





FACULTY OF SCIENCES DEPARTMENT OF LIFE SCIENCES

COURSE: M.Sc. SEMESTER: III

SUBJECT NAME: Microbial Genetics & Molecular Microbiology

SUBJECT CODE: 5SC03MIG1

Teaching & Evaluation Scheme:-

Tea	ching	hour	s/week	Credit			Evalu	chem				
						The	eory			Practical		
Th	Tu	Pr	Total		Session Exar		Univer Exai	•	Into	ernal	University	Total Marks
					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
UNIT I	Mendel's work on transmission of traits; Genetic Variation; Molecular	15
	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	
UNIT	Mutations- Induced versus Spontaneous mutations, Suppressor	15
II	mutations, Molecular basis of Mutations, mutant enrichment;	
	Complementation tests; recombination tests and gene replacements;	
	Cloning genes by complementation and marker rescue; DNA repair	
	mechanisms	
UNIT	Molecular mechanism of gene transfer by conjugation. Regulation of gene	15
III	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	
	B. subtilis. Artificially induced competence. Generalized versus	
	specialized transduction, T4 and lambda phage. Mapping bacterial genes	
	by transduction; Positive and negative gene regulation and attenuation,	

M. Sc. (Microbiology) Sem III





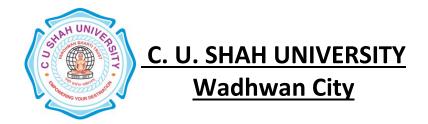
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	using the <i>lac</i> , <i>gal</i> , <i>trp</i> , <i>ara</i> and tol operons, with emphasis on recent advances.	
UNIT	Lytic cycle of T4 and T7 bacteriphages, Regulation of expression of genes	15
IV	in phage T4 and T7. Replication and packaging of filamentous phages M13 and f1. Benzer's experiments with the rII 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.	
	Total	60

Learning Outcomes :- The students can acquire knowledge about –

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

- 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.



FACULTY OF SCIENCES <u>DEPARTMENT OF LIFE SCIENCES</u>

COURSE: M.Sc. SEMESTER: III

SUBJECT NAME: Environmental Microbiology

SUBJECT CODE: 5SC03EMB1

Teaching & Evaluation Scheme:-

Tea	ching	hour	s/week	Credit	Evaluation Sc			chem				
						The	eory			Pra	ctical	
Th	Tu	Pr	Total		Sessio Exai		Univer Exai	•	Inte	ernal	University	Total Marks
					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
UNIT I	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.	15
UNIT	1 2/ 1 /	15
II	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,	



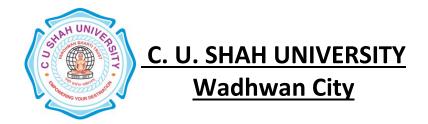
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	Biofertilizers, vesicular arbuscular mycorrhizae (VAM).	
UNIT	Waste treatment: Wastes; types - solid and liquid wastes	15
III	characterization, waste treatments: physical, chemical and	
	biological. solid waste treatment, saccharification, gasification,	
	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.	
UNIT	Microbial diversity, use of micro-organisms like in waste treatment;	15
IV	production of enzymes like cellulase, proteases, amylases; alcohol	
	and acetic acid production, Petroleum pollutant biodegradation.	
	Biodegradation lignin, pesticides.	
	Total	60

Learning Outcomes :- The students can acquire knowledge about –

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

- 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.



FACULTY OF SCIENCES <u>DEPARTMENT OF LIFE SCIENCES</u>

COURSE: M.Sc. SEMESTER: III

SUBJECT NAME: Immunology **SUBJECT CODE:** 5SC03IMM1

Teaching & Evaluation Scheme:-

Tea	ching	hour	s/week	Credit	Evaluation Second			cheme/semester				
						The	eory			Pra	ctical	
Th	Tu	Pr	Total		Sessio Exai		Univer Exai	•	Into	ernal	University	Total Marks
					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
UNIT I	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, immunopotentiation and immunosuppression.	15
UNIT II	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.	15
UNIT	Organization of Major histocompatibility complex (mice and	15



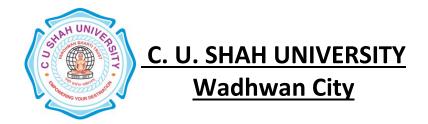
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III	humans). Structure and cellular distribution of HLA antigens, antigen processing and presentation, cytosolic and endocytic pathways. Complement system: Components of the complement activation, classical, alternative and lectin pathways; Complement activation	
UNIT IV	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.	15
Total		60

Learning Outcomes: - The students can acquire knowledge about -

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

- 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.



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:-

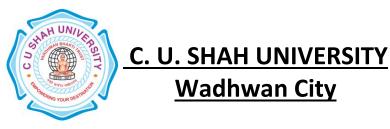
Tea	ching	hour	s/week	Credit	Evaluation Second			Scheme/semester				
						The	eory			Practical		
Th	Tu	Pr	Total		Sessio Exai		Univer Exai		Into	ernal	University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1	70	3	-	-	-	100

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
UNIT I	Microscopic techniques: light microscopy, Confocal Microscope, resolving powers of different microscopes, scanning and transmission microscopes, different fixation and staining techniques for EM, freezeetch and freeze-fracture methods for EM. Differential centrifugation and purification by density gradient centrifugation.	15
UNIT II	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.	15
UNIT	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.	15



UNIT IV	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.	15
	Total	60

Learning Outcomes :- The students can acquire knowledge about –

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

- 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:-

	8												
Teaching hours/week					Credit	Evaluation Scheme/semester							
							The	eory	Practical				
	Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
						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

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.

Demonstration of SDS-PAGE of proteins; Polymerase chain reaction; RAPD analysis; DNA restriction analysis. Determine total leucocyte count (TLC) of a given blood sample,

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.

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

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COURSE: M.Sc. SEMESTER: III

SUBJECT NAME: Microbiology Industrial Assignment

SUBJECT CODE: 5SC03MIA1

Teaching & Evaluation Scheme:-

Teaching hours/week					Credit	Evaluation Scheme/semester							
						Theory				Practical			
	Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
						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).