ENV 301 ENVIRONMENTAL BIOTECHNOLOGY – ENV 301

M.Sc. 3rd SEM

Teaching Scheme				Credits	Evaluation Scheme				
Th	Tu	P	Total		Internal		External		Total
					Th	Pr	Th	Pr	
4	-	0	4	4	30	50	70	-	150

UNIT-1 General Aspects and Case Studies

Cleaner Bioprocesses and Sustainable Development, Environmental Impact of Nitrogen Fertilizers, Impermeable Barrier Liners in Containment Type Landfills, Control of Submicron Air Toxin Particles after Coal Combustion Utilizing Calcium Magnesium Acetate.

UNIT-2 Recycling and Treatment of Organic Wastes

Duckweed-Based Wastewater Treatment for Rational Resource Recovery and Reuse, Anaerobic Treatment of Tequila Vinasse, Immobilization of Living Microalgae and their Use for Inorganic Nitrogen and Phosphorus Removal from Water, Engineered Reed Bed Systems for the Treatment of Dirty Waters.

UNIT-3 Removal of Recalcitrant Compounds

Immobilization of Non-viable Cyanobacteria and their use for Heavy Metal Adsorption from Water, Bioremediation: Clean-up Biotechnologies for Soils and Aquifers, Increasing Bioavailability of Recalcitrant Molecules in Contaminated Soils, Bioremediation of Contaminated Soils, Environmental Oil Biocatalysis.

UNIT-4 Cleaner Bioprocesses

Clean Biological Bleaching Processes in the Pulp and Paper Industry, Clean Technologies through Microbial Processes for Economic Benefits and Sustainability, Cleaner Biotechnologies and the Oil Agroindustry, Cleaner Production Activities.

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Course outcome: This paper teaches about replacing chemical materials and processes with biological technologies can reduce environmental damage.

REFERENCES

1) Eugenia J. Olguin, Gloria Sanchez, and Elizabeth Hernandez, "***Environmental Biotechnology and Cleaner Bioprocesses"***, Taylor & Francis Publishing House, London, 2000.
2) Anderson, J.M., and Ingram, J.S.I., "***Tropical Soil Biology and Fertility, A Handbook of Methods"***, 2nd Edn., Oxford CAB International, 1993.
3) Arceivala, S.J., ***"Wastewater Treatment for Pollution Control***", Tata McGraw-Hill, New Delhi, India, 1986.
4) Ehrlich, H.L., and Brierley, C.L., ***"Microbial Mineral Recovery***", McGraw-Hill, New York, 1990.
5) Alezander, M., ***"Biodegradation and Bioremediation***", Academic Press Inc., San Diego, California, 1994.
6) Wise, L.D., ***"Global Environmental Biotechnology***", Elsevier, Amsterdam, 1997.
7) R.M. Atlas, "***Microbiology: Fundamental and Applications"***, 2nd Edition, Macmilan, New York, 1988.

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ENVIRONMENTAL TOXICOLOGY AND ITS IMPACT – ENV- 302

M.Sc. SEMESTER – III

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

UNIT-1 Toxicology Chemistry

Introduction to Toxicology and Toxicological Chemistry, Dose – Response Relationships, Relative Toxicities, Reversibility and Sensitivity, Xenobiotic and Endogenous Substances, Kinetic Phase and Dynamic Phase, Teratogenesis, Mutagenesis, Carcinogenesis, and Effects on the Immune and Reproductive Systems, Health Hazards.

UNIT-2 Toxicology of Chemical Substances

Introduction, Toxic elements and elemental forms, Ozone, White Phosphorus, Elemental Halogens, Heavy metals, Cadmium, Lead, Arsenic, Toxic Inorganic Compounds, Cyanide, Carbon Monoxide, Nitrogen Oxides, Hydrogen Halides, Hydrogen Fluorides, Hydrogen Chlorides, Interhalogen Compounds and Halogen Oxides, Inorganic Compounds of Silicon, Asbestos, Inorganic Phosphorus Compounds, Phosphine, Tetraphosphorus decoxide, Inorganic Compounds of Sulphur, Organometallic Compounds, Organolead Compounds, Organotin Compounds, Carbonyls, Toxicology of Organic Compounds.

UNIT-3 Heavy Metals in Environment

Arsenic: Biochemical Effects of Arsenic, Transformation.

Cadmium: Emissions to the Environment, Toxicity, Emission Control and OtherMeasures, Biochemical Effects of Cadmium.

Lead: Emissions, Toxicity, Transformation, Biochemical Effects of Lead.

Mercury: Biochemical Effects of Mercury, Toxic Effect, Biological Methylation, Remedial Measures.

Chromium: Sources, Toxicity.

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UNIT-4 Environmental Impact of Pesticides

Introduction, Historical Aspects, Classification, Application Potential, Limitation of Pesticides Uses, Toxicology of Major Pesticides, Pesticide Persistence, Bioaccumulation and Biomagnification.

Course outcome: Students get enlighten about environmental toxicology, its mechanismin body as well as its impacts in environment.

REFERENCES

1) Stanley, E. Manahan, "***Environmental Chemistry"***, 7th Edn, Lewis Publishers,New York, 2000.
2) S.C. Santra, "***Environmental Science"***, New Central Book Agency (P) Ltd., 2006.
3) Cockerham, Lerris, G., and Barbara, S. Shane, "***Basic Environmental Toxicology"***, CRC Press/Lewis Publishers, Boca Raton, FL, 1994.
4) Bridggs, SHirley, and The Rachel Carson Council, "***Basic Guide to Pesticides :Their Characteristics & Hazards"***, Taylor& Francis, Washington, 1992.
5) S.A. Abbasi, N.Abbasi, R. Soni, "***Heavy Metals in The Environment"***, Mittal Publications, New Delhi, India, 1997.
6) A Wallace Hayes, ***"Principles and Method of Toxicology"***, Published by RavenPress, New York.
7) Perry G., ***"Introduction of Environmental Toxicology",*** Elsevier, Netherland,1980.

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ENVIRONMENTAL RULES AND REGULATIONS – ENV-303

M.Sc. SEMESTER – III

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

UNIT-1 Environmental Laws and Acts

Introduction, Environmental Legislation : Status in India, Some Indian Environmental Laws (i) The Water (Prevention and Control of Pollution) Act, 1974, (ii) The Air (Prevention and Control of Pollution) Act, 1981, (iii) The Environment (Protection) Act, 1986, (iv) The Biological Diversity Act, 2002, Environmental Legislation in USA, Introduction and Schedule of the factories Act, 1948, Protection of Specified Plants in the Wildlife Act, Sanctuaries, National Parks and Closed Areas, Sanctuaries or National Parks Declared by Central Government.

UNIT-2 National Conservation Strategy and Policy Statement on Environment and Development

Environmental Problems: Nature and Dimensions, Actions Taken, Legal, Institutions, Prevention and Control of Pollution, Conservation of Forests and Wildlife, Land and Soil, Environmental Impact Assessment, Other Activities, Constraints and Agenda for Action, Priorities and Strategies for Action, Development Policies from Environmental Perspectives, Energy Generation and Use, Industrial Development, Mining and Quarrying, Tourism, Transportation, Human Settlements, International Cooperation, Support Policies and Systems.

UNIT-3 Policy Statement for Abatement of Pollution

Future Directions and Objectives, Critically Polluted Areas, Assistance for Adoption of Clean Technologies by Small-Scale Industries, Standards, Fiscal Measures, Integration, Environmental Audit, Environmental Statistics, Public Partnership.

UNIT-4 The National Environment Tribunal Bill, 1992

Introduction, Preliminary, Compensation for Death of, or Injury to a Person and Damage to

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Property and Environment, Establishment of National Environment Tribunal and Benches thereof, Jurisdiction and Proceedings of the Tribunal, Miscellaneous.

Course outcome: The purpose of this paper is to teach students environmental laws and its regulations which protects the environment and create rules for people about the appropriate utility of natural resources due to degradation of environment.

REFERENCES

1) S.C. Santra, "***Environmental Science"***, New Central Book Agency (P) Ltd, India, 2006.
2) Hunter, Malcolm L. Jr., "***Wildlife, Forests and Foretry: Principles of Managing Forests for Biodiversity"***, Englewood Cliffs N.J., Prentice Hall, 1990.
3) S.K. Mohanty, "***Environment and Pollution Laws"***, Universal Law Publishing Co.Pvt. Ltd., New Delhi, 2008.
4) P.W. Birnie and A.E. Boyle, "***International Law and The Environment"***, 2nd Edition, Oxford University Press, 2004.
5) Cassese, "***International Law in a Divided World"***, Oxford, 1986.
6) Caldwell, "***International Environmental Policy and Law"***, 1st Edition, Durham, NC, 1980.
7) H.M. Tiwari, "***Environmental Law'***, 2008.

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M.Sc. SEMESTER – III

ENVIRONMENTAL IMPACT ASSESSMENT- ENV-304

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

UNIT-1 Fundamental Approach and Methodology of EIA

Basic Concept, EIA as Planning Tool for Major Project Activities, Comparative Evaluation from EIA Studies, Criteria for Selection of EIA Methodology, EIA Method, Predictive Models for Impact Assessment.

UNIT-2 Prediction and Assessment of Impacts

Prediction and Assessment of Impacts: Noise, Transport, Landscape, Archaeological and other materials as well as Cultural Assets, Air Quality and Climate, Soil, geology and geomorphology, Water, Ecology, Freshwater Ecology, Coastal Ecology, Noise Environment, Socio-Economic and Human Health.

UNIT-3 Environmental Risk Assessment (ERA) and Risk Management in EIA

Introduction, Definition and Concept, Legislative and policy background, Key-steps in Performing an ERA, Different levels of risk analysis, Parallels between ERA and EIA, Opportunities and Challenges in ERA .

UNIT-4 Environmental Remote Sensing (RS), Geographical Information System (GIS) and EIA

Introduction, Definition and concepts, Sources of remote sensing information, software, data, Application of Remote Sensing with particular reference to EIA, GIS and Environment impact assessment, GIS in screening, scoping, baseline studies, impact prediction, mitigation, and monitoring, EIA Case Studies.

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Course Outline: By studying this paper, students learn how to identify, predict and evaluate the economic, environmental and social impact of development activities.

REFERENCES

1) P. Morris, and R. Therivel, ***"Methods of Environmental Impact Assessment",*** 2nd Edition, Spon Press, Newyork, 2001.
2) Y. Anjaneyulu and V. Manickam, ***"Environmental Impact Assessment"***, 2nd Edition, B.S. Publication, Hyderabad, 2007.
3) S.C. Santra, "***Environmental Science"***, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2005.
4) P. Calow, ***"Handbook of Environmental Risk Management"***, Blackwell Publishing Ltd., Australia, 1998.
5) J. Glasson, R. Therivel and A. Chadwick, ***"Introduction to Environmental Impact Assessment"***, 3rd Edition , Routledge, Newyork, 2009.
6) H. Abaza, R. Bisset, B. Sadler, ***"Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach"***, 1st Edition, 2004.
7) P. Wathern, ***"Environmental Impact Assessment: Theory and Practice"***, Routledge, London and Newyork, 1998.

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ENV 401 REMOTE SENSING AND GEOGRAPHICAL INFORMATION

M.Sc. 4th SEM

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	0	4	4	70	00	70	-	

Unit - I

Definition, Introduction and scope of remote sensing. Electromagnetic radiation, atmosphere window, Platforms, Sensors and type of scaning systems. Basic characteristics of sensors; salient features of sensors used in LANDSAT, SPOT and Indian remote sensing satellites.

Unit - 2

Aerial photography- vantage point, cameras, Filters and types of films. Elements of visual image interpretation. Multispectral Remote sensing, Microwave Remote sensing, Photogrammetry - Introduction, Stereo- scopic vision, Projection types.

Unit - 3

Digital image and image structure, Image restroration and image and image enhancement. Image classification. Remote sensing application in Forestry, Ecology and environment, Landuse, Agriculture, soils and geology, Disaster management.

Unit- 4

GIS technology and its uses in environmental science, Hardware and software requirement for GIS. Conceptual model of spatial information, Conceptual model of non-spatial information. GPS.

Course outcome: This paper teaches about replacing chemical materials and processes with biological technologies can reduce environmental damage.

References :

1. Introduction to Environmental remote sensing - Curtis
2. Principles of Remote sensing - Lily and kliffer.
3. Remote sensing of the Environment – Jenson

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ENV 402 ENVIRONMENTAL MODELLING AND BIOSTATISTICS

M.Sc. SEMESTER – IV

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	70	00	70	-	

UNIT - I

Measurement of central tendency - mean (Geometric and Harmonic), median, mode, Measurement of dispersion moments, standard deviation, skewness and kurtosis, Correlation and linear regression of one independent variable, Basic laws and concepts of probability

UNIT - II

Definition of random variable, density function, Basic concepts of binomial and normal distributions. Sampling measurement and distribution of attributes, moments, matrics and simultaneous linear equations, tests of hypothesis and significance.

UNIT - III

Role of modelling in environmental sciences, Model classification deterministic models, stochastic models, steady state models, dynamic models, different stages involved in model building. Simple microbial growth kinetics monod equation, methods for formulation of dynamic balance equations mass balance procedures.

UNIT - IV

Models of population growth and interactions Lotka Volterra model, Leslies matrix model, Point source stream pollution, Box model, Gaussian plume model, Linear, simple and multiple regression models, validation and forecasting.

Course outcome: Students get enlighten about environmental Statistical and modelling, its mechanismin body as well as its impacts in environment.

REFERENCES

1. Dynamics of Environmental Bioprocesses-Modelling and simulation-Snape and Dunn.
2. Environmental Modeling - Jorgensen

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SWARRNIM SCIENCE COLLEGE

MSc Pharmacognosy Programme

Semester 1

Course Title: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES-I

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256110101	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of this course, the student should be able to:

CO1: Explain and demonstrate the principles of UV-visible spectroscopy along with its instrumentation and application

CO2: Describe the theory, principle, instrumentation, and applications of IR spectroscopy

CO3: Explain the theory, application, and instrumentation including ionization techniques, analysers, and detectors. Also understand the different ions, fragmentation rules, and rearrangements.

CO4: Understand and get knowledge about the basics of NMR and the different terms involved in it with an overview of C13NMR.

CO5: Discuss and classify Chromatography and its techniques and explain the theory, principle, methodology, pros, cons, and applications of Adsorption and partition, column, TLC and paper chromatography, ion exchange, affinity, gel chromatography

CO6: Outline the theory, instrumentation, and parameters of Gas chromatography as well as HPLC along with its advantages, disadvantages, and applications.

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Syllabus:

Module	Contents	No of Sessions	Weightage
1.	**UV-Visible Spectroscopy:** Brief review of electromagnetic spectrum and absorption of radiations. The chromophore concept, absorption law, and limitations. Theory of electronic spectroscopy, absorption by organic molecules, choice of solvent, and solvent effects. Applications of UV-visible spectroscopy, multi-component assay, difference spectra and derivative spectra	**08**	20 %
2.	**IR Spectroscopy:** Theory of absorption of Infrared radiation by molecules; Molecular vibrations; Factors influencing vibrational frequencies; Calculation of vibrational frequencies (Hooke's law); Sample handling techniques; Instrumentation (Dispersion and FTIR spectrometer) and applications of IR Spectroscopy; Calibration of IR Spectrophotometer as per Pharmacopoeia	**08**	20 %
3.	**Mass Spectrometry:** Theory; Ionization techniques, Ion separating techniques; Different types of ions and their significance in mass spectra, Fragmentation rules and rearrangements; Instrumentation and applications of mass spectrometry	**08**	15 %
4.	**Nuclear Magnetic Resonance spectroscopy:** Fundamental Principles - nuclear spin, magnetic moment; Proton NMR spectroscopy - theory, chemical shift and factors 8 affecting chemical shift, spin- spin coupling, coupling constant, relaxation process, Instrumentation and applications of PMR; Brief overview of C13 NMR	**08**	20 %
5.	**Chromatography:** Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High	**06**	25%

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	Performance Liquid chromato g) Affinity chromatography		

2. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

3. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Dr. B.K Sharma	Instrumental Methods of Chemical Analysis	Krishna Prakashan	24th
2.	A.I. Vogel,	Vogel's Textbook of Quantitative Chemical Analysis	Pearson Education	6th
3	D. C. Garrett	Quantitative Analysis of Drugs	Springer US	3rd

4. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	P. D. Sethi	Quantitative Analysis of Drugs in Pharmaceutical Formulations	CBS Publishers & Distributors	3rd
2.	Robert M Silverstein	Spectrometric Identification of Organic compounds -	John Wiley & Sons	6th
3.	Willards	Instrumental methods of analysis	CBS publishers	7th
4.	Doglas A Skoog, F. James Holler, Timothy A. Nieman	Principles of Instrumental Analysis -	Eastern press	5th

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SWARRNIM SCIENCE COLLEGE

MSc Pharmacognosy Programme

Semester 1

Course Title: PHARMACEUTICAL DOSAGE FORMS

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	**256110102**	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of this course the student should be able to:

CO1: Outline basics of different dosage forms like tablet capsules, aerosol and parenteral.

CO2: Design and develop various conventional dosage forms.

CO3: Discuss the basic requirement of cGMP and industrial management.

CO4: Categories the biopharmaceutical consideration for product development

CO5: Prioritise the factor affecting drug product performance.

CO6: Illustrate the requirement of scale up and post approval changes.

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Syllabus:

Module	Contents	No of Sessions	Weightage
1.	**Tablets:** a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling. **Capsules:** a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. Size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. b. Soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules	**08**	20 %
2.	**Parenteral Products:** a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injection. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. **Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies	**08**	20 %
3.	**Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance:** Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile	**08**	20 %

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	comparisons, drug product stability, ations in the design of a drug product.		
4.	**Drug Product Performance,** In Viv ilability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. generic biologics (biosimilar drug products),clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution	**08**	20 %
5.	**cGMP & Industrial Management:** Objectives and policies of current good manufacturing practices, layout of buildings, services, equipment and their maintenance Production management: Production organization, materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship.	**06**	15%
6.	**Pilot plant scale up techniques**: General considerations – including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology	**04**	5%

5. Evaluation

1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

6. Basic Text Books:

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Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Lachmann and Libermann	Theory and Practice of Industrial Pharmacy	Publisher Lea & Febiger,U.S.	3rd
2.	Sidney H. Willig.	Good manufacturing practices for Pharmaceuticals: A plan for total quality control	Marcel Dekker Inc	2nd
3	Gillbert and S. Banker.	Modern Pharmaceutics	CRC press	4th

7. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	P.P. Sharma.	How to practice GMPs	Vandhana Publications, Agra	5th
2.	Rawlins.	Bentley's Textbook of Pharmaceutics	Elsevier	Old

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SWARRNIM SCIENCE COLLEGE

MSc Pharmacognosy Programme

Semester 1

Course Title: FUNDAMENTALS OF PHARMACOLOGY AND CLINICAL RESEARCH

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256110103	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

8. Course Outcomes

Upon completion of syllabus, students can able to

CO1. Identify various routes of administration of drugs and their pharmacokinetic processes.

CO2. Understand the concepts of drug action and mechanisms involved along with basics of cell biology and secondary messengers.

CO3. Summarize the basic principles of transmission including transmission of neurotransmitters of autonomic and central nervous system.

CO4. Describe the principles and applications of various techniques used in basic research.

CO5. Demonstrate about the laboratory animals, their maintenance as per the guidelines, basic knowledge of preclinical and toxicological evaluation processes.

CO6. Illustrate the basic fundamentals of clinical research.

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9. Syllabus:

Module	Contents	No of Sessions	Weightage
1	**General Pharmacology** Routes of Drug Administration Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Significance of protein binding.	**05**	12.5 %
2	**Cell biology and cell signalling:** Structure and functions of cell and its organelles, Transport across the cell membrane. Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors. Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol 1, 4, 5-trisphosphate, (IP3), NO, and diacylglycerol.	**06**	15 %
3	**Neurotransmission** a. General aspects and steps involved in neurotransmission. b. Neurohumoral transmission in autonomic nervous system c. Neurohumoral transmission in central nervous system	**05**	12.5 %
4	**Principles and applications of following tools** DNA electrophoresis, Polymerase chain reaction, SDS page, ELISA, Western blotting technique, Recombinant DNA technology and gene therapy.	**08**	20 %
5	**Preclinical and toxicological screening** Common laboratory animals, Transgenic animals, CPCSEA guidelines to conduct experiments on animals. Anaesthesia and euthanasia of experimental animals. General principles of preclinical screening.	**10**	25%

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	Basic definition and types of toxicol guidelines for conducting toxicity studies. Oral and icity studies as per OECD guidelines. General principles of treatment of poisoning.		
6	**Basics of clinical research** a. Introduction to Clinical research. b. Adverse drug reactions: Definition, Terminologies and types of ADR. Causality assessment, Severity and seriousness assessment. c. Drug interactions (Pharmacokinetic and Pharmacodynamic interactions) d. Phases of clinical trials e. Origin and Principles of ICH-GCP (Good Clinical Practice) guidelines f. Institutional Review Board	**06**	15%

10. Evaluation

1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

11. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	K. D. Tripathi	Essentials of Medical Pharmacology	Jaypee Brothers Medical Publishers Ltd	7th
2.	Julia Lloyd and Ann Raven	Handbook of clinical Research	Churchill Livingstone	2nd
3.	Karen E. Stine, Thomas M. Brown	Principles of toxicology	CRC Press	3rd

12. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition

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1.	Bjorn Knollmann, Laurence Brunton	Goodman and Gilman's, The Pharmacological Therapeutics	McGraw-Hill Education	14th
2.	David Machin, Simon Day, Sylvan Green	Textbook of Clinical Trials	John Wiley and Sons	2nd

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SWARRNIM SCIENCE COLLEGE

MSc Pharmacognosy Programme

Semester 1

Course Title: CONCEPTS OF NATURAL PRODUCTS

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	**256110104**	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

13. Course Outcomes

Upon completion of this course the student should be able to:

CO1: Explain medicinal importance of natural drugs

CO2: Illustrate the importance of quality control of drugs of natural origin.

CO3: Describe importance of primary and secondary metabolites of medicinal plants.

CO4: Discuss the principles of alternative system of medicines.

CO5: Demonstrate various extraction and estimation techniques of Phytoconstituents.

CO6: Brief outline the uses of herbs in nutraceuticals and cosmeceuticals.

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Syllabus

Module	Contents	No of Sessions	Weightage
1.	Definition, history, present status, and scope of Pharmacognosy **Classification of Natural drugs:** ● Alphabetical ● Taxonomical ● Morphological ● Pharmacological ● Chemical ● Chemo-taxonomical Adulteration of drugs of natural origin. WHO guidelines in quality assessment of herbal drugs.	**07**	15 %
2.	**Introduction to primary and secondary metabolites:** Definition, classification, properties and test for identification of Carbohydrates, Proteins, Lipids, Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins **Basic principles involved in the traditional systems of medicine** like: Ayurveda, Siddha, Unani and Homeopathy	**10**	20 %
3.	Biological source, chemical constituents, and therapeutic efficacy of thefollowing categories of crude drugs.	**08**	20 %
	Cardiotonic — Digitalis		
	Drugs acting on GI tract — Fennel, Ginger, Black Pepper,		
	Asafoetida, Senna		
	Drugs acting on nervous system — Datura, Opium, Tea leaves, Coffee seeds		
	Anti-hypertensive — Rauwolfia		

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	Anti-Cancer	Vinca, ophyllum, Taxus		
	Antidiabetics	Pterocarpus, Gymnema		
	Antiseptics and disinfectants	Neem, Turmeric, Tulsi		
	Antimalarials	Cinchona, Artemisia		
4.	**Basics of Phytochemistry** Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of natural drugs.		**08**	20 %
5.	**Nutraceuticals:** Brief introduction, Regulatory aspects, FSSAI guidelines and therapeutic applications of Nutraceuticals. Different herbs used as a health food. **Herbal cosmetics**: Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.		**07**	25%

14. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

15. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition

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1.	C.K. Kokate, Purohit, Gokhlae.	Text book of Pharmacognosy, ae (2007),	Nirali Prakashan, Pune, 2007	37th
2.	V.D. Rangari	Textbook of Pharmacognosy & Phytochemistry; Vol 1	Career publication	-
3	H.Pande	Herbal Cosmetics	Asia Pacific Business press, Inc, New Delhi.	-
4.	Mohammad Ali	Pharmacognosy	CBS Publishers & Distributors, New Delhi 2008	2008

16. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	W. C. Evans, Trease and Evans	Pharmacognosy	W.B. Sounders & Co., London, 2009	16th
2.	WHO	WHO: Quality Control Methods for Medicinal Plant Materials	WHO, Geneva	1988
3.	Mukherjee P.W.	Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals	Business Horizons Publishers, New Delhi, India	2002
4.	Agrawal S.S.	Herbal Drug Technology	Orient Blackswan, New Delhi, 2012	2nd

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SWARRNIM SCIENCE COLLEGE

MSc Clinical Research Programme

Semester 2

Course Title: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES-II

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256100201	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70%	-

1. Course Outcomes

Upon completion of this course, the student should be able to:

CO1: Explain and demonstrate the principles of Fluorescence spectroscopy and Atomic absorption and emission spectroscopy along with its instrumentation and application

CO2: Describe the theory, principle, instrumentation, and applications of Gas chromatography

CO3: Explain the theory, principle, methodology, pros, cons, and applications of High-performance liquid chromatography

CO4: Understand and get knowledge about the basics of High-performance Thin layer chromatography with its instrumentation and applications.

CO5: Develop theoretical and practical skills for validation and calibration of various analytical instruments

CO6: Outline the HPLC and Bio-analytical method development

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2. Syllabus:

Module	Contents	No of Sessions	Weightage
1.	**Atomic Absorption And Plasma Emission Spectroscopy:** Principle, instrumentation, interferences and applications in Pharmacy **Spectrofluorimetry:** Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer	**08**	20 %
2.	**Gas Chromatography:** Introduction; Theory and Principle of Gas-Chromatography; Mobile phase, Stationary phases for GSC and GLC; Instrumentation (including temperature programming and derivatization) and applications of GC; Overview of GC-MS. **High-Performance Liquid Chromatography:** Introduction; Theory, Classification and Principle of HPLC; Mobile phase, Stationary phases for normal and reversed-phase HPLC; Instrumentation (including the significance of guard column) and applications of HPLC; Comparison of HPLC with GC; Overview of LC-MS, LC-MS/MS.	**12**	25 %
3.	**HPTLC** Principle; Comparison with HPLC; Instrumentation, applications, advantages, and limitations of HPTLC	8	15 %
4.	**Validation and calibration of various instruments used for drug analysis:** pH Meter, Conductometer, UV Visible Spectrophotometer, IR Spectrophotometer, HPLC, HPTLC	4	15 %
5.	**HPLC Method Development:** Basics of separation including Column resolution, Plate number, Plate height, Selectivity factor, Capacity factor, and their optimization. Selection of detector and column Mobile phase optimization including the selection of the correct pH value **Bio-analytical HPLC method development and validation:** Biological sample preparation: Protein precipitation, liquid–liquid extractions, solid phase extractions, and membrane separations	8	25%

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3. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

4. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Dr. B.K Sharma	Instrumental Methods of Chemical Analysis	Krishna Prakashan	24th
2.	A.I. Vogel,	Vogel's Textbook of Quantitative Chemical Analysis	Pearson Education	6th
3	D. C. Garrett	Quantitative Analysis of Drugs	Springer US	3rd

5. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	P. D. Sethi	Quantitative Analysis of Drugs in Pharmaceutical Formulations	CBS Publishers & Distributors	3rd
2.	Robert M Silverstein	Spectrometric Identification of Organic compounds	John Wiley & Sons	6th
3.	Willards	Instrumental methods of analysis	CBS publishers	7th
4.	Doglas A Skoog, F. James Holler, Timothy A. Nieman	Principles of Instrumental Analysis	Eastern press	5th

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SWARRNIM SCIENCE COLLEGE

MSc Clinical Research Programme

Semester 2

Course Title: REGULATORY AFFAIRS

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256100202	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of this course, the student should be able to:

CO1. The Concepts of innovator and generic drugs, drug development process.

CO2. The Regulatory guidance's and guidelines for filing and approval Process

CO3. Preparation of Dossiers and their submission to regulatory agencies in different countries

CO4. Post approval regulatory requirements for actives and drug products

CO5. Submission of global documents in CTD/ eCTD formats

CO6. Clinical trials requirements for approvals for conducting clinical trials, Pharmacovigilance and process of monitoring in clinical trials.

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2. Syllabus

Module	Contents	No of Sessions	Weightage
1.	a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction, Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION), drug product performance, invitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in – vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs	15	37.5%
2	CMC, post approval regulatory affairs. Regulation for combination Products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	10	25%
3	Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB)	7	17.5%
4	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials.	8	20%

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3. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

4. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	by Ira R. Berry and Robert P.Martin,	The Pharmaceutical Regulatory Process, Second Edition Edited Drugs and the Pharmaceutical Sciences,	Informa Health care Publishers	Vol.185
2.	Fay A.Rozovsky and Rodney K. Adams	Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance	-	-

5. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Richard A Guarino,	New Drug Approval Process: Accelerating Global Registrations	Drugs and the Pharmaceutical Sciences,Vol.190	5th
2.	Leon Shargel and IsaderKaufer	Generic Drug Product Development, Solid Oral Dosage forms	Marcel Dekker series,	Vol.143

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SWARRNIM SCIENCE COLLEGE

MSc Programme

MSc Clinical Research Semester 2

Course Title: Advanced Pharmacology

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256100203	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of syllabus, students can able to

CO1. Describe the pharmacology of drugs acting on parasympathetic and sympathetic nervous system.

CO2. Illustrate the pharmacological aspects of drugs acting on central nervous system, local anaesthetics, opioid and non-opioid analgesics.

CO3. Classify drugs acting on cardiovascular-haemopoietic system and discuss their pharmacology.

CO4. Understand the basic concepts and pharmacology of diuretics, anti-histamines and drugs used in the treatment of asthma, ulcer, diabetes and hyperthyroidism.

CO5. Explain the basics of chemotherapy along with the detailed study of Antibiotics.

CO6. Summarize the drug classes and their pharmacological role in cancer, tuberculosis, malaria, fungal and viral infections.

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2. Syllabus:

Module	Contents	No of Sessions	Weightage
1	**Pharmacology of drugs acting on Autonomic nervous system** a) Parasympathomimetics and lytics b) Sympathomimetics and lytics c) Agents affecting neuromuscular junction	**05**	12.5 %
2	**Pharmacology of drugs acting on Central nervous system** a) General and local anesthetics b) Sedatives and hypnotics c) Anti-depressants d) Anti-psychotic agents e) Antiepileptic agents f) Drugs used for the treatment of neurodegenerative diseases g) Narcotic and non-narcotic analgesics	**09**	22.5 %
3	**Pharmacology of drugs acting on Cardiovascular system** a) Antihypertensives b) Anti-ischemics c) Anti- arrhythmics d) Drugs for heart failure e) Anti-hyperlipidemic f) Anticoagulants g) Fibrinolytics and antiplatelet drugs	**08**	20 %
4	**Pharmacology of following drugs** a) Diuretics b) Anti-asthmatic agents c) Anti-ulcer drugs d) Anti-diabetic drugs e) Anti-thyroid drugs f) Anti-histamines	**07**	17.5 %

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5	**Chemotherapeutic agents** a) Anti-bacterial agents: Sulphonamides, Fluoroqunilones, Penicillins, Cephalosporins, Tetracyc Chloramphenicol, Aminoglycosides b) Anti-fungal agents c) Anti-viral agents d) Anti-malarial agents e) Anti-tubercle agents f) Anti-cancer agents	**11**	27.5%

3. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

4. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Bikash Medhi, Ajay Prakash	Advanced Pharmacology	PharmaMed Press / BSP Books	2nd
2.	Padmaja Udaykumar	Pharmacology for Pharmacy students	CBC publishers and Distributors Pvt. Ltd.	1st
3.	HL Sharma, KK Sharma	Principles of Pharmacology	Paras Medical Publisher	3rd

5. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	K. D. Tripathi	Essentials of Medical Pharmacology	Jaypee Brothers Medical Publishers Ltd	7th
2.	Bjorn Knollmann, Laurence Brunton	Goodman and Gillman's, The Pharmacological Basis of Therapeutics	McGraw-Hill Education	14th
3	Rang HP, Dale MM, Ritter JM, Flower RJ	Rang and Dale's Pharmacology,	Churchil Livingstone Elsevier	10th

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SWARRNIM SCIENCE COLLEGE

MSc Pharmaceutics Programme

Semester 2

Course Title: DRUG DELIVERY SYSTEM

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256070203	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of this course, the student should be able to:

CO1. To understand various approaches for development of various controlled drug delivery system.

CO2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

CO3. Differentiate the transdermal delivery approaches and its evaluation.

CO4. Explore various approaches for gastroretentive drug delivery system.

CO5. Demonstrate various approaches of microencapsulation and mucosal drug delivery.

CO6. Design and develop nasopulmonary and ocular drug delivery system.

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Sr. No	Course (	Total Hrs
1.	**Controlled drug delivery systems**: Int, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems	8
2	**Microencapsulation:** Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications **Mucosal Drug Delivery system:** Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems	10
3	**Transdermal Drug Delivery Systems:** Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches **Gastroretentive drug delivery systems**: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications	12
4	**Nasopulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers **Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications	10

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2. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

3. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	N.K. Jain,	Controlled and Novel Drug Delivery,	CBS Publishers & Distributors, New Delhi, First	Edition 1997 (reprint in 2001).
2.	S.P. Vyas and R.K. Khar,	Controlled Drug Delivery - concepts and advances, First	Vallabh Prakashan, New Delhi,	edition 2002.

4. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Edith Mathiowitz, Published by Wiley Interscience Publication,	Encyclopedia of Controlled Delivery.	John Wiley and Sons, Inc, New York	-
2.	Robinson, J. R., Lee V. H. L,	Controlled Drug Delivery Systems,	Marcel Dekker, Inc., New York, 1992.	-

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SWARRNIM SCIENCE COLLEGE

MSc Pharmacognosy Programme

Semester 2

Course Title: Advanced Pharmacognosy-I

Category of Course	Course Code	Credit	Content Hours	Internal			External	
				Theory	Continuous Assessment	Practical	Theory	Practical
Core	**256110203**	4	40	20 %	10 %	-	70 %	-

1. Course Outcomes: Upon completion of this course the student should be able to:

CO1: Understand biosynthetic pathways for secondary metabolite production in plants

CO2: Explain the importance of primary metabolites of medicinal plants.

CO3: Describe different category of Plant products with their pharmaceutical applications

CO4: to understand the in vitro techniques in the cultivation and production of crude drugs

CO5: to know the extraction techniques, isolation, characterization, and identification of the phytoconstituents

CO6: to know the content of monograph for herbal drugs and their biological evaluation by in vivo & in vitro models

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Syllabus:

Module	Contents	No of Sessions	Weightage
1	**Metabolic pathways in higher plants and their determination** a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	**05**	10 %
2	**Primary metabolites:** General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids for the following Primary metabolites: **Carbohydrates:** Acacia, Tragacanth, Honey, Starch **Enzymes:** proteolytic enzymes (Papain, bromelain, urokinase, pepsin). **Lipids** (Waxes, fats, fixed oils): Castor oil, Wool Fat, Bees Wax	**06**	20 %
3	**Plant Products:** **Fibers** - Cotton, Jute, Hemp **Hallucinogens, Teratogens, Natural allergens** **Marine Drugs**: Novel medicinal agents from marine sources	**05**	10 %
4	**Plant Tissue Culture:** Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth, and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	**07**	20 %
5	**Isolation, Identification and Analysis of Phytoconstituents** a) Terpenoids: Menthol, Citral b) Glycosides: Glycyrhetinic acid, Sennosides c)Alkaloids: Atropine, Quinine, Caffeine d) Resins: Podophyllotoxin, Curcumin	**08**	20%
6	**Monographs of herbal drugs:** General parameters of monographs of herbal drugs and comparative study in different Pharmacopoeia,	**03**	5%
7	**Biological screening of herbal drugs:** In vivo & In vitro evaluation techniques for different category of herbal drugs and Toxicity studies as per OECD guidelines	**06**	15 %

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2. Evaluation		
1	Assignments / Quizzes / Class Par / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

3. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	C.K. Kokate, Purohit, Gokhlae.	Text book of Pharmacognosy, Gokhlae (2007),	Nirali Prakashan, Pune, 2007	37th
2.	V.D. Rangari	Textbook of Pharmacognosy & Phytochemistry; Vol 1	Career publication	-
3	S. V. Bhat, B. A. Naga Sampagi, M. Shivakumar	Chemistry of Natural Products	Narosa Publishing House, New Delhi, 2015	
4	R Endress	Plant cell Biotechnology	Springer-Verlag, Berlin, 1994	1994
5	Gurdeep R Chatwal	Organic Chemistry of Natural Products, Vol. 1 & 2.	Himalaya Publishing House, 2016	4th Edition
6	Vyas and Dixit	Text Book of Biotechnology	-	-

4. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	W. C. Evans, Trease and Evans	Pharmacognosy	W.B. Sounders & Co., London, 2009	16th
2.	WHO	WHO: Quality Control Methods for Medicinal Plant Materials	WHO, Geneva	1988
3.	Mukherjee P.W.	Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals	Business Horizons Publishers, New Delhi, India	2002
4.	Agrawal S.S.	Herbal Drug Technology	Orient Blackswan, New Delhi, 2012	2nd

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5.	Indian Pharmacopoeian Commisiion	Indian Pharmacopoeia	Ministry of health & family welfare, Gov. of India	2008
6.	Hildebert Wagner and Sabine Bladt	Plant Drug Analysis	Springer, NY, 1996	2nd Edition

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SWARRNIM SCIENCE COLLEGE

MSc Programme

MSc Pharmacology Semester 2

Course Title: Advanced Pharmacology

Category of Course	Course Code	Credit	Content Hours	Internal			External	
Core	256090203	4	40	Theory	Continuous Assessment	Practical	Theory	Practical
				20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of syllabus, students can able to

CO1. Describe the pharmacology of drugs acting on parasympathetic and sympathetic nervous system.

CO2. Illustrate the pharmacological aspects of drugs acting on central nervous system, local anaesthetics, opioid and non-opioid analgesics.

CO3. Classify drugs acting on cardiovascular-haemopoietic system and discuss their pharmacology.

CO4. Understand the basic concepts and pharmacology of diuretics, anti-histamines and drugs used in the treatment of asthma, ulcer, diabetes and hyperthyroidism.

CO5. Explain the basics of chemotherapy along with the detailed study of Antibiotics.

CO6. Summarize the drug classes and their pharmacological role in cancer, tuberculosis, malaria, fungal and viral infections.

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2. Syllabus:

Module	Contents	No of Sessions	Weightage
1	**Pharmacology of drugs acting on Autonomic nervous system** a) Parasympathomimetics and lytics b) Sympathomimetics and lytics c) Agents affecting neuromuscular junction	**05**	12.5 %
2	**Pharmacology of drugs acting on Central nervous system** a) General and local anesthetics b) Sedatives and hypnotics c) Anti-depressants d) Anti-psychotic agents e) Antiepileptic agents f) Drugs used for the treatment of neurodegenerative diseases g) Narcotic and non-narcotic analgesics	**09**	22.5 %
3	**Pharmacology of drugs acting on Cardiovascular system** a) Antihypertensives b) Anti-ischemics c) Anti- arrhythmics d) Drugs for heart failure e) Anti-hyperlipidemic f) Anticoagulants g) Fibrinolytics and antiplatelet drugs	**08**	20 %
4	**Pharmacology of following drugs** a) Diuretics b) Anti-asthmatic agents c) Anti-ulcer drugs d) Anti-diabetic drugs e) Anti-thyroid drugs f) Anti-histamines	**07**	17.5 %

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5	**Chemotherapeutic agents** a) Anti-bacterial agents: Sulphonamides, Fluoroqunilones, Penicillins, Cephalosporins, Tetracyc Chloramphenicol, Aminoglycosides b) Anti-fungal agents c) Anti-viral agents d) Anti-malarial agents e) Anti-tubercle agents f) Anti-cancer agents	**11**	27.5%

3. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

4. Basic Text Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	Bikash Medhi, Ajay Prakash	Advanced Pharmacology	PharmaMed Press / BSP Books	2nd
2.	Padmaja Udaykumar	Pharmacology for Pharmacy students	CBC publishers and Distributors Pvt. Ltd.	1st
3.	HL Sharma, KK Sharma	Principles of Pharmacology	Paras Medical Publisher	3rd

5. Reference Books:

Sr. No.	Author/s	Name of the Book	Publisher	Edition
1.	K. D. Tripathi	Essentials of Medical Pharmacology	Jaypee Brothers Medical Publishers Ltd	7th
2.	Bjorn Knollmann, Laurence Brunton	Goodman and Gillman's, The Pharmacological Basis of Therapeutics	McGraw-Hill Education	14th
3	Rang HP, Dale MM, Ritter JM, Flower RJ	Rang and Dale's Pharmacology,	Churchil Livingstone Elsevier	10th

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Course Title: PHARMACEUTICAL VALI[illegible] AND QUALITY MANAGEMENT SYS[illegible]

Category of Course	Course Code	Credit	Content Hours	Internal			External	
				Theory	Continuous Assessment	Practical	Theory	Practical
Core	256080203	4	40	20 %	10 %	-	70 %	-

1. Course Outcomes

Upon completion of this course, the student should be able to:

CO1: Explain and demonstrate the principles of Fluorescence spectroscopy and Atomic absorption and emission spectroscopy along with its instrumentation and application

CO2: Describe the theory, principle, instrumentation, and applications of Gas chromatography

CO3: Explain the theory, principle, methodology, pros, cons, and applications of High-performance liquid chromatography

CO4: Understand and get knowledge about the basics of High-performance Thin layer chromatography with its instrumentation and applications.

CO5: Develop theoretical and practical skills for validation and calibration of various analytical instruments

CO6: Outline the HPLC and Bio-analytical method development

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Syllabus:

Module	Contents	No of Sessions	Weightage
1.	**Introduction to validation:** Defin Calibration, Qualification and Validation, Scope, Frequency, and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of Validation, scope of Validation, Organization for Validation, Validation Master plan, Types of Validation, Streamlining of qualification and validation process and Validation Master Plan. **Qualification:** User requirement specification, Design qualification, Factory Acceptance Test (FAT)/Site Acceptance Test (SAT), Installation qualification, Operational qualification, Performance qualification, Re-Qualification (Maintaining status Calibration Preventive Maintenance, Change management).	8	25 %
2.	**Process Validation:** Concept, Process, and documentation of Process Validation. Prospective, Concurrent & Retrospective Validation, Re validation criteria, Process Validation of various formulations (Coated tablets, Capsules, Ointment/Creams, Liquid Orals, and aerosols.), Aseptic filling: Media fill validation, USFDA guidelines on Process Validation-A life cycle approach. Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP	8	20 %
3.	**Cleaning Validation:** Cleaning Method development, Validation of analytical method used in cleaning, Cleaning of Equipment, Cleaning of Facilities. Cleaning in place(CIP). Validation of facilities in sterile and non-sterile plants. Computerized system validation: Electronic records and digital signature-21CFR Part11and GAMP	8	20 %
4.	**Process analytical technology (PAT):** FDA initiative on process analytical technology. PAT as a driver for improving quality and reducing costs: quality by design (QbD), QA, QC, and GAMP. PAT guidance, standards, and regulatory requirements	8	15 %
5.	**Quality as a Strategic Decision:** Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality **Six System Inspection model:** Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and Labeling system. Concept of self-inspection. Quality	8	20 %

	systems: Change Management/ Change control. Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling. Investigation and determination of root cause, Corrective and preventive Actions (CAPA), Returns and Recalls. Qualification, Annual Product Reviews, Batch Review. Batch Release. Concept area clearance/ Line clearance.		

2. Evaluation		
1	Assignments / Quizzes / Class Participation / Role Play/ Project etc.	10% (Internal Assessment)
2	Internal Examination	20% (Internal Assessment)
3	External Examination (University Exam)	70% (External Assessment)

3. Basic Text Books:

Sr. No.	**Author/s**	**Name of the Book**	**Publisher**	**Edition**
1.	Nancy R. Tague	The Quality Toolbox		2nd
2.	Duke Okes	Root Cause Analysis, The Core of Problem Solving and Corrective Action	ASQ Publications	-
3.	Phillip A.Cloud	Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook	Interpharm Press	-
4.	Huber L.	Validation and Qualification in Analytical Laboratories.	Informa Healthcare	-
5.	Snyder, Kirkland, Glaich	Practical HPLC Method Development	John Wiley & Sons, New Jersey. USA	2nd

4. Reference Books:

Sr. No.	**Author/s**	**Name of the Book**	**Publisher**	**Edition**
1.	B. T. Loftus & R. A. Nash	Pharmaceutical Process Validation, Drugs and Pharm Sci. Series, Vol. 129	Marcel Dekker Inc.,N.Y	3rd

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2.	Frederick J. Carlton and James Agalloco	Validation of Pharmaceutical Processes: Sterile Products	Marcel Dekker Inc.,N.Y	-
3	Frederick J. Carlton and James Agalloco	Validation of Aseptic Pharmaceutical Processes	Marcel Dekker Inc.,N.Y	2nd
4	Joseph M. Juran and Joseph A. De Feo	Juran's Quality Handbook	ASQ Publications	6th
5	Christine Avery; Diane Zabel, Routledge	The Quality Management Sourcebook: An International Guide to Materials and Resources	----	-
6	James W. Fairfield-Sonn	Corporate Culture and the Quality Organization	Quorum Books	-
7	Roger L Bertholf, Ruth E Winecker	Chromatographic methods in clinical chemistry & Toxicology	John Wiley & Sons, New Jersey, USA. 2007	-
8	John A Adamovics	Chromatographic Analysis of Pharmaceuticals	Marcel Dekker, New York, USA. 1997	2nd

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIAL BIOTECHNOLOGY
Subject Code: 256030301

M.Sc. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	--	100

Objectives

- To provide students basic knowledge of Microbial Biotechnology. It covers up general concept of microbial production and fermentation of various products.
- The purpose of the course is to give knowledge about production process of primary & secondary metabolites using fermentation technology and microorganisms.
- To provide an understanding of other microbial products such as microbial polysaccharides, beverages, polyhydroxyalkanoates, bio-surfactants and biotransformation of steroids.
- To understand the concepts of biomass production of microorganisms and its applications.

Prerequisites

Student must have studied First year (FY) of M.Sc. with Microbiology as a major subject and knowledge of basic biotechnology.

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Microbial production of primary metabolites** • Amino acids: Glutamic acid, Lysine • Enzymes: Proteases, Amylases • Organic acids: Citric acid, Acetic acid • Industrial Alcohol	**10**
2	**Microbial production of secondary metabolites** • Antibiotics: Penicillin, Streptomycin • Vitamins: B_{12}, B_2 • Ergot Alkaloids • Carotenoid pigments: β-carotene, lycopene	**10**
3	**Microbial production of other products & Biotransformation** • Microbial polysaccharides: Xanthan, Alginate and Dextran • Beverages: Beer, Wine • Polyhydroxyalkanoates: PHA and PHB • Biosurfactants • Steroid transformation	**10**
4	**Biomass production and applications** • Fungal biomass- baker's yeast and single cell oil • Mushroom cultivation • Use of Algal biomass. • Microbial production for food and feed	**10**
		40

Learning Outcomes

- The students will be able to apply the knowledge of the Microbial production to understands concepts of various fields like food and dairy industries, pharmaceutical industries, Fermentation industries, beverages industries, etc.

- Student should be able to understand basic concepts of various products like amino acids, enzymes, vitamins, organic acids, industrial alcohol, beer, wine, microbial polysaccharides, Biosurfactants as well as biotransformation of steroids. Students also apply knowledge of mushroom cultivation, fungal biomass production, algal biomass and other microbial production for food and feed.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by Microbiologists, biotechnologist, researchers and scientists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. A.N. Glazer and H. Nikaido. (2007) *Microbial Biotechnology. Fundamentals of Applied Microbiology.* (2nd edition)
2. E. M. T. El-Mansi, E. M. T. El-Mansi, C. F. A. Bryce, Arnold L. Demain, A.R. Allman (2006) *Fermentation Microbiology and Biotechnology* (2nd edition)
3. James.M. Jay, Martin J. Loessner, David. A. Golden (2005). *Modern Food Microbiology* 7th Edition (Food Science Texts Series)
4. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton (2001). *Industrial Microbiology: An Introduction*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

ENZYMOLOGY

CODE: 256030302

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70		100

Objectives:-

- The objectives of the paper is students will get about the protein structure, classification of enzymes, terminology, enzyme activity and purification of enzymes and strategy for separation and purification.
- The student will get idea about the enzyme kinetics and mechanism. What is significance of Km, Vmax and Kcat and importance of steady state equilibrium. Enzyme inhibition and its types. Thermal kinetics.
- To provide the mechanism and action of enzyme and its role of activators. Allosteric regulation and its mechanism.
- The study will help in understanding the what are isoenzymes and physiological significance role of different types of enzymes.

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Course Outcome:

Unit	Description in Detail	Weightage (In Hours)
1	**Introduction**: Enzymology and historical developments in enzymology Protein Structure: Primary, secondary, tertiary and quaternary structure, techniques used in enzyme characterization Enzyme classification: IUB enzyme classification. Enzyme Activity: Principle and techniques of enzymatic analysis, factors affecting enzyme Activity, Extraction and Purification of enzyme: Objectives and strategy, separation techniques, test of purity.	08
2	**Enzyme Kinetics:** Bioenergetics and Catalysis Single substrate kinetics: Equilibrium and Steady state kinetics, significance of Km, Vmax & Kcat. Pre-steady state and Relaxation kinetics. Multisubstrate kinetics: General rate equation, compulsory order, random order and ping-pong mechanisms and their primary and secondary plots. Enzyme inhibition and its kinetics: Reversible and irreversible inhibition, competitive, noncompetitive and uncompetitive, mixed, partial, substrate and allosteric inhibition. Thermal kinetics: Effect of temperature on reaction rate, enzyme stability, Arrhenius equation and activation energy.	10
3	**Mechanism of Enzyme Action:** Enzyme activators, co-enzymes and co-factors in enzyme catalysis, Enzyme and substrate Specificity Investigation of active Centre, Factors affecting catalytic efficiency, Experimental approaches to determine enzyme mechanisms. Enzyme mechanisms: Lysozyme, Chymotrypsin, Carboxypeptidase, Restriction endonuclease, Aspartate trans carbomylase. Allosteric enzymes and sigmoidal	10

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	kinetics: Protein ligand binding, Co-operativity, MWC & KNF models, Regulation of enzyme activity. Control of metabolic pathways.	
4	Isoenzymes and its physiological significance, Ribozymes and Abzymes Enzyme engineering: Chemical modification of enzymes: methods of modification of primary structure, catalytic and allosteric properties, use of group specific reagents. Enzyme Immobilization Enzymes in non conventional media, Enzymes sensors, Enzymes as analytical reagents.	08

Learning Outcomes:

- The students will be able to understand and deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines.
- Student should be able to understand basic concepts of the present day scope and applications of enzymology.
- The course is designed to give students an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.
- This is a course where the topics to be studied include enzyme active sites / mechanisms of enzyme action; enzyme kinetics and regulation; Isozymes and their clinical significances /function relationship etc as tools for understanding functions of enzymes.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

1. *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd Edition,* authored by Trevor Palmer and Philip Bonner Affiliated East-West Press Pvt. Ltd.
2. Textbook of biochemistry – Vasudevan Shreekumari
3. Biochemistry – Lehninger 6th edition
4. Fundamentals of Enzymologist: Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
5. Enzyme Structure and mechanism: Alan Fersht, Reading, USA.
6. The chemical kinetics of enzyme action: K. J. Laider and P. S. Bunting, Oxford University Press,London.
7. Enzymes: M. Dixon, E. C.Webb, CJR Thorne and K. F. Tipton, Longmans, London.
8. Biochemistry: Lubert Stryer

E-Resources

- https://www.feedspot.com/infiniterss.php?_src=feed_title&followfeedid=4812449&q=site:https%3A%2F%2Fwww.nature.com%2Fsubjects%2Fbiochemistry.rss
- https://www.sciencedaily.com/news/matter_energy/biochemistry/
- https://thebiochemistblog.com/
- https://www.longdom.org/microbial-biochemical-technology.html
- https://bmcbiochem.biomedcentral.com/
- https://www.slideshare.net/mohdsakharkar/enzyme-final

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

FOOD & DAIRY MICROBIOLOGY

CODE: 256030303

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	--	100

Objectives:-

- To provide basic knowledge of food & dairy microbiology.
- In this course the meaning of food microbiology and interaction between microorganism and foods and how food spoilage will be study.
- The pathogenic and non-pathogenic microorganism that found in food and how can they contaminated the foods will be study, in the other hand mycotoxins which is one of the toxin secreted by fungi will be study
- After knowledge of contamination of foods by microorganism the way for preservation of foods from contamination will be study.
- To identify the causative agent in food known as microorganisms
- Understand the mechanism of their reaction in food to make it unsuitable for consumption
- To describe how some microbes proved to be beneficial in the production of food products
- To describe how some bacteria are used in the preservation of food rather than spoil it
- To identify the sources and causes of microbes causing food spoilage

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Prerequisites:-

- Student Must have studied B.Sc. with microbiology/biotechnology as a major subject and knowledge of basic biology

Unit	Description in Detail	Weightage (In hours)
1	1. Scope of food microbiology 2. Food as a substrate a) Mircoorganims important in food microbiology- Bacteria, yeast & Moulds b) Factors influencing microbial growth in food.	04
2	1. Food spoilage a) General principles underlying food spoilage and contamination b) Spoilage of canned food, sugar products, vegetables, fruits, meat,milk & milk products, fish, sea food and poultry 2. Food Poisoning a) Indicator food borne pathogens b) Bacterial food borne infections and intoxications- *Clostridum, Escherichia,Salmonella Shigella* c) General methods for diagnosis of infections, intoxication and preventive measures.	06
3	**Food Preservation** **a)** Principles of food preservation-Asepsis, removal of micro organisms, anaerobic conditions, high and low temperature, drying, irriadiation **b)** Chemical and bio preservatives and food additives **c)** Food packaging and labeling.	06
4	Genetically modified foods. Biosensors in food research organizations/institutes in India. Recent food borne outbreaks. Food sanitation-Microbiology of food plant sanitation, water and milk testing food laws and quality control-HACCP, Codex alimentarious, PFA, FPO, MFPO, BIS, AGMARK.	08

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Learning Outcomes:

- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.
- Explain why microbiological quality control programme are necessary in food production.
- At the end of the course, the students have acquired skills related to: the microbiological food control through appropriate and targeted applications of physical chemical and biological treatments; the use of basic microbiological methods for the evaluation of the microbial load in the different food matrices; the microbial monitoring of fermented foods; the use of selection scheme for starter cultures.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Food microbiology, Frazier and Westhoff
- Food microbiology, Adam and Moss
- Dairy Microbiology By Robinson. Volume I and II
- Fundamental food microbiology, Bibek ray and Arun Bhuniya

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E-Resources

- https://www.slideshare.net/vasantharvasu/dairy-microbiology-39885550
- https://www.slideshare.net/HiwrHastear/food-microbiology-60301420
- https://www.biologyexams4u.com/2016/11/12-methods-of-food-preservation.html#.X5v9am4zbcc
- https://www.toppr.com/guides/evs/mangoes-round-the-year/food-spoilage/

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

AGRICULTURAL MICROBIOLOGY

Subject Code: 256030304

M.Sc. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	--	100

Objectives

- To impart in-depth information on soil and agriculture
- To make the students understand the role of microbes in agriculture
- To give an overview on plant microbe interaction. To understand infection process and control measures
- To know the importance of bio-fertilizers and bio-pesticides and To make the students to know about various techniques involved in bio-fertilizers and bio-pesticides production

Prerequisites

Student must have studied First year (FY) of M.Sc. with Microbiology as a major subject and knowledge of basic biotechnology.

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Soil Microbiology** • Composition of Lithosphere, • Soil Microbes & Factors influencing soil microbial population. • The soil environment-Distribution and abundance, generic groups and nutrition of bacteria, actinomycetes, fungi, algae, protozoa and viruses.	10
2	**Microbial transformations of minerals** • Phosphorus, sulphur, iron and other elements - Chemistry, cycles mineralization and immobilization and oxidation/reduction	10
3	**Microbes in agriculture** • Biofertilizer: types, production and applications • Ammonia assimilation in Nitrogen-Fixing legume nodules- Hydrogen Metabolism, action of Hydrogenase - factors controlling the Legume - Rhizobium symbiosis • Azotobacter sp and Azospirillum sp and their functions - Cyanobacteria (BGA) and their associations in Nitrogen fixation • Phospahte solubilizing microbes • Mycorhizae and plant growth promoting rhizobacteria (PGPR) • Role of biofertilizers • Role of biofertilizer in integrated nutrient management	10
4	**Plant pathogenic microorganisms** • Algal, fungal, bacterial, viral, mycoplasma, Nematode diseases and symptoms • Mode of entry of pathogens and factors affecting disease incidence - Plant disease resistance and various control measures Phenolic compounds. • Interaction of plant pathogens with host. • Definition and History of Biopesticides – Viral (NPV, CPV & GV), bacterial (Bacillus thuringiensis, B.popillae & Pseudomonas sp.), Fungal (Entomophthora musca, Beaveria sp., Metarrhizium sp. & Verticillium sp.), Protozoan (Mattesia sp., Nosema sp., Octospora muscaedomesticae & Lambornella sp.)	10
		40

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Learning Outcomes

- By the end of this course students will be able to understand the role of microbes in the different cycles and their role in agriculture. Also understand biological nitrogen fixation in symbiotic and non-symbiotic associations with plants.

- Student should be able to know the value, production, application and crop response of bio-fertilizers and bio-pesticides and to have an in-depth knowledge on bio-pesticides and their role in pest control.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by Microbiologists, biotechnologist, researchers and scientists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Gupta, S.K.2014 Approaches and trends in plant disease management. Scientific publishers, Jodhpur, India.
2. Jamaluddin *et al* 2013 Microbes and sustainable plant productivity. Scintific Publishers Jodhpur, India. G

Subba Rao, N. S. 1997. Biofertilizers in Agriculture and Forestry, III Ed., Oxford & IBH Publishing Co.Pvt.Ltd.,New Delhi.

Subba Rao, N. S. 1995. Soil microorganisms and plant growth. Oxford & IBH Publishing Co.Pvt.Ltd. New Delhi.

5. Martin Alexander 1983. Introduction to Soil Microbiology, Wiley eastern Ltd., New Delhi.
6. Newton, W.E and Orme, Johnson, W.H.1980. Nitrogen fixation vol II: Symbiotic Associations and Cyanobacteria. University Park Press Baltimore, USA.
7. Wheeler, B. E. 1976. An Introduction to Plant Disease. ELBS and John Wiley and Sons, Ltd.
8. Gaur, A.C., 1999. Microbial technology for Composting of Agricultural Residues by Improved Methods, 1st print, ICAR, New Delhi.
9. Glick, B.R. AND Pasternak, J.J 1994. Molecular Biotechnology, ASM Press, Washington DC.
10. Purohit, S. S., Kothari, P. R. and Mathur 1993. Basic and Agricultural Biotechnology, Agrobotanical Publishers (India). Bikaner.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

MICROBIAL BIOTECHNOLOGY
Subject Code: 256010301

M.Sc. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	--	100

Objectives

- To provide students basic knowledge of Microbial Biotechnology. It covers up general concept of microbial production and fermentation of various products.
- The purpose of the course is to give knowledge about production process of primary & secondary metabolites using fermentation technology and microorganisms.
- To provide an understanding of other microbial products such as microbial polysaccharides, beverages, polyhydroxyalkanoates, bio-surfactants and biotransformation of steroids.
- To understand the concepts of biomass production of microorganisms and its applications.

Prerequisites

Student must have studied First year (FY) of M.Sc. with Microbiology as a major subject and knowledge of basic biotechnology.

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Microbial production of primary metabolites** • Amino acids: Glutamic acid, Lysine • Enzymes: Proteases, Amylases • Organic acids: Citric acid, Acetic acid • Industrial Alcohol	**10**
2	**Microbial production of secondary metabolites** • Antibiotics: Penicillin, Streptomycin • Vitamins: B_{12}, B_2 • Ergot Alkaloids • Carotenoid pigments: β-carotene, lycopene	**10**
3	**Microbial production of other products & Biotransformation** • Microbial polysaccharides: Xanthan, Alginate and Dextran • Beverages: Beer, Wine • Polyhydroxyalkanoates: PHA and PHB • Biosurfactants • Steroid transformation	**10**
4	**Biomass production and applications** • Fungal biomass- baker's yeast and single cell oil • Mushroom cultivation • Use of Algal biomass. • Microbial production for food and feed	**10**
		40

Learning Outcomes

- The students will be able to apply the knowledge of the Microbial production to understands concepts of various fields like food and dairy industries, pharmaceutical industries, Fermentation industries, beverages industries, etc.

- Student should be able to understand basic concepts of various products like amino acids, enzymes, vitamins, organic acids, industrial alcohol, beer, wine, microbial polysaccharides, Biosurfactants as well as biotransformation of steroids. Students also apply knowledge of mushroom cultivation, fungal biomass production, algal biomass and other microbial production for food and feed.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

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- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by Microbiologists, biotechnologist, researchers and scientists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. A.N. Glazer and H. Nikaido. (2007) *Microbial Biotechnology. Fundamentals of Applied Microbiology.* (2nd edition)
2. E. M. T. El-Mansi, E. M. T. El-Mansi, C. F. A. Bryce, Arnold L. Demain, A.R. Allman (2006) *Fermentation Microbiology and Biotechnology* (2nd edition)
3. James.M. Jay, Martin J. Loessner, David. A. Golden (2005). *Modern Food Microbiology* 7th Edition (Food Science Texts Series)
4. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton (2001). *Industrial Microbiology: An Introduction*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

ENZYMOLOGY

CODE: 256010302

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70		100

Objectives:-

- The objectives of the paper is students will get about the protein structure, classification of enzymes, terminology, enzyme activity and purification of enzymes and strategy for separation and purification.
- The student will get idea about the enzyme kinetics and mechanism. What is significance of Km, Vmax and Kcat and importance of steady state equilibrium. Enzyme inhibition and its types. Thermal kinetics.
- To provide the mechanism and action of enzyme and its role of activators. Allosteric regulation and its mechanism.
- The study will help in understanding the what are isoenzymes and physiological significance role of different types of enzymes.

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Course Outcome:

Unit	Description in Detail	Weightage (In Hours)
1	**Introduction**: Enzymology and historical developments in enzymology Protein Structure: Primary, secondary, tertiary and quaternary structure, techniques used in enzyme characterization Enzyme classification: IUB enzyme classification. Enzyme Activity: Principle and techniques of enzymatic analysis, factors affecting enzyme Activity, Extraction and Purification of enzyme: Objectives and strategy, separation techniques, test of purity.	08
2	**Enzyme Kinetics:** Bioenergetics and Catalysis Single substrate kinetics: Equilibrium and Steady state kinetics, significance of Km, Vmax & Kcat. Pre-steady state and Relaxation kinetics. Multisubstrate kinetics: General rate equation, compulsory order, random order and ping-pong mechanisms and their primary and secondary plots. Enzyme inhibition and its kinetics: Reversible and irreversible inhibition, competitive, noncompetitive and uncompetitive, mixed, partial, substrate and allosteric inhibition. Thermal kinetics: Effect of temperature on reaction rate, enzyme stability, Arrhenius equation and activation energy.	10
3	**Mechanism of Enzyme Action:** Enzyme activators, co-enzymes and co-factors in enzyme catalysis, Enzyme and substrate Specificity Investigation of active Centre, Factors affecting catalytic efficiency, Experimental approaches to determine enzyme mechanisms. Enzyme mechanisms: Lysozyme, Chymotrypsin, Carboxypeptidase, Restriction endonuclease, Aspartate trans carbomylase. Allosteric enzymes and sigmoidal	10

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	kinetics: Protein ligand binding, Co-operativity, MWC & KNF models, Regulation of enzyme activity. Control of metabolic pathways.	
4	Isoenzymes and its physiological significance, Ribozymes and Abzymes Enzyme engineering: Chemical modification of enzymes: methods of modification of primary structure, catalytic and allosteric properties, use of group specific reagents. Enzyme Immobilization Enzymes in non conventional media, Enzymes sensors, Enzymes as analytical reagents.	08

Learning Outcomes:

- The students will be able to understand and deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines.
- Student should be able to understand basic concepts of the present day scope and applications of enzymology.
- The course is designed to give students an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.
- This is a course where the topics to be studied include enzyme active sites / mechanisms of enzyme action; enzyme kinetics and regulation; Isozymes and their clinical significances /function relationship etc as tools for understanding functions of enzymes.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

1. *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd Edition,* authored by Trevor Palmer and Philip Bonner Affiliated East-West Press Pvt. Ltd.
2. Textbook of biochemistry – Vasudevan Shreekumari
3. Biochemistry – Lehninger 6th edition
4. Fundamentals of Enzymologist: Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
5. Enzyme Structure and mechanism: Alan Fersht, Reading, USA.
6. The chemical kinetics of enzyme action: K. J. Laider and P. S. Bunting, Oxford University Press,London.
7. Enzymes: M. Dixon, E. C.Webb, CJR Thorne and K. F. Tipton, Longmans, London.
8. Biochemistry: Lubert Stryer

E-Resources

- https://www.feedspot.com/infiniterss.php?_src=feed_title&followfeedid=4812449&q=site:https%3A%2F%2Fwww.nature.com%2Fsubjects%2Fbiochemistry.rss
- https://www.sciencedaily.com/news/matter_energy/biochemistry/
- https://thebiochemistblog.com/
- https://www.longdom.org/microbial-biochemical-technology.html
- https://bmcbiochem.biomedcentral.com/
- https://www.slideshare.net/mohdsakharkar/enzyme-final

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

r-DNA Technology
Subject Code: 256010303
M.SC. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students the basic knowledge of R-DNA technology (Recombinant DNA technology).
- The purpose of the course is to give student to introduction of Recombinant DNA technology and its cover up scope of genetic engineering, Cloning, Recombinant, and PCR.
- To provide an understanding of Scope of genetic engineering, concept & important of genetic engineering, chemical synthesis of gene cloning & expression vectors, and PCR techniques.

Prerequisites

Student must have studied M.Sc. with microbiology as a major subject and knowledge of basic microbiology/Life science.

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Course outline

Sr. No.	Course Contents	Teaching hours
1.	Scope of Genetic Engineering, Concept and importance of Genetic Engineering; General strategies and Steps involved in gene cloning; Extraction and purification of DNA from bacteria, plant and animal cells; Restriction enzymes, DNA lipase and other enzymes involved in gene cloning; mRNA and cDNA preparation.	06
2.	Chemical synthesis of gene/DNA Cloning and expression vectors- Plasmids, _-bacteriophages, M-13 based vectors, Phagemids, Cosmids, YAC, BAC,HAC/MAC, etc. Expression of cloned gene in heterologous host Introduction of DNA into different host systems.	06
3.	Recombinant selection and screening Southern blotting & hybridization, Northern analysis, Western blot analysis, Agarose gel electrophoresis, Pulse Field Gel Electrophoresis, Rotating Gel. Electrophoresis (RGE), Mapping Regulatory Sequences by in vivo expression assay Mapping of Protein Binding Site by DNAse I Protection, Mobility Gel Shift Assay Protein Activity Assay – Yeast-one hybrid, Yeast-two hybrid and Yeast-three hybrid system. Phage display, Subtractive hybridization and cloning, HRT/HART, Chromosomal Walk. Characterization of Cloned genes .Restriction map,S1 mapping ,Denaturation mapping ,Heterogonous mapping DNA sequencing, Nucleic Acid Microarray, Metagenomics, Metabolism, gene therapy.	10
4	Polymerase chain reaction, Molecular markers Linkage mapping using meiotic recombination frequencies, Genomic mapping using radiation induced Chromosome rearrangement, Genomic mapping using DNA sequence polymorphism as genetic marker, In vitro Mutagenesis, Metagenomics, Metabolic engineering, Gene therapy Recombinant products- recombinant hormones ,recombinant DNA vaccines, Transgenic plants, Transgenic animals, Genetic Engineering Guidelines, Levels of Physical containment, Levels of Biological Containment, The Indian Guidelines.	10

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Learning Outcomes

- The students will be able to understand the Knowledge of r-DNA technology to understand concept of various fields like research, gene manipulation, genetic engineering, gene cloning, fermentation industries, etc.

- Student should be able to understand basic concepts of recombination, methods of genetic engineering, screening methods, enzymes involved in r-DNA technology, DNA sequencing, vectors, gene markers, transgenic plants and animals as well as gene therapy.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by microbiologists, biotechnologists, researchers and scientist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1 Genomes TA Brown 3rd Edition
2 Principles of Genetic Manipulation- Old & Primrose
3 Genetic Engineering – Rastogi & Pathak
4 Recombinant DNA technology by keya chaudhari

E-Resources

- https://www.slideshare.net/mobile/SECBIO/genetic-engineering-13933607
- https://www.slideshare.net/mobile/ImdadTakkar/artificial-gene-synthesis
- https://www.slideshare.net/mobile/FarazaJaved/pcr-76618045
- https://www.slideshare.net/mobile/fizz92fizzuo/vectors-49902617

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Animal Tissue Culture and Pharmaceutical Biotechnology

CODE: 256010304

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70		100

Unit 1: Animal tissue culture

- Primary culture and established cell line cultures
- Equipment and material for animal cell technology
- Basic media and techniques of mammalian cell culture
- Manipulation and application of animal cell culture

Unit 2: Bioprocess economics and IPR

- Expenses for industrial materials, equipment, product recovery and effluent treatments
- Cost recovery due to waste usages and recycling
- IPR and patent process
- Benefits, problems and management of IPR
- International harmonization of patent law

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➢ Patents of biotechnological process and their protection

➢ Indian scenario

Unit 3: Regulatory affairs

➢ Introduction to pharmacopoeia, good microbiological techniques and good laboratory practice (GLP)

➢ Basic principles of quality control (QA) and quality assurance (QC)

➢ Guidelines for QA and QC: raw materials, sterilization, media, stock cultures and products

➢ Validation study and toxicity testing

➢ Role of culture collection centre, public health laboratories and regulatory agencies

Unit 4: Biosafety and bioethics

➢ Biosafety guidelines

➢ Risk and risk assessment

➢ Biosafety levels, laboratory biosecurity concepts

➢ Introduction to drug design

➢ Pre-clinical and clinical trials

➢ Basics of bioethics principles, international codes and guidelines in India

➢ Ethics in post-genomic era

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SWARRNIM SCIENCE COLLEGE

Department of Chemistry

Natural Products and Biomolecules

Subject Code: 256020301

M.Sc. Semester- III

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Natural Pigment** Natural colouring matter, general classification, method of synthesis, biosynthesis studies of anthocyanins (cyanine) flavones (chryosin) and flavanol (Querecetin), Porphyrin-structure, spectral properties and synthesis, general and structure determination of Haemoglobin, chlorophyll and Bilirubin.	14
2	**Alkaloids and Vitamins** Alkaloids: General biogenetic studies of alkaloids, chemistry of	14

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	quinine, morphine , reserpine and colchicine Vitamins : Introduction, synthesis and biochemical function of vitamin B(Thiamine), Vitamin H and α -tocopherol (Vitamin E), vitamin C.	
3	**Steroids and Hormones** General biosynthesis studies of steroids, structure of cholesterol and ergosterol (No synthesis). Stereochemistry of steroids, chemistry of bile acids. Chemistry of androgens, oestrogens and gestrogens, their synthesis and biochemical role. Adrenocortical hormones, partial synthesis of cortisone.	14
4	**Terpenoids and Carotenoids** Classification, nomenclature, general methods of structure determination, chemistry and synthesis of abietic acid and gibberellic acid (gibberllin-A), farnesol, zingeberine and squalene. Biosynthetic studies on triterpenoids and tetraterpenoides.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

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- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Organic chemistry vol I & II (sixth edition) I.L.Finar
2. Chemistry of vitamins-S.F.Dyke
3. Chemistry of natural products by Bantely, Vol 1-10
4. L.J.Wade Jr. Organic chemistry, Prentice nall, England cliffs, 1987
5. Chemistry of Natural products vol I & II by O.P.Agrawal

E-Resources

- https://www.invaluable.com/blog/naturalpigments/#:~:text=A%20natural%20pigment%20is%20one,to%20create%20a%20desired%20hue.&text=Artists%20used%20whatever%20pigment%20was,and%20white%20from%20ground%20calcite.
- https://www.foodcolor.com/natural-pigments
- https://www.britannica.com/science/alkaloid
- https://en.wikipedia.org/wiki/Steroid_hormone
- https://www.gfmer.ch/Books/Reproductive_health/Steroid_hormone_metabolism.html
- https://conagen.com/products-we-make/terpenoids-carotenoids/

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Medicinal Chemistry
Subject Code: 256020302
M.Sc. Semester- III

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Antibiotics** Antibiotics that interfere with the biosynthesis of bacterial cell wall. A. The β -lactum antibiotics : Penicillin and cephalosporin B. Non lactum antibiotics (only name and structures) C. Bacitracin, vancomycin and cycloserine (only name and structures) Antibiotics that interfere with the protien biosynthesis in	14

	microorganisms : non lactum antibiotics, tetracycline, chloroamphenicol Structure actively relationship (SAR) among penicillinis and tetracyclins Non classifiable antibiotics (only structure and therapeutic uses) Synthesis of pencillin V, ampicillin, cephalosporin and chloroamphenicol.	
2	**Psychoactive drugs** CNS depressant: **A**. General and local anaesthetics **B.** Sedative and hypnotics Antipsychotic drugs **A.** Antidepressant **B.** Neuroleptics Synthesis of the following: Thiopental, amobarbital, diazepam, chlorozepan, alprazolam, glutethimide, nikethamide, procaine, lidocaine and dibucaine, Ibuprofin, meclofenate sodium, novalgin, pethidine	14
3	**Antimalarial and Antituberculosis drugs** Antimalarials: Modern chemotherapy of malaria, 4-amino and 8-amino quinolins, 9-amino acridine. Synthesis of mefloquines, chloroquine, primaquine and daraprim Mode of action of antimalarial agents SAR of antimalarial agents Anti tuberculosis: Synthesis of only the following drugs: Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone)	14
4	**Cardiovascular, diuretics and hypoglycemic agents** Synthesis of amyl nitrate, diltiazim, atenolol, methyl dopa, tolbutamide, chloropropamide, glibenclamide, acetazolamide, chlorothiazide, furosemic and ethacrycnic acid.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

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Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Burger's medicinal chemistry and drug design (5/e) 1997, vol 1 to 5 edited by Manfred E.Woltt (John wiley and sons Mc. New york)

2. Principles of medicinal chemistry by William A. Foye (ied), lea and febiys (Philadelphia)

3. Principles of medicinal chemistry vol I & II (5/e) F.S.kadam, K.R. Mahadic ad K.G.Bohra (Nirali publication)

4. Medicinal chemistry by ashutosh kar

5. The organic chemistry of drug synthesis vol I, II and III (1980) ed by D. lednicer and L.A. mitscher (Johyn wiley and sons, New york)

6. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry (5/e,1982) by Robert Doerge (J.B. lippincoff company, phaladophia/ Toppan co.Ltd, Tokyo)

7. Topics in medicinal chemistry vol I & II by rabinowitz Myerson (interscience 1968)

8. The pharmaceutical basis of theraperutics by Geoman and Gilman (Mcmillan co.)

E-Resources

- https://www.medicalnewstoday.com/articles/10278
- https://www.drugs.com/article/antibiotics.html
- https://medlineplus.gov/antibiotics.html

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Spectroscopy
Subject Code: 256020303
M.Sc. Semester- III

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

- Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**UV & IR Spectroscopy** UV: Electronic transitions, chromophores, auxochromes, bathochromic and hypsochromic shifts, solvent effects, wood ward fieser rules for dienes, enones and aromatic compounds applications of U.V., instrumentation. I.R. Vibrational transitions, important group frequencies, factors	14

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	affecting I.R. group frequency, applications of I.R. instrumentation	
2	**NMR** Elementary ideas of NMR integration, chemical shifts, Factors affecting, chemical shifts, coupling (first order, analysis) instrumentation and principles and instrumentation, FT, chemical shifts, spin-spin coupling different spin systems, mechanism of spin coupling. E.q. AB, ABX, factors affecting vicinal and geminal couplings, rate processes, long range couplings, spin decoupling, shift reagents, solvent shifts, nuclear overhauser effect. 2D NMR (COSY and HETCOR) applications.	14
3	**C13 NMR and Mass spectrometry** C13 NMR: elementary ideas, instrumental problems ,chemical shift features of hydrocarbons, effect of substituent on chemical shifts olefinic, acetylenic, aromatic and carbonyl carbons, effects of coupling. Mass spectrometry: theory, instrumentation, modes of ionization, types of detectors, modes of fragmentation. Different types of ions, molecular ions, isotopic peaks, factors controlling fragmentation, hyphenated mass spectroscopy techniques.	14
4	Structural elucidation of drug molecules based on joint application of UV, IR, PMR, CMR and mass spectroscopy.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.

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- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.

- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Spectroscopic methods in organic chemistry, D.H.Williams and Tan fleming
2. Spectrometric identification of organic compounds, T.C.Morril R.M.Silverstein and G.Bassler, 6th edition, John Wiley and sons
3. Introduction to spectroscopy, D.L.Pavia, G.M.Lampman and G.S.Kriz, 3rd edn, Harcourt college publishers.
4. Organic spectroscopy by W.Kemp
5. Organic spectroscopy by P.S.Kalsi

E-Resources

- https://www.itwreagents.com/iberia/en/sa_spectroscopy-uv-vis-ir#:~:text=The%20UV%2DVis%20spectroscopy%20is,between%20200%20and%20800%20nm).&text=The%20IR%20spectroscopy%20is%20another%20very%20useful%20analytical%20tool%20for%20compounds%20characterization.

- https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Book%3A_Analytical_Chemistry_2.1_(Harvey)/10%3A_Spectroscopic_Methods/10.03%3A_UV/Vis_and_IR_Spectroscopy

- https://www.mps.mpg.de/phd/space-instrumentation-ir-uv-spectroscopy

- https://www.youtube.com/watch?v=MW4PwJxxyt0

- https://www.youtube.com/watch?v=t5stvnKNXbg

- https://www.youtube.com/watch?v=t5stvnKNXbg

- https://www.youtube.com/watch?v=H6_GgJN39vY

- https://www.youtube.com/watch?v=EZzYXmX8XGk

- http://sppu.in/Syllabi_PDF/revised_2009/sci/6%20%20(5)%20%20M.Sc.%20II,%20%20Drug%20Chemistry.pdf

- https://www.researchgate.net/post/Which_is_the_best_spectroscopic_method_for_the_structure_elucidation_of_organic_molecule_without_the_help_of_other_method

- https://www.arcjournals.org/pdfs/ijarcs/v2-i8/5.pdf

- https://www.sydney.edu.au/science/chemistry/~george/spectroscopy.html

- https://nptel.ac.in/content/storage2/courses/104106075/Week8/MODULE%2036.pdf

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF Chemistry

Industrial Chemistry
Subject Code: 256020304
M.Sc. Semester - III

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
1	**Basic principles** Basic chemical data, batch versus continuous operation, design, flow charts, chemical process selection, safely, hazardous, fire toxic materials, research and development patents, good manufacturing practice and laboratory practice.	14

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2	**Unit processes in organic chemistry** Nitration, sulfonation, halogenation, amination and alkylation methods and industrial chemicals derived from benzene, naphthalene and anthracene using unit process.	14
3	Green chemistry -12 principles of green chemistry Green solvents- aqueous phase reactions Wurtz reaction, witting-Horner reaction, Michael reaction - Solid phase reactions: halogenation, aldol condensation, grignard reaction. - Ionic liquid as green solvent- hydrogenation, diels-alder reaction, o- alkylation and N-alkylation Green catalysts of green reagents (introduction)	14
4	Manufacture and uses of -Argochemics (insecticides, fungicides, plant nutrients and plant hormones, Weedicides, pesticides) -Unit operations	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a

programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended

1. Unit processes in organic synthesis by P.H.Groggins
2. Industrial Chemical process by R.N.Shreve
3. Riegels handlook of industrial chemistry ed by James and Kent
4. Dryden's outlines of chemical Technology M.Gopal Rao

E-Resources

- http://ccc.chem.pitt.edu/wipf/Web/HCH.pdf
- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Arenes/Reactivity_of_Arenes/Nitration_and_Sulfonation_of_Benzene
- https://www.masterorganicchemistry.com/2018/04/30/electrophilic-aromatic-substitutions-2-nitration-and-sulfonation/
- https://www.azocleantech.com/article.aspx?ArticleID=559

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Cellular Biology
Subject Code :253010301
B.Sc. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives:-

- To provide basic knowledge of Applications of Biotechnology
- To provide students basic knowledge of cell biology
- Students will understand how these cellular components are used to generate and utilize energy in cells.
- Explain how DNA allows for the passage of genetic information between generations.
- Compare the structure of prokaryotic and eukaryotic genetic information storage molecules.

Prerequisites:-

- Student Must have studied 2years B.Sc. with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

Course outline:-

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Unit No.	Course Contents	Teaching Hours
1.	**Structure of cell:** • Chemistry and Ultra structure of cellwall, • Membrane, • Flagella and Cilia organells • Mitochondria, • Chloroplast, • Golgi bodies, • peroxysome, • Endoplasmic reticulum, • Ribosome, • Nature of Cytosol, • Cytoskeleton structures, • Cellular diversity at structural and compositional levels among Prokaryotes, Archeobacteria and Eukaryotes (Plant, Animal and Fungi)	**10**
2.	**Cellular Metabolism:** • Oxidation-Reduction, • Energy and carbons source utilization, Electron transport chain and ATP generation, • Metabolism: Anabolism, Catabolism, Respiration, Passive transport, Facilitated diffusion, Group translocation, • Enzymes: Properties, • Mechanism of catalysis, • Allosteric controls	**10**
3.	**Cell Division:** • Cell division, Phases, Mitosis, Growth and tumour, • Cell cycle, Senescence and Apoptosis	**10**
4.	**Cell Expression:** • Central dogma of life, • Concept of gene, Transcription, Translation and Expression, Operon model, Coordination of Metabolism at enzyme Activity and Synthesis levels, • Cell Communication: Single molecules, Receptors, junction, Plasmodesmata and cell signalling	**10**
		40

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Learning Outcomes:

- At the end of the course the student would have basic knowledge of Applications of Biotechnology
- The student can make predictions about natural phenomena occurring during the cell cycle.
- The student can describe the events that occur in the cell cycle.
- The student is able to construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.
- The student is able to represent the connection between meiosis and increased genetic diversity necessary for evolution.
- The student is able to evaluate evidence provided by data sets to support the claim that heritable information is passed from one generation to another generation through mitosis, or meiosis followed by fertilization.

Teaching & learning Methodology:

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
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Books Recommended

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- Dr.A.C Deb. *Fundamentals of Biochemistry*
- U Satyanaryan. *Biochemistry*

- Verma, P. S., & Agrawal, V. K. (2006). *Cell Biology, Genetics, Molecular Biology, Evolution & Ecology (1 ed.). S .Chand and company Ltd.*
- Lodish sixth edition. *Molecular Cell Biology*
- Thomas D. Pollard *Cell biology*

- Luby-Phelps K. *The physical chemistry of cytoplasm and its influence on cell function*

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

MOLECULAR BIOLOGY-I
Subject Code: 253010302
B.SC. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students the basic knowledge of molecular genetics of prokaryotes.
- The purpose of the course is to give students to introduction of replication, transcription, and translation in prokaryotes.
- To provide an understanding of DNA damage and repair system and also get idea about transposons and its applications.
- At the end of the course the students would have basic fundamentals of biotechnology.

Prerequisites

Student must have basic knowledge of molecular biology.

Course outline

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Unit No.	Course Contents	Teaching hours
1.	**Prokaryotic Replication:** • Definition, property and features of prokaryotic DNA. • Unidirectional, bidirectional. • Initiation, elongation and termination of replication. • Closed clamp and rolling model. • DNA damage and repair system.	**10**
2.	**Prokaryotic Transcription:** • Definition. • Concept of gene, promoter. • Initiation, Elongation, termination and anti-termination of transcription. • Post transcription modification. • Operon concept-Lac and Trp operon.	10
3.	**Prokaryotic Translation:** • Genetic code • Wobble Hypothesis An overview of translation in prokaryotes. Initiation, elongation and termination of translation. • Post-translation modification	10
4.	**Restriction Modification system:** • Introduction, • Restriction enzymes, types, nomenclature, properties and examples (Eco RI, Bam HI, SmaI)	10
		40

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Learning Outcomes

- The students will be able to apply the knowledge of the molecular biology to understand the concept of various fields like research fields, Gene manipulation, Genetic engineering, etc.

- Student should be able to understand basic concepts of Replication, Transcription, Translation, and restriction modification system in prokaryotes, DNA damage and repair mechanisms.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Prescott, Harley, and Klein's Microbiology, J. M. Willey, L. M. Sherwood, C. J. Woolverton, 7 th Edition (2008), McGraw Hill Higher Education- USA
- Principles of Microbiology, R. M. Atlas, 2nd Edition (Indian Edition) (2015), McGraw Hill Education (India) Private Limited –New Delhi.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIAL PHYSIOLOGY
Subject Code: 253040301
B.Sc. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students basic knowledge of Biochemistry and Metabolism.
- The purpose of the course is to give students an introduction of bacterial nutrition, uptakes of solutes, their growth requirements and growth measurements.
- To provide an understanding of energy production and regulation in cells, fundamentals of enzymology, etc.

Prerequisites

Student must have studied first year (FY) of B.Sc. with Microbiology as a major subject and knowledge of basic biology.

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Unit No.	Course Contents	Teaching hours
1	**Biomolecules** • Chemical structure, properties, classification and Biological significance of Biomolecules: ➢ Carbohydrates ➢ Protein ➢ Lipids ➢ Nucleic acids	**10**
2	**Enzymes** • General introduction: Physical &Chemical properties • Structure of enzymes: Prosthetic group, Apo-enzyme, coenzyme, cofactors. • Localization of enzymes: Extra cellular and intra cellular • Nomenclature and classification of enzymes, IUB system of enzyme classification • Enzyme action: active site of enzymes • Mechanism of Enzyme action • Factors affecting on enzyme activity • Inhibition of enzyme activity: Competitive and Non competitive	**10**
3	**Microbial Nutrition and Introduction to Metabolism** • Types of Culture Media • Modes of Nutrition Uptake: Entry of nutrients in cell, Passive diffusion, facilitated diffusion and active transport • Classification of bacteria on the basis of growth supporting environmental factors such as oxygen, temperature, pH, osmotic pressure, salt and hydrostatic pressure • Introduction to microbial metabolism: Anabolism, catabolism, primary and secondary metabolism • Role of reducing power, precursor metabolites and energy rich compounds in cell metabolism	**10**
4	**Microbial growth** • Methods of reproduction in bacteria and new cell formation • Growth: Introduction to growth rate, generation time ➢ Criteria for growth measurement: Cell mass and Cell number, methods of their measurement ➢ Normal growth curve of bacteria ➢ Continuous growth and synchronous growth. • Chemotherapeutic agents as growth inhibitors: ➢ Principles of chemotherapy ➢ General mode of action of various chemotherapeutic agents: Sulfonamides, Antibiotics (penicillin, streptomycin, polymyxin)	**10**
		40

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Learning Outcomes

- The students will be able to apply the knowledge of the physiology of microbes to understands concepts of various fields like research fields, fermentation industries, food industries, etc.

- Student should be able to understand basic concepts of culture media, modes of nutrition uptake, classification of bacteria based on physiological properties, physical and chemical properties of enzymes, mechanism of enzyme action, methods of reproduction in bacteria, growth and their measurements and chemotherapeutic agents, classification of biomolecules, anabolism, catabolism, primary and secondary metabolism, role of reducing power.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data and laboratory experiments clearly and concisely that incorporates the stylistic conventions used by microbiologists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. PelczarJr, M J, Chan E C S, Krieg N R, (1986) Microbiology, 5thedn, McGraw-Hill Book company, NY
2. IngrahamJ L, and Ingraham, C L, (2000) Introduction to Microbiology, 2nd edition, Brooks/Cole, Singapore
3. Black J G, (2002) Microbiology: Principles and Explorations, 5thedn, John Wiley and Sons, Inc. NY.
4. Atlas R M, (1977), Principles of Microbiology2nd Edition, Wm. C. Brown Publ. Iowa USA

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BHOYAN RATHOD, KALOL, GANDHINAGAR.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY
Soil & Water Microbiology
CODE: 253040302
B.Sc. 3rd Sem

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70		100

Objectives: -

- To provide basic knowledge of properties of soil its physicochemical characteristics, micro flora present in soil. What kind of interactions take place in soil.
- Student will learn about the importance of microorganism and its co-relation of soil & microbes.
- How the biogeochemical cycles run in the nature i.e rotation of various elements like nitrogen, sulfur, carbon, iron and phosphorus.
- Importance of soil fertility.
- To provide the importance of drinking water, how to check whether the water is potable or not, get to know different test like SPC,MPN, PA Test about qualitative and quantitative analysis of drinking water
- To provide the information of properties and types of waste water, what can be sources of the waste water.
- The purpose of the course is to provide the knowledge about the importance of treatment of waste water, how it can be treated by different methods and then disposed off in the environment.

Prerequisites

Student Must have studied S.Y B.Sc. with Microbiology as a major subject and knowledge of basic biology

Course outline:-

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Sr. No.	Course Contents	Number of Hours
1	**Microbiology of soil** • Physicochemical characteristic of soil: Soil as culture media and Soil micro flora • Methods of soil micro flora: • Direct microscopic methods, Agar plate technique, Enrichment culture technique, Buried slide technique and soil respiration technique • Microbial soil interactions: (A) Neutral, Positive and Negative associations (B) Interaction between plant roots and micro organisms (i) Rhizosphere and its significance (ii) Mycorrhiza	**8**
2	**Microorganisms as Biogeochemical agents:** • Biogeochemical transformations in soil: Mineralization and immobilization of elements • Rotation of elements in nature: (A) Nitrogen cycle (B) Sulfur cycle(C) Carbon Cycle (D) Iron cycle (E) Phosphorus Cycle) • Soil fertility: Biofertilizers	**10**
3	**Microbiology of drinking water:** • Natural waters: Sources of contamination • Microbial indicators of fecal pollution (A) Coliforms as indicator (B) Methods for differentiation: IMViC test and Elevated temperature test (C) Microbial indicators other than coliforms • Nuisance organisms in water: Slime forming bacteria, Iron and Sulphur bacteria and Algae • Water borne diseases • Bacteriological examination of drinking water: (A) Sampling (B) Quantitative analysis: Total viable count, Membrane filter technique (C) Qualitative substrate test, P-A (Presence Absence test) • Purification of drinking water.	**8**
4	**Microbiology of Wastewater:** • Type of wastewater: Chemical and Microbiological characteristics of waste water • BOD ,COD, TOD as indicators of untreated waste water, Pollution problems due to disposal of untreated waste. • Methods of wastewater treatment: (A)Primary treatment and secondary treatment: Principles and role of microorganisms in: Septic tank, Imhoff tank, trickling filters, activated sludge process and oxidation ponds. (B) Advanced treatment and Final treatment (C) Solid waste processing: Anaerobic sludge digestion and composting	**10**

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Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Soil and Water Microbiology such as

- The students will learn about the properties of soil, nature of soil, types of soil present in the environment.
- Students get knowledge about how the microbes present in the soil interact with soil and help in increasing the soil fertility.
- This study will help them to know about the biogeochemical cycles running in nature how the elements are maintained in the environment and also how organism interact.
- The students will be able to understand the importance of drinking water, types of contaminants present in the water. With the help of practical also get to know about the how quality of water can be tested for its portability.
- The study will help in learning the quality, types, properties of waste water and also why waste water should be treated. Also learn about various methods like BOD, COD, TOC, TOD for treatment of waste water.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

1. PelczarJr, M J, Chan E C S, Krieg N R, (1986) Microbiology, 5th edn, McGraw-Hill Book Company,NY.
2. Alexander M, (1977), Soil Microbiology, 2nd Edition Krieger Publ. Co. Melbourne, FL
3. Atlas R M, (1977), Principles of Microbiology 2nd Edition, Wm. C. Brown Publ. Iowa USA

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Fundamentals of Organic Chemistry
CODE : 253020301

B.Sc.3rdSemester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	-	100

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**[A] Carbohydrates:** Introduction, classification of carbohydrates, osazone formation, epimerization, step up and step down reactions of monosaccharides, simple structures of glucose and fructose, Fischer's proof of configuration of D-glucose. **[B] Amino acid :** Introduction of amino acid, Classification and properties of amino acids, Zwitter ion , Isoelectric point, Strecker's and Gabreil pthalimide synthesis of amino acids.	14
2	**[A] Electrophilic aromatic Substitution:** Introduction, effect of substituent groups, determination of orientation and relative reactivity,classification of substituent groups, electrophilic substitution (ES) reactions.	14

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	(Nitration,Sulfonation, Halogenation, Friedel Craft alkylation and acylation), Orientation in mono and disubstituted benzene.	
3	**[A] Heterocyclic Compounds** Introduction, structure of Pyrrole, Furan and Thiophene, Paal Knorr synthesis and electrophilic substitution of Pyrrole, Furan and Thiophene, reactivity and orientation of electrophilic substitution reactions (ESR) in five membered heterocycles (Pyrrole, Furan and Thiophene) Structure of Pyridine, Electrophilic and Nucleophilic substitution reactions of pyridine. Basicity of pyridine.	14
4	**Chemical Reactivity and Molecular Structure: (Acid- Base Properties)** Acid-Bases, scale of acidity-basicity, Resonance effect, Hybridization, Inductive effect and electronic effects, steric effect and hydrogen bonding, Lewis acid and bases,	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Robert Thornot Morrison and Robert Neilson Boyd, ***"Organic Chemistry"***, Prentice Hall of India Pvt Ltd, New Delhi, Sixth Edition, 1992.
2. Bhupinder Mehta, Manju Mehta, ***"Organic Chemistry"***, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
3. James B Hedrickson Donald J. Cram and George S. Hammond, ***"Organic Chemistry",*** Mc-Graw-Hill Kogakusha,Ltd., Third Edition.
4. Arun Bahl, B. S. Bahl, ***"Advance Organic Chemistry"***, S. Chand & Company Ltd., New Delhi, First Edition, 2003.
5. I. L. Finar, ***"Organic Chemistry"***, Pearson Education Pet Ltd, New Delhi, First Edition, 2002.
6. G. Marc Loudon, ***"Organic Chemistry"***, Oxford University Press, Forth Indian edition, 2010.
7. P.S.Kalsi, ***"Text book of Organic Chemistry"*****,** MacMillan of India Pvt. Ltd., 1999.
8. P.L. Soni and H.M. Chawala, ***"Text book of Organic Chemistry",*** Sultan Chand & Sons

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Fundamentals of Analytical Chemistry
CODE : 253020302

B.Sc.3rdSemester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	--	100

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**[A] Basic concepts of Qualitative and Quantitative Analysis** Introduction, Solubility product principle, Common ion effect, Separation of cations of each groups and separation of anions (acid radicals), Introduction of volumetric titration based on normality and morality of the solution, Conditions for volumetric analysis and types of titrimetric analysis. **[B] Redox titration:** Theory of redox titration, study of redox titration by electrochemical potential method, Ways of locating the end point for redox titration	8 6
2	**Acid Base Titration**: Theory of acid-base titration, Ways of locating the end point of an acid-base titration, Titration of strong acid with strong base, Titration of weak acid with strong base, Titration of weak base with strong	14

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	acid, Titration of weak base with weak acid, Factors determining the exact form of a pH curve.	
3	**Complexometric Titrations** : Theory of complexometric titration involving EDTA, Study of EDTA complex formation taking disodium salt of EDTA and effect of pH, Ways of locating the end point, Estimation of calcium and magnesium by complexometric titration by EDTA [B] Precipitation Titration [6 marks] Titration curves, Feasibility, Indicators, Mohr, Volhard and Fajans' Methods, Factors affecting solubility **Precipitation Titration** Titration curves, Feasibility, Indicators, Mohr, Volhard and Fajans' Methods, Factors affecting solubility	8 6
4	**Precipitation Gravimetric** [14 marks] Introduction, Precipitation, Digestion, Filtration, Washing of the precipitate, Drying and/or incineration of the precipitate, Weighing, Specific and selective precipitation, Organic precipitants, Masking or sequestering agent, Problems involved in precipitation gravimetry.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Dhruba Charan Dash, "Analytical Chemistry", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. R.A.Day, A.L.Underwood, "Quantitative Analysis", Prentice-Hall of India Pvt.Ltd., New Delhi, 2004. (Sixth edition)
3. Gary D. Christian, "Analytical Chemistry", John Wiely & Sons, INC, New York, 1994. (Fifth edition) 4. Douglas A. Skoog, Donald M. West, F.James Holler, "Analytical Chemistry An Introduction", Saunders College Publishing, Harcourt Brace College Publishers, Philadelphia, 1994. (Sixth edition)
4. Y.Anjaneyulu, K.Chandrasekhar, Valli Manickam, "A Textbook of Analytical Chemistry", Pharma Book Syndicate, Hyderabad, India, 2006.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

ENVIRONMENTAL MICROBIOLOGY

CODE: 256030401

M.Sc. 4th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	-	100

Objectives:-

- To provide basic knowledge of Environmental Microbiology. It covers up scope of global warming, environmental problems, biodegradation, bioleaching.
- To provide basic knowledge of microbes in environment.
- The main goal is to know and understand the role of microbes in biogeochemical processes in different ecosystems. The students will learn the basic microbiological principles, the methods in microbial ecology and their theoretical and practical use.
- The knowledge can give the base for understanding processes and changes in the environment.
- The students can get some skills to recognise the ecological problems and critical evaluation of the human impacts on pollution, climate changes and as well as environmental protection.
- The lectures will be implemented with individual practical work in the laboratory and presentations of the seminars.
- The students can get general competences in microbial ecology.

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Prerequisites:-

- Student Must have studied B.Sc. with microbiology/biotechnology as a major subject and knowledge of basic biology

Course outline:-

Unit	Description in Detail	Weightage
1	**Global environmental problems:** Global warming, Ozone depletion, Acid rain. Global warming and infectious diseases. Water pollution: sources and types, physical, chemical and biological pollution. Eutrophication and its control Microbial indicators of water pollution Biodeterioration of wood and metals. Role of microorganism, mechanism and control.	08
2	**Biogeochemical cycles:** Carbon, Nitrogen,Sulphur, iron and phosphorous cycles. Detrimental effects of diverted biogeochemical cycles. Acid mine drainage, nitrous oxide emission, nitrate pollution of ground water. Biological nitrogen fixation in detail: Asymbiotic, Symbiotic and associative nitrogen fixation. Structure, function and genetic regulation of nitrogenase.	08
3	**Biodegradation of organic pollutants:** Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides. Bioremediation: Intrinsic bioremediation, Biostimulation and Bioaugmentation. In situ and ex situ bioremediation echnologies. Bioremediation of oil spills. Bioremediation of heavy metal pollution, Phytoremediation. Use of GMO in bioremediation. Biological treatment of waste gas (polluted air): biofilters, bioscrubbers, membrane bioreactors, biotrickling filters.	10
4	**Bioleaching of metals:** Characteristics of commercially important microbes, mechanisms of bioleaching,	

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	factors affecting bioleaching and current biomining processes. Biobeneficiation of gold ores. Microbially enhanced oil recovery. Biodesulfurization of coal: Removal of organic and inorganic sulphur from coal. Microbial Insecticides: Bacterial, fungal and viral insecticides in pest management. Biofertilizers: Nitrogen fixing and phosphate solubilizing biofertilizers.	10

Learning Outcomes:

- At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.
- Students will get the basic knowledge how to prepare and perform sampling and microbial analyses to determine the abundance, growth rate and microbial community composition together with the basic environmental parameters.
- The knowledge can be used to prevent infections and to protect human and environmental health.
- Students will get basic knowledge to determine the role of microbes:

- in different habitates,

- in different biogeochemical cycles,

- to determine their role in nutrient cycling

- to determine water quality,

- in degradation of natural organic compounds and selected pollutants in the environment.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Environmental Microbiology –RM Maier, IL Pepper & GP Gerba
- Comprehensive Biotechnology- Vol 4, Murray Moo Young
- Biotechnology – Rehm and Reid
- Environmental Science 0 BJ Nebel and RT Wright
- Environmental Biotechnology –HJ Jordening & Josef Winter

E-Resources

- https://www.slideshare.net/nischayn1/acid-rain-ppt
- https://www.slideshare.net/AbinoDavid/global-warming-14620613
- https://www.slideshare.net/PanthoSarker/eutrophication-it
- https://www.slideshare.net/VarugheseGeorge/infectious-diseases-174252970

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

r-DNA Technology
Subject Code: 256030402
M.SC. Semester -4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students the basic knowledge of R-DNA technology (Recombinant DNA technology).
- The purpose of the course is to give student to introduction of Recombinant DNA technology and its cover up scope of genetic engineering, Cloning, Recombinant, and PCR.
- To provide an understanding of Scope of genetic engineering, concept & important of genetic engineering, chemical synthesis of gene cloning & expression vectors, and PCR techniques.

Prerequisites

Student must have studied M.Sc. with microbiology as a major subject and knowledge of basic microbiology/Life science.

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Course outline

Sr. No.	Course Contents	Teaching hours
1.	Scope of Genetic Engineering, Concept and importance of Genetic Engineering; General strategies and Steps involved in gene cloning; Extraction and purification of DNA from bacteria, plant and animal cells; Restriction enzymes, DNA lipase and other enzymes involved in gene cloning; mRNA and cDNA preparation.	06
2.	Chemical synthesis of gene/DNA Cloning and expression vectors- Plasmids, _-bacteriophages, M-13 based vectors, Phagemids, Cosmids, YAC, BAC,HAC/MAC, etc. Expression of cloned gene in heterologous host Introduction of DNA into different host systems.	06
3.	Recombinant selection and screening Southern blotting & hybridization, Northern analysis, Western blot analysis, Agarose gel electrophoresis, Pulse Field Gel Electrophoresis, Rotating Gel. Electrophoresis (RGE), Mapping Regulatory Sequences by in vivo expression assay Mapping of Protein Binding Site by DNAse I Protection, Mobility Gel Shift Assay Protein Activity Assay – Yeast-one hybrid, Yeast-two hybrid and Yeast-three hybrid system. Phage display, Subtractive hybridization and cloning, HRT/HART, Chromosomal Walk. Characterization of Cloned genes .Restriction map,S1 mapping ,Denaturation mapping ,Heterogonous mapping DNA sequencing, Nucleic Acid Microarray, Metagenomics, Metabolism, gene therapy.	10
4	Polymerase chain reaction Molecular markers Linkage mapping using meiotic recombination frequencies Genomic mapping using radiation induced Chromosome rearrangement Genomic mapping using DNA sequence polymorphism as genetic marker In vitro Mutagenesis Metagenomics Metabolic engineering Gene therapy Recombinant products- recombinant hormones ,recombinant DNA vaccines, Transgenic plants, Transgenic animals, Genetic Engineering Guidelines, Levels of Physical containment, Levels of Biological Containment, The Indian Guidelines.	10

Learning Outcomes

- The students will be able to understand the Knowledge of r-DNA technology to understand concept of various fields like research, gene manipulation, genetic engineering, gene cloning, fermentation industries, etc.

- Student should be able to understand basic concepts of recombination, methods of genetic engineering, screening methods, enzymes involved in r-DNA technology, DNA sequencing, vectors, gene markers, transgenic plants and animals as well as gene therapy.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by microbiologists, biotechnologists, researchers and scientist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

Genomes TA Brown 3rd Edition

2. Principles of Genetic Manipulation- Old & Primrose
3. Genetic Engineering – Rastogi & Pathak
4 .Recombinant DNA technology by keya chaudhari

E-Resources

- https://www.slideshare.net/mobile/SECBIO/genetic-engineering-13933607
- https://www.slideshare.net/mobile/ImdadTakkar/artificial-gene-synthesis
- https://www.slideshare.net/mobile/FarazaJaved/pcr-76618045
- https://www.slideshare.net/mobile/fizz92fizzuo/vectors-49902617

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY
ENVIRONMENTAL BIOTECHNOLOGY
CODE: 256010402
M.Sc 4th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70		100

Objectives:-

- To provide knowledge about environment monitoring, its assessment using bio-indicators, biomarkers, biosensors and toxicity testing. Various environmental laws.
- Student will an get idea about bioremediation techniques, strategies involved in bioremediation. Phytoremediation, GMO and impact on bioremediation.
- To provide an idea about principles of biodegradation and mechanism of detoxification, biodegradation of various compounds like detergents, pesticide, lignin, hydrocarbon and dyes.
- Provide knowledge about Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration, Biodeterioration of selected material.

Prerequisites

Student must have studied B.Sc with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

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COURSE OUTLINE:

Unit	Description in Detail	Weightage
1	**Environmental problems and monitoring:** Environmental monitoring: environmental impacts and their assessments using bio-indicators, biomarkers, biosensors and toxicity testing, rDNA technology, Conservation strategies, Environmental laws and policies in India	06
2	**Bioremediation:** Bioremediation principles, Strategies and techniques of bioremediation: *in situ* and *ex situ,* Bioremediation of metals, Phytoremediation, GMOs and their impact on bioremediations	06
3	**Biodegradation:** Principles of biodegradation and mechanism of detoxification, Biodegradation of detergent, pesticide, lignin, hydrocarbon and dyes	10
4	**Biodeterioration:** Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration, Biodeterioration of selected materials	10

Learning Outcomes

- To provide knowledge about environment monitoring, its assessment using bio-indicators, biomarkers, biosensors and toxicity testing. Various environmental laws. Student will an get idea about bioremediation techniques, strategies involved in bioremediation. Phytoremediation, GMO and impact on bioremediation.

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- To provide an idea about principles of biodegradation and mechanism of detoxification, biodegradation of various compounds like detergents, pesticide, lignin, hydrocarbon and dyes.
- Provide knowledge about Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration, Biodeterioration of selected material.
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Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Biotechnology- U. Satyanarayana
2. Environmental engineering and management- S. K. Dhameja, Publ: Kataria & Sons
3. Textbook of Biotechnology- H.K.Das
4. Methods in Biotechnology- Hans-peter-schmauder
5. Environmental Biotechnology- B.C. Bhattacharyya and R. Banerjee
6. Environmental biotechnology- G. M. Evans and J. C. Furlong
7. Environmental biotechnology- A. Scragg, Oxford

E-Resources

1. https://www.slideshare.net/Omodhu/bioremediation-71688629
2. https://www.slideshare.net/vanithagopal/bioremediation-41934065
3. https://www.slideshare.net/halalarahman/phytoremediationppt
4. https://www.slideshare.net/Christa_belle/phytoremediation-43828173
5. https://www.slideshare.net/tanujanautiyal/environmental-biotechnology-50099488

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Plant Biotechnology

Subject Code: 256010401

M.Sc. Semester-4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70		100

Objectives

- To provide basic knowledge of plant biotechnology, secondary metabolites and about genetic engineering technology.
- To provide basic knowledge of Plant Biotechnology. It covers up about cell & tissue culture, methods of propagation, plant tissue culture.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ medical / Environmental Sciences.

Prerequisites

Student must have studied B.Sc with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1	Cell & tissue culture in plants; callus cultures; in-vitro morphogenesis organogenesis and embryogenesis; Artificial Seeds, Micropropagation (Clonal propagation); Haploidy; anther and ovule cultures, Embryo cultures; Protoplast isolation, culture and protoplast fusion and somatic hybridization, Cybrids, Somaclonal Variation; in-vitro mutation methods; Virus elimination, pathogen indexing; Cryopreservation	08
2	Production of secondary metabolites; Sources of plant secondary metabolites; criteria for cell selection, factors affecting the culture of cells; different bioreactors and their use in secondary metabolite production; biochemical pathways for the production of different secondary metabolites; and biotransformation.	06
3	Principles and methods of genetic engineering, and its applications in Agriculture. Methods for genetic transformation and transgenic plants production through Agro bacterim tumefaciens and A. rhizogenes; Gene transfer methods in plants; PEG mediated, microinjection, particle bombardment, electroporation, Molecular markers and their importance in plant breeding, Marker Assisted Selection (MAS).	10
4	Molecular plant pathology: Mechanisms of disease resistance in plants against pathogens; Signalling pathways and molecular events during pathogen – plant interaction. Biotechnology and intellectual property rights (IPR); Plant genetic resources GATT & TRIPS; Patent for higher plant genes and DNA sequence	08

Learning Outcomes

The aim of this course is to provide a thorough understanding of theoretical and practical aspects of plant cell and tissue culture. Topics include: plant regeneration, genetic modification, cellular & physiological aspects of differentiation and hormonal regulation of differentiation.

- Student should be able to understand Explain basic metabolic pathways of plants and formation of different secondary metabolites through various biosynthetic pathways in plants

- The course is designed to give students an understanding of the students will have knowledge of tools and strategies used in genetic engineering. Understanding of applications of recombinant DNA technology and genetic engineering. from academic and industrial perspective

- The students will learn how to select and apply the methodologies to be used in molecular plant pathology

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Elements of Biotechnology – P K Gupta

- Principles of plant biotechnology: An introduction to genetic engineering in plants – S H Mantel, et. al.

- Advances in Biochemical engineering / Biotechnology – Anderson, et. al.

Plant cell culture technology – M M Yeoman

E-Resources

- https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant-biotechnology
- https://en.wikipedia.org/wiki/Genetic_engineering#:~:text=Genetic%20engineering
- https://bsppjournals.onlinelibrary.wiley.com/journal/13643703
- https://www.slideshare.net/abhishekindurkar/production-of-secondary-metabolite
- https://www.slideshare.net/VamsiIntellectual/types-of-cells-and-tissues

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

Department of Chemistry

Advanced Organic Chemistry

Subject Code: 256020401

M.Sc. Semester- IV

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Pericyclic Reactions** Introduction, classification of pericyclic reactions, stereochemistry, molecular orbital symmetry, frontier orbitals of ethelene, 1,3 – butadiene, 1,3,5-hexatriene and allyl system, F.M.O. and PMO approach to cycloaddition and electrocyclic reactions: Generalisation of wood-ward Hoffmann rule, sigmatropic rearrangement-suprafacial and antrafacial shifts of H.Stereoselectivity in sigmatropic rearrangement, enantioselectinity in pericyclic reactions.	14
2	**Conformational Analysis**	14

	Confirmation at cyclic systems: Confirmation of cyclohexane, mono and disubstituted cyclohexane, heterocyclic compounds, five and six membered heterocycles, stereoelectronic effects, fused bicyclic sptem, decalin, dodecalin, polyclin system, perhydrophenanthrene, bridged systems-conformation of sugars, steric strains due to unavoidable crowding, stereochemistry of the compounds containing nitrogen, sulphur and phosphorous.	
3	**Oxidation** Introduction, different oxidation processes, hydrocarbons-alkenes, aromatic rings, saturated C-H group (activated and unactivated), alcohols, diols, aldehydes, ketones, amines, hydrazine and sulphides.	14
4	**Reduction** Introduction, different reductive processes, hydrocarbons-alkanes, alkenes, alkynes and aromatic rings, Carbonyl compounds-aldehydes, ketones, acids and their derivatives, epoxides, nitro, nitroso, azo and oxime groups, Preparation and properties and application of pd and Ti compounds as organometallic agents	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.

Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.

- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Advance organic chemistry by Jerry March
2. Advance organic chemistry by Carey and Sundberg,
3. Advance organic chemistry by Francis A. carey

E-Resources

- https://www.youtube.com/watch?v=oio3RJHAxOw
- https://www.asu.edu/courses/chm332/PericyclicReactions.pdf
- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Reactions/Pericyclic_Reactions
- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/21%3A_Resonance_and_Molecular_Orbital_Methods/21.11%3A_Pericyclic_Reactions
- https://courses.lumenlearning.com/suny-potsdam-organicchemistry/chapter/conformational-analysis/#:~:text=Conformational%20analysis%20is%20the%20study,through%2Dspace%20interactions%20of%20substituents.
- https://www.ch.ic.ac.uk/local/organic/conf/c1_definitions.html
- https://www.youtube.com/watch?v=ua0_UNoashU
- https://www.thoughtco.com/definition-of-oxidation-in-chemistry-605456#:~:text=Oxidation%20is%20the%20loss%20of,%2C%20molecule%2C%20or%20ion%20decreases.
- https://www.chemguide.co.uk/inorganic/redox/definitions.html
- https://www.khanacademy.org/science/ap-chemistry/redox-reactions-and-electrochemistry-ap/redox-oxidation-reduction-tutorial-ap/v/introduction-to-oxidation-and-reduction
- https://chemed.chem.purdue.edu/genchem/topicreview/bp/ch9/redox.php

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Advanced Organic Synthesis
Subject Code: 256020402
M.Sc. Semester- IV

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Protection of groups** Principle of protection of hydroxyl, amino, carbonyl, carboxylic acid with different reagents and their deprotection, synthetic equivalent groups, synthetic analysis and planning, control of stereochemistry.	14
2		14

	Disconnection approach An introduction to synthesis, and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis one group C-X and two group C-X disconnections, chemo-selectivity, reversal and polarity.	
3	**One group C-C disconnections** Alcohols and carbonyl compounds, region-selectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.	14
4	**Ring synthesis** Saturated heterocycles, synthesis of 3, 4, 5, and 6-membered rings, aromatic heterocycles in organic synthesis.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Organic synthesis: the disconnection approach by stuart Warren (wiley student edition)

2. Organic chemistry- clayden, greeves, warren and wothers, (oxford press)

E-Resources

- https://www.organic-chemistry.org/protectivegroups/
- https://en.wikipedia.org/wiki/Protecting_group#:~:text=A%20protecting%20group%20or%20protective,role%20in%20multistep%20organic%20synthesis.&text=This%20step%20is%20called%20deprotection.
- http://www.chem.ucalgary.ca/courses/351/Carey5th/Ch17/ch17-3-4-3.html
- https://www.youtube.com/watch?v=YYC_vbrgZDY
- https://mazams.weebly.com/uploads/4/8/2/6/48260335/organic_synthesis_the_disconnection_approach_2nd_edition_by_stuart_warren.pdf
- https://www.chemistry.tcd.ie/assets/pdf/sfchemistry/tg/HandoutsSFLecturesinIntroductiontoOrganicChemistry2009.pdf
- http://rushim.ru/books/uchebnik/Warren.pdf
- https://www.slideshare.net/dragnerkar/retrosynthesis-agn-compatibility-mode
- https://www.slideshare.net/RabiaAziz6/retrosynthesis-122337747
- https://www.vanderbilt.edu/AnS/Chemistry/Rizzo/chem223/rings6.pdf

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Bio-organic Chemistry
Subject Code: 256020403
M.Sc. Semester- IV

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Water and vitamins** Water –interaction among biomolecules in aqueous systems, buffering against pH changes, in biological systems, participation of water in biological reactions. Vitamins-classification, introduction, chemistry, absorption transport, mobilization and biochemical functions of Vitamins A, D, E, K, C, B, B2, B6, H and folic acid	14
2	**Proteins and enzymes**	14

	Proteins: properties and conventions of common amino acids, stereoisomerism in α -amino acid, Peptides: formation, compositions and sizes of protein separation, purification and characterization, sequencing of peptides, sanger's method, edman degradation, outline of other methods, protein sequences and evolution. Oxygen binding proteins, haemoglobin and myoglobin in oxygen transport and storage. **Enzymes:** classification, nomenclature and extraction factors affecting catalytic activity and specificity in action, regulation of enzyme activity, enzyme inhibition, illustrative enzymatic reactions using chymotropsin, hexokinase, enolase and lysozyme	
3	**Carbohydrates and nucleic acid** **Carbohydrates:** classification and stereochemistry, biologically important hexose derivatives, nomenclature of disaccharides, structure and role of some homo and hetero polysaccharides, glucoconjugates : proteoglycans, glycoproteins and glycolipids **Nucleic acid:** compounds of nucleic acids, nomenclature of nucleotides, nucleosides, structure of DNA and structure of RNA	14
4	**Lipids** Nomenclature, structure and physical properties of some naturally occurring fatty acids, triacelglycerol and waxes as sources of stored energy, insulation of water repellants, types of membrane lipids, introduction to glycerophospho lipids, galactolipids, sphingo lipids, phospholipids and sterols, bile acids.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Principles of biochemistry –Donald J.Voet, Judish G.Voet, charlotte w. pratt (John willey and sons)
2. Lehninger principles of biochemistry- David L.Nelson and Michael M.wx (Palgrave Macmillan / w.h. freeman company new york)
3. 3. Biochemistry – U.Satyanarayana Baro and allied P.Ltd., kolkata

E-Resources

- https://kidshealth.org/en/teens/vitaminsminerals.html#:~:text=The%20water%2Dsoluble%20vitamins%20%E2%80%94%20C,can't%20store%20these%20vitamins.
- https://www.healthline.com/nutrition/water-soluble-vitamins
- https://www.who.int/water_sanitation_health/dwq/nutrientschap13.pdf
- https://www.freedrinkingwater.com/water-education3/34-water-vitamins.htm
- https://www.medicinenet.com/water_soluble_vitamins_vs_fat_soluble_vitamins/ask.htm
- https://extension.colostate.edu/topic-areas/nutrition-food-safety-health/water-soluble-vitamins-b-complex-and-vitamin-c-9-312/
- https://www.nature.com/scitable/topicpage/protein-function-14123348/#:~:text=Enzymes%20are%20proteins%2C%20and%20they,highly%20specific%20to%20their%20substrates.
- https://www.britannica.com/science/protein/Enzymes
- https://chem.libretexts.org/Bookshelves/Biological_Chemistry/Supplemental_Modules_(Biological_Chemistry)/Enzymes/3._Proteins_as_Enzymes
- https://www.ncbi.nlm.nih.gov/books/NBK9921/
- https://www.ncbi.nlm.nih.gov/books/NBK554481/

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF Chemistry

Selected topics in Medicinal Chemistry
Subject Code: 256020404
M.Sc. Semester - IV

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

- Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
1	**Drug design** Introduction, naming of organic medicinal compounds, literature of medicinal chemistry, development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, pro drugs, soft drugs, phase I, II and III clinical trials, structure activity relationship, theories of drug activity : occupational theory, rate theory, induced fit theory, quantitative	14

	structure activity relationship, history and development of QSAR. Concept of drug receptors, elementary treatment of drug receptor interactions, physio chemical parameters lipophilicity, partition coefficient, electronic ionization constant, concept of 3-D QSAR.	
2	**Pharmacokinetic and pharmacodynamics** Pharmacokinetics: introduction to drug absorption, distribution, metabolism, elimination. important pharmacokinetic parameters in defining drug deposition and in therapeutics, uses of pharmaceutics in drug development process Pharmacodynamics: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, drug metabolism, biotransformation, significance of drug metabolism in medicinal chemistry.	14
3	**Dosage forms, Quality control and application of computers in chemistry** Dosage forms, types of dosages, different roots of administration, quality control of drugs pharmacopias, modern methods of pharmaceutical analysis. **Computer in chemistry** Use of computer in chemistry and industry Important websites for data search chemistry Information about online journals for chemistry	14
4	**Medicine** Overview, Medicinal use of nanomaterials-Drug delivery Protein and peptide delivery –cancer, surgery, visualization, nanoparticle targeting Medical application of molecular nanotechnology-nanorobots, cell repair machines, nanonephrology.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Edited by ManFred E. Wolff (John Wiley & Sons, inc., New York).

2. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).

3. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).

4. QSAR: quantitative structure-activity relationships in drug design by Jean-Luc Fauchère. ISBN:084515141X, 9780845151419

5. QSAR : Hansch analysis and related approaches By Hugo Kubinyi

E-Resources

- https://en.wikipedia.org/wiki/Drug_design#:~:text=Drug%20design%2C%20often%20referred%20to,knowledge%20of%20a%20biological%20target.
- https://www.dovepress.com/journal-editor-drug-design-development-and-therapy-eic19
- https://www.pharmatutor.org/articles/drug-designing-review
- https://newdrugapprovals.org/drug-design/
- https://www.bioagilytix.com/blog/2020/10/05/the-difference-between-pharmacokinetics-and pharmacodynamics/#:~:text=Pharmacokinetics%20is%20the%20study%20of,drug%20does%20to%20the%20body.&text=When%20referring%20to%20pharmaceuticals%2C%20pharmacokinetics,how%20your%20body%20excretes%20it.
- https://www.ashp.org/-/media/store%20files/p2418-sample-chapter-1.pdf
- https://www.ausmed.com/cpd/articles/pharmacokinetics-and-pharmacodynamics
- https://en.wikipedia.org/wiki/Medicine

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

IMMUNOLOGY-I
Subject Code: 253010401
B.SC. Semester -4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students the basic knowledge of immunology, immune system, immunity, antigen, Antibody, and its Interaction. Also detection technique of Ag-Ab.
- The purpose of the course is to introduce students to Introduction of immune system , types of the immunity, and antigen antibody interaction.
- To provide an understanding of the blood grouping technique, Ag-ab detection technique and various cells and organ of immune systems.

Prerequisites

Student Must have studied B.Sc. with Biotechnology as a major subject and knowledge of basic Principle of Immunology.

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Course outline

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Unit No.	Course Contents	Teaching hours
1.	**Immune System:** • Introduction to immune system. • Immune system: Hematopoiesis, Cells and organs of immune system (T cell, B cell, NK cells, APC)	10
2.	**Immunity and its types:** • Types of immunity: a) innate and acquired, b) active and passive, c) humoral and cell-mediated). • Immune response- primary and secondary.	10
3.	**Antigens and Antibodies:** • **Antigen**- Definition, properties and classification, epitopes and hapten. • **Antibody**- Definition, structure, type and function, blood group types, ABO and Rh system,	10
4.	**Antigen –Antibody Interaction:** • Introduction to antigen-antibody interaction. • Precipitation, Agglutination, Cross-reactivity. • Ag-Ab detection techniques: ELISA, RIA, Western blotting	10
		40

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Learning Outcomes

- The students will be able to understand and apply antigen antibody techniques and easily understand the immune system in our body.
- Student should be able to understand basic concepts of Immune system, Types of Immunity, Ag-Ab detection techniques.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- Communicate verbally, graphically, and/or in writing the results of theoretical and laboratory experiments in a clear and concise manner that incorporates the conventions used by biotechnologists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Prescott, Harley, and Klein's Microbiology, J. M. Willey, L. M. Sherwood, C. J. Woolverton, 7 th Edition (2008), McGraw Hill Higher Education- USA .
- Principles of Microbiology, R. M. Atlas, 2nd Edition (Indian Edition) (2015), McGraw Hill Education (India) Private Limited –New Delhi .
- Baker and Silverton's Introduction to Medical Laboratory Technology, Baker F J, Silverton R E Pallister C J, 7th edition (1998), Butterworths-Heinemann, Oxford, UK

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

BIOINSTRUMENTATION

Subject Code: 253010402

B.Sc. 4th Semester

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students basic knowledge of Bio-analytical techniques. This course begins with a review of basic bio analytical technique and an introduction to general terminologies
- The purpose of the course is to introduce students to methods of Bioanalysis and to develop required microbiological skills which will be helpful in their future.
- This course contains bio analytical techniques along with their theory, working principal, common instrumentation and possible applications. This course will be equally beneficial to various scientific areas including, life science, chemical science, material science and environmental science.

Prerequisites

Student Must have studied 2years B.Sc. with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

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Course outline

Unit. No.	Course Contents	Teaching hours
1	**COLORIMETERY AND SPECTROPHOTOMETRY** • Principle, Instrumentation Method and Application of UV-Visible Spectroscopy, • Atomic Absorption Spectroscopy • Flame Photometry • Nephlometery, Infra-Red Spectroscopy • Mass Spectroscopy for Protein Characterization & Identification.	10
2	**ELECTROPHORESIS AND CENTRIFUGATION** **Electrophoresis** • Principle, Support Media • Types and application. Separation of protein and nucleic acids (PAGE, SDS-PAGE, Agarose and IEF) **Centrifugation** • Basic Principles of Sedimentation, types and Applications of Density Gradient Centrifugation (Rate Zonal andIsopycnic), Ultracentrifugation (Introduction and Applications)	10
3	**CHROMATOGRAPHY** • Introduction, Definition and Types of Chromatography, • General Principles Underlying Chromatographic techniques, • Paper chromatography and Thin Layer Chromatography, • Adsorption, chromatography, Ion Exchange Chromatography, • Gas Liquid Chromatography • HPLC, Affinity CHROMATOGRAPHY	10
4	**Bioinformatics** • Definition. Branches of Bioinformatics. • Aim of Bioinformatics. • Scope of Bioinformatics. **Databases** • Types of Databases Primary, secondary ,tertiary and composite databases. • Database retrieval system. **Bioinformatics basic tools** • Blast, sequence alignment, protein structure analysis. NCBI,EBI	10

Learning Outcomes

- The students will be able to use selected analytical techniques. Familiarity with working principals, tools and techniques of analytical techniques. student should be able to understand basic concepts of the present day scope and applications of Bioanalytical techniques.

- The course is designed to understand the strengths, limitations and creative use of techniques for problem-solving.

- The students will be able to select analytical technique for case study. able to design experiments and understand the instrumentation. Students can use their knowedge in Academic and industrial research organization ,Industries based on biotechnology, pharmacy, agriculture, and chemical

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

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Books Recommended

- K. Wilson, J. M. Walker,Principles and techniques of biochemistry and molecular biology (Cambridge University Press, Cambridge, UK : New York, 7th ed., 2009).
- R. F. Boyer, Biochemistry laboratory: modern theory and techniques (Prentice Hall, Boston, 2nd ed., 2012).
- R. Katoch, Analytical techniques in biochemistry and molecular biology (Springer, New York, 2011).
- D. L. Spector, R. D. Goldman, Eds., Basic methods in microscopy: protocols and concepts from cells: a laboratory manual (Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y, 2006).
- R. L. Switzer, Experimental biochemistry (W. H. Freeman and Co, New York, 3rd ed., 1999).
- R. F. Boyer, Modern experimental biochemistry (Benjamin Cummings, San Francisco, 3rd ed., 2000).
- J. R. Lakowicz, Principles of fluorescen

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

BACTERIAL DIVERSITY

Subject Code: 253040401
B.Sc. Semester -4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students basic knowledge of Microbial diversity of Archea bacteria and Eubacteria.
- The purpose of the course is to give students to introduction and basic knowledge of bacterial and archaeal diversity.
- To provide an understanding of different genera of eubacteria.

Prerequisites

Student must have studied First year (FY) of B.Sc. with Microbiology as a major subject and knowledge of basic biology.

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Archea bacteria** • Introduction and phylogeny • General properties ➢ Cell wall and cell membrane ➢ Chromosome ➢ Ribosome • Salient features of: ➢ Methanogens ➢ Halophiles ➢ Thermophillic S^0 metabolizers	**10**
2	**Eubacteria-I** • Photosynthetic bacteria: General properties ➢ Oxygenic photosynthetic bacteria ➢ An-oxygenic photosynthetic bacteria • Chemolithotrophic bacteria ➢ Nitrifying bacteria ➢ Colorless Sulphur bacteria ➢ Iron, Hydrogen and Magnetotactic bacteria	**10**
3	**Eubacteria II** • Gram negative spiral and curved rods: ➢ Spirocheatales ➢ Spiral bacteria ➢ Curved rods • Gram negative aerobic rods and cocci: ➢ Pseudomonadaceae ➢ Neisseriaceae • Gram-negative anaerobic and facultative rods and cocci: ➢ Enterobacteriaceae ➢ Vibrionaceae ➢ Veillonellaceae • Obligatory Parasites: ➢ Rickettsiaceae ➢ Chlamydiaceae ➢ Mollicutes	**10**
	Eubacteria III • Gram positive rods and cocci ➢ Micrococcaceae ➢ Deinococcaceae ➢ Other genera: Streptococcus, Leuconostoc, Peptococcus ➢ Endospore formers ➢ Non spore forming Rods • Gram positive irregular rods	**10**

	➢ Nonfilamentous rods ➢ Aerobic curved rods ➢ Nocardioforms • Filamentous bacteria with complex morphology • Bacteria with unusual morphology ➢ Prosthecate budding/nonbudding bacteria ➢ Nonprosthecate budding/nonbudding bacteria ➢ Sheathed bacteria ➢ Gliding fruiting/nonfruiting bacteria	
TOTAL		**40**

Learning Outcomes

- The students will be able to apply the knowledge of bacterial diversity to understand concepts of various fields like research fields, fermentation industries, food industries, culture collection centers etc. to identification of organism or strains.

- Student should be able to understand basic concepts of Archea bacteria, phylogeny, general features of methanogens; halophiles; Thermophiles. Students also should be able to get knowledge of morphological, cellular, physiological, metabolic and ecological diversity of selected genera of eubacteria.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by microbiologists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups

- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Atlas R M, (2015), *Principles of Microbiology* 2nd Edition, McGraw Hill education, Mumbai
2. Garrity George M, Noel R Krieg et al (2011) *Bergey's Manual of Systematic Bacteriology* (Vol. I to IV) 2ndedition, Editors James T Staley and Aidan C Parte Springer
3. PelczarJr, M J, Chan E C S, Krieg N R, (1986) *Microbiology*, 5thedn, McGraw-Hill Book company, NY

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Food & Dairy Microbiology

CODE:253040402

B.Sc. 4th Sem

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70		100

Objectives: -

- This study will provide the information about the microflora present in food, food and milk borne infections. It will also describe about the food poisoning and also will study about the role of *Staphylococcus aureus*, *Clostridium botulinium* and *Salmonella* etc.
- Students will learn about the various sources of microbial spoilage of food and milk product, how to preserve the food & milk and methods of preservation.
- It will provide the information about how to use microbe as food and food products like various Indian fermented food, mushrooms, spirulina and yeasts.
- Students will get an idea how to grade the quality of food and milk samples using different methods like SPC, CFU, MPN, Acid-fast staining etc.

Prerequisites:-

- Student Must have studied F.Y Year B.Sc. with microbiology as a major subject and knowledge of basic biology.

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- **Course outline:-**

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Sr. No.	Course Contents	Number of Hours
1	**Microbes in food infection and poisoning:** • Food as a substrate for microorganism • Microbial flora of foods: fruits, vegetables, meat, eggs, biochemical, temperature and pathogenic types of milk • Factors affecting kinds and number of microorganisms: intrinsic and extrinsic • Food and Milk borne infections: Microorganism involved, source of infection, Incubation period and characteristics in brief: (A) Bacterial infection: *Salmonella sp*., *Shigella sp*., *E.coli*., *Vibrio sp*., *Campylobacter jejuni*, *Listeria monocytogenes*(B) Viral Infections: *Rotavirus*, Hepatitis A, Polio virus (C) Protozoal infections: *Entamoeba* • Food poisoning: (A) Role of *Staphylococcus aureus*, *Clostridium botulinium*, *Salmonella spp*. (B) Molds as poisoning agents: Role of Mushroom, *Aspergillus*, *Claviceps purpurea*, *Fusarium moniliformis*	**10**

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2	**Microbial food spoilage and preservation:** • Microbial spoilage of food (A) Spoilage of milk and milk product, fruits, vegetables, eggs, meat (B) Spoilage of canned foods • Preservation of food and milk: (A) General principles (B) Preservation of food and Milk :(i) Use of aseptic handling (ii) High temperature: Pasteurization, Sterilization, canning (iii) Low temperature : Refrigeration and freezing (iv) Dehydration (v) Osmotic pressure (vi) Preservatives (vii) Radiations: Ionizing and non-ionizing radiation	**10**
3	**Microbes as food and food products:** • Fermented dairy products (A) Starter culture (B) Cheese: Types, curdling, processing, ripening (C) Other fermented dairy products: Yogurt, cultured buttermilk, acidophilus milk, Kefir and cultured sour milk (D) Introduction to probiotics, prebiotics and synbiotics • Indian fermented food products: Pickles, sauerkraut and bread • Microbes as food: Mushrooms, spirulina and yeasts.	**10**
4	**Methods in food microbiology:** • Biological methods: Generalized scheme for microbiological examination (A) Direct microscopic examination, colony forming units (CFU) (B) Most probable number (MPN) (C) Identification of specific group or species of microorganisms • Bacteriological analysis of milk (03) (A) Grading of milk: Methylene Blue Reduction test and Resazurin test (B) Determination of efficiency of pasteurization: Phosphatase test (C) Determination of MPN (D) Acid-fast staining • Microbiological analysis of mil (A) Microbial standards for food (B) FDA, BIS, Food safety and Standard Act of India (C) Food certification marks in India: ISI, Agmark,	**10**

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	FPO, BIS, FSSAI	
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Learning Outcomes:-

- At the end of the course student will know about the microflora present in foods, different infections caused by food and milk. They will have an idea about the different sources of contamination and also diseases caused by different micro-organisms.
- Students will get an idea about how the food and milk are spoiled and methods for preservation and storage will be learned by them.
- This course will help in knowing the use of microbes as food and food products like Indian fermented foods, using of other sources as energy and food.
- Lastly students will have an idea about the different technology that can be used for monitoring the quality of food and milk.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

1. Pelczar Jr, M J, Chan E C S, Krieg N R, (1986), *Microbiology: An Application Based Approach*, 5th edn. McGraw-Hill Book Company, NY
2. Frazier W C and Westhoff D C (1988), *Food Microbiology*, 4th edn. McGraw-Hill Book Company, NY
3. Prescott L, Harley J P, and Klein D A, (2008), *Microbiology*, 7th edn. Wm C. Brown - McGraw Hill, Dubuque, IA.
4. Indian Standards: Food Hygiene-Microbiological Criteria-Principles for Establishment and Application
5. Fssai: Manual of methods of analysis of foods- food safety and standards authority of India, Ministry of health and family welfare, Government of India, New Delhi, 2015

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Fundamentals of Inorganic Chemistry
CODE : 253020401
B.Sc. 4th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Wave –Mechanics:** Basic postulates of quantum mechanics (Postulates 1,2,3 and 4); Operators: their addition, subtraction and multiplication; Commutators; Particle in a box (One dimensional); Zero potential energy; Characteristics of the wave functions; Electron in a ring.	14
2	**Coordination Compounds:** Application of valence bond theory to some complexes; Shortcoming of valance bond theory; Crystal Field Theory; Orientation of d-orbitals and Crystal Field Splitting of Energy levels; Crystal Field Splitting in Octahedral complexes; Crystal Field Stabilization Energy (CFSE); Crystal Field Splitting in Tetrahedral Complexes; Crystal Field Splitting in Tetragonal and square Planar Complexes; Magnetic Properties of Metal Complexes and Crystal Field Theory; Factors	14

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	influences the magnitude of Crystal Field Splitting; Color of Transition Metal Complexes; Crystal Field Effects on Ionic Radii; Crystal Field Effects on Lattice Energies; Jahn- Teller Effect.	
3	**Chemical Bonding** : Molecular orbital Theory; LCAO Molecular Orbital Theory; Energy Level Diagram for Molecular Orbitals; Mixing of Orbitals; Filling up of Molecular Orbitals; Electronic Configuration of Heteronuclear Diatomic molecules (CO, NO, HF, HCl); Molecular orbitals of Polyatomic Species (BeH2, CO2 , NH3)(Excluding Walsh diagram); M.O. Theory of [Co (NH3)6] 3+ and [CoF6] 3-; Molecular orbital or Band Theory for metals.	14
4	**Non Aqueous Solvents:** Introduction; Classification of Solvents; General Properties of Ionising Solvents (a) Liquid Ammonia (NH3): Physical Properties, Auto-ionization , Acid-Base reactions, Ammonia as a proton – acceptor, Precipitation reactions, Complex formation reaction, Ammonolysis reactions, Reactions of Metal-Ammonia solution, Reduction –Oxidation (Redox) reactions; Advantages and disadvantages of using liquid Ammonia as a solvent. (b) Liquid SO2: Physical Properties, solubility of Inorganic materials and Organic Compounds, Electrolytic conductance behavior of solutions, Acid-Base reactions, Solvolysis, Precipitation reactions, Complex formation reactions, Reduction –Oxidation (Redox) reactions (c) Liquid HF: Physical Properties, Solvent effect, Amphoteric behavior, Precipitation reactions, Reduction –Oxidation (Redox) reactions, Solutions of Compounds of Biological Interest.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Gurdeep Raj, "Advanced Inorganic Chemistry", Goel Publishing House, Meerut, Volume –I, 24th Revised Edition,1998.
2. R.D. Madan, "Modern Inorganic Chemistry', S. Chand & Co. Ltd., New Delhi, 2nd Edition, 2006.
3. J.D. Lee, "Concise Inorganic Chemistry", Wiley India Publication, 5th Edition, 1996, Reprint 2011. 4. W.V. Malik, G.D. Tuli, R.D. Madan, "Selected Topics in Inorganic Chemistry", S.Chand & Co. Ltd., New Delhi, 7th Edition, 2007.

4. A.K. Chandra, “Introductory Quantum Chemistry”, Tata- McGraw Hill Pub. Co. Ltd., New Delhi, 4th Edition.

5. Puri, Sharma, Kalia, “Principles of Inorganic Chemistry”, Milestone Publishers & Distributors, New Delhi, 3rd Edition, 2006.

6. R.K.Prasad, “Quantum chemistry”, New Age International (P) Ltd., Publishers, 4th Edition, 2010. 8. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, “Shriver & Atkins’ Inorganic Chemistry”, Oxford University Press, 2011.

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DEPARTMENT OF CHEMISTRY

Fundamentals of Physical Chemistry
CODE : 253020402
B.Sc. 4th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Thermodynamics** Physical significance of entropy; Entropy change during phase change - solid to liquid and liquid to vapor; Entropy of mixing of ideal gases; Entropy change in reversible and irreversible process; Work and free energy functions; Helmoltz function and variation of free energy change with temperature and pressure; Gibbs Helmoltz equation, derivation. **(B) Chemical Kinetics** Theories of reaction rates: Collision theory of bimolecular gaseous reactions and Activated Complex theory of bimolecular reactions; Effects of temperature on	8 6

	reaction rates; Derivation of Arrhenius equation.	
2	**(A) Electrochemistry** Transport number; Determination of transport numbers by moving boundary method; Conductometric titrations: Principle and advantages; Titration of Strong acid against strong base (HCl vs NaOH); Titration of Weak acid against strong base (CH3COOHvs NaOH); Titration of Strong acid against weak base (HCl vs NH4OH); Titration of very weak acid against strong base (H3BO3 vs NaOH); Titration of mixture of acids against strong base (HCl + CH3COOH vs NaOH); Activity and activity coefficient;Ionic strength. **(B) Phase Rule** Theoretical derivation of phase rule; One component system : water system and sulphur system; Condensed phase rule; Silver – lead (Ag-Pb) system;	14
3	**(A) Adsorption** Definition of terms, Types of adsorption (physical, chemical and their difference), Types of adsorption isotherms (5 types), Derivation of Freundlich adsorption isotherm, Derivation of Langmuir adsorption isotherm, Applications of adsorption **(B) Catalysis** Characteristic of catalysis, Homogenous and heterogeneous catalysis, Enzyme catalysed reaction and derivation mechanism, Marten reaction.	8 6
4	**Polymer Chemistry** Definition: Monomer, Polymer, Polymerization, Classification of Polymers; Chain polymerization:Free radical and Ionic polymerization [cationic and anionic], Coordination polymerization, Step polymerization: Polycondensation and Polyaddition and Ring Opening Polymerization. **(B) Colloids** Colloidal Systems; Preparation of Colloidal Solutions; General Properties of Colloidal Systems; Properties of hydrophobic Colloidal Systems	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Robert Thornot Morrison and Robert Neilson Boyd, ***"Organic Chemistry"***, Prentice Hall

of India Pvt Ltd, New Delhi, Sixth Edition, 1992.
2. Bhupinder Mehta, Manju Mehta, ***"Organic Chemistry"***, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
3. James B Hedrickson Donald J. Cram and George S. Hammond, ***"Organic Chemistry",*** Mc-Graw-Hill Kogakusha,Ltd., Third Edition.
4. Arun Bahl, B. S. Bahl, ***"Advance Organic Chemistry"***, S. Chand & Company Ltd., New Delhi, First Edition, 2003.
5. I. L. Finar, ***"Organic Chemistry"***, Pearson Education Pet Ltd, New Delhi, First Edition, 2002.
6. G. Marc Loudon, ***"Organic Chemistry"***, Oxford University Press, Forth Indian edition, 2010.
7. P.S.Kalsi, ***"Text book of Organic Chemistry"*****,** MacMillan of India Pvt. Ltd., 1999.
8. P.L. Soni and H.M. Chawala, ***"Text book of Organic Chemistry",*** Sultan Chand & Sons Publication, New Delhi, 26th Edition, 1995.

Environmental Science and Ecology-ENV-101
Code:
M.Sc. : 1st SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Basic of Ecology and Ecosystem** Introduction, Interactions between species, Natural selection, Species richness, Ecological succession, Food chains and food webs, Primary production, Energy flow in ecosystems, Secondary productivity, Decomposition, Ecosystem stability.	6
2	**Terrestrial Biomes and Forest Resources** Introduction, Tundra and Taiga, Temperate deciduous forest, Mediterranean vegetation, Temperate and tropical grasslands, Desert and tropical rainforest, Forest Resources-Uses, Forest Type and Management, World Forest Cover, Forest Resources of India, Deforestation, Effect of Deforestation on Tribal People, Effect of Dams on Forest, Forest Degradation in India, Sustainable Forest Management.	8
3	**Mineral and Food Resources** Introduction, Exhaustibility, Localized Occurrence, Uses and Exploration of Mineral Resources, Environmental Effects of Mineral Exploration and Usage, World Food Problems and Production, Pesticides in Modern Agriculture and Environmental Problems, Environmental Limits for Increasing Food Production, Solutions: Sustainable Agriculture, Impact of Irrigation on Environmental Quality.	6
4	**Conservation of Natural Resources and Environmental Management** Conservation of Natural Resources, Role of Individuals in Sustainable Environmental Management, Value System and Equitable Resources Use for Sustainable Life System, Role of Individuals in Conservation and Prevention of Pollution.	4

ENV 101 PR **Ecological Experiments**

1. Determination of minimum size quadrat by the Species Curve method.
2. Determination of minimum no. of quadrat to be laid down in the field under the study.
3. Study of vegetation using line transect method.
4. Study of vegetation using belt transect method.
5. Study of vegetation using chart quadrat method.
6. Determination of important value index (IVI).

Reference Books

1) Y. Anjaneyulu, "*Introduction to Environmental Science"*, BS Publications,Hyderabad, India, 2004.
2) H. Kaur, "*Environmental Studies"*, Pragati Prakashan, 2006.
3) Andrew R.W., Jackson & Julie M. Jackson, "*Environmental Science – The Natural Environment and Human Impact"*, Addison Wesley Longman Limited, 1996.
4) S.C. Santra, "*Environmental Science"*, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2005.
5) Richard T. Wright, *"Environmental Chemistry",* Pearson Education Inc., South Asia, 2007.
6) Sharma B.K., "*Environmental Chemistry"*, Goel Publ. House, Meerut, 2001.
7) Wanger K.D., "*Environmental Management"*, W.B. Saunders Co. Philadelphia, USA, 1998.
8) Krebs J.R., Davies N.B., "*Behavioral Ecology: An Evolutionary Approach"*, 3rd Edition, Oxford: Blackwell Scientific, 1991.
9) Ricklifs R.E., "*Ecology"*, 3rd Edition, W.H. Ereeman, New York, 1990.
10) O' Neill P., "*Environmental Chemistry"*, 2nd Edition, Chapman & Hall, London, 1993.
11) Bunce N. J., "*Environmental Chemistry"*, Wuerz, Winnipeg, 1990.
12) Y. Anjaneyulu, "*Introduction to Environmental Science"*, BS Publications,Hyderabad, India, 2004.
13) H. Kaur, "*Environmental Studies"*, Pragati Prakashan, 2006.
14) Andrew R.W., Jackson & Julie M. Jackson, "*Environmental Science – The Natural*

Environment and Human Impact", Addison Wesley Longman Limited, 1996.

15) Richard T. Wright, *"Environmental Chemistry",* Pearson Education Inc., South Asia, 2007.
16) Sharma B.K., "*Environmental Chemistry"*, Goel Publ. House, Meerut, 2001.
17) Wanger K.D., "*Environmental Management"*, W.B. Saunders Co. Philadelphia, USA, 1998.
18) Krebs J.R., Davies N.B., "*Behavioral Ecology: An Evolutionary Approach"*, 3rd Edition, Oxford: Blackwell Scientific, 1991.
19) Ricklifs R.E., "*Ecology"*, 3rd Edition, W.H. Ereeman, New York, 1990.
20) O' Neill P., "*Environmental Chemistry"*, 2nd Edition, Chapman & Hall, London, 1993.
21) Bunce N. J., "*Environmental Chemistry"*, Wuerz, Winnipeg, 1990.

ENVIRONMENTAL ISSUES AND IMPACTS-102
Code:
M.Sc. : 1st SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

Sr. No.	Course Contents	Number of Hours
1	**The Atmosphere and Acid Rain** Composition of the atmosphere, Residence times, sources and sinks, Evolution of the primitive atmosphere, Temperature profile of the atmosphere, Atmospheres around the other planets, Nature and Development of Acid Rain, Acid Rain and its impacts on geological Environment, Terrestrial Environment, and Build Environment, Impact of Acid Rain on Human Health and Mitigation of its problems.	5
2	**Stratospheric Ozone and Tropospheric Chemistry** The ozone layer, Formation and destruction of ozone, Chlorofluorocarbons, The Montreal Protocol, CFC replacement compounds, Nitrogen oxides as ozone depleters, The hydroxyl radical as an oxidant, Oxidation of carbon monoxide by OH, Oxidation of methane, Photochemical smog, Tropospheric concentration of OH, Particles in the atmosphere, London smog, Particles and climate, Control of particles.	5
3	**Global Warming and Climate Change** Introduction, Greenhouse Gases and Global Climate Changes, Global Warming Potential, Possible Impact of Global Warming, Greenhouse Effect – Policy Response, Kyoto Protocol, EI NINO- Climate Cycle.	5

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	Ozone in the Atmosphere, Ozone Hole, Worldwide Ozone Trends, Consequence of Ozone Depletion, Consequences of global CO_2 changes, Strategies for Conservation of Environmental Changes Induced by CO_2 Rise.	
4	**Radiation Hazardous and Environmental Degradation** Introduction, Radiation: Atomic and Natural Background, Measurement of Radio Activity, Nuclear Winter, Radioactive Waste, Ionizing Radiation, Anthropogenic Sources and Effects of Radioactive Pollution, Preventive Measurements.	**5**

Course Outcome: A wide range of aspect is covered about the atmosphere and its correlation with environment. However, addition to this, knowledge on atmospheric radiation dwindling around and its degradation is also notified to give better understanding of global warming and climate change.

Reference Books

1) Nigel J. Bunce, "*Environmental Chemistry"*, Wuerz Publishing Ltd, Winnipeg, Canada, 1991.
2) S.C. Santra, "*Environmental Science"*, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2005.
3) H. Kaur, "*Environmental Studies"*, Pragati Prakashan, 2006.
4) Joner J.AA., "*Global Hydrology: Processes, Resources and Environment"*, Longman, Essenx, England, 1997.
5) Wilson E.O., "*Biodiversity"*, National Academy Press, Washinton, DC, 1988.
6) Tudge, Colin, "*Global Ecology"*, Oup, New York, 1991.
7) Moeller, Dave W., "*Environmental Health"*, Mass: Harvard University Press,Cambridge, 1992.
8) Eds. J.D. Coyle, R.R. Hill and D.R. Roberts, "*Light, Chemical Change and Life"*, Open University press, Milton Keynes, England, 1982.

B.J. Finlayson-Pitts and J.N. Pitts, "*Atmospheric Chemistry"*, Wiley-Interscience, New York, 1986.

ENERGY AND ENVIRONMENT -103
Code:
M.Sc. : 1st SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

Sr. No.	Course Contents	Number of Hours
1	**Energy Flow and Equilibrium** Introduction, The laws of energy flow, Dynamic equilibrium and spontaneous change, Chemical kinetics, Atoms and elements, Molecules and covalent compounds, Valency and periodic table of the elements, Oxidation states, Compound mixtures, Chemical species and chemical reactions, The atomic nucleus and nuclear reactions.	4
2	**Energy Production and Management** Introduction, Energy Production and Consumption, Sources of Energy, Renewable Energy, Energy Conservation, Solar Energy Input, Conventional Fuels, Natural Gas, Uranium, Nuclear Energy and Nuclear Reactions, The Risk of Nuclear Accidents	4
3	**Non-Conventional and Biological Energy** Introduction, Photovoltaics, Solar Heating, Wind Energy, Tidal Power, Biomass and Biofuels, Natural Vegetation, Energy Tree Plantations, Specific Energy Crops, Power from Biomass, Biomass Programs, Biomass and the Environment.	5

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4	**Energy from Wastes** Introduction, Water-Based Biomass, Energy from Wastes, Solid Wastes, Research and Development, Biogas Plants in India and its use, Utilization of Effluent, Cost of Installation and Annual Savings, Financial Assistance from Government, Organization of the Biogas Sector, Potential for Biogas Generation and Digester Construction, Future Energy Scenario of the World.	5

Reference Books

1) Andrew R.W., Jackson & Julie, M. Jackson, "*Environmental Science – The Natural Environment and Human Impact"*, Addison Wesley Longman Limited, 1996.
2) S.C. Santra, "*Environmental Science"*, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2005.
3) Flowler, John M., "*Energy and the Environment"*, 2nd Edition, McGraw Hill, New York, 1984.
4) Atkins P.W. and J.A. Beran, "*General Chemistry"*, 2nd Edition, W.H. Ereeman, NewYork, 1992.
5) Weast R.C., "*Handbook of Chemistry and Physics"*, CRC Press, 1994.
6) Ebbing, D.D., *"General Chemistry",* (International 4th Edition) MA: Houghton Mifflin,Boston, 1993.
7) Carless, Jennifer, *"Renewable Energy: A Concise Guide to Green Alternative"*, Walker, New York, 1993.
8) Gray, N.E., *"Biology of Wastewater Treatment"*, Oxford University Press, New York, 1992.

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ENVIRONMENT AND SOIL -104

Code:

M.Sc. : 1st SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	50	70	-	150

Sr. No.	Course Contents	Number of Hours
1	**Soil Composition, Formation and Morphology** Preview and Historical Perspectives, Weathering of Soil Minerals, Soil Formation and the factors, Land, Development and Horizons, Degradation and Destruction, Quality Assessment, Soil Individual and Mapping Units, GIS and GPS for Soil.	6
2	**Physical Properties of Soil** Soil Texture, Rock Fragments, Soil Structure, Particle Density and Bulk Density, Soil Porosity and Permeability, Soil Air, Rhizotrons, Soil Consistence, Soil Color, Soil Temperature, Other Soil Physical Properties.	6
3	**Soil Water Properties** Water and its Relation to Soil, Terminology and Classifications for Soil Water, Soil as Water Reservoirs, Soil Water Content, Instruments for determining Water Content or Potential, Water Flow into and through Soils, Water Uptake by Plants, Consumptive Use and Water Efficiency, Reducing Water Loss	6
4	**Chemical and Acidic Properties of Soil** Soil Clays, Organic Colloids, Cation/Anion Exchange and Adsorption, Reactions and Buffering in Soils, Ecological Relation of Soil Acidity, Composition and Reactions of Lime, Crops, Lime and Soil, Lime Balance Sheet, Acidifying Soils.	6

ENV 104 PR Soil Analysis

1. Soil moisture measurement.
2. Determination of soil pH.
3. Determination of salt in soil.
4. Determination of calcium and magnesium in soil.
5. Determination of chloride in soil.
6. Determination of carbonate and bicarbonate in soil.
7. Determination of total phosphorus.

Books Recommended:

1) Raymond W. Miller, Duane T. Gardiner, "*Soil in our Environment"*, 8th Edition,Upper Saddle River, New Jersey, 1998.
2) Dr. H. Kaur, *"Environmental Chemistry*", 2nd Edition, Pragati Prakashan, Meerut,2007.
3) E.A. FitzPatrick, "*Soils: Their Formation, Classification and Distribution"*, Longman Publishers, 1980.
4) Karl Terzaghi, Ralph B. Peck and Gholamreza Mesri, "*Soil Mechanics in Engineering Practice"*, 3rd Edition, John Wiley & Sons, New York, 1996.
5) R.G.Burns, "*Soil Enzymes"*, Academic Press, New York, 1978.
6) S.L. Tisdale, W.L. Nelson, J.P. Beaton and John L. Havlin, "*Soil Fertility and Fertilizers"*, 5th Edition, Macmillan, New York, 1993.
7) F.R. Troch, J.A. Hobbs, and R.L. Donahue, "*Soil and Water Conservation"*, 2nd Edition, Prentice-Hall Englewood Cliffs, NJ, 1991.

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WATER QUALITY AND WASTEWATER TREATMENT TECHNIQUES -ENV-201
Code:
M.Sc. : 2nd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	0	4	4	30	00	70	-	100

Sr. No.	Course Contents	Number of Hours
1	**Water Resources and Classification of Water Pollutants** Introduction, Hydrological Cycle, Surface Water, Ground Water, Natural Conditions That Influence Water Quality, Methods for Managing Water Resources, Utilization of water, Origin of Wastewater, Types of Water Pollutants and their Effects.	5
2	**Wastewater Sampling and Analysis Methods** Sampling, Methods of Analysis, Determination of Organic Matter, Determination of Inorganic Substances, Physical Characteristics, Bacteriological Measurement.	4
3	**Wastewater Treatment Techniques** Basic Process of Water Treatment, Primary Treatment, Secondary (Biological) Treatment, Advanced Wastewater Treatment, Recovery of Materials from Process Effluents.	6
4	**Industrial Chemical Processes and Water Quality Regulations** Sugar Industry and Distillery, Pesticides, Drugs and Pharmaceuticals, Pulp and Paper Industry, Tanneries, Dye and Dye Intermediates, Paints and Synthetic Resins, Fertilizer Industry, Dairy Industry, Water Quality Regulations.	6

Course Outcome: Water is very important aspect of life and this paper enlightens students about its availability, use, presence of pollutants, conservation and rules and regulations.

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ENV PR WATER ANALYSIS

1. Determination of pH, Conductivity.
2. Determination of Total Hardness.
3. Determination of Chloride, Acidity and Alkalinity.
4. Determination of DO, BOD and COD.
5. Determination of Phosphate, Iron, Sulphate, Fluoride.
6. Determination of Oil and Grease.

Reference Books

1) Y. Anjaneyulu, "***Introduction to Environmental Science"***, BS Publications, Hyderabad, India, 2004.
2) K. Vigil, ***"Clean Water- An Introduction to Water Quality and WaterPollution Control",*** 2nd Edition, Oregon State University Press, USA, 2003.
3) C.S. Rao, ***"Environmental Pollution Control Engineering",*** Wiley EasternLimited, New Delhi, India, 1995.
4) S.C. Bhatia., ***"Solid and Hazardous Waste Management",*** Atlantic Publishers and Distributors (P) Ltd., 2007.
5) Brown, R.L., ***"Treatment of Water and Solid Wastes",*** Springer Field, New York.
6) S.C. Santra, "***Environmental Science"***, 2nd Edition, New Central BookAgency (P) Ltd, Kolkata, India, 2005.
7) S.N. Kaul., Arvind Kumar., ***"Waste Water Engineering",*** APH Publishing Corporation, New Delhi, India, 2006.
8) G.S.Sodhi., ***"Fundamental Concepts of Environment Chemistry",*** (3rd Edition), Narosa Publishing House Pvt. Ltd., New Delhi, India, 2009.
9) Mark M. Benjamin***., "Water Chemiatry",*** McGraw-Hill, New York, 2002. 10)J.C. Currie, and A.T. Pepper, ***"Water and The Environment",*** Ellis Horwood Limited, England, 1993.

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INTEGRATED SOLID WASTE MANAGEMENT - ENV 202

Code:

M.Sc. : 2nd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Sr. No.	Course Contents	Number of Hours
1	**Basic Concepts of Solid Waste Management and Volume Reduction Technologies** Introduction, Types of Solid Waste, Solid Waste Collection, Factors in Planning, Reducing the Amount of Garbage, Hierarchy of Waste Management, Source Reduction Policy: Goals and measurement methodology, initiatives, government programmes, Cost of Environmental Management, Concentrating Methods: vaccum filtration, rotary drum precoat filter, pressure filteration, centrifuge dewatering, Incineration of Municipal Sludge.	8
2	**Recycling of Solid Waste** Introduction, Ways to Recycle, Collection of Recyclables, Processing Equipment for Recycling Facilities: Baling, magnetic separation, screening, Size Reduction, Air classification, Processing Recyclables: source separated recyclables, glass, plastics, can and metal processing, Recycling of PVC and related products, Automotive and Household Batteries.	6
3	**Composting and Landfilling of Municipal Solid Waste** Introduction, Definition, Classification of Compost Process, Compost Phases, Environmental Factors and Operational parameters affecting Composting, Classification of Compost system, Classification of Landfills, Landfilling Methods, Generation and Composition of Landfill Gases, Formation and Composition of Leachate.	5
4	**Hazardous Waste** Introduction, Definition of various Hazardous Waste, Transportation of Hazardous Waste, Treatment, Storage and Disposal, Site Remediation, Hazardous Waste Minimization, Medical and Hospital Wastes, Nuclear Pollution and Radio-active Wastes.	4

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Course Outcome: To improve environment it is necessary to eradicate solid waste. Thus, student understand types, source, recycling and management of solid waste by studying this paper.

Reference Books

1) S.C. Bhatia., ***"Solid and Hazardous Waste Management",*** Atlantic Publishers and Distributors (P) Ltd., 2007.

2) Curds, C.R. and Hawkes, H.A., ***"Basic Hazardous Waste Management",*** Academic Pres, London.

3) Goldberg, E.D., ***"Hazardous Waste Management",*** Gordon and Breach, Science Publishers, New York.

4) Odum, E.P., ***"Integrated Solid Waste Management",*** John Wiley & Sons,New York.

5) Lehr, J.H., Tyler, E.G., Wayne, A.P. and Jack, D., ***"Handbook of Solid Waste Management",*** McGraw-Hill, New York.

6) Nemerow, N.L., ***"Industrial Waste Management",*** Addison-Wesley Publishing Company, Philippines.

7) James, A. and Evison, L., ***"Treatment of Industrial Wastes",*** John Wiley& Sons, New York.

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Aquatic and marine Environmental Chemistry - ENV 203

Code:

M.Sc. : 2nd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Sr. No.	Course Contents	Number of Hours
1	**Fundamentals of Aquatic and Marine Chemistry** The Aquatic Environment, The Acidity of Water, Metal Complexes in Solution, Oxidation and Reduction, Deposition Dissolution and Processes, Pharmaceuticalsfrom the Sea.	8
2	**Contamination and Pollutants in the Marine Environment** Introduction, Pollution of Marine Environment, Sources and Nature of pollutants, Oil Pollution and Marine Biota, Microbial Degradation of Oil and Petrochemical in the Sea, Metallic Pollutant and Aquatic Biota of the Sea, Status of Coastal and Estuarine Pollution in India, Mitigation of Marine Pollution	6
3	**The Oceans and Climate** Introduction, The Complex Medium Called Seawater, Spatial Scales and the Potential for Change, Oceanic Gases and the Carbon Cycle, Oceanic Gases and Cloud Physics, Feedback Processes Involving Marine Chemistry and Climate, Future Prospects	5
4	**Remote Sensing and Geographical Information and PositioningSystem** Principles of Remote Sensing, Types of Remote Sensing, System Overview in Remote Sensing, Application of Remote Sensing, GIS and GPS.	4

Course Outcome: Earth consist of water and thus it is extremely necessary to understand water bodies present as it serves main source of living that is water. So, this paper gives students are wider vision towards the chemistry prevailing in aquatic and marine zone and apart from that their conservation. However, inclusion of remote sensing is also done just to give knowledge about correlation between remote sensing and its usefulness to environment.

Reference Books

1) Alan, G. Howard, "***Aquatic Environmental Chemistry"***, Oxford UniversityPress, Oxford, New York, 1997.
2) R.E. Hester and R.M. Harrison, "***Chemistry in the Marine Environment"***, Published by The Royal Society of the Chemistry, Cambridge, UK, 2000.
3) S.C. Santra, "***Environmental Science"***, 2nd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2005.
4) Manahan, S.E., "***Environmental Chemistry"***, Lewis Publishers, Chelsea Michigan, 1995.
5) Ward, R.C., and Robinson, M., "***Principles of Hydrology"***, 3rd Edition,McGraw-Hill, Maidenhead, 1989.
6) J.A. Knauss, "***An Introduction to Physical Oceanography"***, Prentice Hall, Englewood, NJ, 1978.
7) G.R. Bigg., "***The Oceans and Climate"***, Cambridge University Press,Cambridge, 1996.
8) J.T. Houghton, L.G. Meira Filho, B.A. Callander, N. Harris, "***Climate Change"***, Cambridge University, Cambridge, 1996.
9) S. Grabley and R. Thiericke, "***Drug Discovery from Nature"***, Springer,Berlin, 1999.

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AIR POLLUTION: QUALITY AND CONTROL METHODS - ENV 204

Code:

M.Sc. : 2nd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Sr. No.	Course Contents	Number of Hours
1	**Sources and Effects of Air Pollution** Definition, Classification and Properties of Air Pollutants, Emission Sources, Behavior and Fate of Air Pollutants, Photochemical Smog, Effects of Air Pollution: human health, vegetation and materials, Air (Prevention and Control of Pollution) Act1981	6
2	**Sampling and Measurement of Air Pollutants** Types of Pollutant Sampling and Measurement, Ambient Air Sampling, Collection of Gaseous Air Pollutants: garb sampling, absorption in liquids, adsorption on solids, freeze out sampling, Collection of Particulate Pollutants, Stack Sampling: sampling system, particulate and gaseous sampling, Analysis of Air Pollutants.	6
3	**Air Pollution Control Methods and Equipment** Introduction, Source Correction Methods, Particulate Emission Control Equipments: gravitational settling chambers, cyclone separators, fabric filters, electrostatic precipitators, wet collectors, Control of Gaseous Pollutants: Control of Sulphur, Dioxide Emission, Nitrogen Oxides, Carbon Monoxide, Hydrocarbons, Mobile Sources.	6
4	**Indoor Air Quality** Nature, Sources and Toxicity of Indoor Air Pollutants, Syndromes related to indoor air quality: Sick building syndrome, building related illness, multiple chemical sensitivity or chemical hypersensitivity syndrome, Sources and Sinks in the Indoor Environment.	6

Course Outcome: This paper illuminates' students about air quality prevailing in environment. Apart from this it also educates them about the toxicity lead due to air pollution and measures to treat them.

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Books Recommended:

1 C.S. Rao, ***"Environmental Pollution Control Engineering",*** Wiley Eastern Limited, New Delhi, India, 1995.

2 M. Marconi, B. Seifert and T. Limdwall, ***"Indoor Air Quality"***, ElsevierScience B.V., Netherland, 1995.

3 S.H. Stoker, and S.L. Seager, ***"Environmental Chemistry: Air and Water Pollution"***, Scott Foresman & Co., New York, 1976.

4 P.O. Warner, ***"Analysis of Air Pollutants",*** John Wiley & Sons, New York,1976.

5 J.D. Butler, ***"Air Pollution Chemistry",*** Academic Press, London, 1979.

6 S.C. Santra, "***Environmental Science"***, 2nd Edition, New Central BookAgency (P) Ltd, Kolkata, India, 2005.

7 Y. Anjaneyulu, "***Introduction to Environmental Science"***, BS Publications, Hyderabad, India, 2004.

8 Trivedi, R.K. and P.K. Goal, ***"Introduction to Air Pollution",*** Techno-Science Publications.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

MOLECULAR TECHNIQUES

Subject Code :253010502

B.Sc. Semester- 5

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives:-

- To provide basic knowledge Molecular Techniques
- **Molecular biology** is the branch of biology that concerns the molecular basis of biological activity in and between cells, including molecular synthesis, modification, mechanisms and interactions. The central dogma of molecular biology describes the process in which DNA is transcribed into RNA then translated into protein.
- Particular areas of interest include the following: stability and expression of cloned gene products, cell transformation, gene cloning systems and the production of recombinant proteins, protein purification and analysis, transgenic species, developmental **biology**, mutation analysis, the applications of DNA fingerprinting, RNA interference, and PCR technology, microarray technology..
- Molecular Biotechnology publishes original research papers on the application of molecular biology to both basic and applied research in the field of biotechnology.
- Increasing knowledge of the molecular basis of disease and advances in technology for analyzing nucleic acids and gene products are changing pathology practice.
- The explosion of information regarding inherited susceptibility to disease is an important aspect of this transformation.

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Prerequisites:-

- Student Must have studied 2years B.Sc. with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.
- Students must have basic knowledge of Molecular Techniques

Course outline:-

Unit No.	Course Contents	Teaching Hours
1.	**Gene libraries:** • Genomic libraries, cDNA libraries, • PCR: types and applications-Basic PCR and RT-PCR	10
2.	**Techniques:** • Nucleic acid hybridization, • Colony and plaque hybridization, • Southern, Northern and Western blotting, • Dot-Blot, • Differential screening. • In situ hybridization, • FISH (radioactive and non-radioactive detection of hybridization), • Autoradiography.	10
3.	**Molecular markers:** • RFLP, • RAPD, • AFLP, • SNP, • Satellite DNA. • DNA Fingerprinting- process and its application.	10
4.	**DNA sequencing:** • Chain termination, chemical cleavage and automated. • DNA Foot printing- types and application. • *In vitro* transcription and *in vitro* translation, various systems and application.	10
		40

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Learning Outcomes:

- At the end of the course the student would have basic knowledge of molecular techniques.
- Increasing knowledge of the molecular basis of disease and advances in technology for analyzing nucleic acids and gene products are changing pathology practice
- The practice of anatomic and clinical pathology is being transformed by new knowledge in molecular pathology and human genetics and by advances in the application of molecular biology technology.
- Many residents enter pathology training with sophisticated backgrounds in molecular biology and human genetics obtained from research experiences, graduate programs, and medical school courses

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Winnacker, Ernst L. (1987), *From genes to clones :* introduction to gene technology
- R. W. Old and S. B. Primrose, *Principles of Gene Manipulation. An Introduction to Genetic Engineering. 1981*
- PK Gupta. *Biotechnology and Genomics*
- RC Dubey. *A text of biotechnology –*

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DEPARTMENT OF BIOTECHNOLOGY

FERMENTATION TECHNOLOGY- I

CODE: 253010501

B.Sc. 5th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives: -

- To provide basic knowledge of bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. What are primary and secondary screening, how to isolate enzymes producing microbes.
- Need to know the importance of strain improvement, what different methods can be used for strain improvement. Students get to know about the use of precursors in the fermentation process.
- This study gives idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- The student will get an idea about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.
- To provide the idea about down streaming process how to get end product in the fermentation.

Prerequisites:-

Student must be passed second year B.Sc in Microbiology as major subject along with the knowledge of biology.

Course outline:-

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Sr. No.	Course Contents	Number of Hours
1.	**Introduction to fermentation technology** • Fundamental concepts of fermentation • Chronological development in industrial microbiology • Introduction to the component parts of fermentation process • Range of fermentation processes	10
2.	**Industrially important microorganisms** • SCREENING: (A) Characteristics of industrially important microorganisms (B) Primary screening of organic acid producers, Primary screening of antibiotics, growth factors, and enzyme producers. (C)Significance of secondary screening • STRAIN IMPROVEMENT (A) STRAGIES i. Selection of induced mutants ii. Selection of recombinants (B) Strain improvement for modification of properties other than yield (C) Preservation: Principle, methods and quality control	10
3.	**Fermenter Design & Fermentation Process** • Stirred tank bioreactor (A) Basic functions of fermenter and design (B) Structural components of fermentor (C) Devices of aeration and agitation (D) Devices for monitoring pH, temerpature, foam and dissolved oxygen • Types of fermentation - Submerge (Batch, Fed batch and Continuous). • Solid state fermentation.	10
4.	**Fermentation media and inoculum development** • Fermentation media (A) Principles of media formulation (B) Media ingredients: water, carbon sources, nitrogen sources, minerals, growth factors, buffers, chelators, precursors, inducers, inhibitiors, antifoam agents • Methods of sterilization (A) Use of high pressure steam: principle, batch and Continuous sterilization process (B) Use of filtration: principle, types of filter.	10

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	• Inoculum development: general principles for development of seed culture for bacterial, yeast and fungal processes	
		40

Learning Outcomes:

- Student will learn about the bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. Types of substrate used for fermentation and about medium optimization.
- Provide an idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- Get knowledge about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.
- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.

Teaching & learning Methodology:

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

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Basic Text & Reference Books:

- Principles of Fermentation Technology : Whitaker & Stanbury Comprehensive
- Biotechnology : Murray Moo Young
- Methods in Industrial Microbiology : Sikyta
- Fermentation Microbiology and Biotechnology, El Mansi and Bryc

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY

Subject Code: 253010503

B.SC. Semester -5

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide students the basic knowledge of Environmental of biotechnology.
- The purpose of the course is to give student to introduce about biotechnology field like environmental biotechnology.
- To provide an understanding of various types of pollutions, bioleaching process, biomagnifications, biodegradation and bioremediation process and knowledge of biosensor mechanism.

Prerequisites

Student must have studied B.Sc. with biotechnology as a major subject and knowledge of basic Environmental biotechnology.

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Course outline

Unit No.	Course Contents	Teaching hours
1.	**Bioremediation :** • Bioremediation principles • Strategies and techniques of bioremediation: in situ and ex situ • Bioremediation of metals • Phytoremediation • GMOs and their impact on bioremediations	10
2.	**Biodegradation :** • Principles of biodegradation and mechanism of detoxification • Biodegradation of detergent, pesticide, lignin, hydrocarbon and dyes	10
3.	**Biodeterioration:** • Principles and mechanisms of biodeterioration • Methodology to assess biodeterioration • Prevention and control of biodeterioration • Biodeterioration of selected materials	10
4.	**Environmental Problems & monitoring:** • Biosensor: types, principle, applications and limitations. • Bioplastic- Introduction, technology and applications, • Biotransducer	10
		40

Learning Outcomes

- The students will be able to understand the Knowledge of the environmental biotechnology to understand concepts of various types of pollution, waste water treatment process, Bioleaching process, biomagnification, Biosensor process.
- Student should be able to understand basic concepts of Environmental biotechnology such as water treatment process, bioleaching of metal, application of bioremediation process.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- U. Satyanarayana- Biotechnology
- B.C. Bhattacharyya and R. Banerjee- Environmental Biotechnology
- G. M. Evans and J. C. Furlong- Environmental Biotechnology
- S. C. Santra, Central, India- Environmental Science

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Genetic Engineering and Tissue culture

Subject Code: 253010504

B.Sc. Semester-5

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Th	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide basic knowledge of Applications of Biotechnology
- The purpose of the course is to introduce students to methods of 'Biotechnology' combines utilizing the living systems - microorganisms, plants, animals with basic scientific and engineering, for providing various solutions for improving our lives.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ Industrial field/ medical / Environmental Sciences.

Prerequisites

Student Must have studied BS.c with Biotechnology as a major subject and knowledge of genetic engineering

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Recombinant vectors** • Characteristics of an Ideal Vector • Plasmid(pBR322) • pUC vectors • Bacteriophage Lambda • Cosmid • Construction of recombinant DNA and transformation • Visual selection by antibiotic • Blue-white selection.	10
2	**Genetic engineering** • Introduction of Genetic Engineering • Molecular tools of Genetic Engineering • Restriction endonucleases • DNA Cutting enzyme • DNA Ligation Techniques • DNA Modifying Enzymes • Gene transfer methods	10
3	**Tissue culture-I** • Introduction of tissue culture • Types of tissue culture • Plant tissue culture • Method and significance of PTC • Application of PTC	10
4	**Tissue culture-II** • Animal tissue culture introduction • Primary culture and established cell line cultures • Equipment and material for animal cell technology • Basic media and techniques of mammalian cell culture • Manipulation and application of animal cell culture	10
		40

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Learning Outcomes

- The students will be able to understand and the basic principles and, the tools and techniques of Genetic engineering

- The course is designed to give students an understanding of the applications of genetic engineering in various fields.

- This is a course where the topics to be studied include different types of plant cultures, to understand principles of animal culture, media preparation , To describe meristem culture and clonal propagation of plants on a commercial scale.

- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

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Books Recommended

- PRINZIPIEN DER BIOCHEMIE Textbook by Albert L. Lehninger, David L. Nelson, and Michael M. Cox
- Elements of Biotechnology P. K. Gupta Rastogi Publications, 1994 - Biotechnology
- A TEXTBOOK OF BIOTECHNOLOGY BY R C DUBEY
- Biotechnology and genomics P. K. Gupta, Rastogi Publication
- Molecular biology and genetic engineering P. K. Gupta

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Chemistry C -I
CODE : 253020501
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Carbohydrates** Disaccharides, structure of (+) maltose, (+) cellobiose, (+) lactose and (+) sucrose. **(B) Purine and Pyrimidines** **(i)** Purines – Synthesis of Purines, Adenine and Guanine. **(ii)** Pyrimidines – Synthesis of Pyrimidine, Uracil, Thymine and Cytosine.	14
2	**(A) Nucleophilic Substitution at a Saturated Carbon Atom** Mechanism and scope of reaction-available mechanism, Kinetic Characteristics, Scope of reaction, Stereochemistry of S**N**1 and S**N**2 reactions, Relative reactivity in substitution, Solvent effect, variation at carbon site, Relative leaving group activity, S**N**i (substitution nucleophilic internal) Mechanism and Neighboring group participation. Elimination Reactions, E1, E2 and E1cB mechanism, Orientation E1and E2 reactions, Elimination Vs	14

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	Substitution. **(B) Nucleophilic Aromatic Substitution** Nucleophilic aromatic substitution, Bimolecular displacement and its mechanism, Reactivity, Orientation, Electron withdrawal by resonance, Evidence for the two steps-mechanism, Elimination-addition mechanism-Benzyne.	
3	**(A) Inorganic reagents for Organic synthesis** Use of specific reagents and their synthetic applications with mechanism. (i) Aluminium Isopropoxide (ii) Lithium Aluminium Hydride (iii) Adams's catalyst (PtO2) (iv) Selenium Dioxide (v) Osmium Tetroxide (vi) Lead Tetraacetate **(B) Molecular rearrangements and Name Reactions** Rearrangements occurring through Carbocations, carbenes and nitrenes Principle, Mechanism and Synthetic applications of the reactions: (i) Wolf rearrangement (ii) Fries migration (iii) Hoffmann reaction (iv) Oppenauer oxidation reaction (v) Diels-Alder reaction (vi) Birch Reduction	14
4	**(A) Stereo Chemistry (I)** Optical activity in the absence of chiral carbon (Biphenyls, Allenes and Spirans) **(B) Stereoselectivity and Stereospecificity** Stereoselective and stereospecific reactions. Mechanism "Addition of halogens to alkenes". Stereochemistry of E2 reaction (syn and anti elimination).	14

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Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Organic Chemistry**:** I. L. Finar, Vol-II, 5th Edition, Pearson Education Ltd.
2. (2) Organic Chemistry**:** Morrison & Boyd, 6th Edition, Prentice Hall of India Pvt. Ltd.
3. (3) Stereochemistry of carbon compounds**:** E. L. Eliel, Wiley Eastern Ltd.
4. (4) Stereochemistry and mechanism through solved problems**:** P. S. Kalsi, New Age International.
5. (5) Stereochemistry of Organic Compounds: Principles and Applications**:** D. Nasipuri; New Academic Science; 4th Revised Edition.
6. (6) Organic Chemistry**:** Hendrickson, Cram, Hammond, Mc Graw-Hill.
7. (7) Organic Chemistry**:** 6th Edition, John Mcmurry, Brooks Cole, International Edition.
8. (8) Organic Chemistry**:** T.W. Graham Solomons and Craig B. Fryhle Wiley, 8th Edition

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(9) Organic Chemistry: Francis A. Carey, Mc Graw Hill, 7th Edition (10) Organic Chemistry: Leroy G.Wade, Prentice Hall, 6th Edition.
(11) Organic Chemistry: Jonathan Clayden, Nick Greeves, Stuart Warren and Peter Wothers. Oxford University Press, USA

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Inorganic Chemistry C-I
CODE : 253020502
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Molecular symmetry** Introduction, symmetry operations and symmetry elements: Cn, σ, Sn, i and E. Point groups for the molecules (excluding S_{2n} and I_h). Multiplication tables of C_{2v}, C_{2h} and C_{3v} point groups.	14
2	**(A) Chemical bonding (I)** VB and MO treatment of H_2 and H_2^+, comparison of VB and MO MO treatment of $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$, $[V(CN)_6]^{-3}$, $[IrF_6]^{-4}$, $[NiF_4]^{-2}$, $[PtCl_4]^{-2}$ and $[Ni(CN)_4]^{-2}$. **(B) Boron hydrides** Preparation, properties and structure of diborane. Types of bonds found in higher boranes. Structure of B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10} and $B_{10}H_{14}$.	14
3	**(A) Co-ordination chemistry** Reaction, kinetics and mechanism. Trans effect and trans influence, Applications of trans effect in synthesis and analysis. Theories of trans effect: Polarisation theory, π- bonding theory, MO theory. Lability, inertness, stability and instability.	14

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	(B) Kinetics and reaction rates of substitution Ligand field effect and reaction rates, mechanism of substitution reaction. Nucleophilic substitution reaction (S_N1 and S_N2) in octahedral complexes. Substitution in square planar Pt (II)complexes. Substitution in octahedral Co (III) complexes. Acid hydrolysis, base hydrolysis. Cis effect. Electron transfer reaction. Mechanism of redox reaction (inner-sphere and outer-sphere).	
4	**(A) Inorganic polymers** Classification of inorganic polymers. Polymers containing boron and silicon**:** methods of preparation, physical and chemical properties, structures and their uses. **(B) Mossbauer Spectroscopy** Principle and Instrumentation. Experimental technique Application for iron complexes	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Concise Inorganic Chemistry**:** J.D. Lee; Wiley India, 5th Edition (1996).
2. 'Shriver and Atkins' Inorganic Chemistry**:** Atkins, Overton, Rourke, Weller, Armstrong;
3. Oxford University Press, 5th Edition (2011).
4. Advanced Inorganic Chemistry**:**. F.A. Cotton and Wilkinson G.; John Wiley, 5th Edition (1988).
5. Introductory Quantum Chemistry**:** A.K. Chandra; Tata- McGraw Hill, 4th Edition (1994).
6. Quantum chemistry**:** R.K. Prasad; New Age International, 4th Edition (2010).
7. Electron and chemical bonding**:** H. B. Grey, W.A.Benjamin. INC, New York.
8. Inorganic chemistry**:**. James E. Huheey, 4th Edition,Wesley Publishing Company.
9. Mechanism of Inorganic reaction**:** Basalo and Pearson, 2nd Edition, Wiley Eastern Pvt Ltd.
10. Introduction to Advanced Inorganic chemistry, Durrant and Durrant, John Wiley.
11. Advanced Inorganic chemistry**:** (Vol. 1) Satya Prakash, Tuli, Basu and Madan; S. Chand
12. Advanced Inorganic chemistry**:** Gurdeep Raj; Goel Publishing House, 23rd Edition (1998).

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Physical Chemistry C-I
CODE : 253020503
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Thermodynamics** Zeroth law of Thermodynamics, Clausius - Clapeyron equation, Trouton's Rule, Craft's equation, van't Hoff's isotherm and isochore equations.	14
2	**Electrochemistry** Electrochemical cell and Electrolytic cell, Reversible and irreversible electrodes and cell, Poggendorff's compensation method and Weston cell, Reference electrodes (i) Saturated Calomel Electrode (ii) Standard Hydrogen Electrode (iii) Quinhydrone Electrode, Nernst's single electrode potential equation, Applications of emf measurements to calculate ΔG, ΔG_o, ΔH, ΔS , K_{eq}, K_{sp}, K_w and K_h.	14
3	**(A) Chemical Kinetics** Prediction of reaction rate, Primary and secondary salt effect, Heterogeneous reactions, Retarded reaction. **(B) Polymer Chemistry** Polymerization and types of Polymerization, Co-polymers, Bio-	14

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	polymers, Polymer additives, Thermodynamics of polymer solution, Molecular weight determination of polymers: Number average molecular weight, Weight average molecular weight, Viscosity and Osmotic pressure method.	
4	**(A) Nuclear Chemistry** Detection of isotopes, Velocity focusing mass spectrograph, Bainbridge and Neiers mass spectroscopy, Double focusing mass spectroscopy, Applications of isotopes and trace technique examples **(B) Molecular spectra** Pure rotational spectra, Equation for frequency of pure rotational spectral line, Vibrational-Rotational spectra, Equation for frequency of vibrational-rotational spectral line, Ortho and Para hydrogen.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Physical Chemistry**:** G. M. Barrow, 5th Edition, McGraw-Hill education, India.
2. Advanced Physical Chemistry**:** Gurdeep Raj, 35th Edition (2009), Goel / Krshina Publishing House.
3. Principles of Physical Chemistry**:** Puri, Sharma and Pathania, 42nd Edition, Vishal Publishing Company.
4. Polymer Science**:** Gowariker, Viswanathan and Sreedhar, 1st Edition (2012 reprint) New Age International.
5. Essentials of Nuclear Chemistry**:** Arnikar, 4th Edition (2012 reprint), New Age International.
6. Physical Chemistry**:** Atkins, 9th Edition. Oxford University Press.
7. Advanced Physical chemistry**:** Gurtu and Gurtu, 11th Edition , Pragati Prakashan.

Physical chemistry**:** Levine, 6th Edition, McGraw-Hill edu

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DEPARTMENT OF CHEMISTRY

Analytical Chemistry- C-I
CODE : 253020504
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives: - To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Ultraviolet Spectroscopy** Origin of UV Spectra, Principle, Electronic transition (σ-σ*, n-σ*, π-π* and n-π*), relative positions of λmax considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples). Aromatic and Polynuclear aromatic hydrocarbons. **(B) Ultraviolet Spectroscopy (Problems)** Problems of Dienes and enones using Woodward-Fieser rules. Problems of aromatic ketones, aldehydes and esters using empirical rules.	14
2	**(A) Infrared Spectroscopy** Introduction, principle of IR spectroscopy, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications. Application of Hooke's law, characteristic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O functions; factors affecting stretching frequencies (H-bonding, mass effect, electronic factors, bond	14

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	multiplicity, ring size). **(B) Raman Spectra** Basic principal, Instrumentation, Application of Raman spectra, Comparison of IR and Raman spectra.	
3	**(A) Nuclear Magnetic Resonance** Principal, Magnetic and non magnetic nuclei, absorption of radio frequency. Equivalent and non equivalent protons, chemical shifts, anisotropic effect, relative strength of signals, spin-spin coupling, long range coupling, coupling constant, Deuterium labelling, applications to simple structural problems. **(B) Problems based on Spectral data** Structural problems based on UV, IR and NMR	14
4	**(A) Visible Spectroscopy** Introduction, Beer Lambert's law, instrumentation (light source, optical system, wavelength selector, light sensitive device), Accuracy and error of Spectrophotometry. **(B) Atomic Spectroscopy** Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners), Inductively coupled plasma Emission Spectroscopy (ICPES)	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Introduction to Spectroscopy**:** Donald L. Pavia, Gary M. Lampman, George S. Kriz
2. Cengage Learning; 4th Edition.
3. Spectrometric Identification of Organic Compounds**:** Robert M. Silverstein, Francis X. Webster, David Kiemle Wiley; 7th Edition.
4. Infrared spectra of Complex molecules**:** J. Bellamy, John Wiley & Sons, Inc., 3rd Edition.
5. Spectroscopic Method in Organic Chemistry**:** Dudley Williams, Ian Fleming McGraw-Hill Education; 6th Edition.
6. Applications of spectroscopic techniques in Organic Chemistry**:** P.S. Kalsi, New Age International; 6th Edition.
7. Elementary Organic Spectroscopy; Principles And Chemical Applications**:** Y. R. Sharma, S. Chand & Co Pvt Ltd.
8. Fundamentals of Molecular Spectroscopy**:** C. M. Banwell and E. McCash, Tata McGraw Hill, 4th Edition.
9. Modern Raman Spectroscopy**:** A Practical Approach; Ewen Smith, Geoffrey Dent., Wiley; 1st Edition.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

FERMENTATION TECHNOLOGY- I

CODE: 253040501

B.Sc. 5th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives: -

- To provide basic knowledge of bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. What are primary and secondary screening, how to isolate enzymes producing microbes.
- Need to know the importance of strain improvement, what different methods can be used for strain improvement. Students get to know about the use of precursors in the fermentation process.
- This study gives idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- The student will get an idea about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.
- To provide the idea about down streaming process how to get end product in the fermentation.

Prerequisites:-

Student must be passed second year B.Sc in Microbiology as major subject along with the knowledge of biology.

Course outline:-

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Sr. No.	Course Contents	Number of Hours
1.	**Introduction to fermentation technology** • Fundamental concepts of fermentation • Chronological development in industrial microbiology • Introduction to the component parts of fermentation process • Range of fermentation processes	10
2.	**Industrially important microorganisms** • SCREENING: (A) Characteristics of industrially important microorganisms (B) Primary screening of organic acid producers, Primary screening of antibiotics, growth factors, and enzyme producers. (C)Significance of secondary screening • STRAIN IMPROVEMENT (A) STRAGIES i. Selection of induced mutants ii. Selection of recombinants (B) Strain improvement for modification of properties other than yield (C) Preservation: Principle, methods and quality control	10
3.	**Fermenter Design & Fermentation Process** • Stirred tank bioreactor (A) Basic functions of fermenter and design (B) Structural components of fermentor (C) Devices of aeration and agitation (D) Devices for monitoring pH, temerpature, foam and dissolved oxygen • Types of fermentation - Submerge (Batch, Fed batch and Continuous). • Solid state fermentation.	10
4.	**Fermentation media and inoculum development** • Fermentation media (A) Principles of media formulation (B) Media ingredients: water, carbon sources, nitrogen sources, minerals, growth factors, buffers, chelators, precursors, inducers, inhibitiors, antifoam agents • Methods of sterilization (A) Use of high pressure steam: principle, batch and Continuous sterilization process	10

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	(B) Use of filtration: principle, types of filter. • Inoculum development: general principles for development of seed culture for bacterial, yeast and fungal processes	
		40

Learning Outcomes:

- Student will learn about the bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. Types of substrate used for fermentation and about medium optimization.
- Provide an idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- Get knowledge about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.
- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.

Teaching & learning Methodology:

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

- Principles of Fermentation Technology : Whitaker & Stanbury Comprehensive
- Biotechnology : Murray Moo Young
- Methods in Industrial Microbiology : Sikyta
- Fermentation Microbiology and Biotechnology, El Mansi and Bryc

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

BACTERIAL METABOLISM
Subject Code: 253040502
B.SC. Semester -5

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide students the basic knowledge of Bacterial metabolism.
- The purpose of the course is to give student to introduction of enzyme kinetics, chemoheterotophic, chemoautotrophic, phototrophic metabolism and biosynthesis.
- To provide an understanding of various pathways about metabolism process like TCA cycle, PPP pathways Glycolysis pathway etc.

Prerequisites

Student Must have studied B.Sc. with microbiology as a major subject and knowledge of basic Bacterial Metabolism.

Course outline

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Unit No.	Course Contents	Teaching hours
1	**Enzymes and Energy:** • Enzyme kinetics (A) Michaelis-Menten euation. (B)Lineweaver-Burkplot and its significance • Metabolic regulation: Types and Significance. • Energy: its generation and conservation. • Modes of ATP generation.	10
2	**Chemo heterotrophic Metabolism:** • Utilizable substrates. • Catabolism of glucose. • TCA Cycle. • Catabolism of Fatty acids and Proteins.	10
3	**Chemoautotrophic and Phototrophic metabolism:** • Physiological groups of chemoautotroph's. • Generation of ATP and reducing power in chemoautotrophs, Phototrophic metabolism. • Types of photophosphorylation-Cyclic and Non-cyclic photophosphorylation. • Pathway for CO_2 fixation. Calvin-Benson cycle.	10
4	**Biosynthesis:** • Principles governing biosynthesis. • Assimilation of ammonia, nitrate, molecular nitrogen & sulfate. Biosynthesis of saturated and unsaturated fatty acids. • Biosynthesis of Phospholipids. • Methods of studying of Biosynthesis.	10
		40

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Learning Outcomes

- The students will be able to understand the Knowledge of the Bacterial Metabolism to understand concepts of various pathways like PPP pathway, glycolysis pathways, TCA cycle etc.

- Student should be able to understand basic concepts of enzymes and energy, chemo heterotrophic metabolism, chemoautotrophic and phototrophic metabolism, Biosynthesis.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- General Microbiology, Stanier, R. Y., Ingrahm, J. L., Wheelis, M. L. and Painter, P. R. 5 thedn . (1995), Mac Millan Press Ltd., Hong Kong.
- Prescott, Harley, and Klein's Microbiology, J. M. Willey, L. M. Sherwood, C. J. Woolverton, 7th Edition (2008), McGraw Hill Higher Education- USA .
- Principles of Microbiology, R. M. Atlas, 2nd Edition (Indian Edition) (2015), McGraw Hill.

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Enzymology

Subject Code: 253040503

B.Sc. Semester-5

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	-	30	-	70	-	100

Objectives

- To provide students basic knowledge of Enzymology.
- The purpose of the course is to introduce students to methods of microbiology and to develop required microbiological skills which will be helpful in their future.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ medical / Environmental Sciences.

Prerequisites

Student Must have Basic knowledge about terminology Enzymes and their industrial applications.

Course outline

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Unit. No.	Course Contents	Teaching hours
1	**Enzymology** • General characteristics and classification, Terminology: Holoenzymes, coenzymes, Apo enzymes, cofactors, activators, inhibitors, units of enzyme activity, isoenzymes • Turn over number, specific activity • First order and zero order reactions • Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes .	10
2	**Enzyme kinetics** • Derivation of Michaelis and Menten equation and its modifications Line Weaver & Burk plot • Eadie-Hofstee and Hannes & Woolf plots • Enzyme Inhibition –competitive • Non-competitive, uncompetitive, mixed & substrate inhibition.	10
3	**Enzyme immobilization** • Types of immobilization • Methods of immobilization • Application, Advantages & limitations of immobilization • Introduction to reverse micelles and whole cell immobilization	10
4	**Industrial Important Enzymes** • Sources and applications of enzymes- • Amylase, Protease and Lipase in industries (detergent, leather, food, dairy, Textile and medical). • Methods of Industrial production of enzymes.	10
		40

Learning Outcomes

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- The students will be able to understand and deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines.

- Student should be able to understand basic concepts of the present day scope and applications of enzymology.

- The course is designed to give students an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.

- This is a course where the topics to be studied include enzyme active sites / mechanisms of enzyme action; enzyme kinetics and regulation; Isozymes and their clinical significances /function relationship etc as tools for understanding functions of enzymes.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd Edition, *authored* by Trevor Palmer and Philip Bonne(2007)

- Textbook of biochemistry – Vasudevan Shreekumari(2017)
- Biochemistry – Lehninger 6th edition(2013)

- Topics in Enzyme & Fermentation Biotechnology Volumes by Wisemen(1983)
- Biology of Industrial Microorganisms A.L. Duncun(2016)
- Molecular Industrial Mycology Leong & Berka(1992)

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

BIOSAFETY, BIOETHICS & IPR
Subject Code: 253040504
B.Sc. Semester -5

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	3	3	3	30	-	70	-	100

Objectives

- To provide students basic knowledge of Biosafety & Risk assessment, Regulatory affairs, Bioethics and IPR
- The purpose of the course is to give students to introduction of biosafety and biosafety levels, GLP, GMP, QC and QA and also about Bioethics.
- To provide an understanding of Intellectual property and intellectual property rights, Patent process about novel innovation.

Prerequisites

Student must have studied Second year (SY) of B.Sc. with Microbiology as a major subject and knowledge of basic microbiology.

Course outline

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Sr. No.	Course Contents	Teaching hours
1	**Biosafety** • Introduction of Biosafety • Mechanisms of Biosafety: Standard Laboratory practices & Containment strategies • Biosafety levels • Biosafety guidelines in India • Laboratory biosecurity concept • Risk and Risk assessment	**10**
2	**Regulatory affairs** • Good Laboratory Practices • Good Manufacturing Practices • Basic principles of Quality Control and Quality Assurance • Guidelines of QA and QC (raw materials, sterilization, media, products) • Validation study • Role of culture collection center, public health laboratories and regulatory agencies	**10**
3	**Bioethics** • Basics of bioethics • Principles of bioethics • Regulatory concerns • International codes and guidelines in India • Role of NGOs in biological regulations	**10**
4	**Intellectual property rights** • Introduction of intellectual property • International organization of IP • Types of IPR • Benefits, problems and management of IPR • Patent process • International harmonization of patent law • Patents of biotechnological process and their protection • Indian scenario • Infringement, case studies	**10**
		40

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Learning Outcomes

- The students will be able to apply the knowledge of the biosafety to understands concepts of various fields like research fields, fermentation industries, food industries, analytical laboratories, QC and QA, etc.

- Student should be able to understand basic concepts of biosafety levels, Risk and Risk assessment, Biosecurity, basic knowledge of GLP and GMP, fundamentals of Quality control and Quality assurance, basic introduction and principles of bioethics as well as get some idea about intellectual properties and rights.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data and live examples clearly and concisely that incorporates the stylistic conventions used by microbiologists and researchers worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Deepa Goel., & Shomini Parashar. (2013) *IPR, Biosafety and Bioethics*
2. Raj Mohan Joshi. (2006) *Biosafety and Bioethics*

3. Michael R.W. Brown., & Peter Gilbert. (1995) *Microbiological Quality Assurance*
4. B.D. SINGH., (2003). *Biotechnology – expending horizons*, Kalyani publication, Chapter 8
5. R Radhakrishnan., & S. Balasubramanian.(2008) *Intellectual Property Rights: Text and Cases*
6. V K Ahuja. (2015) *Intellectual Property Rights in Indi*a

SWARRNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF Biotechnology

Fermentation Technology-II

CODE: 253010601

B.Sc. 6th Sem

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives:-

- To provide the idea about down streaming process how to get end product in the fermentation. Different methods used for separation of products from fermentation broth.
- Students will get an idea about quality control of the fermented products made using different methods.
- To provide students basic knowledge of Microbial Biotechnology. It covers up general concept of microbial production and fermentation of various products.
- The purpose of the course is to give knowledge about production process using fermentation technology and microorganisms of antibiotics, enzymes, industrial alcohol, organic acids, vitamins, SCP, as well as mushrooms.

Prerequisites:-

Students must have passed 2nd year B.Sc in Microbiology along with basic knowledge of biology

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Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	**Downstream processing** • Introduction • Removal of microbial cells and suspended solids (A) Foam separation (B) Precipitation (C) Filtration (D) Centrifugation • Cell disruption methods (A) Physico-mechnaical methods (B) Chemicals methods • Product concentration and purification (A) Liquid -liquid extraction (B) Membrane processes • Finishing stages (A) Drying (B) Crystallization • Effluent treatment	**10**
2.	**Quality control of fermentation products-** • Detection and assay of fermentation products (A) Physical assays: Titration and gravimetric analysis, turbidity and cell yield determination (B) Chemical assay: Chromatography, spectrophotometry (C) Biological assays: Microbial assay • Microbial quality assurance (A) Sterility testing (B)LAL test • Fermentation economics	**10**
3.	**Fermentation production of :** • Alcohol • Cheese • Baker's Yeast • Glutamic acid • Citric acid	**10**
4.	**Fermentative production of:** • Penicillin and its conversion to semisynthetic derivatives, • Cyanocobalamin • Steriods • Amylase • carotenoids	**10**

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		40

Learning Outcomes:

- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.
- The students will be able to apply the knowledge of the Microbial production to understands concepts of various fields like food and dairy industries, pharmaceutical industries, Fermentation industries, beverages industries, etc.
- Student should be able to understand basic concepts of various products like alcohol, cheese, amino acids like glutamic acid, citric acid fermentation economics.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by Microbiologists, biotechnologist, researchers and scientists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module

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or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. "**Principles of Fermentation Technology,** Stanbury P F, Whitaker A and Hall SJ, (1995) 2
    a. edition, Pergamon Press, London, UK.
2. **Industrial Microbiology: An Introduction,** Waites, M J and Morgan N L, (2002) Blackwell Science.
    a. nd
3. **Biotechnology: A Textbook of Industrial Microbiology,** Crueger W and Crueger A, (2000) 2
    a. edition, Panima Publishing Corporation, New Delhi, India.
4. **Fermentation Microbiology and Biotechnology,** El-Mansi E M T, Bryce CFA, Dahhou B, rd Sanchez S, Demain AL, Allman AR (eds), (2011) 3 edition, CRC Press; Taylor and Francis Group, Boca Raton.
5. **Industrial Microbiology,** Casida LE, Jr. (1968), Wiley Eastern Ltd, New Delhi, India.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Enzymology and Kinetics

Subject Code: 253010602

B.Sc. Semester-6

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide students basic knowledge of Enzymology.
- The purpose of the course is to introduce students to methods of microbiology and to develop required microbiological skills which will be helpful in their future.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ medical / Environmental Sciences.

Prerequisites

Student Must have Basic knowledge of Enzymes and their industrial application.

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Course outline

Unit No.	Course Contents	Teaching hours
1	**Enzymology** • General characteristics and classification Terminology: Holoenzymes, coenzymes, Apo enzymes, cofactors, activators, inhibitors units of enzyme activity and isoenzymes • Turn over number, specific activity first order and zero order reactions Structure of active site of enzymes, specificity of enzyme action Types and factors affecting enzyme activity • Brief introduction of Allosteric enzymes	10
2	**Enzyme kinetics** • Derivation of Michaelis and Menten equation and its modifications Line Weaver & Burk plot • Eadie-Hofstee and Hannes & Woolf plots • Enzyme Inhibition – competitive, non competitive • Uncompetitive, mixed & substrate inhibition.	10
3	**Enzyme immobilization** • Types of immobilization • Methods of immobilization • Application, advantages & limitations of immobilization. • Introduction to reverse micelles.	10
4	**Industrial enzymes:** • Sources and applications of enzymes- • Amylase, protease and lipase in industries (detergent, leather, food, dairy, Textile and medical). Industrial production of enzymes.	10
		40

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Learning Outcomes

- The students will be able to understand and deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines.

- Student should be able to understand basic concepts of the present day scope and applications of enzymology.

- The course is designed to give students an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.

- This is a course where the topics to be studied include enzyme active sites / mechanisms of enzyme action; enzyme kinetics and regulation; Isozymes and their clinical significances /function relationship etc as tools for understanding functions of enzymes.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd Edition, *authored* by Trevor Palmer and Philip Bonne(2007)

- Textbook of biochemistry – Vasudevan Shreekumari(2017)
- Biochemistry – Lehninger 6th edition(2013)

- Topics in Enzyme & Fermentation Biotechnology Volumes by Wisemen(1983)
- Biology of Industrial Microorganisms A.L. Duncun(2016)
- Molecular Industrial Mycology Leong & Berka(1992)

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DEPARTMENT OF BIOTECHNOLOGY

BIOSAFETY, BIOETHICS & IPR
Subject Code: 253010604
B.Sc. Semester -6

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide students basic knowledge of Biosafety & Risk assessment, Regulatory affairs, Bioethics and IPR
- The purpose of the course is to give students to introduction of biosafety and biosafety levels, GLP, GMP, QC and QA and also about Bioethics.
- To provide an understanding of Intellectual property and intellectual property rights, Patent process about novel innovation.

Prerequisites

Student must have studied Second year (SY) of B.Sc. with Microbiology as a major subject and knowledge of basic microbiology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1	**Biosafety** • Introduction of Biosafety • Mechanisms of Biosafety: Standard Laboratory practices & Containment strategies • Biosafety levels • Biosafety guidelines in India • Laboratory biosecurity concept • Risk and Risk assessment	**10**
2	**Regulatory affairs** • Good Laboratory Practices • Good Manufacturing Practices • Basic principles of Quality Control and Quality Assurance • Guidelines of QA and QC (raw materials, sterilization, media, products) • Validation study • Role of culture collection center, public health laboratories and regulatory agencies	**10**
3	**Bioethics** • Basics of bioethics • Principles of bioethics • Regulatory concerns • International codes and guidelines in India • Role of NGOs in biological regulations	**10**
4	**Intellectual property rights** • Introduction of intellectual property • International organization of IP • Types of IPR • Benefits, problems and management of IPR • Patent process • International harmonization of patent law • Patents of biotechnological process and their protection • Indian scenario • Infringement, case studies	**10**
		40

Learning Outcomes

The students will be able to apply the knowledge of the biosafety to understands concepts of various fields like research fields, fermentation industries, food industries, analytical laboratories, QC and QA, etc.

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- Student should be able to understand basic concepts of biosafety levels, Risk and Risk assessment, Biosecurity, basic knowledge of GLP and GMP, fundamentals of Quality control and Quality assurance, basic introduction and principles of bioethics as well as get some idea about intellectual properties and rights.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data and live examples clearly and concisely that incorporates the stylistic conventions used by microbiologists and researchers worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Deepa Goel., & Shomini Parashar. (2013) *IPR, Biosafety and Bioethics*
2. Raj Mohan Joshi. (2006) *Biosafety and Bioethics*
3. Michael R.W. Brown., & Peter Gilbert. (1995) *Microbiological Quality Assurance*
4. B.D. SINGH., (2003). *Biotechnology – expending horizons*, Kalyani publication, Chapter 8
5. R Radhakrishnan., & S. Balasubramanian.(2008) *Intellectual Property Rights: Text and Cases*
6. V K Ahuja. (2015) *Intellectual Property Rights in Indi*a

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Chemistry-C-II
CODE : 253020601
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Synthetic Dyes** Classification of Dyes- Anionic and Cationic dyes, Mordant and Vat dyes, Reactive and Dispersed dyes, Synthesis of Alizarin, Malachite green, Indigo, Congo red, Eosin. **(B) Explosives** Preparation of RDX, PETN, Nitroglycerine, Tetryl. **(C) Pesticides:** Preparation of Aldrine, Malathion, Parathion, Methoxychlor.	14
2	**(A) Synthetic Drugs** General Classification, Chemotherapy, Antipyretics, Analgesics, Hypnotics, Sedatives, Anaesthetics, Antimalerials, Antiseptics, Cardiovascular drugs. (Minimum two illustrations of each, only names without structures). Methods of preparation and uses of Antipyrine, Phenacetin, n-Hexyl resorcinol, Alprazolam, Zaleplon,	14

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	Benzocaine, Lidocaine, Chloroquine, Atenolol, Sulphadiazine, Trimethoprim and Tolbutamide. **(B) Vitamins** Structure and Biochemistry of Vitamin-A (A1) (Retinol), Vitamin-B6 (Pyridoxine).	
3	**A) Alkaloids** Classification, General method of determining structure, analytical and synthetic methods, structure of Coniine, Nicotine, Atropine and Papaverine. **(B) Isoprenoids (Terpenoids)** Classification, General method of determining structure, Isoprene rule, Chemistry of Citral, α-Terpineol, Camphor and their synthesis, study of reactions of β-carotene (No Synthesis).	14
4	**(A) Stereo Chemistry** Concept of prostereo isomerism and chiral synthesis (Asymmetric Induction), Cram's rule, Prelog's generalization, Prelog's rule and assignment of configuration. **(B) Stereochemistry of compounds other then Carbon** Stereo chemistry of the compounds containing Nitrogen. Phosphorus and Sulphur	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Organic Chemistry**:** I. L. Finar, Vol-II, 5th Edition, Pearson Education Ltd.
(2) Organic Chemistry**:** Morrison & Boyd, 6th Edition, Prentice Hall of India Pvt. Ltd.
(3) Stereochemistry of carbon compounds**:** E. L. Eliel, Wiley Eastern Ltd.
(4) Stereochemistry and mechanism through solved problems**:** P. S. Kalsi, New Age International.
(5) Stereochemistry of Organic Compounds: Principles and Applications**:** D. Nasipuri; New Academic Science; 4th Revised Edition.
(6) Organic Chemistry**:** Hendrickson, Cram, Hammond, Mc Graw-Hill.
(7) Organic Chemistry**:** 6th Edition, John Mcmurry, Brooks Cole, International Edition.
(8) Organic Chemistry**:** T.W. Graham Solomons and Craig B. Fryhle Wiley, 8th Edition.
(9) Organic Chemistry**:** Francis A. Carey, Mc Graw-Hill, 7th Edition.

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DEPARTMENT OF CHEMISTRY

Inorganic Chemistry-C-II
CODE : 253020602
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Chemical bonding (II)** The Huckel Molecular Orbital (HMO) theory, variation principle, solution of Secular equation, HMO treatment to ethylene molecule, allylic cation, allylic free radical and allylic anion, Hybridization: Hybridization wave functions of sp, sp^2 and sp^3.	14
2	**(A) Term symbol** Russel Saunders coupling and determination of Term symbols of the ground state. Calculation of number of microstates. Pigeon hole diagram of p^2 and d^2 configurations. Hund's rule. Hole formulation. **(B) Electronic spectra of metal complexes** Electronic spectra of transition metal complexes, Laporte orbital and spin selection rules. Orgel energy level diagram of d^5 and combined diagrams of d^1 - d^9, d^2 – d^8, d^3 – d^7, d^4 – d^6 and their spectra. Jahn Teller distortion. Spectrochemical series.	14
3	**(A) Metal carbonyls** Mono and poly-nuclear metal carbonyls: $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$,	14

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	$Fe_2(CO)_9$, $Fe_3(CO)_{12}$, $Co_2(CO)_8$, $Mn_2(CO)_{10}$, $Ir_4(CO)_{12}$, $Co_4(CO)_{12}$. Metal nitrosyl and metal carbonyl hydrides. Application of IR spectra in the determination of structure of metal carbonyls. **(B) Organometallic compounds** Definition, classification, synthesis (general methods), properties, structure and application of organometallic compounds of Mg, Al and Be, Structure of Ferrocene and dibenzene chromium.	
4	**Quantum chemistry** Setting up of operators for different observables, Hermitian operator, important theorems concerning Hermitian operator, Particle in a three dimensional box, The rigid Rotator, The Schrodinger equation in spherical polar coordinates for hydrogen atom, separation of variables, solution of R, Θ and Φ equations	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Concise Inorganic Chemistry**:** J.D. Lee; Wiley India, 5th Edition (1996).

(2) 'Shriver and Atkins' Inorganic Chemistry**:** Atkins, Overton, Rourke, Weller, Armstrong;

(3) Oxford University Press, 5th Edition (2011).

(4) Advanced Inorganic Chemistry**:**. F.A. Cotton and Wilkinson G.; John Wiley, 5th Edition (1988).

(5) Introductory Quantum Chemistry**:** A.K. Chandra; Tata- McGraw Hill, 4th Edition (1994).

(6) Quantum chemistry**:** R.K. Prasad; New Age International, 4th Edition (2010).

(7) Electron and chemical bonding**:** H. B. Grey, W.A.Benjamin. INC, New York.

(8) Inorganic chemistry**:**. James E. Huheey, 4th Edition,Wesley Publishing Company.

(9) Mechanism of Inorganic reaction**:** Basalo and Pearson, 2nd Edition, Wiley Eastern Pvt Ltd.

(10) Advanced Inorganic chemistry**:** (Vol. 1) Satya Prakash, Tuli, Basu and Madan; S. Chand

(11) Advanced Inorganic chemistry**:** Gurdeep Raj; Goel Publishing House, 23rd Edition (1998).

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DEPARTMENT OF CHEMISTRY

Physical Chemistry-C -II
CODE : 253020603
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Thermodynamics** Colligative properties: Boiling point elevation and freezing point depression. Molal elevation constant (Kb) and Molal depression constant (Kf), Calculation of absolute value of entropy using third law of thermodynamics, Law of mass action using chemical potential, Partial molar quantity.	14
2	**Electrochemistry** Concentration cell: Cell with and without transference, Electrode concentration cell, Gas electrode concentration cell, Activity and activity coefficient determination, Define liquid junction potential and how it can be avoided, Equation for liquid junction potential, Decomposition potential, Overvoltage, Tafel equation	14
3	**(A) Phase Rule** Binary system : Zn-Cd and Pb-Ag ,Zeotropic and azeotropic mixtures, Steam distillation, Zone refining.	14

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	(B) Osmosis Desalination and reverse osmosis, Electrodialysis, Electrochemistry and pollution control, Removal of Cu, Ag and Fe from waste water.	
4	**(A) Photochemistry** Laws of Photochemistry : Grotthuss-Draper Law, Einstein Law, Quantum yield ,Reasons for high and low quantum yield, Fluorescence and Phosphorescence, Chemiluminescence, Photosensitized reactions. **(B) Metallic Corrosion** Types of corrosion, Electrochemical series, Corrosion in acidic and neutral medium, Differential aeration principle, Atmospheric corrosion, Prevention of corrosion by various factor.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Physical Chemistry**:** G. M. Barrow, 5th Edition, McGraw-Hill education, India.

(2) Advanced Physical Chemistry**:** Gurdeep Raj, 35th Edition (2009), Goel / Krshina Publishing House.

(3) Principles of Physical Chemistry**:** Puri, Sharma and Pathania, 42nd Edition, Vishal Publishing Company.

(4) Polymer Science**:** Gowariker, Viswanathan and Sreedhar, 1st Edition (2012 reprint) New Age International.

(5) Essentials of Nuclear Chemistry**:** Arnikar, 4th Edition (2012 reprint), New Age International.

(6) Physical Chemistry**:** Atkins, 9th Edition. Oxford University Press.

(7) Advanced Physical chemistry**:** Gurtu and Gurtu, 11th Edition , Pragati Prakashan.

(8) Physical chemistry**:** Levine, 6th Edition, McGraw-Hill education, India.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Analytical Chemistry-C -II
CODE : 253020604
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Errors and treatment of Analytical data:** Significant figures, Accuracy and precision, Types of errors and minimization of errors. Ways of expressing accuracy and precision. Rejection of a result, Test of significance (Q-Test, Student t-Test and F-Test) correlation coefficient. Literature of Analytical Chemistry. **(B) Organic reagents used in quantitative Analysis** Separation of methods with 8-Hydroxy Quinoline, Cupferron and DMG	14
2	**(A) Chromatographic methods:** General principle, classification of chromatographic separation. Ion exchange chromatography (Ion Exchange equlibria, Types of Ion Exchange capacity, Application of Ion Exchange resins). Gas Chromatography, Instrumentation and evolution of data. High Performance Liquid Chromatography (HPLC) Principle and Instrumentation.	14

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	(B) Solvent Extraction Separation: Principles of solvent extraction, choice of solvent, distribution coefficient, distribution ratio, percentage (%) extraction. The extraction process, solvent extraction of metals, selective extraction and separation efficiency.	
3	**(A) Polarography:** Introduction, Principle, electrode, Types of currents, Determination of half wave potential, Ilkovic equation, methods of determining concentration (Standard addition method and Calibration method) **(B) Potentiometry:** The scope of potentiometric titrations, Precipitation and neutralization titrations, Graphical method including Gran's plot for selecting end point, Differential titration, Dead stop titration, Ion selective Electrode, various types of Ion selective Electrodes and use of Calcium ion selective electrode.	14
4	**Miscellaneous Titrations:** (**A**) **Acid Base Titrations:** Titration of poplyprotic acid and mixture of acids, titration of salts, Differential Alkali titration. (**B**) **Redox titration:** Titration involving Iodine: iodimetry and iodometry, Titration with reducing agents and oxidising agents, metallic reductors. (**C**) **Complexometric titration:** EDTA titration techniques-Direct, Back, Displacement and Indirect Tititration, Masking, Demasking agent, ligand effect and Hydrolysis of EDTA complex, Auxiliary complexing agent- EDTA titration with an auxiliary complexing agent.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Analytical Chemistry**:** Gary D. Christian, 6th Edition; Wiley & Sons
(2) Fundamentals of Analytical Chemistry**:** D. A. Skoog, D. M. West and F. J. Holler, 9th Edition, Cengage Learning.
(3) Instrumental Methods of analysis**:** (CBS) H.H . Willard, L.L. Mirrit, J.A. Dean
(4) Solvent extraction in Analytical Chemistry**:** G.H. Morrison, F. Frieiser, John Wiley & Sons, NY.
(5) Instrumental Methods of Inorganic Analysis**:** A.I. Vogel, ELBS
(6) Chemical Instrumentation**:** A Systematic approach- H.A. Strobel
(7) The principals of ion-selective electrodes and membrane transport**:** W.E.Morf

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(8) Principles of Instrumental Analysis: Douglas A. Skoog., F. James Holler, Stanley R. Crouch, Cengage Learning; 6th Edition.
(9) Quantitative Chemical Analysis: Daniel C. Harris, W H Freeman, New York.
(10) Ion exchange and solvent extraction of metal compounds: Y. Macros, A.S.Kertes, Wiley, Interscience.

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DEPARTMENT OF MICROBIOLOGY

Fermentation Technology-II

CODE: 253040601

B.Sc. 6th Sem

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives:-

- To provide the idea about down streaming process how to get end product in the fermentation. Different methods used for separation of products from fermentation broth.
- Students will get an idea about quality control of the fermented products made using different methods.
- To provide students basic knowledge of Microbial Biotechnology. It covers up general concept of microbial production and fermentation of various products.
- The purpose of the course is to give knowledge about production process using fermentation technology and microorganisms of antibiotics, enzymes, industrial alcohol, organic acids, vitamins, SCP, as well as mushrooms.

Prerequisites:-

Students must have passed 2nd year B.Sc in Microbiology along with basic knowledge of biology

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Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	**Downstream processing** • Introduction • Removal of microbial cells and suspended solids (A) Foam separation (B) Precipitation (C) Filtration (D) Centrifugation • Cell disruption methods (A) Physico-mechnaical methods (B) Chemicals methods • Product concentration and purification (A) Liquid -liquid extraction (B) Membrane processes • Finishing stages (A) Drying (B) Crystallization • Effluent treatment	**10**
2.	**Quality control of fermentation products-** • Detection and assay of fermentation products (A) Physical assays: Titration and gravimetric analysis, turbidity and cell yield determination (B) Chemical assay: Chromatography, spectrophotometry (C) Biological assays: Microbial assay • Microbial quality assurance (A) Sterility testing (B)LAL test • Fermentation economics	**10**
3.	**Fermentation production of :** • Alcohol • Cheese • Baker's Yeast • Glutamic acid • Citric acid	**10**
4.	**Fermentative production of:** • Penicillin and its conversion to semisynthetic derivatives, • Cyanocobalamin • Steriods • Amylase • carotenoids	**10**

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Learning Outcomes:

- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.
- The students will be able to apply the knowledge of the Microbial production to understands concepts of various fields like food and dairy industries, pharmaceutical industries, Fermentation industries, beverages industries, etc.
- Student should be able to understand basic concepts of various products like alcohol, cheese, amino acids like glutamic acid, citric acid fermentation economics.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by Microbiologists, biotechnologist, researchers and scientists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for

key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. "**Principles of Fermentation Technology,** Stanbury P F, Whitaker A and Hall SJ, (1995) 2
    a. edition, Pergamon Press, London, UK.
2. **Industrial Microbiology: An Introduction,** Waites, M J and Morgan N L, (2002) Blackwell Science.
    a. nd
3. **Biotechnology: A Textbook of Industrial Microbiology,** Crueger W and Crueger A, (2000) 2
    a. edition, Panima Publishing Corporation, New Delhi, India.
4. **Fermentation Microbiology and Biotechnology,** El-Mansi E M T, Bryce CFA, Dahhou B, rd Sanchez S, Demain AL, Allman AR (eds), (2011) 3 edition, CRC Press; Taylor and Francis Group, Boca Raton.
5. **Industrial Microbiology,** Casida LE, Jr. (1968), Wiley Eastern Ltd, New Delhi, India.

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DEPARTMENT OF MICROBIOLOGY

MEDICAL MICROBIOLOGY
Subject Code: 253040602
B.SC. Semester -6

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	3	3	3	30	-	70	-	100

Objectives

- To provide students the basic knowledge of medical microbiology
- The purpose of the course is to introduce students to Introduction of Normal flora of the human, various disease caused microorganism, antigen antibody interaction, and detail study in various diseases.
- To provide an understanding of the various bacterial disease of like skin, eye, digestive system, nervous system, respiratory system etc.

Prerequisites

Student Must have studied B.Sc. with Microbiology as a major subject and knowledge of basic medical microbiology.

Course outline

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Unit No.	Course Contents	Teaching hours
1.	**Introduction of medical microbiology:** • Introduction: Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels. Morphology, pathogenesis, symptoms, laboratory diagnosis. • Preventive measures and chemotherapy of gram positive bacteria: *S.aureus, S.pyogenes, B.anthracis, C.perferinges,C.tetani,* • Basic of Bioethics and biosafety guideline related to Contamination, decontamination, disposal and safety from infectious Sources.	**10**
2.	**Morphology, pathogenesis, symptoms, laboratory diagnosis.** • preventive measures and chemotherapy caused by gram negative bacteria: *E.coli, N. gonorrhoea, N. meningitidis, P.aeruginosa, S. typhi, S. dysenteriae, Y. pestis, B. abortus, H. influenzae, V. cholera.*	**10**
3.	**Antigens and Antibody:** • **Antigens**: Antigen processing and presentation, properties of antigen,Hapten and the study of antigenicity microbes as antigen, antigen recognition and MHC molecules. • **Antibodies**: Structure and function,clonal selection,antibody diversity,Monoclonal antibodies and its clinical application.	**10**
4.	**Bacterial disease.** • Bacterial disease of skin & Eyes. • Bacterial disease of Digestive system. • Bacterial disease of nervous system. • Bacterial disease of Respiratory tract.	**10**
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Learning Outcomes

- The students will be able to understand Normal flora of human body , Bioethics and Biosafety guideline , disease caused microorganism , and many bacterial disease in medical microbiology .

- Student should be able to understand basic concepts of blood cells, Anitigen antibody reaction and disease caused bacteria.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, and/or in writing the results of theoretical and laboratory experiments in a clear and concise manner that incorporates the conventions used by Microbiologist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Prescott, Harley, and Klein's Microbiology, J. M. Willey, L. M. Sherwood, C. J. Woolverton, 7 th Edition (2008), McGraw Hill Higher Education- USA.
- Principles of Microbiology, R. M. Atlas, 2nd Edition (Indian Edition) (2015), McGraw Hill Education (India) Private Limited –New Delhi.
- Baker and Silverton's Introduction to Medical Laboratory Technology, Baker F J, Silverton R E, Pallister C J, 7th edition (1998), Butterworths-Heinemann, Oxford, UK.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

IMMUNOLOGY-II
Subject Code: 253040603
B.Sc. Semester -6

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives

- To provide students the ability to fundamentals of immunology, immune system, immune response and immune disorders.
- The purpose of the course is to give students to introduction of complement system, cells and organs of immune system, antigens and antibodies as well as immune reactions.
- To provide an understanding of immunology of transplantation, autoimmunity, autoimmune diseases, etc.

Prerequisites

Student must have studied Second year (SY) of B.Sc. with Microbiology as a major subject and knowledge of basic biology.

Course outline

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Unit No.	Course Contents	Teaching hours
1	**Host Defense Mechanisms:** • Phagocytosis • Complement • Inflammation • Cytokines • Acute Phase Proteins • Cells, Tissues and Organs of the Immune System.	**10**
2	**Specific Immune Responses: I** • Antigens • Hapten • Cluster of Differentiation Molecules • Humoral and Cell Mediated Immunity. • Recognition of Foreignness. • T Cell Biology - T Cell receptors • Types of T Cells, T Cell Activation.	**10**
3	**Specific Immune Responses: II** • Antibodies - (Immunoglobulins - Definition, Structure and Function, Classes of Immunoglobulins. • Antigen-Antibody Reactions: General Features, Measurement of Antigen and Antibody. • Serological Reactions: Precipitation Reactions, Definition, Mechanism - Lattice Hypothesis. Applications-Precipitation in Liquid Medium. • Agglutination reactions- Definition, Applications-Slide agglutination test, Tube agglutination test, Passive agglutination test. • Primary and Secondary Antibody response. • Diversity of Antibodies • Clonal Selection Theory • Monoclonal Antibody Technology.	**10**
4	**Immune Disorders:** • Immuno Deficiency • Hypersensitivity • Autoimmunity - Mechanism & Classification of Autoimmune diseases. • Immunology of Transplantation: Classification of • Transplants • Allograft reaction (mechanism) • Factors favoring Allograft survival. • Graft v/s Host reaction. I • Immunology of Malignancy.	**10**

Learning Outcomes

- The students will be able to apply the knowledge of the immunology, cells and organs of immune system, host defense mechanisms, specific immune responses and immune disorders.

- Student should be able to understand basic concepts of complement system, immune reactions like Ag-Ab reactions, serological reactions, agglutination reactions and also get knowledge about different types of immunity.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data and laboratory experiments clearly and concisely that incorporates the stylistic conventions used by microbiologists worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Coleman, R.M., Lourbard, M.F and Sicard, R.E., (1992). *Fundamental immunology*, 2nd edition
2. Kuby, J. (1997). *Immunology*, W.H Freeman and co., New York.
3. Roitt, I.M. (1988). *Essential of Immunology*, Black Well Scientific Publishers.

SWARNIM STARTUP & INNOVATION UNIVERSITY
SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Environmental Microbiology

Subject Code: 253040604

B.Sc. Semester- 6

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	-	70	-	100

Objectives:-

- To provide basic knowledge of microbes in environment.
- The main goal is to know and understand the role of microbes in biogeochemical processes in different ecosystems. The students will learn the basic microbiological principles, the methods in microbial ecology and their theoretical and practical use.
- The knowledge can give the base for understanding processes and changes in the environment.
- The students can get some skills to recognise the ecological problems and critical evaluation of the human impacts on pollution, climate changes and as well as environmental protection.
- The lectures will be implemented with individual practical work in the laboratory and presentations of the seminars.
- The students can get general competences in microbial ecology.

Prerequisites:-

- Student must have studied 2years B.Sc. with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

Course outline:-

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Unit No.	Course Contents	Teaching Hours
1.	**Nitrogen fixation** • Symbiotic & asymbiotic nitrogen fixation. • Nitrogenase- Structure & mechanism. • Biofertilizers- Definition, Azotobacter & Rhizobia (With Production) • Microbial insecticides.	**10**
2.	**Biodeterioration & Bioremediation** • Biodeterioration of wood, paint & metal. • Bioremediation-introduction. • Bioremediation of petroleum hydrocarbon & chlorinated compounds. • Microbial enhanced oil recovery..	**10**
3.	**Concept of xenobiotics & recalcitrance.** • Biomagnification. • Biodegradation of environmental pollutants.(ABS, Chlorinated hydrocarbons, Oil pollutants.) • Biodegradable polymers.	**10**
4.	**Introduction to biofuels.** • Renewable & nonrenewable energy resources. • Biofuels: types (a) Biogas - substrate, microorganisms & production. • Advantages & disadvantages of Biogas production. (b) Hydrogen (c) alcohol	**10**
		40

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Learning Outcomes:

- At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.
- Students will get the basic knowledge how to prepare and perform sampling and microbial analyses to determine the abundance, growth rate and microbial community composition together with the basic environmental paramethers.
- The knowledge can be used to prevent infections and to protect human and environmental health.
- Students will get basic knowledge to determine the role of microbes:

- in different habitates,

- in different biogeochemical cycles,

- to determine their role in nutrient cycling

- to determine water quality,

- in degradation of natural organic compounds and selected pollutants in the environment.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
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Books Recommended

- RM Atlas *Principles of Microbiology*
- Prescott LM *Microbiology*
- BD Singh. (2003) *Fundamentals of genetics.*
- HK Das. (2004) *Textbook of biotechnology*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF SCIENCE

ENVIRONMENT CONSERVATION & HAZARD MANAGEMENT

CODE: 253000603

SEMESTER 1

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	50	70	-	150

Objectives: - To provide a comprehensive knowledge for awareness of environment conservation and hazard management.

Prerequisites:- Environment Conservation & Hazard Management

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	Ecology and Environment	6
2	Solar power	10
3	Seismic engineering and disaster management	6
4	Sustainable development	8

Learning Outcomes:- At the closing stage of the course, the students will be able to understand the importance of environment conservation and the concepts of hazard management.

Teaching & Learning Methodology:- The Syllabus for Environmental Studies includes classroom teaching. The syllabus is divided into four units covering 30 lectures. The units are classroom teaching based to enhance knowledge skilled and attitude to environment.

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Books Recommended:

1. R. R. Mahitcha – "Environment Conservation and Hazard Management", Atul Prakashan.
2. Solanki and Chetan Singh – "Renewable Energy Technologies", PHI Learning.
3. Izrael Y.A. – "Ecology and Control of the Natural Environment", Kluwer Academic Publisher.
4. Sharma, Sanjay K. – "Environment Engineering and Disaster Management", Laxmi Publications.
5. Earnest, Joshua and Wizelius, Tore – "Wind Power Plants and Project Development, PHI Learning.
6. Anandita Basak – "Environmental Studies", Pearson Publication.
7. K. S. Valadia – "Coping with Natural Hazards Indian Context", Orient Longman Publication.
8. Edward S. Rubin –"Engineering and Environment", McGraw Hill Publication

SYLLABUS

Unit-1

Ecology and Environment: Importance of environment and scope, Engineering and Environment issues, The natural system, Biotic and Biotic components and processes of natural system, Eco system, Food chain, webs and other biological Systems, Causes of environmental pollution, Pollution due to solid waste, Water pollution, Air pollution, The noise as pollution, Pollution of land due to industrial and chemical waste, Radiation and its effects on vegetables and animals

Unit-2

Solar power: Features of solar thermal and PV systems, Types of solar cookers and solar water heaters, Solar PV systems and its components and their working, Types of solar PV cells, Rating and Costing.

Unit-3

Seismic engineering and disaster management: Introduction of Seismic engineering and its application, Features of disasters such as floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc., Management and Mitigation of disasters.

Unit-4

Sustainable development: Concept of sustainable development, Natural resources, Abiotic and Biotic resources, Principles of conservation of energy and management, Need of renewable energy, Growth of renewable energy in India and the world, Concept of waste management and recycling.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

GENE STRUCTURE AND FUNCTION
Subject Code: 256010101
M.Sc. Semester -1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	-	100

Objectives

- To provide students basic knowledge of Molecular biology of prokaryotes as well as eukaryotes.
- The purpose of the course is to give students to introduction of replication, transcription, translation and post-translation protein processing in prokaryotes and eukaryotes.
- To provide an understanding of Gene regulation and expression system and also get idea about transposons and topology of DNA.

Prerequisites

Student Must have studied B.Sc. with Biotechnology or Microbiology as a major subject and knowledge of basic biology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1	**DNA structure** Chemistry of DNA, Forces stabilizing DNA structure, Helix parameters, Forms of DNA, Watson –Crick and Hoogsteen base pairing, Physical properties of ds DNA (UV-Absorption spectra, Denaturation and Renaturation, Cot curves, DNA hybridization), Chemicals that react with DNA. DNA topology: DNA supercoiling, Supercoiled forms of DNA, Superhelical density, energetics of supercoiled DNA, Biology of supercoiled DNA (Topological domains of DNA, DNA topoisomerases, Mechanisms of supercoiling in cells, Mechanism of action of Topoisomerase I and II, effect of supercoiling on structure of DNA and role of supercoiling in gene expression and DNA replication) DNA-protein Interactions: General features, Interaction of Helix-turn Helix motif, B-sheet, Zn- DNA binding domains, etc with DNA.	08
2	**Organization of DNA into chromosomes** Packaging of DNA and organization of chromosome in bacterial cells; Packaging of DNA in eukaryotic nucleosome and chromatin condensation, assembly of nucleosomes upon replication, Chromatin modification and genome expression. DNA replication: Mechanism of DNA polymerase catalyzed synthesis of DNA, Types of DNA polymerases in bacteria and their role. Initiation of chromosomal DNA replication and its regulation in prokaryotes, assembly of replisome and progress of replication fork, termination of replication. Types and function of eukaryotic DNA polymerases, initiation of replication in eukaryotes, role of telomerases in replication of eukaryotic chromosomes. Inhibitors of DNA replication (blocking precursor synthesis, nucleotide polymerization, altering DNA structure).	08
3	**Transcription** RNA polymerases, features of prokaryotic and eukaryotic promoters, assembly of transcription initiation complex in prokaryotes and eukaryotes and its regulation; synthesis and processing of prokaryotic and eukaryotic transcripts. Transport of RNA within eukaryotic cell. **Translation** Structure and role of t-RNA in protein synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).	08
4	**Processing of proteome** Posttranslational processing of proteins (protein folding, processing by proteolytic cleavage, processing by chemical modification),	08

	Protein degradation. Regulation of gene expression in prokaryotes: Operon concept, positive and negative regulation. Examples of lac-, Ara-, His- and Trp-operon regulation; antitermination, global regulatory responses; Regulation of gene expression in eukaryotes: Transcriptional, translational and processing level control mechanisms.	

Learning Outcomes

- The students will be able to apply the knowledge of the Molecular biology to understands concepts of various fields like research fields, Gene manipulation, Genetic engineering, Genetics, etc.
- Student should be able to understand basic concepts of Replication, transcription and translation in prokaryotes as well as eukaryotes, gene regulations, protein targeting, transposons, retrotransposons, application of transposons, protein degradation, gene expression, operon systems.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by biotechnologist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

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Books Recommended

1. Lewin's GENES X, Volume 10Benjamin Lewin, Jocelyn Krebs, Stephen Kilpatrick, Elliott Goldstein-Jones & Bartlett Learning, 2011
2. Molecular Biology of the gene – Watson, Hopkins, Roberts 4TH edition
3. Molecular biology of the cell (third edition): By B Alberts, D Bray, J Lewis, M Raff, K Roberts and J D Watson.
4. iGenetics: A Molecular Approach (3rd Edition). by Peter J. Russell

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Bioinstrumentation

CODE:256010102

M.Sc. 1st semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	--	100

Objectives:-

- To provide students basic knowledge of Bio-analytical techniques. This course begins with a review of basic bio analytical technique and an introduction to general terminologies
- The purpose of the course is to introduce students to methods of Bioanalysis and to develop required microbiological skills which will be helpful in their future.
- This course contains bio analytical techniques along with their theory, working principal, common instrumentation and possible applications. This course will be equally beneficial to various scientific areas including, life science, chemical science, material science and environmental science.

Prerequisites:-

Student must have passed B.Sc in Microbiology as major subject and have knowledge about biology field.

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Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	Electrochemistry: pH and buffers, potentiometric and conductometric titration. Principle and application of light, phase contrast, fluorescence, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, confocal microscopy, cytophotometry and flow cytometry. Preparation of microbial, animal and plant samples for microscopy.	10
2.	Principle methodology and applications of gel – filtration, ion –exchange and affinity chromatography; Thin layer and gas chromatography; High performance liquid chromatography, FPLC. Electrophoresis: Principle and applications of Native and SDS PAGE; Agarose and 2D gel electrophoresis.	10
3.	Spectroscopy: UV, Visible, IR, NMR and ESR spectroscopy. Atomic absorption and plasma emission spectroscopy; MS and MALDI-TOF.	10
4.	Centrifugation: Basic principle and application; Differential, density and Ultracentrifugation. Principle of biophysical method and used for analysis of biopolymer structure; X ray diffraction, flurorescence, Principle and applications of tracer technique in biology: Radioactive Isotopes and half life of isotopes; Effect of radiation on biological system; autoradiography; cerenkov radiation; radiation dosimetry; scintillation counting. Biosensors: Principle and application	10

Learning Outcomes:

- The students will be able to use selected analytical techniques. Familiarity with working principals, tools and techniques of analytical techniques. student should be able to understand basic concepts of the present day scope and applications of Bioanalytical techniques.
- The course is designed to understand the strengths, limitations and creative use of techniques for problem-solving.

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- The students will be able to select analytical technique for case study. able to design experiments and understand the instrumentation. Students can use their knowedge in Academic and industrial research organization ,Industries based on biotechnology, pharmacy, agriculture, and chemical

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- K. Wilson, J. M. Walker, Eds., Principles and techniques of biochemistry and molecular biology (Cambridge University Press, Cambridge, UK : New York, 7th ed., 2009).
- R. F. Boyer, Biochemistry laboratory: modern theory and techniques (Prentice Hall, Boston, 2nd ed., 2012).
- R. Katoch, Analytical techniques in biochemistry and molecular biology (Springer, New York, 2011).
- D. L. Spector, R. D. Goldman, Eds., Basic methods in microscopy: protocols and concepts from cells: a laboratory manual (Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y, 2006).
- R. L. Switzer, Experimental biochemistry (W. H. Freeman and Co, New York, 3rd ed., 1999).

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- R. F. Boyer, Modern experimental biochemistry (Benjamin Cummings, San Francisco, 3rd ed., 2000).
- J. R. Lakowicz, Principles of fluorescen

E-Resources

- https://www.slideshare.net/drmohsin3/colorimetry-spectrophotometry
- https://www.tandfonline.com/doi/abs/10.1081/SPM-100100006?journalCode
- https://www.fishersci.se/se/en/scientific-products/centrifuge-guide/centrifugation-theory.html
- https://en.wikipedia.org/wiki/Chromatography#:~:text=Chromatography
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/#:~:text=Bi

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Microbial Diversity

Subject Code: 256010103

M.SC. Semester -1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	-	100

Objectives

- To provide students the basic knowledge cell, cell structure & its function and role of various biomolecules.
- The purpose of the course is to give student to introduction of Evolution of the cell, Chemical and physical foundations of biomolecules, Nucleotides, Biological membranes.
- To provide an understanding of various cell organelles, amino acids, Lipids, vitamins, and membrane structure and transport mechanisms.

Prerequisites

Student must have studied M.Sc. with microbiology as a major subject and knowledge of basic Microbial diversity.

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Course outline

Sr. No.	Course Contents	Teaching hours
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	10
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	10
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	10
4.	**Diversity of Archaea** • Systematics occurrence, diversity, characteristics features, of different groups of archaea bacteria • Survival, adaptation and potential applications: Halophiles, Thermophiles, Alkalophiles and Acidophile	10

Learning Outcomes

- The students will be able to understand the Knowledge of Diversity.
- Student should be able to understand basic concepts of Microbial diversity ,Diversity of Yeast and moulds ,Diversity of Archaea.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

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Teaching & Learning Methodology

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- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Oladele Ogunseitan(2004), Microbial Diversity. Form and Function in Prokaryotes**.**
- Mikel A. Becerro, Maria J. Uriz, Manuel Maldonado and Xavier Turon (Eds.)(2012), Advances in Sponge Science: Physiology, Chemical and Microbial Diversity, Biotechnology.
- Christine E. Salomon; Nathan A. Magarvey; David H. Sherman(2004), Merging the Potential of Microbial Genetics with Biological and Chemical Diversity: An Even Brighter Future for Marine Natural Product Drug Discovery
- Burnet et.al(1980), A guide to identifying and classifying yeast.
- Colwd. D,Microbial diversity.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Microbial Diversity

Subject Code: 256010103

M.SC. Semester -1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	50	70	-	150

Objectives

- To provide students the basic knowledge cell, cell structure & its function and role of various biomolecules.
- The purpose of the course is to give student to introduction of Evolution of the cell, Chemical and physical foundations of biomolecules, Nucleotides, Biological membranes.
- To provide an understanding of various cell organelles, amino acids, Lipids, vitamins, and membrane structure and transport mechanisms.

Prerequisites

Student must have studied M.Sc. with microbiology as a major subject and knowledge of basic Microbial diversity.

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Course outline

Sr. No.	Course Contents	Teaching hours
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	10
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	10
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	10
4.	**Diversity of Archaea** • Systematics occurrence, diversity, characteristics features, of different groups of archaea bacteria • Survival, adaptation and potential applications: Halophiles, Thermophiles, Alkalophiles and Acidophile	10

Learning Outcomes

- The students will be able to understand the Knowledge of Diversity.
- Student should be able to understand basic concepts of Microbial diversity ,Diversity of Yeast and moulds ,Diversity of Archaea.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

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Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Oladele Ogunseitan(2004), Microbial Diversity. Form and Function in Prokaryotes**.**
- Mikel A. Becerro, Maria J. Uriz, Manuel Maldonado and Xavier Turon (Eds.)(2012), Advances in Sponge Science: Physiology, Chemical and Microbial Diversity, Biotechnology.
- Christine E. Salomon; Nathan A. Magarvey; David H. Sherman(2004), Merging the Potential of Microbial Genetics with Biological and Chemical Diversity: An Even Brighter Future for Marine Natural Product Drug Discovery
- Burnet et.al(1980), A guide to identifying and classifying yeast.
- Colwd. D,Microbial diversity.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Biogeohydrotechnology and Biofuels

Subject Code: 256010104

M.Sc. Semester-1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	8	30	50	70	50	200

Objectives

- To provide applied knowledge of waste management with different biological methods, marine biotechnology, microbiology of minerals and fuel biology.
- Learn about the Methodology of waste treatment, marine bacterial diversity, bioleaching methods & bio-oxidation.
- Get awareness on the conservation of energy and migration towards bioenergy such as biogas, bio-hydrogen, bioethanol, etc.

Prerequisites

Student must have basic knowledge about waste treatment, bacterial diversity as well as energy resources.

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Course outline

Unit. No.	Course Contents	Teaching hours
1	**Waste treatment:** • Classification and characterization of waste • Principles and mechanisms of waste treatment • Biological methods of liquid waste treatment • Biological methods for solid waste management	10
2	**Marine Biotechnology:** • Marine environment and bacterial diversity • Cultivation and enumeration of marine bacteria • Application of indicators of marine microbial enzymes, polysaccharide, antimicrobial peptides and carotenoids	10
3	**Microbiology of Minerals:** • Bioleaching and Bio-oxidation • Biogeohydrotechnology of sulphidic minerals • Biobeneficiation • Acid mine drainage formation and control • Bioleaching methods and factors affecting bioleaching	10
4	**Fuel Biotechnology:** • Types of energy resources and their uses • Biotechnology for biogas, bioethanol, biodiesel and bio-hydrogen production ➢ Desirable and undesirable features of biofuels ➢ Energy crops ➢ MEOR ➢ Mode of utilization of biomass	10
		40

Learning Outcomes

- The students will be able to apply the knowledge of the biological methods for solid and liquid waste treatment, also get knowledge about classification and characterization of waste.

- Student should be able to understand marine bacterial diversity and also learn techniques for cultivation and enumeration of marine bacteria and get knowledge about indicators of marine microbial enzymes and its applications.

- The course is designed to give students understanding different methods of bioleaching, bio-oxidation, bio-beneficiation as well as biogeohydrotechnology of sulphidic minerals. The study fuel biotechnology also helps students to understand importance of energy resources with knowledge of biogas, bioethanol, biodiesel, bio-hydrogen technology.

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- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically, and/or in writing the theoretical data and laboratory experiments clearly and concisely that incorporates the stylistic conventions used by microbiologists worldwide.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
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- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Bimal C Bhattacharyya., & Rintu Banerjee (2007). *Environmental biotechnology.*
- Ronald M. Atlas., & Richard Bartha (1998). *Microbial Ecology: Fundamentals and Applications*, 4th Edition
- Brierley, C. L., Ehrlich, H. Lutz. (1990). *Microbial mineral recovery.*
- T. Scheper (1983). *Advances in biochemical engineering/biotechnology.*
- Garg, Sudhi. (2011). *Environmental Security: Human and Animal Health.*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Chemistry - I

Subject Code: 256020101

M.Sc. Semester-1

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
	(A) Elimination Reaction The E1, E2, E1CB 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. Nucleophilicsubstitution 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	**(A) Aromaticit** 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, Huckelsmoleculer 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** Concept, pKa, Hammette equation, Concept of hindered base, The effect of structure on the strength of acids and bases.	14
3	**(A) 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) Curtiusrearrangment (ii) Schmidt rearrangment (3) Carbon to oxygen migration of and Ar	14

	(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, prochiralcentre, biphenyl, allenes, spirans, compounds containing chiral nitrogen and sulfur, .stereospecific and stereoslective synthesis, dynamic resolution.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Advanced Organic Chemistry, Reactions Mechanisms and Structure , J. March, 6th Edition, John Wiley.
2. Carbenes, nitrenes and arynes, T.L. Gilchrist and C.W. Rees.

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3. Guidebook to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition, Prentice Hall.
4. Advanced Organic Chemistry Part A: Structure and Mechanism and Part B:Reaction and synthesis ,Francis A. Carey, Richard J. Sundberg, 5th Edition, Springer .
5. Organic Chemistry, JohnathanClayden, Nick Geeves, Stuart Warren, 1st Edition, Oxford University Press.
6. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, 3rd Edition, Blackie Academic and Proffessional.
7. Stereo Chemistry, P.S. Kalsi , New Age Publications.
8. Reagents in Organic Synthesis- Fieser and Fieser, John Wiley.
9. Physical Organic Chemistry by Jack Hynes,(plenum publication)
10. Organic Chemistry, T.W. Graham Solomons and Graig B. Frymes, John Wiley and Sons.
11. Organic Chemistry, F. A. Carey, McGraw Hill Edition.
12. General Organic Chemistry Sachin Kumar Ghose, New Central book agency.
13. Organic Chemistry Vol 1-2 I.L.Finar 5th edition,ELBS.

E-Resources

- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_General_Chemistry_(Petrucci_et_al.)/27%3A_Reactions_of_Organic_Compounds/27.03%3A_Introduction_to_Elimination_Reactions
- http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch08/ch8-0.html
- https://www.masterorganicchemistry.com/2017/02/23/rules-for-aromaticity/
- https://classnotes.org.in/class11/chemistry/ionic-equilibrium/concepts-acids-bases/
- http://burton.chem.ox.ac.uk/rearrangements-and-reactive.pdf
- https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/rearrang.htm
- https://www.masterorganicchemistry.com/2011/10/17/introduction-to-rearrangement-reactions/
- http://www.colby.edu/chemistry/CH241F/Chapter%204.pdf

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Inorganic Chemistry - I

Subject Code: 256020102

M.Sc. Semester-1

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental inorganic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
	Quantum theory and Atomic Structure Postulates of quantum mechanics, setting up of different observables, Eigen value of angular momenta and commutation relations, step-up and step-down operators, and angular momenta	14

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	in many electron atoms. Schrodinger wave equation and applications: particle on a ring and the simple harmonic oscillator. H-atom wave functions, solutions of R(r) θ(θ) and ϕ(φ) equations, quantum numbers, angular and radial wave function, shapes of the orbitals, angular momentum of inner quantum number j, physical interpretation of hydrogenic orbitals; space quantization of electronic orbits; electron spin. Approximation methods: Variation method and application to H atom. Perturbation theory (first order and non-degenerate, application to the Helium atom.	
2	**Symmetry and Group Theory** Representation of groups-some properties of matrices & vectors, representation of groups, the Great orthogonality theorem and its consequences, character table, wave functions as basis for irreducible representations, direct product, identifying nonzero matrix elements.	14
3	**Magnetochemistry** Magnetic susceptibility and basic derivation of diamagnetic susceptibility, pascal constant and its utility, Curie law and Curie-Weiss law, antiferromagnetism and ferromagnetism. Types of antiferromagnetism, antiferro magnetic exchange pathway : Direct – metal- metal interaction and Indirect-atom exchange i.e. super exchange mechanism.	14
4	**Bio-inorganic Chemistry** Metalloporphyrins (enzymes) definition, hemoglobin and myoglobin, cytochrome, vitamin B12 (cyanocobalamin), zincmetallo enzymes, nitrogen fixation, essential and trace elements in biological system, biochemistry of non-metals K, Na pump (action of bath ions), toxic metals and their toxicity. Co-ordination compounds in medicine Chelation therapy, gold compounds and rheumatoid arthritis, anticancer drugs –platinum complexes, gold complexes, metallocenesetc, antimicrobial agents, metal complexes as radiodiagnostic agents, magnetic resonance imaging.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of inorganic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

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- Include group work, with groups representing diverse cultures.

Books Recommended

1. Introduction to Quantum Chemistry, A. K. Chandra, Tata MacGraw Hill
2. Quantum Chemistry, Ira N. Levine, Prentice Hall
3. Quantum Chemistry by R. K. Prasad, New Age International Publishers (1985)
4. Elementary Quantum Chemistry by D. L. Pilar, McGraw Hill Book Co, New York (1968)
5. D. A. McQuarrie Quantum Chemistry, OUP 1983
6. M. W. Hanna, Quantum Mechanics in Chemistry, The Benjamin Pub.
7. Molecular Quantum Mechanics, Third Edition, P. W. Atkins and R.S. Friedman
8. Group theory and symmetry in chemistry, L. H. Hall(McGraw Hill)
9. F. A. Cotton, Chemical Applications of Group theory, Wiley Eastern 2nd Edn.1992
10. V. Ramkrishnan& M. S. Gopinadhan, Group theory in Chemistry Vishal Pub.1996.
11. Inorganic Chemistry, Third Edition, Alan G. Sharpe
12. Theoretical Inorganic Chemistry, M. C. Day, J. Shellin
13. Chemistry, Fifth Edition, John E. McMurry, Robert C. Fay
14. Hermann Dugas, Bioorganic Chemistry, A Chemical Approach to Enzyme Action, Springer International Edition
15. An Introduction to Theoretical Chemistry, Jack Simons, Cambridge
16. Progress in inorganic Chemistry, Vols 18 and 38 ed. J. J. Lippard, Wiley
17. Inorganic Reaction Mechanisms, M. L. Tobe, Nelson Pub
18. Inorganic Chemistry, K. F. Purcell and J. C. Kotz.
19. Principles of Bioinorganic Chemistry, S. J. Lippard and J. M. Bers
20. Bioinorganic Chemistry, I. Bertini, H. B. Gray and S. J. Lippard
21. Principals of Biooganic Chemistry, S. J. Lippard and J. M. Berg, University Science Books
22. Bioinorganic Chemistry, I. Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine, University Science Books.
23. Inorganic Biochemistry vols I and II ed. G. L. Eichhorn, Elsevier
24. Introduction to Magnetochemistry, Alan Earnshaw, 1968

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25. Elements of Magnetochemistry, Dutta and Syamal, 1993

E-Resources

- https://mysite.science.uottawa.ca/sgambarotta/sites/default/files/CHM%201311F/slide%20show/Ch-6%20atom/7_lecture.pdf
- https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Group_Theory/Group_Theory%3A_Theory
- http://www.ccl.net/cca/documents/dyoung/topics-orig/magnet.html
- https://www.mdpi.com/journal/magnetochemistry

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Physical Chemistry - I

Subject Code: 256020103

M.Sc. Semester-1

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental physical chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
	Chemical thermodynamics Nernst heat theorem and its applications to gaseous system, third law of thermodynamics and its applications to evaluate absolute entropies of solids, liquids and gases; partial molar quantities and their determination, Gibbs-Duhem equation, chemical potential,	

	chemical potential of idea gases and solutions, Raoult's law, real solutions, free energy and solutions, activity and activity coefficients, methods of determination of activity and activity coefficients, fugacity of gases and liquids and methods of its determination. Non equilibrium thermodynamics-basic concepts.	
2	**Chemical Kinetics** Unimolecular reactions, chain reactions and branched chain reactions, explosion limits, chain reaction between hydrogen and bromine, theory of absolute reaction rates, kinetic isotope effect. Enzyme catalyzed reactions, mechanism, kinetics and some examples.	14
3	**Solid state chemistry** Bonding in solids and electronic structure in solids, bond theory-metals, semiconductors and insulators, defects in crystals, calculation of schottly and Frenkel defects using statistical method, non stoichiometry, solid electrolytes, and diffusion in solids, electrical conductivity in solids, super conductivity, perovskites.	14
4	**Surface chemistry** Physical and chemical adsorption, BET and HJ equations, heat of adsorption, determination of surface area of adsorbents, surface tension, Gibb's equation, surface active agents, micellisation, critical micellar concentration (cmc), detergency.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Physical Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Textbook of physical chemistry – W.J.Moore.
2. Textbook of physical chemistry – Glasstone .
3. Textbook of physical chemistry – P.Atkins
4. Advanced physical chemistry – Surdeep Raj
5. Advanced physical chemistry – J.N.Gurtu, A.Gurtu
6. Thermodynamics for chemists –Glasstone
7. Physical chemistry – S. Castellian
8. Thermodynamics of non equilibrium processes- Karapitianeh
9. Chemical Kinetics- Laidler
10. Chemical Kinetics – Frost and Pearson
11. Solid state chemistry – H.Keer
12. Solid state chemistry- Hannay
13. Chemistry of solids – Azaroff
14. Surface chemistry – Adamson
15. Surface chemistry – Osipov

E-Resources

- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/19%3A_Chemical_Thermodynamics
- https://www.slideshare.net/shahzad_ali27/chemical-kinetics-32001888
- https://www.youtube.com/watch?v=W8FhlGNnMkg
- https://byjus.com/jee/surface-chemistry/
- https://www.youtube.com/watch?v=w4yMyWa4-lQ

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Analytical Chemistry - I

Subject Code: 256020104

M.Sc. Semester-1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental analytical chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
	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.	14
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.	14
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.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Analytical Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Quantitative Chemical Analysis" by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
2. "Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
3. "Principles of Instrumental Analysis" by Douglas A. Skoog, 3rd Edition, HoltSaunders International Edition.
4. "Instrumental Methods of Chemical Analysis" by Galen W. Ewing, 4th Edition, International Student Edition.

E-Resources

- http://c3162802.workcast.net/10211_Introduction,_Objectives,_and_Key_Requirements_for_GLP_Regulations_2011106145213.pdf
- http://web.iyte.edu.tr/~serifeyalcin/lectures/chem201/cn_8.pdf
- https://www.slideshare.net/MuhammadAsif564/fundamentals-of-spectrophotometer
- https://www.slideshare.net/rey216/spect

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF CHEMISTRY

Basic Chemistry-1

CODE : 253020101

B.Sc. 1st Semester

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives: -

Prerequisites: - Students should have basic knowledge of chemistry up to 10+2 level.

Course outline: -

Sr. No.	Course Contents	Number of Hours
1	**Unit I : Inorganic Chemistry (14 Marks)** **(a) Lanthanides:-** Electron configuration, Oxidation states, Magnetic properties, Color and absorption spectra of lanthanide ions, Lanthanide contraction, Separation and purification of Lanthanides: Ion-exchange and solvent extraction methods. **(b) Actinides:-** Electron configuration, Oxidation states, Magnetic properties, Color and absorption spectra of actinide ions, actinide contraction, Nuclear synthesis of trans uranic elements, Chain reaction, importance of Uranium, Comparison with lanthanide.	10
2	**Unit II : Organic Chemistry (14 Marks)** **(a) Quantitative Analysis & Determination of Molecular Formula:-** Determination of Nitrogen by Kjeldahl's method and Kjeldahl's method modified with boric acid . Molecular weight of organic acid by Ag-salt	12

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	method and organic base by Chloropicrate method, Numerical based on empirical and molecula formula. **(b) Fundamentals of Organic Reactions:-** Fission of covalent bond, types of reagents, Substitution Nucleophilic Unimolecular reaction mechanism (SN_1), Substitution Nucleophilic Bimolecular reaction mechanism (SN_2), Electrophilic Aromatic Substitution – Elementary treatment only (Nitration, Sulfonation, Halogenation & Friedel- Crafts Alkylation and Acylation)	
3	**Unit III : Organic Chemistry (14 Marks)** **(a) Alkanes:- (Saturated Hydrocarbons)** Introduction, IUPAC nomenclature, Reduction of R-X, Wurtz's reaction, Hydrolysis of R-Mg-X, Decarboxylation of acid, Kolbe's electrolytic process, Free radical mechanism (Chlorination of Methane). **(b) Alkenes & Alkynes:- (Unsaturated Hydrocarbons)** Introduction, IUPAC nomenclature, Preparations (dehydration, dehalogenation, dehydrohalogenation), Reactions with H_2, X_2, HX, HOCl, H_2SO_4, and Hydroboration; Oxidation reactions: (i) with cold alkaline $KMnO_4$ (Baeyer's reagent), (ii) Oxidative cleavage with acidified or hot $KMnO_4$, (iii) Ozonolysis (O_3); Polymerization; Reactions of terminal Acetylenes: (i) Addition of water, (ii) Na / liquid NH_3.	10
4	**Unit IV: Physical Chemistry (14 Marks)** **(a) Thermodynamics:-** Zeroth law, first law, Second law of thermodynamics; proof of 2nd law (Carnot's Cycle); Entropy, of Gas and calculation of entropy for different processes; Kirchhoff's equation. **(b) Chemical Kinetics:-** Basic terms: molecularity, order of reactions. Unit for rate constant; Derivation of: first order rate constant, Second order rate constant for (a=b) and (a ≠ b). Third order rate equation (a=b=c). Determination of Half Life Time for 1st, 2nd and 3rd order reactions.	10

Learning Outcomes:-

- Basic knowledge of valence bond theory and its applications.
- Knowledge of f-block elements and their periodic properties.
- Understanding of the concept of lanthanide contraction.
- Understanding of the concepts of general organic chemistry.
- Knowledge of reactions and mechanisms in organic chemistry.
- Basic concepts and theories of thermodynamic chemistry.
- Introduction of analytical chemistry and related terms.

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Teaching & Learning Methodology:- Chalk and Talk, Video Lectures

Books Recommended:-

1	‘Source Book on Atomic Energy' by Glastone, 1969.
2	‘Modern Inorganic Chemistry' by G.F. Liporni, ELBS, 4th edn, Colling Educational, 1983.
3	'Organic reaction and mechanism, P.S. Kalsi, New Age international Publishers.
4	Text book of organic Chemistry, P.S. Kalsi, New Age international Publishers.
5	Text book of Organic Chemistry, ArunBahal, S.Chand.
6	Physical Chemistry (Question and Answer) by R.N. Madan, G.D. Tuli, S.Chand.
7	Fundamentals of Analytical Chemistry by Skoos& West.
8	Analytical Chemistry, Garry D. Christain.
1	‘Inorganic Chemistry' D.F. Shriver, P.W. Atkinss and C.H. Longford, 3 rdedn, ELPS Oxford University Press, 1999.
2	‘Nuclear and Redio Chemistry' by G fried lander, J.W. Kennedy, E.S. Macias and J.M. Miller, 3rd edn, John Wiley, 1981.
3	Essentials of Nuclear Chemistry' H.J. Arnical, 4th edn, New Age International, 1995
4	‘Concise Inorganic Chemistry' J.D. Lee, 5th edn.
5	‘Inorganic Chemistry', D.F. Shriver, P.W. Atkinss, 3rd edn, Oxferd, 1999.
6	Concise Inorganic Chemistry' J.D. Lee, 4th edn, Champman and Hall ELBS, 1991.
7	Inorganic Chemistry' by A.G. Sharp, 3rd edn, ELBS, Longman, 1990.
8	Organic Chemistry Vol. I & II, S.M. Mukherji, S.P.Singh, R.P. Kapoor.
9	Reaction mechanism in Organic Chemistry, S.M. Mukhergi, S.P. Singh. 3rd edn, Macmillan.
10	Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4th edn, Himalaya Publication House.
11	Advance Physical Chemistry by Gurdeepraj.
12	Organic Chemistry, R. Morrison and R. Boyd, 6th edn, Pearson Education 2003.
13	Organic Chemistry, T.W. Graham Solomons , 4th edn, John Wilay, 1998.
14	Principal of Physical Chemistry by Puri, Sharma, Pathania.
15	Chemical Thermodynamics by R.P. Rastogi and R.R. Misra.
16	Nuclear Chemistry by C.V. Shekhar, Dominent-Publisher, New Delhi.
17	Essentials of physical Chemistry by B.S. Bahal, ArunBahal, G.D. Tuli.
18	Physical Chemistry by P.W.Atkins, 5th edn, Oxford 1994 7th edn-2002.
19	Physical Chemistry by R.A. Albert and R.J. Silby, John Wiley1995.
20	Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988, 6th edn, 1996.
21	Physical Chemistry by W.J. Moore, 4th edn, Orient Longmans 1969.
22	Analytical Chemistry, Day & Underwood.
23	Analytical Chemistry by Lerry&Hergins.
24	Qualitative Analysis by A.I. Vogel, 5th edn.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

INTRODUCTION TO BIOTECHNOLOGY

Subject Code: 253010101

B.Sc. Semester -1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives:-

- To provide introduction to biotechnology, basic concepts of genes, DNA & RNA, basic concepts of genetic engineering and applications of biotechnology in industries.
- The graduate program in Biotechnology is a joint interdisciplinary program of the five Departments namely Biology, Chemistry, Food Engineering, Environmental Engineering and Chemical Engineering offering M.Sc. and Ph. D. degrees with thesis.
- Biotechnology will result only from integration of multiplicity of scientific disciplines and technologies, including microbiology, biochemistry, genetics, molecular biology, bioinformatics, chemistry, chemical and process engineering, metabolic engineering and more recently a variety of fields.
- As a merger of science and business, biotechnology industry demands a multi-disciplinary workforce skilled in basic-research, product development, regulatory affairs, technology transfer and commercialization.

Prerequisites:-

- Students have basic knowledge of biotechnology, basic concepts of genes, DNA & RNA, basic concepts of genetic engineering and applications of biotechnology in industries.

Course outline:-

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Unit No.	Course Contents	Teaching Hours
1.	**Introduction to Biotechnology:** • What is Biotechnology? History, Interdisciplinary nature, Branches of Biotechnology, • Biotechnology in India.	10
2.	**Basic concepts of Genes, DNA & RNA:** • Gene Concepts, Chemical nature of DNA, chemical composition of DNA, Nucleotides, Nucleosides, Polynucleotide, Physical nature of DNA, • Chargaff's rule of equivalence, Watson and cricks model of DNA, circular and super helical DNA, • Organization of DNA in eukaryotes, • Types of DNA, RNA, Various types of RNA, Structure of RNA.	10
3.	**Basic of Genetic Engineering:** • What is Genetic Engineering?, • Basic steps involved in Genetic Engineering, • Scope and Importance of Genetic engineering	10
4.	**Application of Biotechnology:** • Forensics –parental test, DNA fingerprint • Transgenic crop- Bt cotton, Bt Brinjal • Transgenic Animals-Dolly • Biotechnology in Health care- Diagnostic and treatment. • Biotechnology in industries.	10
		40

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Learning Outcomes:

- At the end of the course the student would have basic knowledge of Biotechnology and its application
- Cognitive Knowledge: To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
- Information and Computer Literacy: To educate and make them up to date with the current scientific literature, computer programs and web information.
- Experimental Skills: To provide broad based training in technical skills in methods of biotechnology.
- Critical Thinking: To empower students with the ability to think and solve problems in the field of biotechnology.
- Scientific Communication: To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
- Professional Attitude: To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.

Teaching & learning Methodology:

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties

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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

- BD Singh. (2003) *Fundamentals of genetics.*
- HK Das. (2004) *Textbook of biotechnology*
- PK Gupta. (2000) *Genetics*
- U. Satyanarayan. *Biotechnology*
- U. Satyanarayan. *Biochemistry*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Introduction to Microbial world

Subject Code: 253040101

B.Sc. Semester-1

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide basic knowledge of Applications of Microbiology
- The purpose of the course is to provide basic knowledge of natural history of infectious organisms, contribution of various scientist in the field of microbiology, developments of first microscope and other technique used for isolation, study, characterization of microorganism. Instruments required to study the morphology of the microorganisms.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ Industrial field/ medical / Environmental Sciences.

Prerequisites

Student Must have Basic idea about Microorganisms, dyes and staining.

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Course outline

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Unit. No.	Course Contents	Teaching hours
1	**Developments of Microbiology as a new discipline of Biological science** • Discovery of Microbial World • Theory of Biogenesis, Discovery of viruses • Developments in Pure culture techniques • Germ Theory of disease and fermentation • Vaccines and Chemotherapy	10
2	**The Microbial World** • Habitats of Microbes, • Introduction to Prokaryotes and Eukaryotes • Comparison of Prokaryotes and Eukaryotes • Significance of Microbiology • Branches of Microbiology • Applied Microbiology • Genetic Engineering and Biotechnology	10
3	**Pure Culture Technique** • Principle and Method of Pure Culture Techniques • Method of Isolation and Preservation of Pure Culture • Culture Collection • Techniques used to Study Microorganisms • Principle of Microscopy, Light Microscopy, Dark Field Microscopy • Phase Contrast Microscopy, Fluorescence Microscopy, Electron Microscopy	10
4	**Dyes and Staining** • Chemistry of Dyes and stain, Smear • Mechanism and type of staining • Microbiological uses of dyes and stains.	10
		40

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Learning Outcomes

- The students will be able to understand the historical developments , the tools and techniques of Microbiology.
- The course is designed to give students an understanding of the types of organisms and application of Microbiology in various fields.
- At the end of the course the student would have basic knowledge of microbiology, different microbial techniques, learn about dyes and staining, structure of bacteria, method to isolate the microbes.
- Handling of microscopes and specimen preparation

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

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Books Recommended

- Gerard Tortora . Berdell Funke . Christine Case. Derek Weber. Warner Bair III

  Microbiology: An Introduction 13th Edition Published by Pearson (January 17th 2018)
- H.A. Modi.(2019) Elementary Microbiology ASIN : B081HCRN82
- Pelczar Jr. M J, Chan E C S. Krieg N R. (1986)
- Atlas R. (2015) Principles of Microbiology 2 nd Edition
- Ingraham J L and Ingraham C A Introduction to Microbiology: Thomson Brooks/Cole
- Michael T. Madigan & John M. Martinko (2010) Basic biology of microorganisms (11th edition)

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Microbial Genetics
CODE: 256010201
M.Sc. 2nd semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70		100

Objectives

- To provide students basic knowledge of Genetics of microbial organisms.
- The purpose of the course is to give students to introduction of replication, transcription and translation in eukaryotes.
- To provide an understanding of DNA damage and repair system and also get idea about transposons and its applications.

Prerequisites

Student Must have studied B.Sc. with biotechnology/Microbiology as a major subject and knowledge of basic biology.

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Course outline

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Sr. No.	Course Contents	Teaching hours
1	**Mutation and DNA Repair** Mutation, Spontaneous mutations (Random v/s adaptive nature of mutation, Luria and Delbruck experiment, Newcombe experiment, Lederberg's experiment, Mutation rate and its determination, Origin of spontaneous mutations), DNA damages (Deamination of bases, alkylation, damage due to reactive oxygen, UV induced damage) and it repair pathways (Methyl-directed mismatch repair, Nucleotide excision repair, Base excision repair, recombinational repair, SOS inducible repair, specific repair for oxidative DNA damage, pyrimidine dimers and alkylation induced damage and adaptive response). **Plasmid Biology** Types, compatibility, replication, control of copy number and plasmid segregation	10
2	**Recombination** Types of recombination, Models for Homologous recombination, Molecular mechanism of homologous recombination, Homologous recombination in eukaryotes, Mating- type switching. Molecular mechanism for site-specific recombination, Biological roles of site-specific recombination **Conjugation** Conjugation by E. coli F factor (Structure of F-factor, Regulation of F-factor fertility, establishment of cell contact, DNA mobilization and transfer and separation of mating pair, Hfr conjugation and chromosomal transfer, F-prime conjugation and merodiploid, Conjugation of fertility inhibited F-like plasmids, Nonconjugative, mobilizable plasmids, Broad Host Range self-transmissible plasmids, Chromosome mobilization by Non-F plasmids, Plasmid based conjugation in other bacteria (Salmonella, Pseudomonas, Streptomyces and Streptococcus. Interrupted mating and conjugational mapping. **Agrobacterium genetics** Ti-plasmid, Interkingdom gene transfer (Key early experiments, vir regulon, protein secretion apparatus, conjugation model of T-DNA transfer, Integration products).	10
3	**Transformation** Mechanism of Natural competence and transformation in Bacillus subtilis, Streptococcus pneumoniae and Haemophiles influenzae. Transformation by inducing artificial competence, Gene linkage and mapping by transformation. **Transduction Viral genetics** Generalized transduction in P22, P1, T4, γ and Mu bacteriophages, homologous recombination with recipient's chromosome, measuring transduction (cotransduction of markers, marker effects, abortive transduction, transduction of plasmids) Applications of generalized	10

	transduction. Specialized transduction in □ and its applications. **Viral genetics** Bacteriophages (T-series, γ-biology, Miniphages (M-13, γ X 174, Mu), Bacteriophage recombination (complementation, fine structure analysis).	
4	**Transposons Fungal genetics** Tetrad analysis and Mitotic recombination **Restriction-Modification systems** Role of Restriction-Modification systems, Types of RM systems, Modification, Restriction and Regulation. Transposable elements: Types of transposable elements, Structure, genetic organization and mechanism of transposition of Tn5, Tn3 and related transposons, Bacteriophage Mu, Tn7 and IS911, Integrons, Retrotransposons, Conjugative and Mobilizable transposons. Assays of transposition. **Molecular biology of tumor** Control of cell proliferation, oncogene activation, role of tumor suppressor genes, Apoptosis.	10

Learning Outcomes

- The students will be able to apply the knowledge of the Genetics of Microbes to understands concepts of various fields like R&D fields, Gene transfer among bacteria, etc.
- Student should be able to understand basic concepts of Mutation, DNA repair, Recombination, Conjugation, Transformation, Viral genetics, Transposons, Restriction-Modification systems, Molecular biology of tumor.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- Communicate verbally, graphically, and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by biotechnologist/Microbiologist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc.) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Lewin's GENES X, Volume 10Benjamin Lewin, Jocelyn Krebs, Stephen Kilpatrick, Elliott Goldstein-Jones & Bartlett Learning, 2011
2. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
3. Molecular biology of the cell (third edition): By B Alberts, D Bray, J Lewis, M Raff, K Roberts and J D Watson.
4. Biotechnology and genomics by P. K. Gupta, Rastogi Publication
5. Molecular Genetics of Bacteria: 3rd (third) Edition-Larry Snyder

E-Resources

- https://www.nature.com/scitable/topicpage/dna-damage-repair-mechanisms-for-maintaining-dna-344/
- https://www.microscopemaster.com/plasmids.html
- https://aklectures.com/lecture/cell-cycle-and-cell-division/conjugation-transformation-and-transduction
- https://aklectures.com/lecture/cell-cycle-and-cell-division/conjugation-transformation-and-transduction
- http://grupo.us.es/gfnl/dna/genetic_ingeniering/transposons.htm

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Immunology
Subject Code: 256010202
M.SC. Semester -2

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide students the basic knowledge of immunity, system of immunology, interaction of Ag-Ab.
- The purpose of the course is to give student to introduction of Types of immunity, antigen- antibody reaction, Hypersensitivity reaction etc.
- To provide an understanding of immune system in the body, types of cells etc..

Prerequisites

Student Must have studied M.Sc. with microbiology as a major subject and knowledge of basic Immunology and medical microbiology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1.	Adaptive immunity and innate immunity: inflammation, role of cells, receptors and proteins in innate immunity, ubiquity of the innate system. Cells and organs of the immune system: Hematopoiesis, cells of the immune system, primary and secondary lymphoid organs. Antigens and antibodies: properties of immunogens, haptens, epitopes, structure and classes of immunoglobulins, biological activities and effector functions, monoclonal antibodies and anzymes. Antibody diversity: models, organization of Ig genes, mechanism of gene rearrangement, generation of diversity; expression, synthesis and class switching, antibody engineering.	10
2.	Antigen-antibody interactions: principles and applications. Complement: components of the system, activation, regulation, biological consequences and deficiency diseases. Major histocompatibility complex and antigen presentation: MHC-organization, inheritance, genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction, cytosolic and endocytic pathway for antigen processing.	10
3.	T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells. Generation, activation and differentiation of B cells: B cell maturation, activation and proliferation, germinal centres, regulation of the responses. Cytokines: properties, receptors, associated diseases, therapeutic applications. Leukocyte activation and migration: CAM, chemokines, recirculation and extravasation, inflammation and anti-inflammatory agents. Cell mediated cytotoxicity: effector T cells, cytotoxic T cells, NK cells, ADCC.	10
4.	Hypersensitivity reactions: classification and types of hypersensitivity reactions. Immune tolerance and autoimmunity: establishment and failure of tolerance, autoimmune diseases, mechanisms for the induction, animal models, treatment. Transplantation immunology: basis and manifestation of graft rejection, immunosuppressive therapy, immune tolerance. Cancer and immune system. Immunodeficiency.	10

Learning Outcomes

- The students will be able to understand the Knowledge of the types of immune system , Ag-Ab reaction techniques in the body ,hypersensitivity reaction etc.
- Student should be able to understand basic concepts of immunity and types of the cell, classification of the hypersensitivity :its types and function.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- At the end of the course the student would have basic knowledge of immunity, system of immunology, interaction of Ag-Ab.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Kuby-Immunology: T. J. Kindt, R. A. Goldsby and B. A. Osborne; W. H. Freeman
- Janeway's Immunology: K. Murphy, P. Travers and M. Walport; Garland Sciences
- Immunology: Ivan Roitt, J. Brostoff and D. Male; Mosby
- Essential immunology: Ivan Roitt; Oxford: Blackwell
- Topic related review articles.

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E-Resources

- https://www.slideshare.net/mobile/Jsjahnabi/types-of-immunity
- https://www.slideshare.net/mobile/mprasadnaidu/immunity-32908889
- https://www.slideshare.net/mobile/ArunimaSur/antigen-antibody-interaction-55880086
- https://www.slideshare.net/mobile/VELSPHARMD/hypersensitivity-24449005
- https://www.slideshare.net/mobile/VamsiIntellectual/types-of-cells-and-tissues

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Bioprocess Technology

CODE: 256010203

M.Sc. 2nd semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70		100

Objectives:-

- To provide basic knowledge of bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. Types of substrate used for fermentation and about medium optimization.
- This study gives idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- The student will get an idea about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.
- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.

Prerequisites: -

Student must have passed BSc Microbiology as major subject with basic knowledge of biology.

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Course outline: -

Sr. No.	Course Contents	Number of Hours
1.	Introduction to bioprocess technology Isolation, preservation and improvement of industrially important organisms. Substrates for fermentation processes Medium optimization	10
2.	Bioreactor design: Laboratory, pilot and large scale reactors. Plug flow reactors, enzyme reactors. Sterilization of media and air. Scale up and Scale down Mass transfer of oxygen: Agitation and aeration, Determination of K_La, factors affecting K_La, fluid rheology. Inoculum development, aseptic inoculation and sampling.	10
3.	Bioprocess kinetics: Kinetics of growth and substrate utilization in batch, fed batch and continuous systems. Control of process parameters: Instrumentation for monitoring bioreactor and fermentation processes, Sensors, Controllers, fermentation control systems and architecture, Incubation and sequence control, advanced control. Dynamic modelling of fermentation processes.	10
4.	Downstream processing: Methods of Cell separation, Disruption and product purification. Fermentation Economics	10

Learning Outcomes:

- Student will learn about the bioprocess technology in the industry, how to isolate the micro-organisms, its preservation. How the strain can be improved for industrially important organisms. Types of substrate used for fermentation and about medium optimization.
- Provide an idea about the bioreactor design. Types of bioreactor used in the industry. how the sterilization of media and air can be done. Importance of mass transfer and determination of Kla, inoculum development.
- Get knowledge about kinetic of substrate and utilization of batch, types of fermentation i.e fed batch and batch fermentation. What can be control system for monitoring the fermentation process.

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- To provide the idea about down streaming process how to get end product in the fermentation. What different methods can be used for down streaming process.

Teaching & learning Methodology:

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

- Principles of Fermentation Technology : Whitaker & Stanbury Comprehensive
- Biotechnology : Murray Moo Young
- Methods in Industrial Microbiology : Sikyta
- Fermentation Microbiology and Biotechnology, El Mansi and Bryc

E-Resources

- https://www.slideshare.net/zeal_eagle/fermentation-technology
- https://www.slideshare.net/asertseminar/bioreactor-ppt
- https://www.cheric.org/files/education/cyberlecture/e200402/e200402-901.pdf
- https://science.sciencemag.org/content/219/4585/728
- https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/downstream-processing

https://www.slideshare.net/AyushJain378/downstream-processing-73275843

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Tools and techniques in synthetic microbiology

CODE: 256010204

M.Sc. 2ND SEMSTER

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	4	4	6	30	-	70		100

Objectives:-

- To provide basic knowledge of microscopy & its types, fixation & storage & cytology.
- The aim of the course is to provide students with the basic principles of cytochemistry and histochemistry.
- The preparation techniques for sample analysis used in cytochemistry, histochemistry, immunocytochemistry and in situ hybridization will be illustrated.
- Basic knowledge will also be provided for optical and electronic visualization of biological interest macromolecules.
- Theoretical lessons will be associated with seminars / workshops relating to examples of application of these methods to the study of cellular biology and instrument observation tools.
- The Microscope. Learning Objectives By the end of this topic, you will be able to: Name the parts of the microscope and their functions.

Prerequisites:-

- Student Must have studied B.Sc. with microbiology/biotechnology as a major subject and knowledge of basic biology

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Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	Light microscopy:- Optical corrections, Properties and types of objectives. Oculars, Illumination. Types of light microscopes: Bright field, dark field, fluorescence, phase contrast, polarizing, differential interference contrast. Micrometry.	10
2.	Electron microscopy: Basic components of electron microscopes. Thermionic and field emission electron guns. Types of electron microscopes: TEM, SEM, STEM, ESEM and HVEM	10
3.	Fixation and storage: Classification of fixatives , formulas. (Plant, animal and microbial samples). Factors affecting fixation. Procedures for fixation. Dehydration, infiltration and embedding. Media for embedding. Microtomes: Rotary, sliding cryostat, ultramicrotome and freezing ultra microtome. Preparation of biological samples for light and electron microscopy: Sectioning, maceration, squash and clearing technique. Freeze etching and freeze fracturing. Stains for light and electron microscopy. Staining procedures. Photomicrography.	10
4.	Histochemistry: Histo chemical localization of metabolites:- Starch, proteins, lipids, total carbohydrates, lignin, polyphenols, nucleic acid, histones, cutin, suberin and waxes. Localization of enzymes: Peroxidase, acid phosphatase and succinic dehydrogenase. Ultra structural cytochemistry:- Localization of tannin, protein, cell wall polysaccharide, lignin and membrane. Enzymes: Peroxidase, acid phasphatase. Immunocytochemistry	10

Learning Outcomes:

- At the end of the course the student would have basic knowledge of microscopy & its types, fixation & storage & cytology.

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- At the end of the course, the student will have acquired basic theoretical knowledge related to:
    - -preparation techniques of histological samples and their cyto-histochemical staining;
      -main techniques of immunohistochemistry and in situ hybridization;
      - main methods of in situ observation of biological macromolecules in cells and tissues.
    - It is therefore timely to investigate how microscopy techniques can be taught most efficiently.
    - In this study, different teaching activities (TAs) that are currently used for microscopy training of students will be assessed regarding their value for the realization of intended learning outcomes

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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Books Recommended

- Kuby-Immunology: T. J. Kindt, R. A. Goldsby and B. A. Osborne; W. H. Freeman
- Janeway's Immunology: K. Murphy, P. Travers and M. Walport; Garland Sciences
- Immunology: Ivan Roitt, J. Brostoff and D. Male; Mosby

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- Essential immunology: Ivan Roitt; Oxford: Blackwell
- Topic related review articles.

E-Resources

- https://microbenotes.com/category/microscopy/
- https://www.khanacademy.org/science/high-school-biology/hs-cells/hs-introduction-to-cells/a/microscopy
- https://www.sciencedirect.com/topics/neuroscience/histochemistry
- https://www.sciencedirect.com/topics/medicine-and-dentistry/cytochemistry
- http://cytochemistry.net/

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Chemistry - II

Subject Code: 256020201

M.Sc. Semester-2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	--	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Spectroscopy** 13 CNMR: General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants.Mass spectroscopy: Introduction, ion production, EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds,	14

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	common functional groups, molecular ion peak, metastable peak, McLafferty rearrangement. Nitrogen rule. High resolution mass spectroscopy.Examples of mass spectral fragmentation of organic compounds, NMR, IR, UV with respect to their structure determination.	
2	**(A) Photochemistry** (1) Photochemical reactions: Principles of energy transfer, electronic excitation and molecular orbital view of excitation, excited states and fate of excited molecules (modified Jablonski diagram), Photosensitization. (2) Photochemistry of carbonyl compounds: Representation of excited states of ketones, photoreduction Norrish typeI& Π reactions, Reactions of cyclic Ketone, oxetane formation (Paterno-Buchi reaction) (3) Di-π methane rearrangement, Dienone photochemistry, cis-trans isomerisation and photochemistry of conjugated olefins. **(B) Chemistry of Heterocycles** (1) Nomenclature of heterocycles: Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocycles. General chemical behavior of aromatic heterocycles. (2) Five-membered and benzo fused five member heterocycles: Oxazole, Isoxazole, Thiazole, Pyrazole, Imidazole, Benzothiazole and Benzimidazole. (3) Six membered and benzofused six membered heterocycles: Pyrazine, Pyridazine, Pyrimidine, Cinnoline, Quinazoline, Quinoxaline, Phenoxaline.	14
3	**Name reactions** General nature, method, mechanism and synthetic applications of the following reactions: (i) Vilsmeier-Haack reaction (ii) Mitsunobu reaction (iii) Suzuki reaction (iv) Buchwald Hartwing reaction (cross coupling) (v) Sonogarshira coupling (vi) Stobbe condensation (vii) Jones oxidation (viii) Swern oxidation reaction (ix) Michael addition (x) Darzen'sglycidic ester synthesis (xi) Mannich reaction (xii) Dickmann reaction (xiii) Birch reduction (xiv) Witting reaction (xv) Knoevanagel reaction	14

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4	**Stereo Chemistry** Mechanism selectivity and utility of following reagents: (i) Gilman's reagent-Lithium dimethylcuprate (ii) Lithium diisopropylamide (LDA) (iii) Dicyclohexylcarbodiimide (DCC) (iv) 1,3 – Dithiane (Umpolung reagent) (v) Dess- Martin periodinane (vi) Bakers yeast (vii) Diisobutylauminium hydride(DIBAL –H) (viii) Sodium cyanoborohydride (NaBH3(CN)) (ix) Grignard reagents (x) Sodium borohydride (xi) DDQ (xii) n-Butyl lithium (xiii) Phase transfer catalysis: Quaternary ammonium and phosphonium salts, crown ethers.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a

programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Include group work, with groups representing diverse cultures.

Books Recommended:

1. Modern Synthetic Reactions, H.O.House, W.A. Benjamin.
2. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, 3rd Edition, Blackie Academic and Professional.
3. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, 7th Edition,Wiley.
4. Mass Spectrometry – A Textbook Jurgen Gross, 1st Edition, 2002, Springer – Verlag Berlin Heidelberg.
5. Introductory Photochemistry, A.Cox and T.Camp, McGraw Hill.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Organic Photochemistry, J. Coxon and B. Halton, 2nd Edition, Cambridge University Press.
8. Strategic Applications of Named Reactions in Organic Synthesis, Laszlo Kurti and Barbara Czak, 1st Edition, Academic Press.
9. Name Reactions and Reagents in Organic Synthesis, Bradford P. Mundy, Michael G. Ellerd , Frank G. Favaloro, 2nd Edition, Wiley – Interscience.
10. Name Reactions. A Collection of Detailed Reaction Mechanisms,Jie Jack Li, 3rd Edition, Springer.
11. Heterocyclic Chemistry, volume 1-3, R.R. Gupta, M. Kumar and V. Gupta, Springer-Verlag.
12. Heterocyclic Chemistry, J.A. Joule, K.Mills, and G.F. Smith, 3rd Edition, Chapman and Hall.
13. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
14. Contemporary Heterocyclic Chemistry, G.R. Nikome and W.W. Poudler, Wiley.
15. Comprehensive Heterocyclic Chemistry, A.R. Kartizky, and C.W. Rees.
16. Encyclopedia of Reagents for Organic Synthesis, Leo A. Paquette, David Crich and Phillip L. Fuchs, John Wiley and Sons Inc.
17. Organic Chemistry, T.W. Graham Solomons and Graig B. Frymes, John Wiley and Sons.
18. Organic Chemistry, F. A. Carey, McGraw Hill Edition.
19. General Organic Chemistry Sachin Kumar Ghose, New Central book agency.
20. Guidebook to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition, Prentice Hall.
21. Advanced Organic Chemistry Part A: Structure and Mechanism and Part B:Reaction and synthesis ,Francis A. Carey, Richard J. Sundberg, 5th Edition, SPRINGER.
22. Organic chemistry vol 1-2 I.L Finar 5th edition, ELBS.

E-Resources

- file:///C:/Users/admin/Downloads/spectroscopybasics-180519091436.pdf

https://www.youtube.com/watch?v=p_BMWRaL62w

https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/28%3A_Photochemistry/28.03%3A_Organic_Photochemistry

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Inorganic Chemistry - II

Subject Code: 256020202

M.Sc. Semester-2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental inorganic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
	Chemical Bonding The method of linear combination VSEPR, Walsh diagrams(tri-and penta- atomic molecules), dπ –pπ bonds, Bent rule and energetics of hybridization, some simple reactions of covalently bonded	

	molecules. Simple Huckel theory of linear conjugated systems, simple Huckel theory of the cyclic conjugated system and aromaticity, self-consistent filed method, valence state ionization potentials, Pariser-Parr-Popleappoximation. Band theory of solids, Fermi level, electrical properties, insulators, semiconductors and superconductors (properties).	
2	**Application of symmetry** Application of symmetry to hybrid orbital, molecular orbitals, hybridization schemes for σ orbitals, π bonding and molecular orbital for ABn type of molecules. Application of symmetry to molecular vibrations, interpretation of IR and Raman spectral data.	14
3	**Organometallic Compounds** Organometallic compounds of transition elements, stability of metal carbon bond in complexes. Synthesis, uses and structure of organometallic compounds of π bonding organic ligands, 2-electron ligands, olifinic and acetylinic complexes, compound with 3 electron ligand – allylic complexes, compounds. With 4- electron ligands butadiene complexes, n4 complexes of cyclopentadiene, compounds with 5 electron ligands – cyclopantadionyl, compounds with 6 electron ligands, n6 complexes of benzene and its derivatives. Role of organometallic compounds in catalytic reaction.	14
4	**Reaction Mechanism** Mechanism of substitution reaction in square planar complexes. Kinetics of substitution reaction of platinum (II) complexes Effect of leaving group, effect of charge, steric effect, solvent effect, effect of nucleophile, effect of tempeature and other effects. Oxidation-Reduction reaction, electron transfer, tunnelling effect, Marcus – Hush theory, one and two electron transfer inner sphere and outer sphere, effect of ions on rate, electron transfer through extended bridges, unstable oxidation states, hydrated electron.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of inorganic Chemistry.

Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

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We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures

Books Recommended

1. Introduction to Quantum Chemistry, A. K. Chandra, Tata MacGraw Hill
2. Quantum Chemistry, Ira N. Levine, Prentice Hall
3. Quantum Chemistry by R. K. Prasad, New Age International Publishers (1985)
4. D. A. McQuarrie Quantum Chemistry, OUP 1983
5. M. W. Hanna, Quantum Mechanics in Chemistry, The Benjamin Pub.
6. Lectures on Chemical Bonding and Quantum Chemistry, S. N. Datta, A Prism Book
7. Group theory and symmetry in chemistry, L. H. Hall(McGraw Hill)
8. Coulson's Valence, R. McWeeny, ELBS
9. F. A. Cotton, Chemical Applications of Group theory, Wiley Eastern 2nd Edn.1992
10. V. Ramkrishnan& M. S. Gopinadhan, Group theory in Chemistry Vishal Pub.1996.
11. Inorganic Chemistry, Third Edition, Alan G. Sharpe
12. Theoretical Inorganic Chemistry, M. C. Day, J. Shellin
13. Chemistry, Fifth Edition, John E. McMurry, Robert C. Fay
14. An Introduction to Theoretical Chemistry, Jack Simons, Cambridge
15. Progress in inorganic Chemistry, Vols 18 and 38 ed. J. J. Lippard, Wiley
16. Mechanism of Inorganic Reactions, F. Basolo and R. G. Persons, Wiley Pub
17. Reaction Mechanism of Coordination Compounds, C. H. Langford and H. B. Gray
18. Inorganic Reaction Mechanisms, M. L. Tobe, Nelson Pub
19. Inorganic Chemistry, K. F. Purcell and J. C. Kotz.
20. Principles of Bioinorganic Chemistry, S. J. Lippard and J. M. Bers
21. Mehrotra R. C. and Singh A. Organo Metallic Chemistry, Willey Eastern Ltd, New Delhi

22. Coates G. E. Green MIH Wade, K and Aylett B. J. Organo Metallic Comounds Chapman and Hall, Londo

E-Resources

- https://www.visionlearning.com/en/library/Chemistry/1/Chemical-Bonding/55
- https://www.britannica.com/science/chemical-bonding
- https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Modules_and_Websites_(Inorganic_Chemistry)/Chemical_Compounds/Introduction_to_Chemical_Bonding
- https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Map%3A_Inorganic_Chemistry_(Miessler_Fischer_Tarr)/04%3A_Symmetry_and_Group_Theory/4.04%3A_Examples_and_Applications_of_Symmetry
- https://sites.cns.utexas.edu/jones_ch431/section-1-symmetry
- https://www.britannica.com/science/organometallic-compound
- https://www.youtube.com/watch?v=Efh5GkVbhEc

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Physical Chemistry - II

Subject Code: 256020203

M.Sc. Semester-2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental physical chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
	Statistical thermodynamics Concepts of distribution of molecules, thermodynamic probability, permutations and combinations, Boltzmann's most probable distribution, partition function - translational, vibrational, rotational, electronic nuclear partition functions.	

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2	**Nuclear chemistry** Nuclear properties-nuclear radius, coulombic and nuclear potential radius, nuclear spin and angular momentum, magnetic moment, nuclear binding energy, nuclear models-shell model, liquid drop model, Fermi gas model, collective model, radioactive decay, nuclear reactions, evaporation, spallation, fragmentation, fission and fusion reactions, accelerators, reaction cross section, use of radioisotopes as tracers.	14
3	**Polymer chemistry** Kinetics and mechanism of polymer processes, criteria of polymer solubility, thermodynamics of polymer solutions, polymer characterization, molecular weight of polymer (number average and weight average) , methods of molecular weight determination, properties of polymers and applications.	14
4	**Electrochemistry** Sign convention-American, European and IUPAC; Determination of dissociation constant of monobasic acids by conductometry, determination of dissociation constants of monobasic and polybasic acids by potentiometry. The electrical double layer, the rate of charge transfer, polarization and overvoltage, basic principle of polarography, origin of different types of current; equation of polarographic wave, Ilkovic equation.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Physical Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.

- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.

- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Textbook of physical chemistry – W.J.Moore
2. Textbook of physical chemistry – Glasstone
3. Textbook of physical chemistry – P.Atkins
4. Advanced physical chemistry – Surdeep Raj
5. Advanced physical chemistry – J.N.Gurtu, A.Gurtu
6. Statistical thermodynamics – M.C.Gupta
7. Polymer chemistry – Gowariker
8. Polymer chemistry – Billmayer
9. Principles of polymer science – Bahadur&Sastry
10. Polymer science & technology – Fried
11. Polymer chemistry- Malcolm P. Stevens
12. Nuclear chemistry – Arniker
13. Nuclear and radio chemistry – J.W. Kannedy, G.Friedlander
14. Electrochemistry – Bockris and Reddy

E-Resources

- https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Book%3A_Thermodynamics_and_Chemical_Equilibrium_(Ellgen)/01%3A_Introduction_-_Background_and_a_Look_Ahead/1.04%3A_Statistical_Thermodynamics#:~:text=Statistical%20thermodynamics%20is%20a%20theory,of%20macroscopic%20quantities%20of%20compounds.

- http://web.thu.edu.tw/ghliu/www/0723/CH16StatMech.pdf

- https://uh.edu/engines/StatisticalThermodynamics.pdf

- https://byjus.com/chemistry/nuclear-chemistry/

- http://www.chemistry.wustl.edu/~dgs/chem436/Lectures/Chem-436-Lecture_notes.pdf

- https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/

http://web.mit.edu/5.33/www/lec/poly.pdf

https://www.clearitmedical.com/2019/04/chemistry-notes-electrochemistry.html

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Analytical Chemistry - II

Subject Code: 256020204

M.Sc. Semester-2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental analytical chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
1	**Sample Preparation Techniques** Liquid-liquid extraction/solvent extraction-partition coefficient, distribution ratio and percent extraction. Solvent extraction of metal ions-ion association complexes and metal chelates, multiple batch extraction, Craig's counter-current distribution. Accelerated and	

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	Microwave assisted extraction, protein precipitation and solid phase extraction (SPE).	
2	**Chromatographic Methods** Principles of chromatography, classification of chromatographic techniques based on mechanism of retention, configuration, mobile and stationary phase. Efficiency of separation- plate theory (theoretical plate concept) and rate theory (Van Deemter equation). Principles and applications of Paper chromatography, thin layer chromatography, HPTLC and Ion exchange chromatography. Counter-current chromatography for isolation of natural products.	14
3	**pHmetry and Conductometry** pH measurement with glass electrode, working of glass electrode, mechanism of pH measurement, calibration of glass electrode, errors in pH measurement. Electrical conductance in solutions of electrolytes, measurement of conductance, conductometric titrations- acid-base, precipitation and complex formation titrations.	14
4	**Potentiometry and Ion selective electrodes** Electrochemical cell, cell potentials, sign convention for electrode potentials, types of reference and indicator electrodes-metallic indicator and membrane indicator electrodes. Classification of membrane electrodes-ion-selective and molecular-selective electrodes. Principle, properties and design of ion-selective electrodes. Crystalline and non-crystalline membrane electrodes. Gas-sensing probes and enzyme substrate electrodes. Applications of potentiometric titrations.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Analytical Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Work with students at an early stage of the programmer/module, to identify cultural Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. "Quantitative Chemical Analysis" by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.

2. "Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.

3. "Principles of Instrumental Analysis" by Douglas A. Skoog, 3rd Edition, HoltSaunders International Editions.

E-Resources

- https://www.intechopen.com/books/ideas-and-applications-toward-sample-preparation-for-food-and-beverage-analysis/overview-of-green-sample-preparation-techniques-in-food-analysis
- https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Analytical_Sciences_Digital_Library/Active_Learning/Contextual_Modules/Sample_Preparation/01_Introduction_to_Sample_Preparation
- https://onlinelibrary.wiley.com/doi/pdf/10.1002/0471457817.fmatter
- https://www.slideshare.net/rey216/spect
- https://www.azolifesciences.com/article/What-is-a-pH-Meter-and-How-Does-it-Work.aspx
- http://web.colby.edu/ch331public/ph-measurements/
- https://chem.libretexts.org/Bookshelves/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3A_pH_Measurement_and_Its_Applications_(Experiment)
- https://www.basinc.com/assets/library/issues/18-3/cs18-3c.pdf
- https://chem.libretexts.org/Bookshelves/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_9_Experiments/07%3A_Electrical_Conductivity_of_Aqueous_Solutions_(Experiment)

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Basic Chemistry-2

CODE : 253020201

B.Sc. 2nd Semester

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives: -

Prerequisites: -Students should have basic knowledge of chemistry up to 10+2 level.

Course outline: -

Sr. No.	Course Contents	Number of Hours
1	**UNIT I : Inorganic Chemistry :- (14 Marks)** **(a) Chemical Bonding:-** Covalent bond-Sidgwick Powel Theory, VSEPR Theory, Examples of NH_3, H_2O, ClF_3, SF_4, SF_6, I_3^-, IF_7; Hybridization of atomic orbitals; Rules for Hybridization; Types of Hybridization and shape of some molecules (sp, sp^2, sp^3, sp^3d, sp^3d^2). **(b) Complex Compound**:- Werner's Theory; Labile and inert complexes; Stability of complex compounds; Factors influencing the stability of complexes; Spectrochemical Series; V. B. theory for complexes – Examples of ML_4 & ML_6 type (Fe, Co, Ni, Mn).	15

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2	**UNIT II : Inorganic Chemistry:- (14 Marks)** **(a) Introduction of Wave Mechanics:-** Wave equation and wave functions, its interpretation, significance of Ψ and Ψ^2, Limitations of acceptable wave functions, Normalized and orthogonal (orthonormal) wave functions, Eigen values and Eigen functions **(b) Operator Concept in Quantum Chemistry:-** Operators, type of operators, Hamiltonian Operator for H atom, H_2 molecule, H_2^+ ion, He, Li, Be and B atom.	10
3	**UNIT III : Organic Chemistry:- (14 Marks)** **(a) Fundamentals of Stereochemistry**:- Introduction, Stereochemical aspects of organic molecules, Chirality, Optical isomerism, Enantiomers and Diastereomers, R-S nomenclature, E-Z nomenclature. **(b) Conformations**:- Conformational analysis of Ethane, n-Butane & Cyclohexane.	12
4	**UNIT IV: Physical Chemistry:- (14 Marks)** **(a) Ionic equilibrium**:- Definition of basic terms: Electrical conductance, Specific conductance Equivalent conductance, Molar conductance, Cell constant & degree of Dissociation; Derivation of Oswald's dilution law , its applications and Limitations; pH Scale, Hydrolysis, Relation between K_a, K_b, K_h, & K_w for Strong acid Strong baseStrong acid Weak base Weak acid Strong base Buffer Solution, (Henderson – Hasselbalch equation), Indicator theory, Useful pH range of indicator for acid base titration. **(b) Nuclear Chemistry:-** Radioactivity, Rutherford's disintegration theory, Soddy's group Displacement law, Packing fraction, Factors affecting stability of Nucleus (Mass defect, Binding energy, N / P ratio) .	10

Learning Outcomes:-

- Basic knowledge of valence bond theory and its applications.
- Knowledge of f-block elements and their periodic properties.
- Understanding of the concept of lanthanide contraction.
- Understanding of the concepts of general organic chemistry.
- Knowledge of reactions and mechanisms in organic chemistry.
- Basic concepts and theories of thermodynamic chemistry.
- Introduction of analytical chemistry and related terms.

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Teaching & Learning Methodology:-

Books Recommended:-

Text Books	
1	'Source Book on Atomic Energy' by Glastone, 1969.
2	'Modern Inorganic Chemistry' by G.F. Liporni, ELBS, 4th edn, Colling Educational, 1983.
3	'Organic reaction and mechanism, P.S. Kalsi, New Age international Publishers.
4	Text book of organic Chemistry, P.S. Kalsi, New Age international Publishers.
5	Text book of Organic Chemistry, ArunBahal, S.Chand.
6	Physical Chemistry (Question and Answer) by R.N. Madan, G.D. Tuli, S.Chand.
7	Fundamentals of Analytical Chemistry by Skoos& West.
8	Analytical Chemistry, Garry D. Christain.
Reference Books	
1	'Inorganic Chemistry' D.F. Shriver, P.W. Atkinss and C.H. Longford, 3 rdedn, ELPS Oxford University Press, 1999.
2	'Nuclear and Redio Chemistry' by G fried lander, J.W. Kennedy, E.S. Macias and J.M. Miller, 3rd edn, John Wiley, 1981.
3	Essentials of Nuclear Chemistry' H.J. Arnical, 4th edn, New Age International, 1995
4	'Concise Inorganic Chemistry' J.D. Lee, 5th edn.
5	'Inorganic Chemistry', D.F. Shriver, P.W. Atkinss, 3rd edn, Oxferd, 1999.
6	Concise Inorganic Chemistry' J.D. Lee, 4th edn, Champman and Hall ELBS, 1991.
7	Inorganic Chemistry' by A.G. Sharp, 3rd edn, ELBS, Longman, 1990.
8	Organic Chemistry Vol. I & II, S.M. Mukherji, S.P.Singh, R.P. Kapoor.
9	Reaction mechanism in Organic Chemistry, S.M. Mukhergi, S.P. Singh. 3rd edn, Macmillan.
10	Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4th edn, Himalaya Publication House.
11	Advance Physical Chemistry by Gurdeepraj.
12	Organic Chemistry, R. Morrison and R. Boyd, 6th edn, Pearson Education 2003.
13	Organic Chemistry, T.W. Graham Solomons , 4th edn, John Wilay, 1998.
14	Principal of Physical Chemistry by Puri, Sharma, Pathania.
15	Chemical Thermodynamics by R.P. Rastogi and R.R. Misra.
16	Nuclear Chemistry by C.V. Shekhar, Dominent-Publisher, New Delhi.
17	Essentials of physical Chemistry by B.S. Bahal, ArunBahal, G.D. Tuli.
18	Physical Chemistry by P.W.Atkins, 5th edn, Oxferd 1994 7th edn-2002.
19	Physical Chemistry by R.A. Albert and R.J. Silby, John Wiley1995.
20	Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988, 6th edn, 1996.
21	Physical Chemistry by W.J. Moore, 4th edn, Orient Longmans 1969.
22	Analytical Chemistry, Day & Underwood.
23	Analytical Chemistry by Lerry&Hergins.
24	Qualitative Analysis by A.I. Vogel, 5th edn.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

Origin & Evolution

Subject Code: 253010201

B.Sc. Semester -2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives:-

- To provide basic knowledge of for origin & evolution of life including of Plant and animal kingdom and the microbial world.
- Evolutionary processes over billions of years gave rise to the biodiversity of life on earth.
- With this overview of the origin and evolution of life, you can improve your understanding of topics like natural selection and random mutation. Concise but filled with helpful information, the lessons are designed to help you with further studies.
- Students can know structure and function of plant parts. Also know pollination, fertilization and germination.
- Describe key changes that occurred as more complex animals evolved from simple animals
- Students will understand how these cellular components are used to generate and utilize energy in cells.
- To identify evolutionary relatedness between the different phyla of animals.

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- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.
- To ensure that you can achieve an up to date level of understanding of plant science.

Prerequisites:-

- Students have basic knowledge of for origin & evolution of life including of Plant and animal kingdom and the microbial world.
- Students must have knowledge of structure and function of plant parts. Also know pollination,fertilization and germination.

Course outline:-

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Unit. No.	Course Contents	Teaching Hours
1.	**Origin and evolution of life:** • History of earth, Theories of origin of life, millers experiments, Cell Theory, Cell differentiation, • Levels of organization; • Nature of earliest organisms, • Evolution of Prokaryotes, Eukaryotes, Mitochondria and Chloroplast; Quest for extra-terrestrial life, • Whittaker's five-kingdom classification	**10**
2.	**Plant Kingdom:** • General Characters of plant, • Body organization: Root, Stem and leaves; Tissues: Dermal, vascular and Ground; • Growth: Primary, Secondary, Morphogenesis and Differentiation, • Common types of plants, adaptation to land and response to environment outline of kingdom *Plantae*	**10**
3.	**Animal Kingdom:** • General characters of animal, • Animal evolution, • Body Organization: Systems, organs, Tissues, Coordination, Energy requirements, • Primitive and advanced marine animals, • Adaptation to land, • Exchange with environment, Outline of Kingdom *Animalia*	**10**
4.	**The Microbial world:** • Structure, General character, Reproduction, Classification and Economic importance of Fungi, Algae and Protozoa; • Structure, Chemistry and Reproduction of Viruses, General characters of Prion, Viroid, and Virusoid; Extreme environment, Biodiversity therein	**10**
		40

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Learning Outcomes:

- At the end of the course the student would have knowledge about plant & animal kingdom, Microbial world.
- At the end of the course you should have increased: Your capacity to think critically; your ability to design and execute an experiment; your confidence and ability in communicating ideas. This will serve as a lasting and practical basis for a career.

Teaching & learning Methodology:

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

- HK Das. (2004) *Textbook of biotechnology*
- U. Satyanarayan. *Biotechnology*
- U. Satyanarayan. *Biochemistry*
- B.D Singh,Kalyani Publishers. *Biotechnology Expanding Horizons*
- P.K.Gupta, Rastogi Publication. *Elements of Biotechnology*

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

Basic Bacteriology

Subject Code: 253040201

B.Sc. Semester-2

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- To provide basic knowledge of Applications of Microbiology
- The purpose of the course is to provide basic knowledge of natural history of infectious organisms, contribution of various scientist in the field of microbiology, developments of first microscope and other technique used for isolation, study, characterization of microorganism. Instruments required to study the morphology of the microorganisms.
- To provide basic knowledge of Taxonomy, Morphology, Internal and External structure of Bacteria. Different mode of bacterial nutrition given to the organisms. Methods for controlling the microbial growth.

Prerequisites

Student Must have passed 12th standard with A/B group.

Course outline

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4	**Principles of Microbial control** • General principles: Control by killing, inhibition and removal • Physical agents of microbial control: I) Heat II) Radiation III) Osmotic pressure IV) Filtration • Chemical agents of microbial control: • Ideal antimicrobial agent, Major groups of antimicrobial agents: I) Phenols II) Halogens III) Surfactants IV) Alcohols V) Heavy metals VI) Gaseous agents	10
TOTAL		40

Learning Outcomes

- The students will be able to understand and the basic principles and, the tools and techniques of Microbiology.
- The course is designed to give students an understanding of the applications of Microbiology in various fields.
- At the end of the course the student would have basic knowledge of microbiology, different microbial techniques, learn about dyes and staining, structure of bacteria, method to isolate the microbes.
- The students will be able to understand and Describe specialised parts of cells and their functions.} Identify structures in prokaryotic and eukaryotic cells in light micrographs. } Describe the structure of prokaryotic and eukaryotic and the differences between them.

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Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Gerard Tortora .Berdell Funke .Christine Case.Derek Weber.Warner Bair III Microbiology An Introduction 13th Edition(2019)
- Pelczar Jr. M J. Chan E C S. Krieg N R. (1986)
- Elementary Microbiology- H.A. Modi (2019)
- Microbiology: An Application Based Approach, 5th edn. McGraw-Hill Book Company, NY
- Ingraham J L and Ingraham C A Introduction to Microbiology: Thomson Brooks/Cole(2001)
- Atlas R M.Principles of Microbiology 2 nd Edition(2015)

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -501

CODE : 53010501

B.Sc. 5TH SEMESTER

Teaching & Evaluation Scheme :-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Molecular Techniques

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	**Electrophoresis**- Principle, methodology and factors affecting protein and nucleic acid electrophoresis. PCR- Introduction, Principle, basic methodology, factors affecting and application, Site-directed mutagenesis.	8
2.	Nucleic acid hybridization, colony and plaque hybridization, Southern, Northern and Western blotting, Dot-Blot, differential screening. In situ hybridization, FISH (radioactive and non radioactive detection of hybridization), Autoradiography.	8

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3.	Molecular markers- RFLP, RAPD, AFLP, SNP, Satellite DNA. DNA Fingerprinting- process and its application. Construction of c-DNA library & genomic DNA library.	**8**
4.	DNA sequencing- chain termination, chemical cleavage and automated. DNA Foot printing- types and application. In vitro transcription and in vitro translation, various systems and application.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of molecular techniques.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- From genes to clones –Ernst winnaker
- Genetic engineering – Old & Primrose
- Biotechnology and Genomics – PK Gupta
- A text of biotechnology – RC Dubey

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -502

CODE : 53010502

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives: - To provide basic knowledge Environmental of Biotechnology

Prerequisites:-

Course outline: - Environmental Biotechnology

Sr. No.	Course Contents	Number of Hours
1.	Types of pollutions (Air, water& land). Water pollution-common pollutants, treatment of industrial and domestic waste water (primary, secondary and tertiary treatment) BOD, COD, TOC, Colour, Odour, alkalinity & acidity	10
2.	Bioleaching of metals (copper) General properties of microorganisms involved in it. Types of bioleaching-Heap, Dump & in situ. Mechanism of leaching direct, Indirect and galvanic. Significance of bioleaching	8

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3.	Biomagnification, Biodegradation of xenobiotics(DDT, nitro aromatic compounds), introduction and application bioremediation & phytoremediation.	**8**
4.	Biosensor: types, principle, applications and limitations. Bioplastic- Introduction, technology and applications	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Environmental Pollution Control Engineering – CS Rao
- Industrial Microbiology –Whitaker
- Industrial Microbiology –AH Patel
- A text book of biotechnology – RC Dubey

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -503

CODE : 53010503

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Bio-insrumentation

Prerequisites:-

Course outline:- Bio-insrumentation

Sr. No.	Course Contents	Number of Hours
1.	**COLORIMETERY AND SPECTROPHOTOMETRY** Principle, Instrumentation Method and Application of UV-Visible Spectroscopy Atomic Absorbtion Spectroscopy Flame Photometry Nephlometery Infra Red Spectroscopy Mass Spectroscopy for Protein Characterization & Identification	10
2.	**ELECTROPHORESIS AND CENTRIFUGATION** **Electrophoresis** Principle, Support Media, Methods and Applications of electrophoresis Separation of protein and nucleic acids (PAGE, SDS-	12

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	PAGE, Agarose and IEF) **Centrifugation :** Basic Principles of Sedimentation Methods and Applications of Density Gradient Centrifugation (Rate Zonal and Isopycnic), Ultracentrifugation (Introduction and Applications)	
3.	**CHROMATOGRAPHY** Introduction, Definition and Types of Chromatography General Principles Underlying Chromatographic techniques. Working and Applications of :Thin Layer Chromatography, Adsorption cromatography,Ion Exchange Chromatography,Molecular Sieve Chromatography,Gas Liquid Chromatography,HPLC,Affinity Chromatography	**10**
4.	**Bioinformatics:** Definition.Branches of Bioinformatics. Aim of Bioinformatics. Scope of Bioinformatics. **Databases:** Types of Databases, Database retrieval system. **Biosensors:** Their Principle, Method and Applications. Radioactivity.Nature of Radioactivity, Types of radioactive decay.Safety aspects of Radioactivity. Applications of Radioactivity in Biological Sciences	**12**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Bio-insrumentation

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Biotechnology and Genetic Engineering - P.K. Gupta
- Biophysical chemistry - principles and techniques - Upadhyay, Upadhyay and Nath
- Instrumental methods of chemical analysis - Chatwal and Anand
- Principles and techniques of Practical biochemistry - Wilson and Walker

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SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -504

CODE : 53010504

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge of Metabolism.

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	**Energy metabolism:** Introduction to metabolism, Methods of studying intermediary metabolism ATP (Structure, generation, & role, Modes of ATP generation in bacteria Oxidative phosphorylation - ETC - components and organization. Mechanism of Oxidative phosphorylation, ATP synthase Fermentation and substrate level phosphorylation Bacterial photophosphorylation	12
2.	**Carbohydrate metabolism** **Degradation:** EMP, PP & ED pathway of glucose catabolism.	12

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	Reaction and energies of TCA cycle and its importance. Amphibolic nature of TCA, Anapleuretic reaction and glyoxylate cycle. - Regulation of glycolysis and TCA cycle. **Biosynthesis:** Gluconeogenesis. CO_2 fixation - Calvin Benson cycle.	
3.	**Lipid metabolism :** **Fatty acid degradation**: Beta-oxidation of saturated fatty acid - palmitic acid and its energetics Oxidation of mono unsaturated fatty acids - olic acid. Oxidation of Polyunsaturated fatty acid - linoleic acid - α and ω oxidation of fatty acid **Biosynthesis of fatty acid:** Biosynthesis of saturated fatty acids Biosynthesis of mono unsaturated fatty acids - aerobic and anaerobic pathway Biosysnthesis of poly unsaturated fatty acids - archidonic acid.	**10**
4.	**Biosynthesis of Amino acids**: Aspartate family and Aromatic family. **Biosynthesis of Peptidoglycan:** **Catabolism of Amino acids:**Transamination, oxidative deamination, - Urea cycle , Stickland reaction.	**10**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Metabolism.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Principles of Biochemistry - Lehninger ,Nelson and Cox ,4th edition
- Biochemistry - Zubay, G. L.
- Biochemistry - Stryer, L.
- General Microbiology - Stanier, R. Y.
- Principles of Microbiology - Ronald M. Atlas

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-501
CODE : 53020501
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Carbohydrates** Disaccharides, structure of (+) maltose, (+) cellobiose, (+) lactose and (+) sucrose. **(B) Purine and Pyrimidines** **(i)** Purines – Synthesis of Purines, Adenine and Guanine. **(ii)** Pyrimidines – Synthesis of Pyrimidine, Uracil, Thymine and Cytosine.	14
2	**(A) Nucleophilic Substitution at a Saturated Carbon Atom** Mechanism and scope of reaction-available mechanism, Kinetic Characteristics, Scope of reaction, Stereochemistry of S**N**1 and S**N**2 reactions, Relative reactivity in substitution, Solvent effect, variation at carbon site, Relative leaving group activity, S**N**i (substitution nucleophilic internal) Mechanism and Neighboring group participation. Elimination Reactions, E1, E2 and E1cB mechanism, Orientation E1and E2 reactions, Elimination Vs	14

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	Substitution. **(B) Nucleophilic Aromatic Substitution** Nucleophilic aromatic substitution, Bimolecular displacement and its mechanism, Reactivity, Orientation, Electron withdrawal by resonance, Evidence for the two steps-mechanism, Elimination-addition mechanism-Benzyne.	
3	**(A) Inorganic reagents for Organic synthesis** Use of specific reagents and their synthetic applications with mechanism. (i) Aluminium Isopropoxide (ii) Lithium Aluminium Hydride (iii) Adams's catalyst (PtO2) (iv) Selenium Dioxide (v) Osmium Tetroxide (vi) Lead Tetraacetate **(B) Molecular rearrangements and Name Reactions** Rearrangements occurring through Carbocations, carbenes and nitrenes Principle, Mechanism and Synthetic applications of the reactions: (i) Wolf rearrangement (ii) Fries migration (iii) Hoffmann reaction (iv) Oppenauer oxidation reaction (v) Diels-Alder reaction (vi) Birch Reduction	14
4	**(A) Stereo Chemistry (I)** Optical activity in the absence of chiral carbon (Biphenyls, Allenes and Spirans) **(B) Stereoselectivity and Stereospecificity** Stereoselective and stereospecific reactions. Mechanism "Addition of halogens to alkenes". Stereochemistry of E2 reaction (syn and anti elimination).	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Organic Chemistry**:** I. L. Finar, Vol-II, 5th Edition, Pearson Education Ltd.
2. (2) Organic Chemistry**:** Morrison & Boyd, 6th Edition, Prentice Hall of India Pvt. Ltd.
3. (3) Stereochemistry of carbon compounds**:** E. L. Eliel, Wiley Eastern Ltd.
4. (4) Stereochemistry and mechanism through solved problems**:** P. S. Kalsi, New Age International.
5. (5) Stereochemistry of Organic Compounds: Principles and Applications**:** D. Nasipuri; New Academic Science; 4th Revised Edition.
6. (6) Organic Chemistry**:** Hendrickson, Cram, Hammond, Mc Graw-Hill.
7. (7) Organic Chemistry**:** 6th Edition, John Mcmurry, Brooks Cole, International Edition.
8. (8) Organic Chemistry**:** T.W. Graham Solomons and Craig B. Fryhle Wiley, 8th Edition.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-502
CODE : 53020502
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Molecular symmetry** Introduction, symmetry operations and symmetry elements: Cn, σ, Sn, i and E. Point groups for the molecules (excluding S_{2n} and I_h). Multiplication tables of C_{2v}, C_{2h} and C_{3v} point groups.	14
2	**(A) Chemical bonding (I)** VB and MO treatment of H_2 and H_2^+, comparison of VB and MO MO treatment of $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$, $[V(CN)_6]^{-3}$, $[IrF_6]^{-4}$, $[NiF_4]^{-2}$, $[PtCl_4]^{-2}$ and $[Ni(CN)_4]^{-2}$. **(B) Boron hydrides** Preparation, properties and structure of diborane. Types of bonds found in higher boranes. Structure of B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10} and $B_{10}H_{14}$.	14
3	**(A) Co-ordination chemistry** Reaction, kinetics and mechanism. Trans effect and trans influence, Applications of trans effect in synthesis and analysis. Theories of trans effect: Polarisation theory, π- bonding theory, MO theory. Lability, inertness, stability and instability.	14

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	(B) Kinetics and reaction rates of substitution Ligand field effect and reaction rates, mechanism of substitution reaction. Nucleophilic substitution reaction (S_N1 and S_N2) in octahedral complexes. Substitution in square planar Pt (II)complexes. Substitution in octahedral Co (III) complexes. Acid hydrolysis, base hydrolysis. Cis effect. Electron transfer reaction. Mechanism of redox reaction (inner-sphere and outer-sphere).	
4	**(A) Inorganic polymers** Classification of inorganic polymers. Polymers containing boron and silicon**:** methods of preparation, physical and chemical properties, structures and their uses. **(B) Mossbauer Spectroscopy** Principle and Instrumentation. Experimental technique Application for iron complexes	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Concise Inorganic Chemistry**:** J.D. Lee; Wiley India, 5th Edition (1996).
2. 'Shriver and Atkins' Inorganic Chemistry**:** Atkins, Overton, Rourke, Weller, Armstrong;
3. Oxford University Press, 5th Edition (2011).
4. Advanced Inorganic Chemistry**:**. F.A. Cotton and Wilkinson G.; John Wiley, 5th Edition (1988).
5. Introductory Quantum Chemistry**:** A.K. Chandra; Tata- McGraw Hill, 4th Edition (1994).
6. Quantum chemistry**:** R.K. Prasad; New Age International, 4th Edition (2010).
7. Electron and chemical bonding**:** H. B. Grey, W.A.Benjamin. INC, New York.
8. Inorganic chemistry**:**. James E. Huheey, 4th Edition,Wesley Publishing Company.
9. Mechanism of Inorganic reaction**:** Basalo and Pearson, 2nd Edition, Wiley Eastern Pvt Ltd.
10. Introduction to Advanced Inorganic chemistry, Durrant and Durrant, John Wiley.
11. Advanced Inorganic chemistry**:** (Vol. 1) Satya Prakash, Tuli, Basu and Madan; S. Chand
12. Advanced Inorganic chemistry**:** Gurdeep Raj; Goel Publishing House, 23rd Edition (1998).

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-503
CODE : 53020503
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Thermodynamics** Zeroth law of Thermodynamics, Clausius - Clapeyron equation, Trouton's Rule, Craft's equation, van't Hoff's isotherm and isochore equations.	14
2	**Electrochemistry** Electrochemical cell and Electrolytic cell, Reversible and irreversible electrodes and cell, Poggendorff's compensation method and Weston cell, Reference electrodes (i) Saturated Calomel Electrode (ii) Standard Hydrogen Electrode (iii) Quinhydrone Electrode, Nernst's single electrode potential equation, Applications of emf measurements to calculate ΔG, ΔG_o, ΔH, ΔS , K_{eq}, K_{sp}, K_w and K_h.	14
3	**(A) Chemical Kinetics** Prediction of reaction rate, Primary and secondary salt effect, Heterogeneous reactions, Retarded reaction. **(B) Polymer Chemistry** Polymerization and types of Polymerization, Co-polymers, Bio-	14

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	polymers, Polymer additives, Thermodynamics of polymer solution, Molecular weight determination of polymers: Number average molecular weight, Weight average molecular weight, Viscosity and Osmotic pressure method.	
4	**(A) Nuclear Chemistry** Detection of isotopes, Velocity focusing mass spectrograph, Bainbridge and Neiers mass spectroscopy, Double focusing mass spectroscopy, Applications of isotopes and trace technique examples **(B) Molecular spectra** Pure rotational spectra, Equation for frequency of pure rotational spectral line, Vibrational-Rotational spectra, Equation for frequency of vibrational-rotational spectral line, Ortho and Para hydrogen.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Physical Chemistry**:** G. M. Barrow, 5th Edition, McGraw-Hill education, India.
2. Advanced Physical Chemistry**:** Gurdeep Raj, 35th Edition (2009), Goel / Krshina Publishing House.
3. Principles of Physical Chemistry**:** Puri, Sharma and Pathania, 42nd Edition, Vishal Publishing Company.
4. Polymer Science**:** Gowariker, Viswanathan and Sreedhar, 1st Edition (2012 reprint) New Age International.
5. Essentials of Nuclear Chemistry**:** Arnikar, 4th Edition (2012 reprint), New Age International.
6. Physical Chemistry**:** Atkins, 9th Edition. Oxford University Press.
7. Advanced Physical chemistry**:** Gurtu and Gurtu, 11th Edition , Pragati Prakashan.
8. Physical chemistry**:** Levine, 6th Edition, McGraw-Hill education, India.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-504
CODE : 53020504
B.Sc. 5th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives: - To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Ultraviolet Spectroscopy** Origin of UV Spectra, Principle, Electronic transition (σ-σ*, n-σ*, π-π* and n-π*), relative positions of λmax considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples). Aromatic and Polynuclear aromatic hydrocarbons. **(B) Ultraviolet Spectroscopy (Problems)** Problems of Dienes and enones using Woodward-Fieser rules. Problems of aromatic ketones, aldehydes and esters using empirical rules.	14
2	**(A) Infrared Spectroscopy** Introduction, principle of IR spectroscopy, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications. Application of Hooke's law, characteristic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O functions; factors affecting stretching frequencies (H-bonding, mass effect, electronic factors, bond	14

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	multiplicity, ring size). **(B) Raman Spectra** Basic principal, Instrumentation, Application of Raman spectra, Comparison of IR and Raman spectra.	
3	**(A) Nuclear Magnetic Resonance** Principal, Magnetic and non magnetic nuclei, absorption of radio frequency. Equivalent and non equivalent protons, chemical shifts, anisotropic effect, relative strength of signals, spin-spin coupling, long range coupling, coupling constant, Deuterium labelling, applications to simple structural problems. **(B) Problems based on Spectral data** Structural problems based on UV, IR and NMR	14
4	**(A) Visible Spectroscopy** Introduction, Beer Lambert's law, instrumentation (light source, optical system, wavelength selector, light sensitive device), Accuracy and error of Spectrophotometry. **(B) Atomic Spectroscopy** Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners), Inductively coupled plasma Emission Spectroscopy (ICPES)	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Introduction to Spectroscopy**:** Donald L. Pavia, Gary M. Lampman, George S. Kriz
2. Cengage Learning; 4th Edition.
3. Spectrometric Identification of Organic Compounds**:** Robert M. Silverstein, Francis X. Webster, David Kiemle Wiley; 7th Edition.
4. Infrared spectra of Complex molecules**:** J. Bellamy, John Wiley & Sons, Inc., 3rd Edition.
5. Spectroscopic Method in Organic Chemistry**:** Dudley Williams, Ian Fleming McGraw-Hill Education; 6th Edition.
6. Applications of spectroscopic techniques in Organic Chemistry**:** P.S. Kalsi, New Age International; 6th Edition.
7. Elementary Organic Spectroscopy; Principles And Chemical Applications**:** Y. R. Sharma, S. Chand & Co Pvt Ltd.
8. Fundamentals of Molecular Spectroscopy**:** C. M. Banwell and E. McCash, Tata McGraw Hill, 4th Edition.
9. Modern Raman Spectroscopy**:** A Practical Approach; Ewen Smith, Geoffrey Dent., Wiley; 1st Edition.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -501

CODE: 53040501

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge of Molecular Genetics of prokaryotes

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Fundamentals:** Nature of Genetic material, Gene structure and function, DNA replication: semi-conservative nature, molecular mechanism, Okazaki fragments	10
2	**Gene Expression and its regulation:** Transcription(Sigma factor, Promoter, Operator), Genetic code, Translation (Initiation, elongation, termination), Regulation of gene expression	10
3	**DNA Damages and Repair:** Spontaneous and induced mutations, Molecular basis of Mutation(Physical, Chemical, Biological Mutagenesis), Consequences of mutation, Repair mechanism (Direct, Indirect, SOS repair)	10

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4	**Gene transfer among Bacteria:** Horizontal and vertical gene transfer, Transformation, Transduction, Conjugation (role of sex factor, transfer of genes during $F^+ \times F$, $Hfr \times f^-$), Bacterial plasmids and transposable elements (Insertion sequences and Tn elements).	**10**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Molecular Genetics of prokaryotes

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Microbiology- Pelczar, Chan and krieg, 5th Ed.
- Elementary Microbiology- H.A. Modi

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY-502

CODE: 53040502

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives: - To provide basic knowledge of Bacterial Metabolism

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Enzymes and Energy:** Enzyme kinetics, Metabolic regulation, significance of metabolic regulation,Energy: its generation and conservation, Modes of ATP generation.	**10**
2	**Chemoheterotrophic Metabolism:** Utilizable substrates, Catabolism of glucose, TCA Cycle, Catabolism of Fatty acids and Proteins.	**10**
3	**Chemoautotrophic and Phototrophic metabolism:** Physiological groups of chemolithotrophs, generation of ATP and reducing power in chemoautotrophs, **Phototrophic metabolism.**	**10**

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4	**Biosynthesis:** Principles governing biosynthesis, assimilation of ammonia, nitrate, molecular nitrogen & sulfate. Biosynthesis of saturated and unsaturated fatty acids, Polymerization, Methods of studying of Biosynthesis	**10**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Bacterial Metabolism

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Microbiology- Pelczar, Chan and krieg, 5th Ed.
- Elementary Microbiology- H.A. Modi
- Fundamental of Biochemistry- Dr.A.C.Deb

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY 503

CODE: 53040503

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50		150

Objectives:- To provide basic knowledge Enzymology

Prerequisites:-

Course outline:- Enzymology

Sr. No.	Course Contents	Number of Hours
1.	Enzymology- General characteristics and classification, Terminology: holoenzymes, coenzymes, Apo enzymes, cofactors, activators, inhibitors, units of enzyme activity, isoenzymes, turn over number, specific activity, first order and zero order reactions. Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes	8
2.	Enzyme kinetics- Derivation of Michaelis and Menten equation and its modifications (Line	8

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	Weaver & Burk plot, Eadie-Hofstee and Hannes & Woolf plots). Enzyme Inhibition – competitive, non competitive, uncompetitive, mixed & substrate inhibition.	
3.	Enzyme immobilization - types, methods, application, advantages & limitations. Introduction to reverse micelles.	**8**
4.	Sources and applications of enzymes- amylase, protease and lipase in industries (detergent, leather, food, dairy, Textile and medical). Industrial production of enzymes.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of Enzymology.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Enzymology –Palmer
- Textbook of biochemistry – Vasudevan Shreekumari
- Biochemistry - Lehninger

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -504

CODE : 53040504

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge of Metabolism.

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Energy metabolism:** Introduction to metabolism, Methods of studying, intermediary metabolism ATP (Structure, generation, & role, Modes of ATP generation in bacteria,Oxidative phosphorylation - ETC - components and organization. Mechanism of Oxidative phosphorylation, ATP synthase Fermentation and substrate level phosphorylation Bacterial photophosphorylation	**12**
2	**Carbohydrate metabolism** **Degradation:** EMP, PP & ED pathway of glucose catabolism.	**12**

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	Reaction and energies of TCA cycle and its importance. Amphibolic nature of TCA, Anapleuretic reaction and glyoxylate cycle. - Regulation of glycolysis and TCA cycle. **Biosynthesis:** Gluconeogenesis. CO2 fixation - Calvin Benson cycle.	
3	**Lipid metabolism :** **Fatty acid degradation**: Beta-oxidation of saturated fatty acid - palmitic acid and its energetics, Oxidation of mono unsaturated fatty acids - olic acid.,Oxidation of Polyunsaturated fatty acid - linoleic acid - α and ω oxidation of fatty acid **Biosynthesis of fatty acid:** Biosynthesis of saturated fatty acids, Biosynthesis of mono unsaturated fatty acids - aerobic and anaerobic pathway, Biosysnthesis of poly unsaturated fatty acids - archidonic acid.	**10**
4	**Biosynthesis of Amino acids**: Aspartate family and Aromatic family. **Biosynthesis of Peptidoglycan:** **Catabolism of Amino acids:**Transamination, oxidative deamination, - Urea cycle , Stickland reaction.	**10**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Metabolism.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Principles of Biochemistry - Lehninger ,Nelson and Cox ,4th edition

SWARNIM STARTUP INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF SCIENCE

ENVIRONMENTAL SCIENCE

CODE: 53000503

SEMESTER 2

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	50	70	-	150

Objectives: - To provide a comprehensive knowledge for awareness of environment conservation and hazard management.

Prerequisites:- Environment Conservation & Hazard Management

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	Earth Science	6
2	Global Environmental Issues	10
3	Natural Resources and Management	6
4	Biomass Energy	8

Learning Outcomes:- At the closing stage of the course, the students will be able to understand the importance of environment conservation and the concepts of hazard management.

Teaching & Learning Methodology:- The Syllabus for Environmental Studies includes classroom teaching. The syllabus is divided into four units covering 30 lectures. The units are classroom teaching based to enhance knowledge skilled and attitude to environment.

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Books Recommended:

1. R. R. Mahitcha – "Environment Conservation and Hazard Management", Atul Prakashan.
2. Solanki and Chetan Singh – "Renewable Energy Technologies", PHI Learning.
3. Izrael Y.A. – "Ecology and Control of the Natural Environment", Kluwer Academic Publisher.
4. Sharma, Sanjay K. – "Environment Engineering and Disaster Management", Laxmi Publications.
5. Earnest, Joshua and Wizelius, Tore – "Wind Power Plants and Project Development, PHI Learning.
6. Anandita Basak – "Environmental Studies", Pearson Publication.
7. K. S. Valadia – "Coping with Natural Hazards Indian Context", Orient Longman Publication.
8. Edward S. Rubin –"Engineering and Environment", McGraw Hill Publication

SYLLABUS

Unit-1

Ecology and Environment: Importance of environment and scope, Engineering and Environment issues, The natural system, Biotic and Biotic components and processes of natural system, Eco system, Food chain, webs and other biological Systems, Causes of environmental pollution, Pollution due to solid waste, Water pollution, Air pollution, The noise as pollution, Pollution of land due to industrial and chemical waste, Radiation and its effects on vegetables and animals

Unit-2

Solar power: Features of solar thermal and PV systems, Types of solar cookers and solar water heaters, Solar PV systems and its components and their working, Types of solar PV cells, Rating and Costing.

Unit-3

Seismic engineering and disaster management: Introduction of Seismic engineering and its application, Features of disasters such as floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc., Management and Mitigation of disasters.

Unit-4

Sustainable development: Concept of sustainable development, Natural resources, Abiotic and Biotic resources, Principles of conservation of energy and management, Need of renewable energy, Growth of renewable energy in India and the world, Concept of waste management and recycling.

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

Department of Chemistry

Natural Products and Bio-molecules

Subject Code: 56020301

M.Sc. Semester- III

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Natural Pigment** Natural colouring matter, general classification, method of synthesis, biosynthesis studies of anthocyanins (cyanine) flavones (chryosin) and flavanol (Querecetin), Porphyrin-structure, spectral properties and synthesis, general and structure determination of Haemoglobin, chlorophyll and Bilirubin.	14

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2	**Alkaloids and Vitamins** Alkaloids: General biogenetic studies of alkaloids, chemistry of quinine, morphine , reserpine and colchicine Vitamins : Introduction, synthesis and biochemical function of vitamin B(Thiamine), Vitamin H and α -tocopherol (Vitamin E), vitamin C.	14
3	**Steroids and Hormones** General biosynthesis studies of steroids, structure of cholesterol and ergosterol (No synthesis). Stereochemistry of steroids, chemistry of bile acids. Chemistry of androgens, oestrogens and gestrogens, their synthesis and biochemical role. Adrenocortical hormones, partial synthesis of cortisone.	14
4	**Terpenoids and Carotenoids** Classification, nomenclature, general methotds of structure determination, chemistry and synthesis of abietic acid and gibberellic acid (gibberllin-A), farnesol, zingeberine and squalene. Biosynthetic studies on triterpenoids and tetraterpenoides.	14

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Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Organic chemistry vol I & II (sixth edition) I.L.Finar
2. Chemistry of vitamins-S.F.Dyke

3. Chemistry of natural products by Berrely, Vol 1-10
4. L.J.Wade Jr. Organic chemistry, Prentice nall, England cliffs, 1987
5. Chemistry of Natural products vol I & II by O.P.Agrawal

E-Resources

- https://www.invaluable.com/blog/naturalpigments/#:~:text=A%20natural%20pigment%20is%20one,to%20create%20a%20desired%20hue.&text=Artists%20used%20whatever%20pigment%20was,and%20white%20from%20ground%20calcite.
- https://www.foodcolor.com/natural-pigments
- https://www.britannica.com/science/alkaloid
- https://en.wikipedia.org/wiki/Steroid_hormone
- https://www.gfmer.ch/Books/Reproductive_health/Steroid_hormone_metabolism.html
- https://conagen.com/products-we-make/terpenoids-carotenoids/

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Medicinal Chemistry
Subject Code: 56020302
M.Sc. Semester- III

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Antibiotics** Antibiotics that interfere with the biosynthesis of bacterial cell wall. A. The β -lactum antibiotics : Penicillin and cephalosporin B. Non lactum antibiotics (only name and structures) C. Bacitracin, vancomycin and cycloserine (only name and	14

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	structures) Antibiotics that interfere with the protien biosynthesis in microorganisms : non lactum antibiotics, tetracycline, chloroamphenicol Structure actively relationship (SAR) among penicillinis and tetracyclins Non classifiable antibiotics (only structure and therapeutic uses) Synthesis of pencillin V, ampicillin, cephalosporin and chloroamphenicol.	
2	**Psychoactive drugs** CNS depressant: **A**. General and local anaesthetics **B.** Sedative and hypnotics Antipsychotic drugs **A.** Antidepressant **B.** Neuroleptics Synthesis of the following: Thiopental, amobarbital, diazepam, chlorozepan, alprazolam, glutethimide, nikethamide, procaine, lidocaine and dibucaine, Ibuprofin, meclofenate sodium, novalgin, pethidine	14
3	**Antimalarial and Antituberculosis drugs** Antimalarials: Modern chemotherapy of malaria, 4-amino and 8-amino quinolins, 9-amino acridine. Synthesis of mefloquines, chloroquine, primaquine and daraprim Mode of action of antimalarial agents SAR of antimalarial agents Anti tuberculosis: Synthesis of only the following drugs: Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone)	14
4	**Cardiovascular, diuretics and hypoglycemic agents** Synthesis of amyl nitrate, diltiazim, atenolol, methyl dopa, tolbutamide, chloropropamide, glibenclamide, acetazolamide, chlorothiazide, furosemic and ethacrycnic acid.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Burger's medicinal chemistry and drug design (5/e) 1997, vol 1 to 5 edited by Manfred E.Woltt (John wiley and sons Mc. New york)

2. Principles of medicinal chemistry by William A. Foye (ied), lea and febiys (Philadelphia)

3. Principles of medicinal chemistry vol I & II (5/e) F.S.kadam, K.R. Mahadic ad K.G.Bohra (Nirali publication)

4. Medicinal chemistry by ashutosh kar

5. The organic chemistry of drug synthesis vol I, II and III (1980) ed by D. lednicer and L.A. mitscher (Johyn wiley and sons, New york)

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Organic Spectroscopy
Subject Code: 56020303
M.Sc. Semester- III

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

- Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**UV & IR Spectroscopy** UV: Electronic transitions, chromophores, auxochromes, bathochromic and hypsochromic shifts, solvent effects, wood ward fieser rules for dienes, enones and aromatic compounds applications of U.V., instrumentation. I.R. Vibrational transitions, important group frequencies, factors affecting I.R. group frequency, applications of I.R. instrumentation	14

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2	**NMR** Elementary ideas of NMR integration, chemical shifts, Factors affecting, chemical shifts, coupling (first order, analysis) instrumentation and principles and instrumentation, FT, chemical shifts, spin-spin coupling different spin systems, mechanism of spin coupling. E.q. AB, ABX, factors affecting vicinal and geminal couplings, rate processes, long range couplings, spin decoupling, shift reagents, solvent shifts, nuclear overhauser effect. 2D NMR (COSY and HETCOR) applications.	14
3	**C13 NMR and Mass spectrometry** C13 NMR: elementary ideas, instrumental problems ,chemical shift features of hydrocarbons, effect of substituent on chemical shifts olefinic, acetylenic, aromatic and carbonyl carbons, effects of coupling. Mass spectrometry: theory, instrumentation, modes of ionization, types of detectors, modes of fragmentation. Different types of ions, molecular ions, isotopic peaks, factors controlling fragmentation, hyphenated mass spectroscopy techniques.	14
4	Structural elucidation of drug molecules based on joint application of UV, IR, PMR, CMR and mass spectroscopy.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.

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- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Spectroscopic methods in organic chemistry, D.H.Williams and Tan fleming
2. Spectrometric identification of organic compounds, T.C.Morril R.M.Silverstein and G.Bassler, 6th edition, John Wiley and sons
3. Introduction to spectroscopy, D.L.Pavia, G.M.Lampman and G.S.Kriz, 3rd edn, Harcourt college publishers.
4. Organic spectroscopy by W.Kemp
5. Organic spectroscopy by P.S.Kalsi

E-Resources

- https://www.itwreagents.com/iberia/en/sa_spectroscopy-uv-vis-ir#:~:text=The%20UV%2DVis%20spectroscopy%20is,between%20200%20and%20800%20nm).&text=The%20IR%20spectroscopy%20is%20another%20very%20useful%20analytical%20tool%20for%20compounds%20characterization.
- https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Book%3A_Analytical_Chemistry_2.1_(Harvey)/10%3A_Spectroscopic_Methods/10.03%3A_UV/Vis_and_IR_Spectroscopy
- https://www.mps.mpg.de/phd/space-instrumentation-ir-uv-spectroscopy
- https://www.youtube.com/watch?v=MW4PwJxxyt0
- https://www.youtube.com/watch?v=t5stvnKNXbg
- https://www.youtube.com/watch?v=t5stvnKNXbg
- https://www.youtube.com/watch?v=H6_GgJN39vY
- https://www.youtube.com/watch?v=EZzYXmX8XGk
- http://sppu.in/Syllabi_PDF/revised_2009/sci/6%20%20(5)%20%20M.Sc.%20II,%20%20Drug%20Chemistry.pdf
- https://www.researchgate.net/post/Which_is_the_best_spectroscopic_method_for_the_structure_elucidation_of_organic_molecule_without_the_help_of_other_method

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF Chemistry

Industrial Chemistry
Subject Code: 56020304
M.Sc. Semester - III

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	-	4	4	30	-	70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
1	**Basic principles** Basic chemical data, batch versus continuous operation, design, flow charts, chemical process selection, safely, hazardous, fire toxic materials, research and development patents, good manufacturing	14

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	practice and laboratory practice.	
2	**Unit processes in organic chemistry** Nitration, sulfonation, halogenation, amination and alkylation methods and industrial chemicals derived from benzene, naphthalene and anthracene using unit process.	14
3	Green chemistry -12 principles of green chemistry Green solvents- aqueous phase reactions Wurtz reaction, witting-Horner reaction, Michael reaction - - Ionic liquid as green solvent- hydrogenation, diels-alder reaction, o- alkylation and N-alkylation Green catalysts of green reagents (introduction)	14
4	Manufacture and uses of -Argochemics (insecticides, fungicides, plant nutrients and plant hormones, Weedicides, pesticides) -Unit operations	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Unit processes in organic synthesis by P.H.Groggins
2. Industrial Chemical process by R.N.Shreve
3. Riegels handlook of industrial chemistry ed by James and Kent
4. Dryden's outlines of chemical Technology M.Gopal Rao

E-Resources

- http://ccc.chem.pitt.edu/wipf/Web/HCH.pdf
- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Arenes/Reactivity_of_Arenes/Nitration_and_Sulfonation_of_Benzene
- https://www.masterorganicchemistry.com/2018/04/30/electrophilic-aromatic-substitutions-2-nitration-and-sulfonation/
- https://www.azocleantech.com/article.aspx?ArticleID=559

SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF BIOTECHNOLOGY
MICROBIAL BIOTECHNOLOGY
CODE: 56010301
M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	8	50	20	50	30	150

Objectives:-To provide basic knowledge of Microbial Biotechnology. It covers up general concept of microbial biotechnology and fermentation of various products.

Unit	Description in Detail	Weightage (In hours)
1	Microbial production of Amino acids: Glutamic acid, Lysine Industrial Alcohol, Beer and wine Vitamins: Vit B12, B2 Ergot alkaloids	08
2	General concept of Microbial biotechnology Microbial production of Antibiotics: penicillin, streptomycin Enzymes: proteases, amylases Organic acids: Citric acid, acetic acid	08
3	**Biotransformations of steroids:**	

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	Production of single cell protein from bacteria, fungi and algae: Nutritional value and safety. Edible Mushrooms: Cultivation of edible and medicinal mushrooms. Bioplastics Single cell oil	08
4	**Microbial Exopolysaccharides:** Xanthan, Alginate Microbial Flavours: Diacetyl, Methyl ketones, Terpenes, Vanillin Fermented food and dairy products: Starter cultures, science and technology of bread, cheese and yogurt manufacture.Fermentation economics	10

Basic Text & Reference Books:

1. Biotechnology: Rehm and Reid.
2. Comprehensive biotechnology: Murray Moo Young.
3. Microbial Technology: Pepler
4. Microbiology and technology of fermented foods: R.W. Hutkins. Blackwell publishing.

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

ENZYMOLOGY

CODE: 56010302

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	4	**50**	**50**	**50**		**150**

Objectives:-

- The objectives of the paper is students will get about the protein structure, classification of enzymes, terminology, enzyme activity and purification of enzymes and strategy for separation and purification.
- The student will get idea about the enzyme kinetics and mechanism. What is significance of Km, Vmax and Kcat and importance of steady state equilibrium. Enzyme inhibition and its types. Thermal kinetics.
- To provide the mechanism and action of enzyme and its role of activators. Allosteric regulation and its mechanism.
- The study will help in understanding the what are isoenzymes and physiological significance role of different types of enzymes.

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Course Outcome:

Unit	Description in Detail	Weightage (In Hours)
1	**Introduction**: Enzymology and historical developments in enzymology Protein Structure: Primary, secondary, tertiary and quaternary structure, techniques used in enzyme characterization Enzyme classification: IUB enzyme classification. Enzyme Activity: Principle and techniques of enzymatic analysis, factors affecting enzyme Activity, Extraction and Purification of enzyme: Objectives and strategy, separation techniques, test of purity.	08
2	**Enzyme Kinetics:** Bioenergetics and Catalysis Single substrate kinetics: Equilibrium and Steady state kinetics, significance of Km, Vmax & Kcat. Pre-steady state and Relaxation kinetics. Multisubstrate kinetics: General rate equation, compulsory order, random order and ping-pong mechanisms and their primary and secondary plots. Enzyme inhibition and its kinetics: Reversible and irreversible inhibition, competitive, noncompetitive and uncompetitive, mixed, partial, substrate and allosteric inhibition. Thermal kinetics: Effect of temperature on reaction rate, enzyme stability, Arrhenius equation and activation energy.	10
3	**Mechanism of Enzyme Action:** Enzyme activators, co-enzymes and co-factors in enzyme catalysis, Enzyme and substrate Specificity Investigation of active Centre, Factors affecting catalytic efficiency, Experimental approaches to determine enzyme mechanisms. Enzyme mechanisms: Lysozyme, Chymotrypsin, Carboxypeptidase, Restriction endonuclease, Aspartate trans carbomylase. Allosteric enzymes and sigmoidal	10

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	kinetics: Protein ligand binding, Co-operativity, MWC & KNF models, Regulation of enzyme activity. Control of metabolic pathways.	
4	Isoenzymes and its physiological significance, Ribozymes and Abzymes Enzyme engineering: Chemical modification of enzymes: methods of modification of primary structure, catalytic and allosteric properties, use of group specific reagents. Enzyme Immobilization Enzymes in non conventional media, Enzymes sensors, Enzymes as analytical reagents.	08

Learning Outcomes:

- The students will be able to understand and deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines.
- Student should be able to understand basic concepts of the present day scope and applications of enzymology.
- The course is designed to give students an understanding of procedures involved in purification of enzymes, enzymes assays and quantitative evaluation of the influencing parameters such as concentrations of substrate / enzyme, pH, temperature and effects of inhibitors on enzyme activity.
- This is a course where the topics to be studied include enzyme active sites / mechanisms of enzyme action; enzyme kinetics and regulation; Isozymes and their clinical significances /function relationship etc as tools for understanding functions of enzymes.

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs

- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Basic Text & Reference Books:

1. *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd Edition,* authored by Trevor Palmer and Philip Bonner Affiliated East-West Press Pvt. Ltd.
2. Textbook of biochemistry – Vasudevan Shreekumari
3. Biochemistry – Lehninger 6th edition
4. Fundamentals of Enzymologist: Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
5. Enzyme Structure and mechanism: Alan Fersht, Reading, USA.
6. The chemical kinetics of enzyme action: K. J. Laider and P. S. Bunting, Oxford University Press,London.
7. Enzymes: M. Dixon, E. C.Webb, CJR Thorne and K. F. Tipton, Longmans, London.
8. Biochemistry: Lubert Stryer

E-Resources

- https://www.feedspot.com/infiniterss.php?_src=feed_title&followfeedid=4812449&q=site:https%3A%2F%2Fwww.nature.com%2Fsubjects%2Fbiochemistry.rss
- https://www.sciencedaily.com/news/matter_energy/biochemistry/
- https://thebiochemistblog.com/
- https://www.longdom.org/microbial-biochemical-technology.html
- https://bmcbiochem.biomedcentral.com/
- https://www.slideshare.net/mohdsakharkar/enzyme-final

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SWARNIM STARTUP & INNOVATION UNIVERSITY

SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

FOOD & DAIRY MICROBIOLOGY

CODE: 56030303

M.Sc 3rd SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	8	30	50	70		150

Objectives:-

- To provide basic knowledge of food & dairy microbiology.
- In this course the meaning of food microbiology and interaction between microorganism and foods and how food spoilage will be study.
- The pathogenic and non-pathogenic microorganism that found in food and how can they contaminated the foods will be study, in the other hand mycotoxins which is one of the toxin secreted by fungi will be study
- After knowledge of contamination of foods by microorganism the way for preservation of foods from contamination will be study.
- To identify the causative agent in food known as microorganisms
- Understand the mechanism of their reaction in food to make it unsuitable for consumption
- To describe how some microbes proved to be beneficial in the production of food products
- To describe how some bacteria are used in the preservation of food rather than spoil it
- To identify the sources and causes of microbes causing food spoilage

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Prerequisites:-

- Student Must have studied B.Sc. with microbiology/biotechnology as a major subject and knowledge of basic biology

Unit	Description in Detail	Weightage (In hours)
1	1. Scope of food microbiology 2. Food as a substrate a) Mircoorganims important in food microbiology- Bacteria, yeast & Moulds b) Factors influencing microbial growth in food.	04
2	1. Food spoilage a) General principles underlying food spoilage and contamination b) Spoilage of canned food, sugar products, vegetables, fruits, meat,milk & milk products, fish, sea food and poultry 2. Food Poisoning a) Indicator food borne pathogens b) Bacterial food borne infections and intoxications- *Clostridum, Escherichia,Salmonella Shigella* c) General methods for diagnosis of infections, intoxication and preventive measures.	06
3	**Food Preservation** **a)** Principles of food preservation-Asepsis, removal of micro organisms, anaerobic conditions, high and low temperature, drying, irriadiation **b)** Chemical and bio preservatives and food additives **c)** Food packaging and labeling.	06
4	Genetically modified foods. Biosensors in food research organizations/institutes in India. Recent food borne outbreaks. Food sanitation-Microbiology of food plant sanitation, water and milk testing food laws and quality control-HACCP, Codex alimentarious, PFA, FPO, MFPO, BIS, AGMARK.	08

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Learning Outcomes:

- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.
- Explain why microbiological quality control programme are necessary in food production.
- At the end of the course, the students have acquired skills related to: the microbiological food control through appropriate and targeted applications of physical chemical and biological treatments; the use of basic microbiological methods for the evaluation of the microbial load in the different food matrices; the microbial monitoring of fermented foods; the use of selection scheme for starter cultures.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Food microbiology, Frazier and Westhoff
- Food microbiology, Adam and Moss
- Dairy Microbiology By Robinson. Volume I and II
- Fundamental food microbiology, Bibek ray and Arun Bhuniya

E-Resources

- https://www.slideshare.net/vasanthanvasu/dairy-microbiology-39885550
- https://www.slideshare.net/HiwrHastear/food-microbiology-60301420
- https://www.biologyexams4u.com/2016/11/12-methods-of-food-preservation.html#.X5v9am4zbcc
- https://www.toppr.com/guides/evs/mangoes-round-the-year/food-spoilage/

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SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

Immunology
Subject Code: 56010303
M.SC. Semester -3

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	50	50	50	-	150

Objectives

- To provide students the basic knowledge of immunity, system of immunology, interaction of Ag-Ab.
- The purpose of the course is to give student to introduction of Types of immunity, antigen- antibody reaction, Hypersensitivity reaction etc.
- To provide an understanding of immune system in the body, types of cells etc..

Prerequisites

Student Must have studied M.Sc. with microbiology as a major subject and knowledge of basic Immunology and medical microbiology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1.	Adaptive immunity and innate immunity: inflammation, role of cells, receptors and proteins in innate immunity, ubiquity of the innate system. Cells and organs of the immune system: Hematopoiesis, cells of the immune system, primary and secondary lymphoid organs. Antigens and antibodies: properties of immunogens, haptens, epitopes, structure and classes of immunoglobulins, biological activities and effector functions, monoclonal antibodies and anzymes. Antibody diversity: models, organization of Ig genes, mechanism of gene rearrangement, generation of diversity; expression, synthesis and class switching, antibody engineering.	10
2.	Antigen-antibody interactions: principles and applications. Complement: components of the system, activation, regulation, biological consequences and deficiency diseases. Major histocompatibility complex and antigen presentation: MHC-organization, inheritance, genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction, cytosolic and endocytic pathway for antigen processing.	10
3.	T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells. Generation, activation and differentiation of B cells: B cell maturation, activation and proliferation, germinal centres, regulation of the responses. Cytokines: properties, receptors, associated diseases, therapeutic applications. Leukocyte activation and migration: CAM, chemokines, recirculation and extravasation, inflammation and anti-inflammatory agents. Cell mediated cytotoxicity: effector T cells, cytotoxic T cells, NK cells, ADCC.	10
4.	Hypersensitivity reactions: classification and types of hypersensitivity reactions. Immune tolerance and autoimmunity: establishment and failure of tolerance, autoimmune diseases, mechanisms for the induction, animal models, treatment. Transplantation immunology: basis and manifestation of graft rejection, immunosuppressive therapy, immune tolerance. Cancer and immune system. Immunodeficiency.	10

Learning Outcomes

- The students will be able to understand the Knowledge of the types of immune system , Ag-Ab reaction techniques in the body ,hypersensitivity reaction etc.
- Student should be able to understand basic concepts of immunity and types of the cell, classification of the hypersensitivity :its types and function.
- Access information on a topic from a variety of sources, and be able to learn new things on one's own.
- At the end of the course the student would have basic knowledge of immunity, system of immunology, interaction of Ag-Ab.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Kuby-Immunology: T. J. Kindt, R. A. Goldsby and B. A. Osborne; W. H. Freeman
- Janeway's Immunology: K. Murphy, P. Travers and M. Walport; Garland Sciences
- Immunology: Ivan Roitt, J. Brostoff and D. Male; Mosby
- Essential immunology: Ivan Roitt; Oxford: Blackwell
- Topic related review articles.

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E-Resources

- https://www.slideshare.net/mobile/Jsjahnabi/types-of-immunity
- https://www.slideshare.net/mobile/mprasadnaidu/immunity-32908889
- https://www.slideshare.net/mobile/ArunimaSur/antigen-antibody-interaction-55880086
- https://www.slideshare.net/mobile/VELSPHARMD/hypersensitivity-24449005
- https://www.slideshare.net/mobile/VamsiIntellectual/types-of-cells-and-tissues

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -601

CODE : 53010601

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Enzymology

Prerequisites:-

Course outline:- Enzymology

Sr. No.	Course Contents	Number of Hours
1.	Enzymology- General characteristics and classification, definition of holoenzymes, coenzymes, apoenzymes, cofactors, activators, inhibitors, units of enzyme activity, isoenzymes, turn over number, specific activity, first order and zero order reactions. Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes	12
2.	Enzyme kinetics- Derivation of Michaelis and Menten equation and its modifications (Line	10

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	weaver & Burk plot, Eadie-Hofstee and Hannes & Woolf plots). Enzyme Inhibition – competitive, non competitive, uncompetitive, mixed & substrate inhibition.	
3.	Enzyme immobilization- types, methods, application, advantages & limitations. Introduction to reverse micelles.	**8**
4.	Sources and applications of enzymes- amylase, protease and lipase in industries (detergent, leather, food, dairy, Textile and medical). Industrial production of enzymes.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of Enzymology.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Enzymology –Palmer
- Textbook of biochemistry – Vasudevan Shreekumari
- Biochemistry - Lehninger

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -602

CODE : 53010602

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Industrial Microbiology

Prerequisites:-

Course outline:- Industrial Microbiology

Sr. No.	Course Contents	Number of Hours
1.	Fermentation (definition and applications), media (crude and synthetic), and sterilization of media. Screening- primary and secondary. Strain improvement	12
2.	Design of fermentor(aeration, agitation and body construction), Downstream processing- Filtration, centrifugation, cell disruption, precipitation & solvent extraction.	10
3.	Effect of aeration and agitation, methods of estimating C_{crit} and KL_a. Measurement of pH and temperature.	8
4.	Production of ethanol, cheese, beer, red & white	8

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	wine, sparkling wine (champagne) Spoilage and preservation of food.	

Learning Outcomes:

At the end of the course the student would have basic knowledge of industrial microbiology

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Industrial microbiology – Whitaker
- Industrial microbiology –AH Patel
- General microbiology - Frobisher

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SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -603

CODE : 53010603

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Molecular Biology

Prerequisites:-

Course outline:- Molecular Biology

Sr. No.	Course Contents	Number of Hours
1.	Replication in Eukaryotes-Problems associated with eukaryotic replication, Enzymes & Proteins involved in replication with its function, DNA damage and repair, mismatch repair, direct repair, excision repair, SOS repair &post-replicative repair.	8
2.	Transcription in Eukaryotes: Initiation, Elongation and Termination. Types of RNA polymerase, types of promoter, enhancers & silencers, Post Transcriptional modification-types of introns, splicing of RNA,t-RNA,r-RNA, modification of 5' and 3' ends.	10

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3.	Translation in Eukaryote- Initiation, Elongation and Termination. Post-translational modification, protein targeting.	**10**
4.	Transposons: Types, mechanism and recombination, Applications of transposons in r-DNA technology.	**10**

Learning Outcomes:

At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Genes – Benjamin Lewin
- Molecular Biology of the gene – Watson et al
- Molecular biology of the cell – Alberts et al

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SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

BIOTECHNOLOGY -604

CODE : 53010604

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	30	20	70	30	150

Objectives:- To provide basic knowledge Cell Biology

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Fluid Mosaic model of membrane**: Functions of plasma membrane. Chemical composition of membrane-types & function of lipids, proteins and carbohydrate. Membrane fluidity.	10
2	**Cytoskeleton** –overview, types (microtubules, intermediate filaments and microfilaments) functions and significance .Molecular motors.	08
3	**Cell signaling** –basic characteristics of cell signaling & significance, second messenger, Role	08

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	of G protein coupled receptors (GPCR) & receptor tyrosine kinases (RTK) in signaling pathway.	
4	**Apoptosis:** overview and significance. Regulation and control of apoptosis.caspases, activation of apoptotic pathways by internal and external stimuli. Cancer – introduction, types, mechanism, concept of proto-oncogenes and oncogenes.	**08**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Cell Biology.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming
  session.

Basic Text & Reference Books:

- Biochemistry-Lehninger
- Text book of biochemistry- Vasudevan & shreekumari

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-601
CODE : 53020601
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Synthetic Dyes** Classification of Dyes- Anionic and Cationic dyes, Mordant and Vat dyes, Reactive and Dispersed dyes, Synthesis of Alizarin, Malachite green, Indigo, Congo red, Eosin. **(B) Explosives** Preparation of RDX, PETN, Nitroglycerine, Tetryl. **(C) Pesticides:** Preparation of Aldrine, Malathion, Parathion, Methoxychlor.	14
2	**(A) Synthetic Drugs** General Classification, Chemotherapy, Antipyretics, Analgesics, Hypnotics, Sedatives, Anaesthetics, Antimalerials, Antiseptics, Cardiovascular drugs. (Minimum two illustrations of each, only names without structures). Methods of preparation and uses of Antipyrine, Phenacetin, n-Hexyl resorcinol, Alprazolam, Zaleplon,	14

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	Benzocaine, Lidocaine, Chloroquine, Atenolol, Sulphadiazine, Trimethoprim and Tolbutamide. **(B) Vitamins** Structure and Biochemistry of Vitamin-A (A1) (Retinol), Vitamin-B6 (Pyridoxine).	
3	**A) Alkaloids** Classification, General method of determining structure, analytical and synthetic methods, structure of Coniine, Nicotine, Atropine and Papaverine. **(B) Isoprenoids (Terpenoids)** Classification, General method of determining structure, Isoprene rule, Chemistry of Citral, α-Terpineol, Camphor and their synthesis, study of reactions of β-carotene (No Synthesis).	14
4	**(A) Stereo Chemistry** Concept of prostereo isomerism and chiral synthesis (Asymmetric Induction), Cram's rule, Prelog's generalization, Prelog's rule and assignment of configuration. **(B) Stereochemistry of compounds other then Carbon** Stereo chemistry of the compounds containing Nitrogen. Phosphorus and Sulphur	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Organic Chemistry**:** I. L. Finar, Vol-II, 5th Edition, Pearson Education Ltd.
(2) Organic Chemistry**:** Morrison & Boyd, 6th Edition, Prentice Hall of India Pvt. Ltd.
(3) Stereochemistry of carbon compounds**:** E. L. Eliel, Wiley Eastern Ltd.
(4) Stereochemistry and mechanism through solved problems**:** P. S. Kalsi, New Age International.
(5) Stereochemistry of Organic Compounds: Principles and Applications**:** D. Nasipuri; New Academic Science; 4th Revised Edition.
(6) Organic Chemistry**:** Hendrickson, Cram, Hammond, Mc Graw-Hill.
(7) Organic Chemistry**:** 6th Edition, John Mcmurry, Brooks Cole, International Edition.
(8) Organic Chemistry**:** T.W. Graham Solomons and Craig B. Fryhle Wiley, 8th Edition.
(9) Organic Chemistry**:** Francis A. Carey, Mc Graw-Hill, 7th Edition.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-602
CODE : 53020602
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Chemical bonding (II)** The Huckel Molecular Orbital (HMO) theory, variation principle, solution of Secular equation, HMO treatment to ethylene molecule, allylic cation, allylic free radical and allylic anion, Hybridization: Hybridization wave functions of sp, sp^2 and sp^3.	14
2	**(A) Term symbol** Russel Saunders coupling and determination of Term symbols of the ground state. Calculation of number of microstates. Pigeon hole diagram of p^2 and d^2 configurations. Hund's rule. Hole formulation. **(B) Electronic spectra of metal complexes** Electronic spectra of transition metal complexes, Laporte orbital and spin selection rules. Orgel energy level diagram of d^5 and combined diagrams of d^1 - d^9, d^2 – d^8, d^3 – d^7, d^4 – d^6 and their spectra. Jahn Teller distortion. Spectrochemical series.	14
3	**(A) Metal carbonyls** Mono and poly-nuclear metal carbonyls: $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$,	14

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	$Fe_2(CO)_9$, $Fe_3(CO)_{12}$, $Co_2(CO)_8$, $Mn_2(CO)_{10}$, $Ir_4(CO)_{12}$, $Co_4(CO)_{12}$. Metal nitrosyl and metal carbonyl hydrides. Application of IR spectra in the determination of structure of metal carbonyls. **(B) Organometallic compounds** Definition, classification, synthesis (general methods), properties, structure and application of organometallic compounds of Mg, Al and Be, Structure of Ferrocene and dibenzene chromium.	
4	**Quantum chemistry** Setting up of operators for different observables, Hermitian operator, important theorems concerning Hermitian operator, Particle in a three dimensional box, The rigid Rotator, The Schrodinger equation in spherical polar coordinates for hydrogen atom, separation of variables, solution of R, Θ and Φ equations	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Concise Inorganic Chemistry**:** J.D. Lee; Wiley India, 5th Edition (1996).

(2) 'Shriver and Atkins' Inorganic Chemistry**:** Atkins, Overton, Rourke, Weller, Armstrong;

(3) Oxford University Press, 5th Edition (2011).

(4) Advanced Inorganic Chemistry**:**. F.A. Cotton and Wilkinson G.; John Wiley, 5th Edition (1988).

(5) Introductory Quantum Chemistry**:** A.K. Chandra; Tata- McGraw Hill, 4th Edition (1994).

(6) Quantum chemistry**:** R.K. Prasad; New Age International, 4th Edition (2010).

(7) Electron and chemical bonding**:** H. B. Grey, W.A.Benjamin. INC, New York.

(8) Inorganic chemistry**:**. James E. Huheey, 4th Edition,Wesley Publishing Company.

(9) Mechanism of Inorganic reaction**:** Basalo and Pearson, 2nd Edition, Wiley Eastern Pvt Ltd.

(10) Advanced Inorganic chemistry**:** (Vol. 1) Satya Prakash, Tuli, Basu and Madan; S. Chand

(11) Advanced Inorganic chemistry**:** Gurdeep Raj; Goel Publishing House, 23rd Edition (1998).

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-603
CODE : 53020603
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**Thermodynamics** Colligative properties: Boiling point elevation and freezing point depression. Molal elevation constant (Kb) and Molal depression constant (Kf), Calculation of absolute value of entropy using third law of thermodynamics, Law of mass action using chemical potential, Partial molar quantity.	14
2	**Electrochemistry** Concentration cell: Cell with and without transference, Electrode concentration cell, Gas electrode concentration cell, Activity and activity coefficient determination, Define liquid junction potential and how it can be avoided, Equation for liquid junction potential, Decomposition potential, Overvoltage, Tafel equation	14
3	**(A) Phase Rule** Binary system : Zn-Cd and Pb-Ag ,Zeotropic and azeotropic mixtures, Steam distillation, Zone refining.	14

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	(B) Osmosis Desalination and reverse osmosis, Electrodialysis, Electrochemistry and pollution control, Removal of Cu, Ag and Fe from waste water.	
4	**(A) Photochemistry** Laws of Photochemistry : Grotthuss-Draper Law, Einstein Law, Quantum yield ,Reasons for high and low quantum yield, Fluorescence and Phosphorescence, Chemiluminescence, Photosensitized reactions. **(B) Metallic Corrosion** Types of corrosion, Electrochemical series, Corrosion in acidic and neutral medium, Differential aeration principle, Atmospheric corrosion, Prevention of corrosion by various factor.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Physical Chemistry**:** G. M. Barrow, 5th Edition, McGraw-Hill education, India.

(2) Advanced Physical Chemistry**:** Gurdeep Raj, 35th Edition (2009), Goel / Krshina Publishing House.

(3) Principles of Physical Chemistry**:** Puri, Sharma and Pathania, 42nd Edition, Vishal Publishing Company.

(4) Polymer Science**:** Gowariker, Viswanathan and Sreedhar, 1st Edition (2012 reprint) New Age International.

(5) Essentials of Nuclear Chemistry**:** Arnikar, 4th Edition (2012 reprint), New Age International.

(6) Physical Chemistry**:** Atkins, 9th Edition. Oxford University Press.

(7) Advanced Physical chemistry**:** Gurtu and Gurtu, 11th Edition , Pragati Prakashan.

(8) Physical chemistry**:** Levine, 6th Edition, McGraw-Hill education, India.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Chemistry-604
CODE : 53020604
B.Sc. 6th Semester

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	50	50	-	150

Objectives:- To provide basic knowledge Chemistry

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	**(A) Errors and treatment of Analytical data:** Significant figures, Accuracy and precision, Types of errors and minimization of errors. Ways of expressing accuracy and precision. Rejection of a result, Test of significance (Q-Test, Student t-Test and F-Test) correlation coefficient. Literature of Analytical Chemistry. **(B) Organic reagents used in quantitative Analysis** Separation of methods with 8-Hydroxy Quinoline, Cupferron and DMG	14
2	**(A) Chromatographic methods:** General principle, classification of chromatographic separation. Ion exchange chromatography (Ion Exchange equlibria, Types of Ion Exchange capacity, Application of Ion Exchange resins). Gas Chromatography, Instrumentation and evolution of data. High Performance Liquid Chromatography (HPLC) Principle and Instrumentation.	14

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	(B) Solvent Extraction Separation: Principles of solvent extraction, choice of solvent, distribution coefficient, distribution ratio, percentage (%) extraction. The extraction process, solvent extraction of metals, selective extraction and separation efficiency.	
3	**(A) Polarography:** Introduction, Principle, electrode, Types of currents, Determination of half wave potential, Ilkovic equation, methods of determining concentration (Standard addition method and Calibration method) **(B) Potentiometry:** The scope of potentiometric titrations, Precipitation and neutralization titrations, Graphical method including Gran's plot for selecting end point, Differential titration, Dead stop titration, Ion selective Electrode, various types of Ion selective Electrodes and use of Calcium ion selective electrode.	14
4	**Miscellaneous Titrations:** (**A**) **Acid Base Titrations:** Titration of poplyprotic acid and mixture of acids, titration of salts, Differential Alkali titration. (**B**) **Redox titration:** Titration involving Iodine: iodimetry and iodometry, Titration with reducing agents and oxidising agents, metallic reductors. (**C**) **Complexometric titration:** EDTA titration techniques-Direct, Back, Displacement and Indirect Tititration, Masking, Demasking agent, ligand effect and Hydrolysis of EDTA complex, Auxiliary complexing agent- EDTA titration with an auxiliary complexing agent.	14

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biochemistry

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

(1) Analytical Chemistry**:** Gary D. Christian, 6th Edition; Wiley & Sons
(2) Fundamentals of Analytical Chemistry**:** D. A. Skoog, D. M. West and F. J. Holler, 9th Edition, Cengage Learning.
(3) Instrumental Methods of analysis**:** (CBS) H.H . Willard, L.L. Mirrit, J.A. Dean
(4) Solvent extraction in Analytical Chemistry**:** G.H. Morrison, F. Frieiser, John Wiley & Sons, NY.
(5) Instrumental Methods of Inorganic Analysis**:** A.I. Vogel, ELBS
(6) Chemical Instrumentation**:** A Systematic approach- H.A. Strobel
(7) The principals of ion-selective electrodes and membrane transport**:** W.E.Morf

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -601

CODE:53040601

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge Enzymology

Prerequisites:-

Course outline:- Enzymology

Sr. No.	Course Contents	Number of Hours
1.	Enzymology- General characteristics and classification, definition of holoenzymes, coenzymes, apoenzymes, cofactors, activators, inhibitors, units of enzyme activity, isoenzymes, turn over number, specific activity, first order and zero order reactions. Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes	12
2.	Enzyme kinetics- Derivation of Michaelis and Menten equation and its modifications (Line	10

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	weaver & Burk plot, Eadie-Hofstee and Hannes & Woolf plots). Enzyme Inhibition – competitive, non competitive, uncompetitive, mixed & substrate inhibition.	
3.	Enzyme immobilization- types, methods, application, advantages & limitations. Introduction to reverse micelles.	**8**
4.	Sources and applications of enzymes- amylase, protease and lipase in industries (detergent, leather, food, dairy, Textile and medical). Industrial production of enzymes.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of Enzymology.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Enzymology –Palmer
- Textbook of biochemistry – Vasudevan Shreekumari
- Biochemistry - Lehninger

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DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -602

CODE : 53040602

B.Sc. 3rd Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge Industrial Biotechnology

Prerequisites:-

Course outline:- Industrial Biotechnology

Sr. No.	Course Contents	Number of Hours
1.	Fermentation (definition and applications), media (crude and synthetic), and sterilization of media. Screening- primary and secondary. Strain improvement	12
2.	Design of fermentor(aeration, agitation and body construction), Downstream processing- Filtration, centrifugation, cell disruption, precipitation & solvent extraction.	10
3.	Effect of aeration and agitation, methods of estimating C_{crit} and KL_a. Measurement of pH and temperature.	8
4.	Production of ethanol, cheese, beer, red & white	8

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	wine, sparkling wine (champagne) Spoilage and preservation of food.	

Learning Outcomes:

At the end of the course the student would have basic knowledge of industrial microbiology

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Industrial microbiology – Whitaker
- Industrial microbiology –AH Patel
- General microbiology - Frobisher

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DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -603

CODE : 53040603

B.Sc. 3rdYear

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge of Metabolism.

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	Non Specific Host Defense Mechanisms: Phagocytosis, Complement, Inflammation, Cytokines Acute Phase Proteins, Cells, Tissues & Organs of the Immune System.	8
2.	**Specific Immune Responses: I** Antigens, Haptens, Cluster of Differentiation Molecules, Humoral & Cell Mediated Immunity. Recognition of Foreignness. T Cell Biology - T Cell receptors, Types of T	8

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	Cells, T Cell Activation. B Cell Biology- B Cell Receptors, B cell Activation.	
3.	**Specific Immune Responses: II** Antibodies - (Immunoglobulins - Definition, Structure & Function, Classes of Immunoglobulins. Antigen-Antibody Reactions: General Features, Measurement of Antigen & Antibody. Serological Reactions: Precipitation Reactions, Definition, Mechanism - Zone Phenomenon & Lattice Hypothesis. Applications- Precipitation in Liquid Medium. Agglutination reactions- Definition, Applications- Slide agglutination test. Tube agglutination test, Passive agglutination test. Primary & Secondary Antibody response. Diversity of Antibodies, Clonal Selection Theory Monoclonal Antibody Technology.	**10**
4.	**Immune Disorders:** Immuno Deficiency. Hypersensitivity Autoimmunity - Mechanism & Classification of Autoimmune diseases. Immunology of Transplantation: Classification of Transplants. Allograft reaction (mechanism) Factors favouring Allograft survival. Graft v/s Host reaction. Immunology of Malignancy.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.

Teaching & learning Methodology:

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- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Text book of Microbiology –Ananthnarayan & Panikar
- Microbiology – Presscott, Harley & klein

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

MICROBIOLOGY -604

CODE : 53040604

B.Sc. 3st Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	2	5	5	50	--	50	50	150

Objectives:- To provide basic knowledge of Metabolism.

Prerequisites:-

Course outline:-

Sr. No.	Course Contents	Number of Hours
1.	Symbiotic & asymbiotic nitrogen fixation. Nitrogen fixation - Structure & mechanism of nitrogenase. Biofertilizers- Definition, Azotobacter & Rhizobia (With Production) Microbial insecticides.	8
2.	Bioleaching & bioleaching of Copper. Biodeterioration of wood, paint & metal. Bioremediation-introduction. Bioremediation of petroleum hydrocarbon & chlorinated compounds.	8

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	Microbial enhanced oil recovery..	
3.	Concept of xenobiotics & recalcitrance. Biomagnification. Biodegradation of environmental pollutants. (ABS, Chlorinated hydrocarbons, Oil pollutants.) Biodegradable polymers.	**8**
4.	Introduction to biofuels. Renewable & nonrenewable energy resources. Features of biofuels. Biogas - substrate, microorganisms & production. Advantages & disadvantages of Biogas production.	**8**

Learning Outcomes:

At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.

Teaching & learning Methodology:

- Use of audiovisual aids
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Basic Text & Reference Books:

- Principles of Microbiology – RM Atlas
- Microbiology – Prescott LM
- Biotechnology- BD Singh

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF SCIENCE

ENVIRONMENT CONSERVATION & HAZARD MANAGEMENT

CODE: 53000603

1st Year

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
3	-	-	3	3	30	50	70	-	150

Objectives: - To provide a comprehensive knowledge for awareness of environment conservation and hazard management.

Prerequisites:- Environment Conservation & Hazard Management

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	Ecology and Environment	6
2	Solar power	10
3	Seismic engineering and disaster management	6
4	Sustainable development	8

Learning Outcomes:- At the closing stage of the course, the students will be able to understand the importance of environment conservation and the concepts of hazard management.

Teaching & Learning Methodology:- The Syllabus for Environmental Studies includes classroom teaching. The syllabus is divided into four units covering 30 lectures. The units are classroom teaching based to enhance knowledge skilled and attitude to environment.

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Books Recommended:

1. R. R. Mahitcha – "Environment Conservation and Hazard Management", Atul Prakashan.
2. Solanki and Chetan Singh – "Renewable Energy Technologies", PHI Learning.
3. Izrael Y.A. – "Ecology and Control of the Natural Environment", Kluwer Academic Publisher.
4. Sharma, Sanjay K. – "Environment Engineering and Disaster Management", Laxmi Publications.
5. Earnest, Joshua and Wizelius, Tore – "Wind Power Plants and Project Development, PHI Learning.
6. Anandita Basak – "Environmental Studies", Pearson Publication.
7. K. S. Valadia – "Coping with Natural Hazards Indian Context", Orient Longman Publication.
8. Edward S. Rubin –"Engineering and Environment", McGraw Hill Publication

SYLLABUS

Unit-1

Ecology and Environment: Importance of environment and scope, Engineering and Environment issues, The natural system, Biotic and Biotic components and processes of natural system, Eco system, Food chain, webs and other biological Systems, Causes of environmental pollution, Pollution due to solid waste, Water pollution, Air pollution, The noise as pollution, Pollution of land due to industrial and chemical waste, Radiation and its effects on vegetables and animals

Unit-2

Solar power: Features of solar thermal and PV systems, Types of solar cookers and solar water heaters, Solar PV systems and its components and their working, Types of solar PV cells, Rating and Costing.

Unit-3

Seismic engineering and disaster management: Introduction of Seismic engineering and its application, Features of disasters such as floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc., Management and Mitigation of disasters.

Unit-4

Sustainable development: Concept of sustainable development, Natural resources, Abiotic and Biotic resources, Principles of conservation of energy and management, Need of renewable energy, Growth of renewable energy in India and the world, Concept of waste management and recycling.

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SWARRNIM SCIENCE COLLEGE

Department of Chemistry

Advanced Organic Chemistry
Subject Code: 56020401
M.Sc. Semester- IV

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Pericyclic Reactions** Introduction, classification of pericyclic reactions, stereochemistry, molecular orbital symmetry, frontier orbitals of ethelene, 1,3 – butadiene, 1,3,5-hexatriene and allyl system, F.M.O. and PMO approach to cycloaddition and electrocyclic reactions: Generalisation of wood-ward Hoffmann rule, sigmatropic rearrangement-suprafacial and antrafacial shifts of	14

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	H.Stereoselectivity in sigmatr earrangement, enantioselectinity in pericyclic reactions.	
2	**Conformational Analysis** Confirmation at cyclic systems: Confirmation of cyclohexane, mono and disubstituted cyclohexane, heterocyclic compounds, five and six membered heterocycles, stereoelectronic effects, fused bicyclic sptem, decalin, dodecalin, polyclin system, perhydrophenanthrene, bridged systems-conformation of sugars, steric strains due to unavoidable crowding, stereochemistry of the compounds containing nitrogen, sulphur and phosphorous.	14
3	**Oxidation** Introduction, different oxidation processes, hydrocarbons-alkenes, aromatic rings, saturated C-H group (activated and unactivated), alcohols, diols, aldehydes, ketones, amines, hydrazine and sulphides.	14
4	**Reduction** Introduction, different reductive processes, hydrocarbons-alkanes, alkenes, alkynes and aromatic rings, Carbonyl compounds-aldehydes, ketones, acids and their derivatives, epoxides, nitro, nitroso, azo and oxime groups, Preparation and properties and application of pd and Ti compounds as organometallic agents	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Che..

  mistry.

- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.

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- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.

- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.

- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Advance organic chemistry by Jerry March
2. Advance organic chemistry by Carey and Sundberg,
3. Advance organic chemistry by Francis A. carey

E-Resources

- https://www.youtube.com/watch?v=oio3RJHAxOw

- https://www.asu.edu/courses/chm332/PericyclicReactions.pdf

- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Reactions/Pericyclic_Reactions

- https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/21%3A_Resonance_and_Molecular_Orbital_Methods/21.11%3A_Pericyclic_Reactions

- https://courses.lumenlearning.com/suny-potsdam-organicchemistry/chapter/conformational-analysis/#:~:text=Conformational%20analysis%20is%20the%20study,through%2Dspace%20interactions%20of%20substituents.

- https://www.ch.ic.ac.uk/local/organic/conf/c1_definitions.html

- https://www.youtube.com/watch?v=ua0_UNoashU

- https://www.thoughtco.com/definition-of-oxidation-in-chemistry-605456#:~:text=Oxidation%20is%20the%20loss%20of,%2C%20molecule%2C%20or%20ion%20decreases.

- https://www.chemguide.co.uk/inorganic/redox/definitions.html

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Advanced Organic Synthesis
Subject Code: 56020402
M.Sc. Semester- IV

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Protection of groups** Principle of protection of hydroxyl, amino, carbonyl, carboxylic acid with different reagents and their deprotection, synthetic equivalent groups, synthetic analysis and planning, control of stereochemistry.	14
2		14

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	Disconnection approach An introduction to synthesis, and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis one group C-X and two group C-X disconnections, chemo-selectivity, reversal and polarity.	
3	**One group C-C disconnections** Alcohols and carbonyl compounds, region-selectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.	14
4	**Ring synthesis** Saturated heterocycles, synthesis of 3, 4, 5, and 6-membered rings, aromatic heterocycles in organic synthesis.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at

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the start of a programme/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

- Include group work, with groups representing diverse cultures.

Books Recommended

1. Organic synthesis: the disconnection approach by stuart Warren (wiley student edition)

2. Organic chemistry- clayden, greeves, warren and wothers, (oxford press)

E-Resources

- https://www.organic-chemistry.org/protectivegroups/
- https://en.wikipedia.org/wiki/Protecting_group#:~:text=A%20protecting%20group%20or%20protective,role%20in%20multistep%20organic%20synthesis.&text=This%20step%20is%20called%20deprotection.
- http://www.chem.ucalgary.ca/courses/351/Carey5th/Ch17/ch17-3-4-3.html
- https://www.youtube.com/watch?v=YYC_vbrgZDY
- https://mazams.weebly.com/uploads/4/8/2/6/48260335/organic_synthesis_the_disconnection_approach_2nd_edition_by_stuart_warren.pdf
- https://www.chemistry.tcd.ie/assets/pdf/sfchemistry/tg/HandoutsSFLectureSinIntroductiontoOrganicChemistry2009.pdf
- http://rushim.ru/books/uchebnik/Warren.pdf
- https://www.slideshare.net/dragnerkar/retrosynthesis-agn-compatibility-mode
- https://www.slideshare.net/RabiaAziz6/retrosynthesis-122337747
- https://www.vanderbilt.edu/AnS/Chemistry/Rizzo/chem223/rings6.pdf

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF CHEMISTRY

Bio-organic Chemistry
Subject Code: 56020403
M.Sc. Semester- IV

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
Th	Tu	P	Total		Internal		External		Total
					Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

Chemistry majors must have a basic understanding of fundamental organic chemistry.

Course outline

Sr. No.	Course Contents	Teaching Hours
1	**Water and vitamins** Water –interaction among biomolecules in aqueous systems, buffering against pH changes, in biological systems, participation of water in biological reactions. Vitamins-classification, introduction, chemistry, absorption transport, mobilization and biochemical functions of Vitamins A, D, E, K, C, B, B2, B6, H and folic acid	14

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2	**Proteins and enzymes** **Proteins:** properties and conventions of common amino acids, stereoisomerism in α -amino acid, Peptides: formation, compositions and sizes of protein separation, purification and characterization, sequencing of peptides, sanger's method, edman degradation, outline of other methods, protein sequences and evolution. Oxygen binding proteins, haemoglobin and myoglobin in oxygen transport and storage. **Enzymes:** classification, nomenclature and extraction factors affecting catalytic activity and specificity in action, regulation of enzyme activity, enzyme inhibition, illustrative enzymatic reactions using chymotropsin, hexokinase, enolase and lysozyme	14
3	**Carbohydrates and nucleic acid** **Carbohydrates:** classification and stereochemistry, biologically important hexose derivatives, nomenclature of disaccharides, structure and role of some homo and hetero polysaccharides, glucoconjugates : proteoglycans, glycoproteins and glycolipids **Nucleic acid:** compounds of nucleic acids, nomenclature of nucleotides, nucleosides, structure of DNA and structure of RNA	14
4	**Lipids** Nomenclature, structure and physical properties of some naturally occurring fatty acids, triacelglycerol and waxes as sources of stored energy, insulation of water repellants, types of membrane lipids, introduction to glycerophospho lipids, galactolipids, sphingo lipids, phospholipids and sterols, bile acids.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology:-

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

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- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended:

1. Principles of biochemistry –Donald J.Voet, Judish G.Voet, charlotte w. pratt (John willey and sons)
2. Lehninger principles of biochemistry- David L.Nelson and Michael M.wx (Palgrave Macmillan / w.h. freeman company new york)
3. 3. Biochemistry – U.Satyanarayana Baro and allied P.Ltd., kolkata

E-Resources

- https://kidshealth.org/en/teens/vitaminsminerals.html#:~:text=The%20water%2Dsoluble%20vitamins%20%E2%80%94%20C,can't%20store%20these%20vitamins.
- https://www.healthline.com/nutrition/water-soluble-vitamins
- https://www.who.int/water_sanitation_health/dwq/nutrientschap13.pdf
- https://www.freedrinkingwater.com/water-education3/34-water-vitamins.htm
- https://www.medicinenet.com/water_soluble_vitamins_vs_fat_soluble_vitamins/ask.htm
- https://extension.colostate.edu/topic-areas/nutrition-food-safety-health/water-soluble-vitamins-b-complex-and-vitamin-c-9-312/
- https://www.nature.com/scitable/topicpage/protein-function-14123348/#:~:text=Enzymes%20are%20proteins%2C%20and%20they,highly%20specific%20to%20their%20substrates.

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF Chemistry

Selected topics in Medicinal Chemistry
Subject Code: 56020404
M.Sc. Semester - IV

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-		4	4	30		70	-	100

Objectives

- The students will understand the interdisciplinary nature of chemistry and to integrate knowledge.
- The students will develop the ability to effectively communicate scientific information and research results in written and oral formats.

Prerequisites

- Chemistry majors must have a basic understanding of fundamental Organic Chemistry.

Course outline

Sr. No.	Course Contents	Teaching hours
1	**Drug design** Introduction, naming of organic medicinal compounds, literature of medicinal chemistry, development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, pro drugs, soft drugs, phase I, II and III clinical trials,	14

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	structure activity relations theories of drug activity : occupational theory, rate theory, induced fit theory, quantitative structure activity relationship, history and development of QSAR. Concept of drug receptors, elementary treatment of drug receptor interactions, physio chemical parameters lipophilicity, partition coefficient, electronic ionization constant, concept of 3-D QSAR.	
2	**Pharmacokinetic and pharmacodynamics** Pharmacokinetics: introduction to drug absorption, distribution, metabolism, elimination. important pharmacokinetic parameters in defining drug deposition and in therapeutics, uses of pharmaceutics in drug development process Pharmacodynamics: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, drug metabolism, biotransformation, significance of drug metabolism in medicinal chemistry.	14
3	**Dosage forms, Quality control and application of computers in chemistry** Dosage forms, types of dosages, different roots of administration, quality control of drugs pharmacopias, modern methods of pharmaceutical analysis. **Computer in chemistry** Use of computer in chemistry and industry Important websites for data search chemistry Information about online journals for chemistry	14
4	**Medicine** Overview, Medicinal use of nanomaterials-Drug delivery Protein and peptide delivery –cancer, surgery, visualization, nanoparticle targeting Medical application of molecular nanotechnology-nanorobots, cell repair machines, nanonephrology.	14

Learning Outcomes

- At the end of the course the student would have sufficient knowledge of Organic Chemistry.
- Students will be able to design and carry out scientific experiments as well as accurately record and analyze the result of such experiments.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

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The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the programmer/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs.
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups.
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties.
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a programmer/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.
- Include group work, with groups representing diverse cultures.

Books Recommended

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Edited by ManFred E. Wolff (John Wiley & Sons, inc., New York).

2. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).

3. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).

4. QSAR: quantitative structure-activity relationships in drug design by Jean-Luc Fauchère. ISBN:084515141X, 9780845151419

5. QSAR : Hansch analysis and related approaches By Hugo Kubinyi

E-Resources

- https://en.wikipedia.org/wiki/Drug_design#:~:text=Drug%20design%2C%20often%20referred%20to,knowledge%20of%20a%20biological%20target.
- https://www.dovepress.com/journal-editor-drug-design-development-and-therapy-eic19
- https://www.pharmatutor.org/articles/drug-designing-review
- https://newdrugapprovals.org/drug-design/
- https://www.bioagilytix.com/blog/2020/10/05/the-difference-between-pharmacokinetics-and

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

ENVIRONMENTAL MICROBIOLOGY

CODE: 56030401

M.Sc. 4th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
Th	Tu	P	Total		Internal		External		Total
					Th	Pr	Th	Pr	
4	-	2	6	8	30	50	70		150

Objectives:-

- To provide basic knowledge of Environmental Microbiology. It covers up scope of global warming, environmental problems, biodegradation, bioleaching.
- To provide basic knowledge of microbes in environment.
- The main goal is to know and understand the role of microbes in biogeochemical processes in different ecosystems. The students will learn the basic microbiological principles, the methods in microbial ecology and their theoretical and practical use.
- The knowledge can give the base for understanding processes and changes in the environment.
- The students can get some skills to recognise the ecological problems and critical evaluation of the human impacts on pollution, climate changes and as well as environmental protection.
- The lectures will be implemented with individual practical work in the laboratory and presentations of the seminars.
- The students can get general competences in microbial ecology.

Prerequisites:-

- Student Must have studied B.Sc. with microbiology/biotechnology as a major subject and knowledge of basic biology

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Course outline:-

Unit	Description in Detail	Weightage
1	Global environmental problems: Global warming, Ozone depletion, Acid rain. Global warming and infectious diseases. Water pollution: sources and types, physical, chemical and biological pollution. Eutrophication and its control Microbial indicators of water pollution Biodeterioration of wood and metals. Role of microorganism, mechanism and control.	10
2	Bioremediation: Intrinsic bioremediation, Biostimulation and Bioaugmentation. In situ and ex situ bioremediation echnologies. Bioremediation of oil spills. Bioremediation of heavy metal pollution, Phytoremediation. Use of GMO in bioremediation. Biological treatment of waste gas (polluted air): biofilters, bioscrubbers, membrane bioreactors, biotrickling filters.	10
3	Biodegradation of organic pollutants: Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides.	10
4	Bioleaching of metals: Characteristics of commercially important microbes, mechanisms of bioleaching, factors affecting bioleaching and current biomining processes. Biobeneficiation of gold ores. Microbially enhanced oil recovery. Biodesulfurization of coal: Removal of organic and inorganic sulphur from coal. Microbial Insecticides: Bacterial, fungal and viral	10

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	insecticides in pest management. Biofertilizers: Nitrogen fixing and phosphate solubilizing biofertilizers.	
		40

Learning Outcomes:

➢ At the end of the course the student would have basic knowledge of microbiology techniques and bacteria.

➢ Students will get the basic knowledge how to prepare and perform sampling and microbial analyses to determine the abundance, growth rate and microbial community composition together with the basic environmental parameters.

➢ The knowledge can be used to prevent infections and to protect human and environmental health.

➢ Students will get basic knowledge to determine the role of microbes:

- in different habitates,

- in different biogeochemical cycles,

- to determine their role in nutrient cycling

- to determine water quality,

- in degradation of natural organic compounds and selected pollutants in the environment.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

➢ Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs

➢ Draw upon the knowledge and understanding brought by students from different

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backgrounds, by encouraging the share and discuss personal knowledge and experience of an issue in tutorial/seminar groups

➢ Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties ➢ Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

➢ . Environmental Microbiology –RM Maier, IL Pepper & GP Gerba
➢ Comprehensive Biotechnology- Vol 4, Murray Moo Young
➢ Biotechnology – Rehm and Reid
➢ Environmental Science 0 BJ Nebel and RT Wright
➢ Environmental Biotechnology –HJ Jordening & Josef Winter

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SWARRNIM SCIENCE COLLEGE

DEPARTMENT OF MICROBIOLOGY

r-DNA Technology
Subject Code: 56030402
M.SC. Semester -4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	8	30	50	70	-	150

Objectives

- To provide students the basic knowledge of R-DNA technology (Recombinant DNA technology).
- The purpose of the course is to give student to introduction of Recombinant DNA technology and its cover up scope of genetic engineering, Cloning, Recombinant, and PCR.
- To provide an understanding of Scope of genetic engineering, concept & important of genetic engineering, chemical synthesis of gene cloning & expression vectors, and PCR techniques.

Prerequisites

Student must have studied M.Sc. with microbiology as a major subject and knowledge of basic microbiology/Life science.

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Course outline

Sr. No.	Course Contents	Teaching hours
1.	Scope of Genetic Engineering, Concept and importance of Genetic Engineering; General strategies and Steps involved in gene cloning; Extraction and purification of DNA from bacteria, plant and animal cells; Restriction enzymes, DNA lipase and other enzymes involved in gene cloning; mRNA and cDNA preparation.	06
2.	Chemical synthesis of gene/DNA Cloning and expression vectors- Plasmids, _-bacteriophages, M-13 based vectors, Phagemids, Cosmids, YAC, BAC,HAC/MAC, etc. Expression of cloned gene in heterologous host Introduction of DNA into different host systems.	06
3.	Recombinant selection and screening Southern blotting & hybridization, Northern analysis, Western blot analysis, Agarose gel electrophoresis, Pulse Field Gel Electrophoresis, Rotating Gel. Electrophoresis (RGE), Mapping Regulatory Sequences by in vivo expression assay Mapping of Protein Binding Site by DNAse I Protection, Mobility Gel Shift Assay Protein Activity Assay – Yeast-one hybrid, Yeast-two hybrid and Yeast-three hybrid system. Phage display, Subtractive hybridization and cloning, HRT/HART, Chromosomal Walk. Characterization of Cloned genes .Restriction map,S1 mapping ,Denaturation mapping ,Heterogonous mapping DNA sequencing, Nucleic Acid Microarray, Metagenomics, Metabolism, gene therapy.	10
4	Polymerase chain reaction Molecular markers Linkage mapping using meiotic recombination frequencies Genomic mapping using radiation induced Chromosome rearrangement Genomic mapping using DNA sequence polymorphism as genetic marker In vitro Mutagenesis Metagenomics Metabolic engineering Gene therapy Recombinant products- recombinant hormones ,recombinant DNA vaccines, Transgenic plants, Transgenic animals, Genetic Engineering Guidelines, Levels of Physical containment, Levels of Biological Containment, The Indian Guidelines.	10

Learning Outcomes

- The students will be able to understand the Knowledge of r-DNA technology to understand concept of various fields like research, gene manipulation, genetic engineering, gene cloning, fermentation industries, etc.

- Student should be able to understand basic concepts of recombination, methods of genetic engineering, screening methods, enzymes involved in r-DNA technology, DNA sequencing, vectors, gene markers, transgenic plants and animals as well as gene therapy.

- Access information on a topic from a variety of sources, and be able to learn new things on one's own.

- Communicate verbally, graphically and/or in writing the theoretical data clearly and concisely that incorporates the stylistic conventions used by microbiologists, biotechnologists, researchers and scientist worldwide.

Teaching & Learning Methodology

We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.

The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:

- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

1. Genomes TA Brown 3rd Edition
2. Principles of Genetic Manipulation- Old & Primrose
3. Genetic Engineering – Rastogi & Pathak
4. Recombinant DNA technology by keya chaudhari

E-Resources

- https://www.slideshare.net/mobile/SECBIO/genetic-engineering-13933607
- https://www.slideshare.net/mobile/ImdadTakkar/artificial-gene-synthesis
- https://www.slideshare.net/mobile/FarazaJaved/pcr-76618045
- https://www.slideshare.net/mobile/fizz92fizzuo/vectors-49902617

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

Plant Biotechnology

Subject Code: 56010401

M.Sc. Semester-4

Teaching & Evaluation Scheme

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	4	**30**	**--**	**70**		**100**

Objectives

- To provide basic knowledge of plant biotechnology, secondary metabolites and about genetic engineering technology.
- To provide basic knowledge of Plant Biotechnology. It covers up about cell & tissue culture, methods of propagation, plant tissue culture.
- The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/ medical / Environmental Sciences.

Prerequisites

Student must have studied B.Sc with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

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Course outline

Sr. No.	Course Contents	Teaching hours
1	Cell & tissue culture in plants; callus cultures; in-vitro morphogenesis organogenesis and embryogenesis; Artificial Seeds, Micropropagation (Clonal propagation); Haploidy; anther and ovule cultures, Embryo cultures; Protoplast isolation, culture and protoplast fusion and somatic hybridization, Cybrids, Somaclonal Variation; in-vitro mutation methods; Virus elimination, pathogen indexing; Cryopreservation	08
2	Production of secondary metabolites; Sources of plant secondary metabolites; criteria for cell selection, factors affecting the culture of cells; different bioreactors and their use in secondary metabolite production; biochemical pathways for the production of different secondary metabolites; and biotransformation.	06
3	Principles and methods of genetic engineering, and its applications in Agriculture. Methods for genetic transformation and transgenic plants production through Agro bacterim tumefaciens and A. rhizogenes; Gene transfer methods in plants; PEG mediated, microinjection, particle bombardment, electroporation, Molecular markers and their importance in plant breeding, Marker Assisted Selection (MAS).	10
4	Molecular plant pathology: Mechanisms of disease resistance in plants against pathogens; Signalling pathways and molecular events during pathogen – plant interaction. Biotechnology and intellectual property rights (IPR); Plant genetic resources GATT & TRIPS; Patent for higher plant genes and DNA sequence	08

Learning Outcomes

- The aim of this course is to provide a thorough understanding of theoretical and practical aspects of plant cell and tissue culture. Topics include: plant regeneration, genetic modification, cellular & physiological aspects of differentiation and hormonal regulation of differentiation.

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- Student should be able to understand Explain basic metabolic pathways of plants and formation of different secondary metabolites through various biosynthetic pathways in plants

- The course is designed to give students an understanding of the students will have knowledge of tools and strategies used in genetic engineering. Understanding of applications of recombinant DNA technology and genetic engineering. from academic and industrial perspective

- The students will learn how to select and apply the methodologies to be used in molecular plant pathology

Teaching & Learning Methodology

- We should aim to provide a range of modes of learning, including, for example, individual work, group work and opportunities for off-campus learning through visit to various research institutions across India or collaborative arrangements.
- The following are some examples of learning and teaching strategies and methods which you may wish to develop for use in your subject area:
- Work with students at an early stage of the program/module, to identify cultural differences in their previous educational experience, their individual learning approaches and needs
- Draw upon the knowledge and understanding brought by students from different backgrounds, by encouraging them to share and discuss personal knowledge and experience of an issue in tutorial/seminar groups
- Use teaching formats such as discussion groups that encourage the participation of all students and help identify areas where students are having difficulties
- Provide learning materials in different formats (written, online, audio, video podcast etc) to support key concepts/knowledge. Particularly at the start of a program/module or for key areas, providing online or hard copy notes before classes can aid comprehension and accessibility.

Books Recommended

- Elements of Biotechnology – P K Gupta

- Principles of plant biotechnology: An introduction to genetic engineering in plants – S H Mantel, et. al.

- Advances in Biochemical engineering / Biotechnology – Anderson, et. al.

- Plant cell culture technology – M M Yeoman

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E-Resources

- https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plant-biotechnology
- https://en.wikipedia.org/wiki/Genetic_engineering#:~:text=Genetic%20engineering
- https://bsppjournals.onlinelibrary.wiley.com/journal/13643703
- https://www.slideshare.net/abhishekindurkar/production-of-secondary-metabolite
- https://www.slideshare.net/VamsiIntellectual/types-of-cells-and-tissues

SWARNIM STARTUP & INNOVATION UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY

CODE: 56010402

M.Sc 4th SEM

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Evaluation Scheme				
					Internal		External		Total
Th	Tu	P	Total		Th	Pr	Th	Pr	
4	-	2	6	6	50	50	50		150

Objectives:-

- To provide knowledge about environment monitoring, its assessment using bio-indicators, biomarkers, biosensors and toxicity testing. Various environmental laws.
- Student will an get idea about bioremediation techniques, strategies involved in bioremediation. Phytoremediation, GMO and impact on bioremediation.
- To provide an idea about principles of biodegradation and mechanism of detoxification, biodegradation of various compounds like detergents, pesticide, lignin, hydrocarbon and dyes.
- Provide knowledge about Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration, Biodeterioration of selected material.

Prerequisites

Student must have studied B.Sc with microbiology/Biotechnology as a major subject and knowledge of basic microbiology.

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COURSE OUTLINE:

Unit	Description in Detail	Weightage
1	**Environmental problems and monitoring:** Environmental monitoring: environmental impacts and their assessments using bio-indicators, biomarkers, biosensors and toxicity testing, rDNA technology, Conservation strategies, Environmental laws and policies in India	06
2	**Bioremediation:** Bioremediation principles, Strategies and techniques of bioremediation: *in situ* and *ex situ*, Bioremediation of metals, Phytoremediation, GMOs and their impact on bioremediations	06
3	**Biodegradation:** Principles of biodegradation and mechanism of detoxification, Biodegradation of detergent, pesticide, lignin, hydrocarbon and dyes	10
4	**Biodeterioration:** Principles and mechanisms of biodeterioration, Methodology to assess biodeterioration, Prevention and control of biodeterioration, Biodeterioration of selected materials	10

Learning Outcomes

- To provide knowledge about environment monitoring, its assessment using bio-indicators, biomarkers, biosensors and toxicity testing. Various environmental laws.
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Books Recommended

1. Biotechnology- U. Satyanarayana
2. Environmental engineering and management- S. K. Dhameja, Publ: Kataria & Sons
3. Textbook of Biotechnology- H.K.Das
4. Methods in Biotechnology- Hans-peter-schmauder
5. Environmental Biotechnology- B.C. Bhattacharyya and R. Banerjee
6. Environmental biotechnology- G. M. Evans and J. C. Furlong
7. Environmental biotechnology- A. Scragg, Oxford

E-Resources

1. https://www.slideshare.net/Omodhu/bioremediation-71688629
2. https://www.slideshare.net/vanithagopal/bioremediation-41934065
3. https://www.slideshare.net/halalarahman/phytoremediationppt
4. https://www.slideshare.net/Christa_belle/phytoremediation-43828173
5. https://www.slideshare.net/tanujanautiyal/environmental-biotechnology-50099488

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