	Total Hours	Weightage
1	CHEMICAL BONDING Valence bond theory, Types of Chemical bonds, Various types of hybridization and shape of simple inorganic molecules, V.S.E.P.R. theory for NH ₃ , H ₂ O, M.O. Theory-Energy level diagram for homo nucleus diatomic molecules (N ₂ and O ₂) and hetero diatomic molecule (CO and NO).	15	33%
2	F-BLOCK ELEMENTS Lanthanide: Lanthanide electronic configuration, Oxidation state, Lanthanide contraction, Effect of lanthanide contraction, Separation methods: a) Solvent extraction methods b) Ion Exchange Method. Actinide: Electronic Configuration, Oxidation state	12	33%
3	THERMODYNAMICS Thermodynamics (only introduction), System and surrounding- work, heat, energy, Thermodynamic properties, Thermodynamic Process, Thermodynamic Co-efficient. First law of thermodynamics-Internal energy, enthalpy, free energy, maximum work function Heat capacity, specific and molar heat capacity, heat capacity at constant, Work done in adiabatic and isothermal reversible expansion of an ideal gas.	18	34%

Reference Books:

Inorganic Chemistry

1. 'Modern Inorganic Chemistry' by G.F. Liporni, ELBS, 4thedn, colling Educational, 1983.
2. 'Inorganic Chemistry' D. F. Shriver, P.W. Atkins and C. H. Longford, 3rdedn, ELPS Oxford University Press, 1999.
3. 'Inorganic Chemistry' by A. G. Sharp, 3rdedn, ELBS, Longman, 1990.

Physical Chemistry

1. Advance Physical Chemistry by Gurdeep raj.
2. Principal of Physical Chemistry by Puri, Sharma, Pathania.
3. Chemical Thermodynamics by R. P. Rastogi and R. R. Misra.

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

List of Experiments:

Note: This syllabus is to be completed by assigning two laboratory sessions per week, each of two hours.

Total laboratory work is 60 hrs/sem (4 hrs/week) or 15 weeks. The number of students in the laboratory batch should not exceed fifteen (15). The medium of instruction should be English in laboratory course.

Sr. No.	Practical Exercise
1.	Demonstrations Calibration of burette and Pipette.
2.	Standardization (Any four) 1) Preparation of standard solution of succinic acid and standardization of NaOH/KOH Soln. 2) Preparation of standard solution of Na ₂ S ₂ O ₃ and standardization of I ₂ solution. 3) Preparation of standard solution of EDTA and estimation of Ca ⁺² /Mg ⁺² in CaCl ₂ /MgCl ₂ solution. 4) Preparation of standard solution of Oxalic acid and standardization of KMnO ₄ solution. 5) Preparation of standard solution of K ₂ Cr ₂ O ₇ and standardization of FeSO ₄ solution

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understanding the chemical bonding in molecules.	1-Remembering 2-Understanding
CLO2	To understand the hybridization & shapes of some molecules by V.S.E.P.R theory.	1-Remembering 2-Understanding
CLO3	Learn basic techniques to Explain the basic terms of thermodynamics.	2-Understanding
CLO4	Understand f-block elements with its chemical properties.	2-Understanding 3-Applying
CLO5	Understand the basic laws of thermodynamics with its applications.	2-Understanding 3-Applying
CLO6	Calibration of burette and Pipette and Standardization of solution.	2-understanding 3-Applying

Mapping of CLOs with POs

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

1: High, 2: Medium, 3: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Theory of Mechanics & Optics
Course Code:	11-PHE201-1C
Pre-requisite Course:	Basics Physics up to 12 th Science.

Course Objectives:

1. To understand Vector, scalar and simple harmonic motion.
2. To understand the basic concept of Mechanics.
3. To understand the harmonic motion.
4. To understand the Special theory of relativity.

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

A. Physics Theory:

Unit	Content	Hours	Weightage
1	Diffraction: Distinction between Interference and diffraction, Fresnel and Fraunhofer types of diffraction, Fraunhofer diffraction at a double slit, Fraunhofer diffraction at double slit (Calculus method), Distinct between single slit and double slit diffraction pattern, Fraunhofer diffraction at N slit, Plane diffraction grating, Theory of plane transmission grating, Dispersive power of Grating Special theory of Relativity: Newtonian Relativity, Michelson-Morley experiment, Special theory of relativity, Lorentz Transformation, Consequences of Lorentz Transformation (a) Relativity of Simultaneity (b) the Lorentz-Fitz Gerald length Contraction (c) Time Dilation, Addition of Velocities, Mass-energy relation, Space time.	15	33%
2	Mechanics of single particle and particles: Motion of Particle subjected to a resistive force (case 1 to 5), Mechanics of a system of particle, motion of a system with variable mass. Motion in a central force field and pendulum: Equivalent one body problem, motion in a central force field, General features of the motion, Motion in a inverse square law force field, Equation of the orbit, Kapler's law of planetary motion. Compound pendulum, bar pendulum.	15	33%
3	Vectors analysis: Triple product of vectors, Scalar triple product, Some important conclusions from scalar triple product, the vector triple product $A \times (B \times C)$, Differentiation of a vector with respect to time, Scalar and vector field, Partial Differentiation and gradient, Rate of flow of a vector field, Vector integration, Surface integral, Gauss's Divergence theorem, Stoke's theorem. Simple Harmonic Motion and Damped Vibration: Composition of two simple harmonic motion along the same direction of the same frequency, Composition of two simple harmonic motion acting upon a particle simultaneously at right angles to each other, same time period but in different in phase, Motion in a resisting medium.	15	34%

Basic Reference book:

1. A textbook on Oscillations, Waves and Acoustics by M. Ghosh & D. Bhattacharya.
2. Waves and Oscillations by N. Subrahmanyam & Brij Lal
3. Thermodynamics and Statistical Physics by Singhal, Agarwal and Prakash.

B. Physics Practical:

1. Simple pendulum
2. M.I of a Fly wheel
3. Refractive index of liquid using convex lens.
4. Study of resonator
5. Verification of Thevenin's theorem.
6. Determination of capacity 'c' of condenser.

List of Open-Source Software/learning website:

1. <https://youtu.be/mphn5DiugP4>
2. <https://youtu.be/TnDCxw0y6YM>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss the knowledge on the fundamentals of scalar and Vectors	2 Understanding
CLO2	Discuss Basics concept of Simple harmonic motion and oscillation.	2 Understanding
CLO3	Acquire fundamentals of Mechanics and Apply it to motion of single particle.	3 Applying
CLO4	Learn basic techniques to Explain motion in central force field and solve the numerical related the same.	3 Applying, 2 Understanding
CLO5	Discuss the basic concept of physics like diffraction and interference	2 Understanding
CLO6	Explain theory of relativity.	2 Understanding

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

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Cell Biology
Course Code:	11-BIE201-1C
Pre-requisite Course:	Basics Biotechnology up to 12 th Science.

Course Objectives:

1. To understand intra and inter-cellular organization, structure and functions of different organelles of cells.
2. To understand the basics of cellular organelles.
3. To understand the functions and their significance in living systems.

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	Eukaryotic cell structure: The cell envelope (boundary layer): cell wall, cell membrane (Structure of Plasma membrane: Fluid Mosaic Model and Various Models, Functions of Cell Membrane: Transport of small molecules, Endocytosis and exocytosis) Cell communication (cell matrix interactions/Cell-Cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata) Endoplasmic Reticulum – Structure and function Golgi Apparatus: Structure (Organization) and functions Structure and function of Lysosomes, micro bodies (Glyoxime and Peroxisome), Mitochondria, Chloroplasts	18	40%
2	Nucleus: Structure, function Chromosome: Size, shape, types and basic structure of chromosome, euchromatin and heterochromatin, karyotyping, Chromatin – Molecular organization Giant Chromosome: Polytenic chromosome and lamp brush chromosome Nucleolus Cell cycle: Cell cycle and its regulation Mitosis and meiosis	12	30%
3	Introduction to Biotechnology: Branches of biotechnology/ Domains of biotechnology Applications and future prospectus of biotechnology in various fields Biotechnology in India: (i) Exams (ii) schemes- i.e. IBTP, JRF etc. (iii) Major research labs across country Cell: classification of organisms by cell structure & Cell Organization – Eukaryotic (Plant and animal cells) and prokaryotic Prokaryotic cell structure: Morphology of Bacterial cell: Size, shape and arrangement of bacterial cells External cell Structures: Flagella, cell wall Internal cell structures: Mesosome, inclusion bodies Dormant forms: Spores and cyst	15	30%

Text Books: Elementary Microbiology by H. A. Modi (Unit-1)

Cell Biology by Verma & Agrawal (Unit-2 & 3)

Reference Books:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons, Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.

3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

4. Powar C. B. 1983 Cell Biology, Himalaya Publishing House, Mumbai, India

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/102/103/102103091/>

<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==>

List of Experiments:

1. Cell division in onion root tip/ insect gonads. (Preparation & study of permanent slides showing different stages of cell division – Meiosis and Mitosis)

2. Staining techniques: Simple-Monochrome and Negative Differential- Grams and Acid Fast Special-Capsule, Spore, Cell wall, Granule, Nucleus, Spirochetes

5. Localization of Barr Body

6. Study of Bacterial Motility

7. Study of Salivary Gland chromosome of Dipteran Larva-Drosophila or Chironomus Spp.

8. Micrometry: Measurement of given biological sample.

9. Study of the Microscope: Basic components of microscope and their working principle

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss the structure of cell and classification of cell.	2 Understanding
CLO2	List the applications of Biotechnology in different area of research in science.	1 Remembering
CLO3	Acquire fundamentals and translate the knowledge that will enable them for cell-based research.	2 Understanding,
CLO4	Learn basic techniques to identify and interpret Protein synthesis and transporting in the cell.	3 Applying, 2 Understanding
CLO5	Learn about membrane transport, evaluate diseases associated with them, identify and compare the exocytosis and endocytosis in the cell.	5,3, 4 Evaluate, Applying, Analyze
CLO6	Discuss the mechanisms involved in mitosis and meiosis.	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		1	1											1	1
CLO2	1	3	1		1	1									2			
CLO3	1	3	1		2	2			2						1			
CLO4	2	3	1		3	3			3								1	
CLO5	2	3	3		3	3			3						3			
CLO6	3	3	3		3	3			3									1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Biodiversity
Course Code:	11-BIE204-1C
Pre-requisite Course:	Basics Biotechnology up to 12 th Science.

Course Objectives:

1. Get a deep knowledge on biodiversity richness in global scale and biogeography of India.
2. Assess the value of biodiversity wealth of our Nation.
3. Analyse various threats to our biodiversity and able to suggest measures for conservation Strategies.

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	Introduction- Definition, Genetic diversity, Species diversity, Ecosystem diversity: Structural and functional aspects. Bio-geographic classification of India. Basic concepts of conservation biology, history of conservation biology, the value of biodiversity and conservation, current practice in conservation, conservation of genetic diversity, conservation of species diversity, conservation of ecosystem diversity, relevance of ecosystem diversity as well as services in conservation	15	30%
2	Value of Biodiversity- Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values. Utilitarian values of biodiversity- goods, services and information. Biodiversity and ecosystem functioning. Biodiversity and stability of ecosystem functioning. Biodiversity at global, national and local levels India as a Mega Diversity Nation. Hotspots of Biodiversity: Criteria for determining hot spots. Indo-Burma (Eastern Himalaya), Western Ghats and Sri Lanka.	18	40%
3	Threats to Biodiversity- Habitat loss, pollution, species introduction, global climate change, overexploitation, poaching of wildlife. Rare species, genetic diversity of rare species, habitat loss and fragmentation. Extinction: mass extinction, extinction process, ecosystem degradation, over exploitation, invasive species. Human factors: social factors, economics, politics and action. Man, wildlife conflicts. Endangered and endemic species of India, common plant species, common animal species.	12	30%

Text Books:

An, S., & Verhoeven, J. T. (Eds.). (2019). Wetlands: Ecosystem Services, Restoration and Wise Use (Vol. 238). Springer

Reference Books:

- Carina Hoorn, Allison Perrigo, Alexandre Antonelli (2018). Mountains, Climate and Biodiversity John Wiley and Sons Ltd, Oxford.

- Copsey, J. A., Black, S. A., Groombridge, J. J., & Jones, C. G. (Eds.). (2018). Species Conservation: Lessons from Islands. Cambridge University Press.
- Krishnamoorthy, K.V (2004) An Advanced text book on Biodiversity- principles and Practice: Oxford and IBH publishing company Pvt. Ltd. New Delhi.

List of Open-Source Software/learning website:

<https://nptel.ac.in/courses/129105008>

<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=0Xvq9yUM2ILDrJ07FvIArQ==>

List of Experiments:

1. Field Survey for studying plant species diversity
2. Ex- situ conservation of plant species using in vitro technique
3. Micropropagation of an endangered plant species
4. Green pod (embryo culture) culture of orchid

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Discuss the Genetic Diversity.	2 Understanding
CLO2	List the current practice in conservation.	1 Remembering
CLO3	Acquire fundamentals and translate the knowledge that will enable them for understanding of overexploitation.	2 Understanding,
CLO4	Learn Habitat loss to identify and interpret over exploitation as treats of biodiversity.	3 Applying, 2 Understanding
CLO5	Learn about Extinction, evaluate ecosystem degradation s associated with them, identify and compare the increase and decrease of Human factors for it.	5,3, 4 EvaluateApplying, Analyze
CLO6	Discuss the mechanisms involved in ecosystem diversity.	6 Creating

Mapping of CLOs with POs & PSOs

3: High, 2: Medium, 1: Low

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														
CLO3	1						1								1			
CLO4								1										
CLO5				1														
CLO6														1				

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Microbiology Scope and Techniques
Course Code:	11-MDC225-1C
Pre-requisite Course:	-

Course Objectives:

- To understand the importance of microbiology and microorganisms in the living world.
- To study the major cell organelles of microorganisms
- Students will learn the historical perspectives associated with the subject of microbiology.
- Students will learn the fundamental aspects of Staining, Microscopy, Isolation, Pure Culture & Preservation Techniques.
- This course will make the student familiar with basic microbiological techniques and processes that will help them understand the prokaryotic processes in a much better way.

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 Microbiology and applied fields of Microbiology Isolation, Pure Culture and Preservation Techniques for Microorganisms Isolation of Bacteria: • Definitions of Terms: Isolation, Pure Culture, Axenic Culture, Colony, Clone • Methods for isolation and Cultivation of Bacteria (aerobic and anaerobic) Preservation of Microorganisms and Culture collection centres: Principles of Staining Techniques & Microscopy Types of Stains & Staining techniques: • Dyes & Stains, • Role of Primary Stains, Counter Stains, Mordants, Decolourizers, Accentuators with suitable examples. • Simple, Differential (Grams' Staining & Acid-Fast Staining), Negative, Structural staining techniques (Spore, Capsule, Flagella, Cell Wall, Metachromatic Granules, etc.) • Principles of Microscopy: Magnification and resolution simple & compound, Bright field.	15	34%
2	History of Microbiology: • Development of microbiology as a discipline, Spontaneous generation vs. biogenesis. • Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Martinus W Beijerinck, Sergei Winogradsky, Selman A Waksman, Paul Ehrlich, EleiMetnikoff, Edward Jenner, • Role of microorganisms in fermentation (Germ Theory of Fermentation) , Germ theory of disease	15	33%
3	Prokaryotic Cell Organization • Shape, size, and arrangement of bacterial cell Structure of bacterial cell • Surface appendages of bacteria: General nature, arrangement, structure and role of flagella, General nature, and significance of pili, pros thecae and stalks	15	33%

•Surface layers of bacteria: General nature and significance of capsule and slime layer, cell wall, cell membrane and Mesosomes •Bacterial cytoplasm and cell organelles: Cytoplasm, cytoplasmic inclusions, nuclear material •Bacterial endospore: Spore structure, sporulation and spore germination		
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Microbiology Practical's:

1. Safety precautions to work in Microbiology Laboratory
2. Preparation of Culture Media: Solid & Liquid
3. Isolation of Bacteria by Streak Plate Method (using Direct & Sector Streaking Methods)
4. Pour Plate Technique for Quantitative Bacteriological Analysis of Given Samples
5. Microscopic observation of bacteria for Morphological characters by Simple (Monochrome & Negative) Staining
6. Differential Staining Technique: Grams' Staining
7. Preservation of Bacterial Cultures

Text Books:

1. Dubey, R. C. and D. K. Maheshwari (2000). "General Microbiology". S. Chand Publications, New Delhi.
2. Pelczar, M.J., Chan, E.C.S. and N.R. Kreig (1993). "Microbiology" 5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. H.A.Modi "Elementary Microbiology"

Reference books:

1. Presscott, M. J., Harley, J.P. and D.A. Klein (2002). "Microbiology", 5th Edition, WCB Mc Graw Hill, New York.
2. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education
3. Atlas, R.M. (1997). Principles of Microbiology. 2nd edition. W.M.T. Brown Publishers.
4. Patel, R. J. "Experimental Microbiology Volume-1 & 2" Aditya publication, Gujarat (2016)

List of Open-Source Software/learning website:

<http://ecoursesonline.iasri.res.in/course/resources.php?id=419>
<https://www.coursera.org>
<https://onlinecourses.nptel.ac.in>

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

CLO	Description	Bloom's Tax on my Level
CLO1	Learn the multifaceted existence of microorganisms.	1 Remember, 2 Understand 3 Apply
CLO2	Discuss various cell organelle and its role	2 Understand, 3 Apply 4 Analyse, 5 Evaluate
CLO3	Learn about the discovery of microbial world and basics of microscopy which can be applied for visualizing microbes.	1 Remember, 2 Understand 3 Apply
CLO4	Gain awareness regarding the development of pure culture and preservation techniques of microbes	1 Remember, 2 Understand 3 Apply
CLO5	Gain understanding regarding dyes and stains Students will learn the theory and technique of staining bacteria.	1 Remember, 2 Understand 3 Apply
CLO6	Able to identify, judge and conclude the morphological characters of bacteria using various staining techniques and microscope.	1 Remember, 2 Understand 3 Apply, 4 Analyse 5 Evaluate

Mapping of CLO s 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									1
CLO2	1	2			1												1	
CLO3	1	3			2													1
CLO4	1	3			2												1	
CLO5	1	2	1		3	2												
CLO6	1	3	1	1	3	3			3				1					

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Matrix, Vector & Differentiation
Course Code:	11-MDC222-1C
Pre-requisite Course:	Basics Mathematics up to 12 th Science.

Course Objectives:

1. To understand Vector, scalar, Polar, spherical, cylinder co-ordinates, divergent, curl, gradient.
2. To understand the basic concept of the matrices.
3. To be justify the concept of the differentiations.

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	Vector Analysis and Different types of Co-ordinates: (a) Vector Analysis: scalar and vector product of three vectors, product of four vectors, reciprocal vectors, vector gradient, differentiation, divergent and curl. (b) Polar co-ordinates, spherical and cylinder co-ordinates and their relations.	17	38%
2	Matrices: Introduction on of matrices, different types of matrices, operations on matrices, theorems on matrices, Symmetric and skew-symmetric matrices, Hermitian and skew- Hermitian matrices, linear dependence and in dependence of row and column matrices. Row rank, Column rank and rank of matrix, Row reduced Echelon form of a matrix and matrix inversion using it.	17	38%
3	Differentiation: Definition of derivatives of function $f(x)$, Derivative of definition. Derivatives of function of the type x^n , e^x , a^x and $\log x$ (without proof). Rules of differentiation (without proof). Logarithmic differentiation. Maxima and Minima. Cases of one variable involving second order derivative.	11	24%

Text Books:

1. Mathematics, NiravPrakashan
2. Business Statistics, by SudhirPrakashan, Ahmedabad.

Reference Books:

1. Vector Analysis, by Murry R. Spiegel.
2. Vector Analysis, by Dr.K.S.Rawat,SARUP& SONS,DELHI.
3. Introduction to Vector Analysis, Fifth Edition, by Herry F. Davis, Arther David Saider.
4. Matrix Operation, by Schaum's Series McGRAW-HILL Book Co.

List of Open-Source Software/learning website:

1. <https://youtu.be/MB4dGEA3fOA>
2. <https://youtu.be/yXJGyHELz8>

Practical

1. Application of Vector Analysis and Different types of Co-ordinates.
2. Application of Matrices.
3. Application of Differentiation.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain Relation between the co-ordinates.	4 Analyzing
CLO2	Discuss Basic concept of vector analysis.	2 Understanding
CLO3	Identify derivatives of different types of functions.	4 Analyzing
CLO4	Describe various types of matrices and Discuss theorems related to it.	1 Remembering, 2 Understanding
CLO5	Use the rule of derivative and solve the example of its.	3 Applying
CLO6	Create an example of derivative, vector and matrices.	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													
CLO2	1	1																1
CLO3		1			1				1									
CLO4	1																1	
CLO5	2																	
CLO6			1							1								

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Cyber Security-I
Course Code:	11-MDC223-1C
Pre-requisite Course:	Basics of computer

Course Objectives:

1. Graduates will have solid basics in Mathematics, Programming, Computer Network, Network, Security, Cyber Security fundamentals and advancements to solve technical problems.
2. Graduates will have the capability to apply their knowledge and skills acquired to solve the issues in real world network and cyber security areas and to develop feasible and reliable systems to prevent and protect systems from security attack.
3. Graduates will have exposure to emerging cutting-edge technologies and excellent training in the field of Computer network, Network security and cyber security related issues.

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	Fundamentals of Cyber security Defining cyberspace and overview of computer and web-technology, architecture of cyberspace, communication and web technology, internet, world wide web, advent of internet, internet infrastructure for data transfer and governance, internet society, regulation of cyberspace, concept of cyber security, issues and challenges of cybersecurity.	15	33%
2	Cyber-crime and Cyber Laws Classification of cyber-crimes, common cyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, cybercriminals modus-operandi, reporting of cyber-crimes, remedial and mitigation measures, legal perspective of cyber-crime, IT act 2000 and its amendments, cyber-crime and offences, organisations dealing with cyber-crime and cyber security in India, case studies	15	33%
3	Social Media Overview and Security Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social	15	34%

	media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, best practices for the use of Social media, Case studies.		
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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 Experiments:

Sr. No	Experiments
1	Study of steps to protect your personal computer system by creating user accounts with passwords and types of user accounts for safety and security.
2	Study the steps to protect a Microsoft word document of different version with different operating system. Study “How to make strong passwords” and “passwords cracking techniques”
3	Study the steps to remove passwords from Microsoft word and various methods of protecting and securing databases.
4	Checklist for reporting cyber-crime at cyber-crime police station. Checklist for reporting cyber-crime online. Reporting phishing emails. Demonstration of email phishing attack and preventive measures.
5	Basic checklist, privacy and security settings for popular social media platforms. Reporting and redressal mechanism for violations and misuse of social media platforms.
5	Evidence collection from running computer, imaging of an evidence, and image analysis using different tools.
6	Windows registry analysis, analysis of windows artifacts, analysis of USB devices different password cracking and steganography techniques
7	Basic checklist, privacy and security settings for popular social media platforms. Reporting and redressal mechanism for violations and misuse of social media platforms.

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 to national infrastructure.	2 Understanding
CLO3	Understand the importance of ethical hacking tool.	2 Understanding
CLO4	Implementing ethical hacking tools in an organization.	3 Applying
CLO5	Apply security principles to system design.	3 Applying
CLO6	Apply methods for authentication, access control, intrusion detection and prevention and conduct research in Cyber Security	3 Analysing and 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																		
CLO2	1																	
CLO3			1					1										
CLO4																		
CLO5						1									1		1	
CLO6																		

3: High, 2: Medium, 1: Low

Branch Name:	Chemistry
Program Code:	SC103
Course Name:	Basic English-I
Course Code:	11-AEC201-1C
Pre-requisite Course:	Basics English Grammar and Composition up to 12 th Science.

Course Objectives:

1. To create an interest in literature and to develop language skills.
2. To acquaint students with communication skills.
3. To inculcate human values among the students through poems and prose.

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 Irregular Verbs' meanings with past and past participle forms, Words often Confused, Punctuation and Capitalization, Abbreviations, Affirmative, Apostrophe 'S', Negative Sentence, Idioms and Phrases.	9	30%
2	SPEAKING Public Speaking: (Teacher has to give Tip to the students about How to deliver speech in front of public) Speeches: Google: a new Guru to the World, Smart Phone/Internet: Use & Misuse, Global Warming, Today's Youth, Movies: good & bad impact on Society (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 1 to 5	9	30%

Text Books:

1. Fantasy a collection of short stories edited by V Sasikumar (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 the factors that influence use of grammar and vocabulary in speech and writing	1 Remembering
CLO2	Use punctuation, capitalization and spelling rules appropriately.	3 Applying
CLO3	Find the meanings of words using context clues.	1 Remembering
CLO4	Use correct verb forms in all tenses effectively.	3 Applying,
CLO5	Explain sentences using collocation words.	2 Understanding
CLO6	Use appropriate note-taking styles for reading and listening texts.	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
CLO1	1																1	
CLO2				1						2								
CLO3																		
CLO4			1															1
CLO5	1								1					1				
CLO6					1												1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Yoga and Meditation
Course Code:	11-IKS101-1C
Pre-requisite Course:	-

Course Objectives:

1. To understand the basic concept of Sectional Breathing.
2. To understand the concept of Pranava Manta.
3. To be able to understand the Mental, Emotional, Physical, Social and Spiritual Health.

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	Topic	Total Hours	Weightage
1	Breathing Practices and Pranayama • Sectional Breathing (Abdominal, Thoracic and Clavicular) • Yogic Deep Breathing • Concept of Puraka, Rechaka, and Kumbhaka • Concept of Bandha and Mudra • Anulmoa Viloma/Nadi Shodhana • Shitali, Bhramari Key Words: Sectional Breathing, Deep Breathing, Bandha & Mudra, Shitali, Bhramari.	30	50%
2	Practices Leading to Meditation • Recitation of Pranava Manta • Recitation of Hymns, In Vocations and Prayers • Anter Maun • Breath Meditation • Om Dhyana Key Words: Pranav Mantra, Antermaun, Breath meditation, Om Dhyana.	30	50%

Reference Books:

- 1) Singh S.P & Yogi Mukesh: Foundation of Yoga, Standard Publication, New Delhi, 2010
- 2) Sarswati, Swami Satyanand: Asana, Pranayama, Mudra, Bandha (APMB), Yoga Publication Trust, Munger, 2013
- 3) Ishwar Bhardwaj: Saral Yog asana, Satyam Publishing House, New Delhi, 2018.

List of Open-Source Software/learning website:

1. <https://sahayji.com/hathayoga-course>
2. <https://theyogagainstitute.org/>
3. www.rishikeshnathyogshala.com

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Tally Accounting
Course Code:	11-SEC201-1C
Pre-requisite Course:	-

Course Objectives:

1. To understand the basic concept of Radius of curvature.
2. To understand the concept of Function.
3. To be able to understand the linear differential equations and its application.

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	Introduction to GST • What is GST? • Dual GST • GST Council • Advantages of GST • Types of GST • GST Rate Computerized Accounting System • Advantages of computerized accounting system. • Tally Asan Accounting Software • Features of Tally Software • Starting Tally software, Gateway of Tally, Button Toolbar • Creating a Company • Ledger and Groups • Opening an existing company • Shutting an Opened company • Exiting Tally software	15	50%
2	Voucher Entry • Concept of Voucher • Activate Voucher Entry screen • Types of Vouchers- Purchase, Sales, Payment, Receipt, Contra, Journal, Debit Note and Credit Note • Editing and Deleting voucher entry Reports • Ledger, Trial Balance, Profit and Loss statement, Balance Sheet	15	50%

	- Ratio Analysis, Cash and Fund Flow statement - Day Book, Bank Book - Purchase-Sales and journal Register		
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Reference Books:

- 1) Tally. ERP 9withGST in Simple Steps by DT Editorial Services
- 2) Learn Tally Prime with GST Book by Gaurav Agrawal

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=HOLVBWEAxmE>
2. <https://www.youtube.com/watch?v=wU4q99qG9NE>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe GST.	1 Remembering
CLO2	Discuss types of GST.	2 Understanding
CLO3	Use Tally as Accounting Software.	3 Applying
CLO4	Explain Editing and Deleting voucher entry.	4 Analyzing
CLO5	Prioritize Advantages of GST.	5 Evaluating
CLO6	Create Profit and Loss statement.	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		1			1		1								1			
CLO2	1	1			1		1											
CLO3		1			1				1	1			2					
CLO4	1			1			1										1	
CLO5		1			1		1								1			
CLO6	1		1	1			2	1			1		1				1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Personality Development
Course Code:	11-SEC202-1C
Pre-requisite Course:	-

Course Objective:

1. To increase Self-Awareness, Personal Development, and Life Skills.
2. To inculcate Leadership qualities and Communication skills.
3. To nurture Social Justice and Responsibility in the students.

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	Lectures	Weightage
1	Introduction to Personality Development: The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis Attitude & Motivation Attitude: Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude-Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation.	15	50%
2	Self-esteem: Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self-esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviors - Lateral thinking. Other Aspects of Personality Development: Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.	15	50%

Reference Books:

- Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
- Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behaviour 16th Edition: Prentice Hall.
- Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-Hill 1988.
- Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn various theories of personality development	1 Remember
CLO2	Basically, understand the factors responsible for decision making and practice efficient decision-making ability	2 Understand 3 Apply
CLO3	Apply the major personality domains and theories to better understand one's own behaviour and the behaviour of others, which helps in development of motivation and leadership ability	3 Apply
CLO4	Analyze the determinants of personality characteristics to better understand their effects on cognitions, emotions, and behavior.	4 Analyze
CLO5	Think critically about and apply theoretical and research-based explanations for human behavior in order to successfully negotiate the challenges of daily living.	5 Evaluate
CLO6	The student would understand diversity to be one of the greatest assets to any community. Fueling the collective creativity and ingenuity, of diverse society which will create an energy of possibility as to negotiate and make positive change.	2 Understand 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													
CLO2		1		1			1			1								
CLO3		2		1			1		1									
CLO4		1		1														
CLO5	1	1	1		1	1		1		1								
CLO6		1		1			1											

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Laser & Fiber Optics
Course Code:	11-SEC203-1C
Pre-requisite Course:	Basics Physics up to 12 th Science.

Course Objectives:

1. To extend the knowledge of Fundamentals of Laser.
2. To understand the production of Laser.
3. To be able to know about fibre optics and its application.

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	Topic	Total Hours	Weightage
1	Fundamental of Laser: LASER, Properties of LASER, Spontaneous Emission, Stimulated Emission, Einstein's Co-efficient, Relation Between Einstein's Coefficient, Lifetime, Optical Resonator, Meta Stable State, Population Inversion, Pumping, Laser Characteristics. Production of LASER: Nd: YAG Laser, CO ₂ Laser, Helium- Neon Laser, Semiconductor Laser, Applications of LASER in Various Field.	15	50%
2	Fiber Optics: Introduction, Fiber optic System, Primary Advantages of fibre optic communication compared to metallic cable communication, Fiber cable construction, Basic principle – Total internal reflection, Acceptance angle and numerical aperture, Types of optical fibre based on mode of propagation.	15	50%

Text Books:

1. Engineering Physics, Vikas Publication. New Delhi

Reference Books:

1. An Introduction to LASERS-N. Aradhana, S. Chand & company (2001)
2. Engineering Physics by G.Vijyakumari Vikas publication new Delhi.

List of Open-Source Software/learning website:

1. <https://youtu.be/fat1DXqtqPE>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the Laser system	1 Remembering
CLO2	Discuss the basic process involve in laser action.	2 Understanding

CLO3	Solve the numerical part related to energy in laser and NA in optical fiber.	3 Applying
CLO4	Explain the communication system as well as fiber optic system.	4 Analyzing
CLO5	Explain the types of optical fibers.	2 Understanding
CLO6	Compare the emission processes as well as absorption process.	4 Analyzing

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

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Business Mathematics-I
Course Code:	11-SEC204-1C
Pre-requisite Course:	-

Course Objectives:

1. To understand the concept of Sphere and its application.
2. To understand the basic concept of cone and cylinder.
3. To able to know graph of some special function.

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	Introduction of Sphere, Cone and Cylinder: (a) Sphere: plane section of sphere, intersection of two sphere, intersection of Sphere and line, power at a point, tangent plane and normal. Plane of contact, Angle of intersection of two spheres, condition of orthogonality. (b) Cone: Definition of cone, vertex, guiding curve, generators, equation of a cone with given vertex and a guiding curve, right circular cone with given vertex, Axis and semi vertical angle. (c) Cylinder: Definition of a cylinder, equation of a cylinder whose generators intersect a given cone and are parallel to a given line, equation of a right Circular cylinder.	15	50%
2	Graphs of some special function: Exponential function, Logarithmic function, Trigonometric and Inverse Trigonometric function, Absolute value function, Greatest Integer function, Fractional part function, Least Integer Function, Signum function.	15	50%

Text Books:

1. Mathematics, Nirav Prakashan, Ahmedabad.

Reference Books:

1. Differential Calculus, Shanti Narayan, Dr. P.K. Mittal, S.Chand

List of Open-Source Software/learning website:

1. <https://www.youtube.com/watch?v=5ETKSoPsfZY>
2. https://www.youtube.com/watch?v=I9s20WW_DxU
3. <https://www.youtube.com/watch?v=RbHD-kVfwPg>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain intersection of two spheres.	2 Understanding
CLO2	Discuss right circular cone with given vertex.	2 Understanding
CLO3	Solve example depend on cylinder.	3 Applying
CLO4	Describe Cone.	1 Remembering
CLO5	Discuss graph of exponential function.	2 Understanding
CLO6	Explain graph of Trigonometric function.	4 Analyzing

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																		
CLO3			1															
CLO4															1			
CLO5																		
CLO6					1												1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Application of Microbiology
Course Code:	11-SEC205-1C
Pre-requisite Course:	Basic Science

Course Objective:

1. To identify and classify Microbes
2. Understanding various classification scheme with details of five kingdom concept
3. Knowing application and scope of microbiology in various fields

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 Content

Unit	Content	Lectures	Weightage
1	Introduction to Microbiology • Taxonomic approach of Microbiology • Major group of Microbiology • Classification of microbes (three kingdoms and five kingdom concept) Application of microbiology in various field • Applications of Microbiology in the field of drinking water • Applications of Microbiology in the field of wastewater and waste management • Applications of Microbiology in the field of agriculture.	15	50%
2	Application of microbiology in various field (cont.) • Applications of Microbiology in the field of medicines • Applications of Microbiology in the field of Dairy & Food Industries • Role of microbiology in public health. • Role of microbes in Immunology and medical microbiology. • Role of microbes in Bioleaching, Aero microbiology & Ex microbiology • Role of microbes in Fermentation Industries (Production of Antibiotics, Organic Acids, Enzymes & Other Specialty Biochemicals)	15	50%

Text Books:

Elementary Microbiology Vol.-1 by H.A.Modi

Reference book:

1. Microbiology by M.J.Pelczar, ECS Chan & NR Krieg
2. Principles of Microbiology by R.M. Atlas
3. Microbiology by Prescott, Harley & Klein
4. Textbook of Microbiology by R.C.Dubey & D.K.Maheshwari

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Enlist microbes used in different areas of microbiology	1 Remember
CLO2	Taxonomically classify various microbes according to their characteristic	1 Remembering 2 Understanding 3 Applying
CLO3	Study the application of microbes in medical and pharmaceutical Microbiology	1 Remembering 2 Understanding 3 Applying
CLO4	Describe the methods used using microbes in the field of agriculture microbiology and food industries.	1 Remembering 2 Understanding 3 Applying
CLO5	The ways and types of microbes used in environmental Microbiology	1 Remembering 2 Understanding 3 Applying
CLO6	To study the use of microbes in space research and geomicrobiology	1 Remembering 2 Understanding 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														1				
CLO2	1									1								
CLO3					1													
CLO4				1														
CLO5									1									
CLO6																	1	

3: High, 2: Medium, 1: Low