SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

Program	**M.Sc** **(Masters of Science)**			
Course	**Chemistry** **Microbiology** **Biotechnology**			
Duration	**Semester-1**	**Semester-2**	**Semester-3**	**Semester-4**
Compulsory Subjects	Chemistry-1	Chemistry-2	Chemistry-3	Chemistry-4
	Microbiology-1	Microbiology-2	Microbiology-3	Microbiology-4
	Biotechnology-1	Biotechnology-2	Biotechnology-3	Biotechnology -4
	Introduction to Innovation & Ideation	Introduction to Innovation & Ideation-2	Introduction to Innovation & Ideation-3	Introduction to Innovation & Ideation-4

- M.Sc Study includes two Years (i.e. 4 semesters).
- Aim and objective of this study is to develop a solid grasp of core concepts and applications of Science. They learn how science and other disciplines have impacted and continue to impact each other and society.
- They develop laboratory skills throughout our curriculum via hands-on experiences with diverse experimental techniques and tools.
- They learn various approaches to data analysis and become comfortable using computational methods to analyze and solve problems.

Exam Assessment : Semester-1

Every semester there will be 1 internal exam and 1-university final exam.

Branch- Microbiology:

Internal Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Microbiology-1	30	12	50	18
Microbiology-2	30	12	50	18
Microbiology-3	30	12	50	18
Microbiology-4	30	12	50	18
Introduction to innovation and Ideation	30	12	20	08

University Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Microbiology-1	70	23	NA	NA
Microbiology-2	70	23	NA	NA
Microbiology-3	70	23	NA	NA
Microbiology-4	70	23	NA	NA
Introduction to innovation and Ideation	70	23	30	12

Branch -Chemistry:

Internal Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Chemistry-1	30	12	50	18
Chemistry-2	30	12	50	18
Introduction to innovation and Ideation	30	12	20	08

University Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Chemistry-1	70	23	NA	NA
Chemistry-2	70	23	NA	NA
Introduction to innovation and Ideation	70	23	30	12

Branch -Biotechnology:

Internal Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Biotechnology-1	30	12	50	18
Biotechnology-2	30	12	50	18
Biotechnology-3	30	12	50	18
Biotechnology-4	30	12	50	18
Introduction to innovation and Ideation	30	12	20	08

University Examination				
Subjects	**Theory Marks**	**Passing Marks**	**Practical Marks**	**Passing Marks**
Biotechnology-1	70	23	NA	NA
Biotechnology-2	70	23	NA	NA
Biotechnology-3	70	23	NA	NA
Biotechnology-4	70	23	NA	NA
Introduction to innovation and Ideation	70	23	30	12

- For each and every exam conducted we require sufficient amount of answer supplementary and question paper printout by university.
- Journals are compulsory in all laboratories, in addition graph papers, lab coat ect are also required.

Syllabus of M.Sc: Semeter-1

1. Chemistry-1:

Sr. No.	Course Contents
1	**Organic Chemistry** **(A) Elimination Reaction** The E_1, E_2, E_1CB mechanism, stereochemistry. Orientation of the double bond *syn* and *anti* eliminations. Reactivity- effects of substrate structures, attacking base, leaving group and medium. Mechanism and orientation in pyrolytic *syn* eliminations – Chugaev and Cope eliminations. **(B) Nucleophilic Substitution Reaction** Mixed SN1, SN2 and SET mechanism. Nucleophilic substitution at (a) Allylic carbon (Allylic rearrangements), (b) An Aliphatic trigonal carbon (the tetrahedral mechanism) and at (c) A Vinyl carbon. Participation of Neighboring groups in Nucleophilic substitution by (a) Carboxylate anion (b) Halogen atoms (c) Hydroxyl groups (d) Acetoxyl group (e) Phenyl group (f) RS group (g) Participation by π-bond.
2	**Aromaticity** Aromaticity, aromatic character, Frost circle diagram for cyclobutadiene, benzene and others. Resonance and chemical stabilization-aromatic character based on NMR criteria, Huckels rule, energy level of π moleculer orbitals, Huckels moleculer orbital(HMO) method, MO of simple organic systems such as ethene, allyl and butadiene Aromaticity in benzenoid and non-benzenoid compounds and charged rings, annulenes, fulvenes, azulenes, antiaromaticity and homoaromaticity. **(B) Acid base** concept, pKa, Hammette equation, Concept of hindered base, The effect of structure on the strength of acids and bases.
3	**Reactive intermediates** (1) Carbocations (classical and non classical) stability , structure, generation and fate

	(2) Carbanions- stability, structure, generation and fate of carbanions (3) Carbenes-stability and structure, the generation and fate of carbenes. (4) Free radicals: stability, structure, generation and fate of free radicals, NBS (5) Nitrene : stability, structure, generation, reaction **(B) Rearrangements:** General mechanistic considerations, nature of migration, migratory aptitude, and memory effects in respect of following**.** **(1) Carbon to Carbon migration of R, H and Ar** (i) Pinacol- Pinacolone rearrangement (ii) Favorskii rearrangement **(2) Carbon to Nitrogen migrations**: (i) Curtius rearrangment (ii) Schmidt rearrangment **(3) Carbon to oxygen migration of and Ar** (i) Baeyer- villiger rearrangement (ii) Rearrangement of hydroperoxide
4	**Stereo Chemistry** Optical and geometrical isomerism, origin of chirality and chiral centre, axis and plane, helicity, Enantiotopic and diastereotopic atoms, groups and faces, prochiral centre, biphenyl, allenes, spirans, compounds containing chiral nitrogen and sulfur, .stereospecific and stereoslective synthesis, dynamic resolution.

Chemistry-2:

Sr. No.	Course Contents
1	**Analytical Chemistry** Analytical Objectives, Data Handling and Good Laboratory Practice (GLP). Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. GLP- standard operating procedures, quality assurance and quality control, validation of analytical methods.
2	**Sampling and Calibration Methods** Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.
3	**Fundamentals of Spectrophotometry** Properties of light, absorption of light, interaction of light with matter and origin of spectra. The spectrophotometer- calibration, sources of light, monochromators and detectors. Beer's law in chemical analysis, photometric accuracy- Ringbom Plot, derivative spectrophotometry, optical rotatory dispersion and circular dichroism.
4	**Applications of Spectrophotometry** Analysis of mixture-resolved and unresolved spectra, measurement of equilibrium constant: Scatchard Plot; Stoichiometry-method of continuous variation- the Jobs plot. Photometric titrations.

2. Microbiology-1

Sr. No.	Course Contents
1	**Diversity of Prokaryotic and Eukaryotic Microorganisms** **Unit 1: Principles of microbial diversity** ➢Principles and concepts of microbial diversity ➢Culturable and non-culturable diversity ➢Methods of studying diversity ➢Principles and concepts of metagenomics ➢Conservation of microbial diversity ➢Metabolic diversity in bacteria
2	**Bacterial systematics** ➢Conventional and molecular systematics and general discussion on the occurrence, diversity, characteristic features, significance and potential applications of various groups of bacteria, comparison of Bergey's Manual of Systematic Bacteriology (Edition 1 and 2) ➢Diversity of actinomycetes ➢Diversity of cyanobacteria
3	**Diversity of yeast and moulds** ➢Systematics and classification of fungi

	➢Properties, structure and reproduction of economically important fungi ➢Mycorrhizal fungi ➢Biology of yeast and its role in industry ➢Ecological importance and significance of fungi
4	**Diversity of Archaea** ➢Systematics occurrence, diversity, characteristics features, of different groups of archaea bacteria ➢Survival, adaptation and potential applications: Halophiles, Thermophiles, Alkalophiles and Acidophiles

Microbiology-2

Sr. No.	Course Contents

1	**<u>Advances in Microbial Biochemistry</u>** **Biomolecules** ➢Specific biomolecules their structure and function ➢Carbohydrates: simple and complex ➢Glycoconjugates- glycoproteins, proteoglycans and glycolipids ➢Central metabolic pathways and feeder pathways ➢Metabolism of fatty acids ➢Metabolism of C1 compounds ➢Fate of pyruvate under anaerobic condition
2	**Biosynthesis and regulation** ➢Biosynthesis and regulation of amino acids ➢Biosynthesis and regulation of nucleotides ➢Nitrogen metabolism: Nitrate and ammonia assimilation, their control and regulation of Nitrogenase
3	**Enzymology I** ➢Extraction and purification of enzymes ➢Structure of enzymes ➢Protein folding and denaturation ➢Mechanism of enzyme action- catalysis mechanisms and lysozyme ➢Kinetics of enzyme catalysed reactions
4	**Enzymology II**

	➢Enzyme inhibition ➢Allosteric enzymes- sigmoidal kinetics ➢Immobilization of enzymes ➢Clinical, analytical and industrial applications of enzymes ➢Ribozymes and Abzymes

Microbiology-3

Sr. No.	**Course Contents**
1	**Microbial Genetics and Biostatistics** **Bacterial genetics and plasmid biology** ➢Mode of gene exchange in bacteria and their applications ➢Use of gene exchange process in gene structure analysis ➢Plasmid biology: types, compatibility, replication, control of copy number and segregation
2	**Genetics of microorganisms** ➢Fungal genetics: tetrad analysis and mitotic recombination of *Neurospora* ➢Bacteriophage genetics: T4, T7, ΦX174 and MS2
3	**Concepts of molecular biology** ➢Genome organization and DNA packaging ➢DNA replication, transcription and translation

	➢Mutation ➢DNA damage and repair
4	**Biostatistics** ➢Meaning of data and their representation in biostatistics ➢Measures of central tendency with computation and their application in biostatistics ➢Measures of dispersion with computation ➢Normal distribution curve, characteristics and uses with computation ➢Correlation: meaning, types and methods of correlation ➢Statistical inference and significance of test in biostatistics ➢Significance difference between means and other biostatistics

Microbiology-4

Sr. No.	**Course Contents**

1	**<u>Microbial Physiology and Immunology</u>** **Principles of physiology** ➢Nutrient transport in prokaryotic cell ➢Signal transduction in bacteria ➢Mechanism of drug resistance ➢Quorum sensing ➢Bacterial Bioluminescence ➢Bacterial differentiation
2	**Microbial growth** ➢Batch and continuous culture, synchronous and diauxic growth ➢Factors affecting growth ➢Growth measurement ➢Growth kinetics ➢Control of microbial growth
3	**Major histocompatibility complex** ➢Antigen processing and presentation ➢MHC: structure and function ➢Cytokines ➢Compliment components and activation ➢T cell and B cell receptors and activation

4	**Immune disorders and immunological techniques** ➢Hybridoma technology of T and B cell ➢Autoimmunity ➢Transplantation immunology ➢AIDS and other immune deficiencies ➢Cancer and the immune system

3. <u>Biotechnology-1</u>

Sr.No.	**Course Contents**
1	**<u>Cellular microbiology</u>** **Bacteriology** ➢Prokaryotic forms (bacteria and archaea) and function ➢Prokaryotic shapes, arrangement and sizes ➢The cell Envelope: The boundary layer of bacteria ➢Bacterial internal structure ➢Introduction to Bergey's manual of systematic bacteriology
2	**Methods of studying Microorganisms** ➢Methods of culturing microorganisms

	➢Inoculation: producing a culture ➢Isolation: Separating one species from another ➢Media: providing nutrients in the laboratory ➢Control of bacterial growth ➢Magnification and microscope design ➢Variations on the light microscope
3	**Eukaryotic cell biology** ➢Forms and function of eukaryotic cells ➢Locomotor appendages ➢Boundary structures of eukaryotic cells ➢The internal structure: Nucleus and cell organelles
4	**Eukaryotic Microorganisms** ➢Fungal nutrition ➢Structure and Reproduction ➢Fungal identification and cultivation ➢The role of fungi in nature and industry ➢Biology and applications of algae ➢Biology and applications of protozoa

Biotechnology-2

Sr.No.	Course Contents
1	**Advances in Biochemistry** **Biomolecules** ➢Specific biomolecules their structure and function ➢Carbohydrates: simple and complex ➢Glycoconjugates- glycoproteins, proteoglycans and glycolipids ➢Central metabolic pathways and feeder pathways ➢Metabolism of fatty acids ➢Metabolism of C1 compounds ➢Fate of pyruvate under anaerobic condition
2	**Biosynthesis and regulation** ➢Biosynthesis and regulation of amino acids ➢Biosynthesis and regulation of nucleotides ➢Nitrogen metabolism: Nitrate and ammonia assimilation, their control and regulation of Nitrogenase

3	**Enzymology I** ➢Extraction and purification of enzymes ➢Structure of enzymes ➢Protein folding and denaturation ➢Mechanism of enzyme action- catalysis mechanisms and lysozyme ➢Kinetics of enzyme catalysed reactions
4	**Enzymology II** ➢Enzyme inhibition ➢Allosteric enzymes- sigmoidal kinetics ➢Immobilization of enzymes ➢Clinical, analytical and industrial applications of enzymes ➢Ribozymes and Abzymes

Biotechnology-3

Sr.No.	**Course Contents**
1	**Genetics and Biostatistics** **Bacterial genetics and plasmid biology** ➢Mode of gene exchange in bacteria and their applications

	➢Use of gene exchange process in gene structure analysis ➢Plasmid biology: types, compatibility, replication, control of copy number and segregation
2	**Genetics of microorganisms** ➢Fungal genetics: tetrad analysis and mitotic recombination of *Neurospora* ➢Bacteriophage genetics: T4, T7, ΦX 174 and MS2
3	**Concepts of molecular biology** ➢Genome organization and DNA packaging ➢DNA replication, transcription and translation ➢Mutation ➢DNA damage and repair
4	**Biostatistics** ➢Meaning of data and their representation in biostatistics ➢Measures of central tendency with computation and their application in biostatistics ➢Measures of dispersion with computation ➢Normal distribution curve, characteristics and uses with computation ➢Correlation: meaning, types and methods of correlation ➢Statistical inference and significance of test in biostatistics ➢Significance difference between means and other biostatistics

Biotechnology-4

Sr.No.	Course Contents
1	**Physiology and Immunology** **Principles of physiology** ➢Nutrient transport in prokaryotic cell ➢Signal transduction in bacteria ➢Mechanism of drug resistance ➢Quorum sensing ➢Bacterial Bioluminescence ➢Bacterial differentiation
2	**Microbial growth** Batch and continuous culture, synchronous and diauxic growth ➢Factors affecting growth ➢Growth measurement ➢Growth kinetics ➢Control of microbial growth
3	**Major histocompatibility complex** ➢Antigen processing and presentation ➢MHC: structure and function ➢Cytokines

	➢Compliment components and activation ➢T cell and B cell receptors and activation
4	**Immune disorders and immunological techniques** ➢Hybridoma technology of T and B cell ➢Autoimmunity ➢Transplantation immunology ➢AIDS and other immune deficiencies ➢Cancer and the immune system