



# C. U. SHAH UNIVERSITY

## FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

**COURSE: M.Sc. SEMESTER: III**  
**SUBJECT NAME: Microbial Genetics & Molecular Microbiology**  
**SUBJECT CODE: 5SC03MIG1**

### Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	0	4	4	30	1	70	3	-	-	-	100	

**Objectives:-** The objective of this course is that the students can learn about basics of Genetics and molecular microbiology.

**Prerequisites:-** Basic knowledge of Biological Sciences.

### Course outline:

	Course contents	Hours
<b>UNIT I</b>	Mendel's work on transmission of traits; Genetic Variation; Molecular basis of Genetic Information; Mitosis and Meiosis; Linkage and crossing over; Cytological basis of crossing over; Molecular mechanism of crossing over; Recombination and recombination frequency	<b>15</b>
<b>UNIT II</b>	Mutations- Induced versus Spontaneous mutations, Suppressor mutations, Molecular basis of Mutations, mutant enrichment; Complementation tests; recombination tests and gene replacements; Cloning genes by complementation and marker rescue; DNA repair mechanisms	<b>15</b>
<b>UNIT III</b>	Molecular mechanism of gene transfer by conjugation. Regulation of gene transfer by conjugation. Mapping bacterial genomes using Hfr strains. Transfer systems in gram positive bacteria. Ti plasmid and application; Transformation and transduction: Natural transformation and competence. Molecular basis of natural transformation; Regulation of competence in <i>B.subtilis</i> . Artificially induced competence. Generalized versus specialized transduction, T4 and lambda phage. Mapping bacterial genes by transduction; Positive and negative gene regulation and attenuation,	<b>15</b>

**M. Sc. (Microbiology) Sem III**



## C. U. SHAH UNIVERSITY



	using the <i>lac</i> , <i>gal</i> , <i>trp</i> , <i>ara</i> and <i>tol</i> operons, with emphasis on recent advances.	
<b>UNIT IV</b>	Lytic cycle of T4 and T7 bacteriophages, Regulation of expression of genes in phage T4 and T7. Replication and packaging of filamentous phages M13 and f1. Benzer's experiments with the <i>rII</i> genes of phage T4 to construct phage genetic linkage maps. Lambda phage – Lytic and lysogenic cycles. Other lysogenic phages – P1 and) x174. Transposons and gene regulation. Yeast Ty-1 transposon. Phase variation system in Salmonella.	<b>15</b>
	<b>Total</b>	<b>60</b>

**Learning Outcomes :-** The students can acquire knowledge about –

- Mendelian genetics and various laws.
- Mutations and about bacteriophage.

### **Books Recommended:**

1. Snyder L. and Chapness W. Molecular Genetics of Bacteria 2007.
2. Birge EA. 1981. Bacterial and Bacteriophage Genetics. Springer Verlag.
3. Gardner JE, Simmons MJ & Snustad DP. 1991. Principles of Genetics. John Wiley & Sons.
4. Lewin B. 1999. Gene. Vols. VI, IX. John Wiley & Sons.
5. Maloy A & Friedfelder D. 1994. Microbial Genetics. Narosa.
6. Scaife J, Leach D & Galizzi A 1985. Genetics of Bacteria. Academic Press.
7. William Hayes 1981. Genetics of Bacteria. Academic Press.
8. Microbial Genetics. Maloy et. al. 1994. Jones & Bartlett Publishers.
9. Dale J.W., Molecular genetics of bacteria. 1994. John Wiley & Sones.
10. Streips & Yasbin. Modern microbial genetics. 1991. Niley. Ltd.



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF SCIENCES**  
**DEPARTMENT OF LIFE SCIENCES**

**COURSE: M.Sc.**

**SEMESTER: III**

**SUBJECT NAME: Environmental Microbiology**

**SUBJECT CODE: 5SC03EMB1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	0	4	4	30	1	70	3	-	-	-	100	

**Objectives:-** The objective of this course is that the students can learn about basics of Environmental microbiology.

**Prerequisites:-** Basic knowledge of Biological Sciences.

**Course outline:**

	Course contents	Hours
<b>UNIT I</b>	Introduction to Microbial Ecology: Evolution of Life on Earth; History and scope of ecology, Concept of autecology, synecology, population, community, biome. Ecological succession. Microorganism in aquatic Environment: major physical and chemical factors (light, temperature, gases, nutrients). Aquatic biota: phytoplankton, zooplankton, benthos, periphyton, macrophytes. Biofilms, Production in lakes, rivers, estuaries and wetlands. Nutrient dynamics in lakes, rivers, estuaries and wetlands. Eutrophication and water pollution: monitoring and control conservation and management of lakes, rivers and wetlands.	<b>15</b>
<b>UNIT II</b>	Microflora of air, assessment of air quality, droplet nuclei, aerosol, Classification of soils- physical and chemical characteristics, microflora of various soil types , bacteria and nematodes in relevance to soil types; rhizosphere, Rehabilitation of specialized habitats: water bodies, mangroves, coral reefs; Brief account of microbial interactions, biogeochemical cycles and the organisms,	<b>15</b>

**M. Sc. (Microbiology) Sem III**



## **C. U. SHAH UNIVERSITY** **Wadhwan City**

	Biofertilizers, vesicular arbuscular mycorrhizae (VAM).	
<b>UNIT III</b>	Waste treatment: Wastes; types - solid and liquid wastes characterization, waste treatments: physical, chemical and biological. solid waste treatment, saccharification, gasification, composting. Utilization of solid wastes; food (SCP, mushroom, yeast), fuel (ethanol, methane), fertilizer (composting), liquid waste treatment: trickling, activated sludge, oxidation pond and oxidation ditch.	<b>15</b>
<b>UNIT IV</b>	Microbial diversity, use of micro-organisms like in waste treatment; production of enzymes like cellulase, proteases, amylases; alcohol and acetic acid production, Petroleum pollutant biodegradation. Biodegradation lignin, pesticides.	<b>15</b>
	<b>Total</b>	<b>60</b>

**Learning Outcomes :-** The students can acquire knowledge about –

- Environmental sciences and its role in nature.
- Role of M.Os in environment.

**Books Recommended:**

1. Johri B. N. 2000. Extremophiles. Springer Verlag. New York
2. Maier R. M. Pepper I. L. & Gerba C. P. 2000. Environmental Microbiology. Academic Press. USA.
3. Baker K. H. & Herson D. S. 1994. Bioremediation, MacGraw Hill Inc. N.Y.
4. Ralph M. A. 1997. Environmental Microbiology. John Wiley and Sons. Inc.
5. Forster C. F. & John D. A. 2000. Environmental Biotechnology, Ellis Horwood Ltd. Publication.
6. Christon J. H. 2001. A Manual of Environmental Microbiology, ASM Publications.
7. Sharma P. D. 2005. Ecology and Environment, Rastogi Publication.
8. Kuhad R. C. and Singh A. 2007. Lignocellulose Biotechnology: Future Prospects. I. K. International Publishing House Pvt. Ltd.



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF SCIENCES**  
**DEPARTMENT OF LIFE SCIENCES**

**COURSE: M.Sc.**

**SEMESTER: III**

**SUBJECT NAME: Immunology**

**SUBJECT CODE: 5SC03IMM1**

**Teaching & Evaluation Scheme :-**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	0	4	4	30	1	70	3	-	-	-	100	

**Objectives:-** The objective of this course is that the students can learn about basics of Immunology.

**Prerequisites:-** Basic knowledge of Biological Sciences.

**Course outline:**

	Course contents	Hours
<b>UNIT I</b>	Historical background, Innate and adaptive immunity; Cells and organs involved in immune system; Antigens and Antibodies- Properties and types; Haptens and Adjuvants. Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype). Genesis of antibody variability. Generation of immune response: B-cell maturation in bone marrow, humoral immune response; T cell maturation in thymus, thymic selection, Generation of cell-mediated immune response; Concept of tolerance, immunopotential and immunosuppression.	<b>15</b>
<b>UNIT II</b>	Immunological principles of various reactions and techniques: Affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA, western blotting, immunofluorescence, flow cytometry and fluorescence, and immunoelectron microscopy; Hybridoma technology, monoclonal antibodies and abzymes; Antibody engineering.	<b>15</b>
<b>UNIT</b>	Organization of Major histocompatibility complex (mice and	<b>15</b>

**M. Sc. (Microbiology) Sem III**



## C. U. SHAH UNIVERSITY Wadhwan City

<b>III</b>	humans). Structure and cellular distribution of HLA antigens, antigen processing and presentation, cytosolic and endocytic pathways. Complement system: Components of the complement activation , classical, alternative and lectin pathways; Complement activation	
<b>UNIT IV</b>	Types and mechanism of hypersensitive reactions; Autoimmunity - theories, mechanism and diseases with their diagnosis; tumor immunology - tumor specific antigens, Immune response to tumors, immunodiagnosis of tumors - detection of tumor markers – I foetal proteins, carcinoembryonic antigen etc Immunodeficiency disorders: Animal models of primary immunodeficiency (nude mouse and SCID mouse). Specific impaired functions in lymphoid lineage (SCID, DiGeorge syndrome), myeloid lineage.	<b>15</b>
<b>Total</b>		<b>60</b>

**Learning Outcomes :-** The students can acquire knowledge about –

- Immune system and its working.
- Immunity and various diseases.

### **Books Recommended:**

1. Clark, W.R., "The Experimental Foundations of Modern Immunology (1991): John Wiley and Sons. Inc.
2. Roitt, I.M: Essential Immunology (1995): Blackwell Scientific Publications, Oxford.
3. Roth, J.A. (1985): Virulence Mechanism of Bacterial Pathogens. American Society for Microbiology, Washington D.C.
4. Stiehm F. (1980), "Immunological Disorders in Infants and Children" (1980): W.B. Saunders & Co., Philadelphia.
5. Stites, D.P. Stobo, J.D. feudenberg, H.H., Wells J.V.:Basic and Clinical Immunology, (1984): Lange Medical Publications., Los Altos., Clifomia.
6. Todd, I.R. (1990): Lecture Notes in Immunology, Blackwell Scientific Publications Ltd.,Oxford.



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF SCIENCES**  
**DEPARTMENT OF LIFE SCIENCES**

**COURSE: M.Sc. SEMESTER: III**

**SUBJECT NAME: Biochemical and Biophysical Techniques (Elective-I)**

**SUBJECT CODE: 5SC03BBT1**

**Teaching & Evaluation Scheme :-**

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical		Total Marks	
					Sessional Exam		University Exam		Internal			University
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1	70	3	-	-	-	100

**Objectives:-** The objective of this course is that the students can learn about basics of various techniques.

**Prerequisites:-** Basic knowledge of Biological Sciences.

**Course outline:**

	Course contents	Hours
<b>UNIT I</b>	Microscopic techniques: light microscopy, Confocal Microscope, resolving powers of different microscopes, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM. Differential centrifugation and purification by density gradient centrifugation.	<b>15</b>
<b>UNIT II</b>	Isolation and purification of microbial protein, Electrophoretic separation of protein. Determination of molecular weight of protein using PAGE/ gel filtration method, Polyacrylamide gel electrophoresis (PAGE), native and SDS, PAGE, 2DPAGE, capillary electrophoresis, IEF.	<b>15</b>
<b>UNIT III</b>	Chromatographic methods of separation, Principles and applications of Paper, Thin layer chromatography, Gas, Liquid chromatography, HPLC; Spectrophotometry: Principles and applications UV, Visible, Mass Spectrometry, MALDI-TOF, Atomic Absorption Spectrometer, X- Ray spectroscopy.	<b>15</b>



## **C. U. SHAH UNIVERSITY** **Wadhwan City**

<b>UNIT IV</b>	Antisense and RNAi technology, Protein and DNA sequencing techniques, Maxam– Gilbert sequencing, Chain termination methods, Massively Parallel Signature Sequencing (MPSS), Pyrosequencing, Illumina (Solexa) sequencing, Solid sequencing, Genomic and cDNA library preparation, RFLP, RAPD and AFLP techniques. Concept of radioactivity and counting methods with principles of different types of counters.	<b>15</b>
	<b>Total</b>	<b>60</b>

**Learning Outcomes :-** The students can acquire knowledge about –

- Various techniques and its working.
- Principle and application of various techniques.

**Books Recommended:**

1. Clark JM. 1977. Experimental Biochemistry. 2nd Ed. WH Freeman. Sawhney SK & Singh R. 2000. Introductory Practical Biochemistry. 2nd Ed. Narosa.
2. Willard M, Merritt LL & Dean JA. 1981. Instrumental Methods of Analysis. 4th Ed. Van Nostrand.
3. William BL & Wilson K. 1975. Principles and Techniques of Practical Biochemistry. Edward Arnold.
4. Wilson K, Walker J & Walker JM. 2005. Principles and Techniques of Practical Biochemistry. Cambridge Univ. Press.
5. Kolowick NP & Kaplan NP. Methods in Enzymology. Academic Press (Series).
6. Plummer DT. 1998. An Introduction to Practical Biochemistry. 3rd Ed. Tata McGraw Hill.
7. Rickwood D. (Ed.). 1984. Practical Approaches in Biochemistry. 2nd Ed. IRL Press, Washington DC.
8. Wilson K & Goulding KH. 1992. A Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd Ed. Cambridge Univ. Press. Wilson K & Walker J. 2000. Principles and Techniques of Practical Biochemistry. 5th Ed. Cambridge Univ. Press.





**FACULTY OF SCIENCES  
DEPARTMENT OF LIFE SCIENCES**

**COURSE: M.Sc. SEMESTER: III**

**SUBJECT NAME: Microbiology Lab-III**

**SUBJECT CODE: 5SC03MBL1**

**Teaching & Evaluation Scheme :-**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
0	0	20	20	10	-	-	-	-	90	-	210	300	

**Objectives:-** The objective of this course is that the students can learn about basics of various Experiments.

**Prerequisites:-** Basic knowledge of Biological Sciences.

**Course outline:**

Experiment
<p>Preparation of stock solutions and buffers; Standard curves of BSA; Estimation of protein, To study agarose gel electrophoresis of genomic DNA, To study genomic DNA isolation from bacteria, DNA isolation from humus rich soil samples, To study restriction profile of isolated DNA and plasmid samples, Isolation of plasmids from E. coli cells, Inactivation of microorganisms by UV mutagenesis, demonstration of transformation of bacterial cell using plasmid DNA Transfer of plasmid by conjugation. Determination of absorption maxima of some important chemicals from their absorption spectra, estimation of biomolecule using spectrophotometer, Separation of carbohydrates and amino acids by paper chromatography, Separation of lipids by thin layer and column chromatography, Separation of proteins by ion exchange and gel filtration chromatography.</p> <p>Demonstration of SDS-PAGE of proteins; Polymerase chain reaction; RAPD analysis; DNA restriction analysis. Determine total leucocyte count (TLC) of a given blood sample,</p> <p>To perform differential leucocyte count (DLC) of the blood sample, Separation of serum from the blood sample, Identification of human blood groups – ABO and Rh factor, Demonstration of Western blotting.</p>

**Learning Outcomes:-** The students are expected to

- Learn various microbial techniques.
- Able to isolate and screen various types of microbes from different sources.
- Learn different types of instrumental handling



# C. U. SHAH UNIVERSITY

## **FACULTY OF SCIENCES** **DEPARTMENT OF LIFE SCIENCES**

**COURSE: M.Sc.**

**SEMESTER: III**

**SUBJECT NAME: Microbiology Industrial Assignment**

**SUBJECT CODE: 5SC03MIA1**

### **Teaching & Evaluation Scheme :-**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
0	0	0	2	2	-	-	-	-	50	-	-	50	

Lab Visit/Industrial Visit/Assignment/Case study: Based on the Lab Visit/Industrial Visit/Assignment/Case study learner is required to submit one report that will be evaluated by the examiner(s).