



SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

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Ready for
Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B.Sc Microbiology

B.Sc Microbiology

Sem	Part	Subject Code	Subject Title	Hrs	Credit (s)	E - Hrs	CA	SE	Total
I	I	LT114	Tamil – I	5	3	3	50	50	100
	II	LE115AT	English – I	5	2	3	50	50	100
	III	ABC102	Allied Biochemistry – I	4	3	3	50	50	100
	III	PABC102	Allied Practical – I	2	1	3	40	60	100
	III	MB103	Fundamentals of Microbiology	4	4	3	50	50	100
	III	MB104	Microbial Diversity and Classification	3	3	3	50	50	100
	III	PMB102	Main Practical – I	3	3	3	50	50	100
	IV	SK104	Communication Skills	2	1	-	-	-	-
	IV	VE105A/ VE105B	Christian Religion – I/Value Education - I	2	1	3	50	50	100
	IV	CE103	Communicative English – I	-	1	-	-	-	-
Total				30	22	-	-	-	-

II	I	LT214	Tamil – II	5	3	3	50	50	100
	II	LE215AT	English – II	5	2	3	50	50	100
	III	ABC202	Allied Biochemistry – II	4	3	3	50	50	100
	III	PABC202	Allied Practical – II	2	1	3	50	50	100
	III	MB203	Microbial Physiology and Metabolism	4	4	3	50	50	100
	III	MB204	Bioinstrumentation	3	3	3	50	50	100
	III	PMB202	Main Practical – II	3	3	3	50	50	100
	IV	SK204	Leadership Skills	2	1	-	-	-	-
	IV	VE205A/ VE205B	Christian Religion – II/Value Education - II	2	1	3	50	50	100
	IV	CE203	Communicative English – II	-	1		-	-	-
Total				30	22	-		-	-
III	I	LT312	Tamil – III	5	3	3	50	50	100
	II	LE309T	English – III	5	2	3	50	50	100
	III	AM310C	Allied Biostatistics – I	6	5	3	50	50	100
	III	MB303	Immunology	4	4	3	50	50	100
	III	MB304	Mushroom Technology	3	3	3	50	50	100
	III	PMB302	Main Practical – III	3	3	3	50	50	100
	IV	SK304	Technical Skills	2	1		-	-	-
	IV	VE306	Human Rights	2	1	3	50	50	100
	IV	LE309P	English Lab - III	-	1	-	50	50	100
Total				30	23	-	-	-	-

IV	I	LT411	Tamil – IV	5	3	3	50	50	100
	II	LE409T	English – IV	5	2	3	50	50	100
	III	AM409C	Allied Biostatistics – II	6	5	3	50	50	100
	III	MB404	Bioinoculant Technology	4	4	3	50	50	100
	III	MB405	Microbial Genetics	3	3	3	50	50	100
	III	PMB402	Main Practical – IV	3	3	3	50	50	100
	IV	SK404	Employment Skills	2	1	-	-	-	-
	IV	VE406	Environmental Science	2	1	3	50	50	100
	IV	LE409P	English Lab IV	-	1	-	50	50	100
	V		Outreach Programme	-	2	-	-	-	-
	V		SHELTERS	-	2	-	-	-	-
	III		Internship	-	2*	-	-	-	-
Total				30	27 + 2*	-	-	-	-

V	III	MB508	Molecular Biology and Genetic Engineering	4	4	3	50	50	100
	III	MB509	Medical Bacteriology	5	5	3	50	50	100
	III	MB510	Medical Virology	5	4	3	50	50	100
	III	MB511	Medical Mycology and Parasitology	5	4	3	50	50	100
	III	PMB502	Main Practical – V	5	4	6	50	50	100
	III	MB512A MB512B MB512C	Major Elective – I a) Public Health Microbiology b) Bioinformatics and Chemoinformatics c) Pharmaceutical Microbiology (One out of three)	4	3	3	50	50	100
	III	NMB502	Non – Major Elective – I	2	1	3	50	50	100
	III	-	SSP – 1: Entrepreneurship Microbiology	-	1*	-	-	-	-
	Total				30	25 + 1*	-	-	-

VI	III	MB608	Microbial Biotechnology	4	4	3	50	50	100
	III	MB609	Environmental Microbiology	5	5	3	50	50	100
	III	MB610	Vermitechnology	4	3	3	50	50	100
	III	MB611	Food Microbiology	5	5	3	50	50	100
	III	MB612	Industrial Microbiology	5	5	3	50	50	100
	III	PMB602	Main Practical – VI	5	4	6	50	50	100
	III	NMB602	Non – Major Elective – II	2	1	3	50	50	100
	III	-	SSP – 2: Probiotic Microbiology	-	1*	-	-	-	-
	III	-	Group Project	-	1*	-	-	-	-
	III	-	NPTEL/MOOCs/Other Certificate courses	-	1*	-	-	-	-
Total				30	27 + 3*	-	-	-	-

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B.Sc Microbiology

S.No.	Course Code	Course Name
1.	MB303	Immunology
2.	MB304	Mushroom Technology
3.	PMB302	Main Practical – III
4.	MB404	Bioinoculant Technology
5.	MB405	Microbial Genetics
6.	PMB402	Main Practical – IV

Syllabus

Semester – III

4 Hours

4 Credits

IMMUNOLOGY

Objectives

- To make the students to understand the Immune system.
- To provide insights to the Human Defense Mechanisms and Vaccines.
- To strengthen the knowledge of students through a detailed study on Antigens, Antibodies and Antigen – Antibody interactions
- To gain knowledge on ABO Blood grouping, Blood transfusion and Rh incompatibilities.
- To learn about various Hypersensitivity reactions and Autoimmune disorders.

Course Outcomes

Introducing the Immunology to study various types of Cells and Organs in Immune systems and Mechanism of immune activation.

Course Outcome (CO)	Description	Cognitive level (K level)
CO-1	Describe the principles of immunity and types of vaccines.	K1
CO-2	Discuss cells and organs of immune system and its role in types of Immunity.	K2
CO-3	Analyse the concepts of Antigens, Haptens, Adjuvants and factors influencing Antigenicity.	K4
CO-4	Apply knowledge on Structure and Types of Immunoglobulins.	K3
CO-5	Evaluate the reactions between various antigens and antibodies and apply the knowledge in diagnosing diseases and disorders.	K3, K5
CO-6	Develop theoretical knowledge of Hypersensitivity reactions and Autoimmune disorders.	K6

Mapping of CO with PO and PSO

C O	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Score s of COs
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	PS O 6	PS O 7	PS O 8	PSO 9	
1	3	2	2	3	2	2	2	2	3	3	3	3	2	3	3	2	2.5
2	3	2	2	3	3	2	3	2	3	2	3	3	2	2	3	2	2.5
3	2	2	2	3	2	2	3	3	1	2	3	2	3	2	2	3	2.3
4	2	2	3	3	2	2	3	2	3	2	3	3	2	2	3	2	2.4
5	2	2	3	2	3	3	2	2	2	1	2	2	2	2	2	2	2.1
6	3	3	2	2	3	3	2	3	2	2	3	3	3	2	2	3	2.5
Mean Overall Score																2.4	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

History of Immunology – Contributions of Louis Pasteur, Edward Jenner, Elie Metchnikoff and Karl Landsteiner; Normal microbial flora of human body; Microbial Infection – Types, Source, Transmission and Factors predisposing to Microbial Pathogenicity; Immunity – Innate and Acquired immunity; Vaccines and Vaccination; Toxoids and Antitoxins.

Unit – II

Lymphoid System – Primary and Secondary lymphoid organs; Hematopoiesis; Cells of the immune system: Lymphoid cells – B - Lymphocytes, T - Lymphocytes and NK cells; Mononuclear Phagocytes – Monocytes and Macrophages; Granulocytic cells – Neutrophils, Eosinophils, Basophils and Mast cells; Antigen presenting cells - Dendritic cells; Platelets; Erythrocytes; Cytokines - Properties and functions of Interleukins and Interferons; Cytokine storm.

Unit – III

Antigens – Types of Antigens, Antigenicity, Determinants of Antigenicity, Epitopes, Haptens and Adjuvants; Immunoglobulins – Structure and types (IgG, IgA, IgM, IgD & IgE); Monoclonal antibodies and its production; Complement system – Properties, Components and Functions.

Unit – IV

Laboratory Techniques in Immunology – Precipitation test (Mancini Radial Immunodiffusion, Ouchterlony Double Immunodiffusion, Immuno-electrophoresis and Rocket electrophoresis), Agglutination test (Hemagglutination, Bacterial Agglutination, Passive Agglutination & Agglutination Inhibition), Complement fixation test, Immunofluorescence test, Flow Cytometry, RIA, ELISA and Western Blot; Immunohematology - Blood groups, Blood transfusion and Rh incompatibilities.

Unit – V

Immunodeficiency diseases; Autoimmune diseases; Hypersensitivity reactions – IgE Mediated Hypersensitivity (Type – I), Antibody Mediated Cytotoxic Hypersensitivity (Type – II), Immune Complex Mediated Hypersensitivity (Type – III) and Delayed Type Hypersensitivity (Type – IV); Major Histocompatibility Complex (MHC) – Structure and functions of Class – I and II MHC molecules; Current Research Thoughts in Immunology.

Text Books

- 1) Judith A. Owen, Jenni Punt, Sharon A. Stanford and Patricia P. Jones. 2009. Kuby's Immunology, 4th Edition, W. H. Freeman and Company, New York.
- 2) Jeffrey K. Actor. 2012. Elsevier's Integrated Review – Immunology and Microbiology, 2nd Edition, Sabre Foundation, China.

References

- 1) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 2) Chakraborty, P. 2013. A Text book of Microbiology, Published by New Central Book Agency (P) Ltd., Kolkata, India.
- 3) Reba Kanungo. 2017. Ananthanarayan and Paniker's Text book of Microbiology, 7th Edition, Orient Longman Limited, Chennai, India.
- 4) Roitt, I. M. 2011. Roitt's Essential Immunology, 12th Edition, Wiley - Blackwell Scientific publishers, London, United Kingdom.

Semester – III
3 Hours

3 Credits

MUSHROOM TECHNOLOGY

Objectives

- To encode the nutritional and medicinal importance of the Mushrooms.
- To differentiate edible and poisonous mushrooms and their effects.
- To gain a good understanding on Substrates and Spawn production for Mushroom cultivation.
- To obtain knowledge on Post-harvest Technology of Mushrooms.
- To understand various Mushroom diseases and its control measures.

Course Outcomes

The paper Mushroom Technology provides the information about the Cultivation, Disease control, Nutritional value and Medicinal value of Mushrooms.

Course Outcome (CO)	Description	Cognitive level (K level)
CO-1	Provides the information about the Cultivation, Nutritional value and Pharmacological value of Mushrooms.	K1
CO-2	Gaining knowledge about different types of Edible and Poisonous mushrooms.	K3
CO-3	Analyze the pathological damages caused by microorganisms on mushrooms.	K4
CO-4	Demonstrate the methods for Disease control in Mushrooms.	K2
CO-5	Assess the Post-harvest Technology of Mushrooms.	K5
CO-6	Develops Entrepreneurial skill on Production and Marketing of Mushroom.	K6

Mapping of CO with PO and PSO

C O	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Score s of COs
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	PS O 6	PS O 7	PS O 8	PSO 9	
1	3	3	2	2	3	3	3	3	3	3	2	3	3	3	2	3	2.7
2	2	2	3	3	2	3	1	2	3	2	3	3	2	2	3	2	2.3
3	3	1	2	3	1	3	3	3	2	3	2	2	3	3	2	3	2.4
4	2	2	3	2	3	2	2	2	3	3	3	3	3	3	3	2	2.5
5	2	3	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2.1
6	3	2	2	3	3	2	3	3	2	3	3	3	3	3	2	3	2.6
Mean Overall Score																2.5	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit - I

Mushroom – Historical development, Origin, Characteristics, Importance, Morphology and Life cycle; Classification of Mushroom; Nutritional value of Mushroom; Medicinal value of Mushroom; Edible mushrooms and Non - edible mushroom; Medicinal and Environmental uses of Mushrooms.

Unit - II

Mushroom farms – Farm layout and Farm hygiene; Substrates used for Mushroom cultivation; Spawn production for Mushroom cultivation – Starter culture, Sterilization process, Clean Environmental Condition, Cultures, Preparation of Media & Slants, Spawn containers, Mother Spawn, Preparation of Final Spawn, Precautions and Storage of Spawn.

Unit - III

Growth factors for Mushroom cultivation; Cultivation of Button mushroom (*Agaricus bisporus*), Oyster mushroom (*Pleurotus sajor – caju*), Milky mushroom (*Calocybe indica*), Reizhi mushroom (*Ganoderma lucidum*) and Paddy straw mushroom (*Volvariella volvacea*); Insect pests and its management during Mushroom cultivation.

Unit - IV

Diseases of Mushrooms – Bacterial disease (Bacterial blotch, Mummy disease & Drippy gill), Viral disease (Die back disease); Fungal diseases (Dry bubble disease, Wet bubble disease, Cobweb disease, *Trichoderma* Blotch and Mildew caused by *Cladobotrym* sp. and *Aphanocladium* disease); Fungal competitors during Mushroom cultivation - Green mould, Olive Green mould, Brown plaster mould, White plaster mould, Inkcaps, Yellow mould, *Sepedonium* Yellow mould, Lipstick mould, *Oedocephalum* mold, False truffle and Cinnamon mould.

Unit - V

Post-harvest Technology of Mushroom – Harvesting, Grading, Packaging & Storage, Transportation, Preservation and Marketing (Fresh market and Drying); Environmental impact of Mushroom cultivation; Mushroom food recipes; Challenges in Mushroom cultivation; Mushroom Research Centers in India; Current Research Thoughts in Mushroom Technology.

Text Books

- 1) Kannaiyan. 2001. Handbook of Edible Mushrooms, TNAU Publication, Coimbatore, India.
- 2) Alice, D., K. Muthusamy and M. Yesuraja. 1999. Mushroom Culture, Agricultural College, Research Institute Publications, Madurai, Tamil Nadu, India.

References

- 1) Marimuthu, T. 1991. Oster Mushroom, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
- 2) Nita Bhal. 2000. Handbook on Mushrooms, 2nd Edition, Volume - I and II, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- 3) Tripathi, D. P. 2005. Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, India.

Semester – III

3 Hours

3 Credits

MAIN PRACTICAL – III

- 1) Blood Grouping and Rh Typing.
- 2) Blood collection and Plasma/Serum separation.
- 3) Staining and Microscopic examination of Blood cells.
- 4) Agglutination reaction – WIDAL Test, RPR Card Test, TPHA Test, ASO Test, RA Test, CRP Test and Pregnancy Test.
- 5) Precipitation reaction – Mancini Radial Immunodiffusion, Ouchterlony Double Immunodiffusion, Immunoelectrophoresis and Rocket electrophoresis.
- 6) ELISA Test (Demonstration) only.

Semester – IV

4 Hours

4 Credits

BIOINOCULANT TECHNOLOGY

Objectives

- To study about the Formulation, Application and Quality control of Bioinoculants.
- To understand the role of Nitrogen fixers and Phosphate solubilizers in Agriculture.
- AM fungi and Algal biofertilizers.
- To learn the ability of Biocontrol agents to control the Plant pathogens.
- To gain the knowledge of Entomopathogens for the control of Insect pests.

Course Outcomes

The course Bioinoculant Technology has been designed to provide the knowledge to the students about Natural organic farming. This paper also provides the details of Production, Formulation, Method of application and Quality control of Bioinoculants.

Course Outcome (CO)	Description	Cognitive level (K level)
CO-1	Acquire knowledge on Microbial inoculants.	K3
CO-2	Gives the knowledge to the students about Production and Formulation of Bioinoculants.	K1, K3
CO-3	Explains the details on Method of application and Quality control of Bioinoculants.	K2
CO-4	Analyzing the Symbiotic relationship between Plant and Mycorrhizal fungi.	K4
CO-5	Developing different methods for the Pest control using microbes.	K6
CO-6	Recommending the factors for good Soil quality and Agricultural output through sustainable Microbiological applications.	K5

Mapping of CO with PO and PSO

C O	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Score s of COs
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	PS O 6	PS O 7	PS O 8	PSO 9	
1	3	2	2	3	2	2	2	2	3	3	3	3	2	3	3	2	2.5
2	3	2	2	3	3	2	3	2	3	2	3	3	2	2	3	2	2.5
3	2	2	2	3	2	2	3	3	1	2	3	2	3	2	2	3	2.3
4	2	2	3	3	2	2	3	2	3	2	3	3	2	2	3	2	2.4
5	2	2	3	2	3	3	2	2	2	1	2	2	2	2	2	2	2.1
6	3	3	2	2	3	3	2	3	2	2	3	3	3	2	2	3	2.5
Mean Overall Score																2.4	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Bioinoculants – Definition, Types and Importance; Advantages of Biofertilizers over Chemical fertilizers; Formulations of Bioinoculants; Methods and application of Bioinoculants in different crops; Quality control of different Bioinoculants; Plant – Microbe Interaction.

Unit – II

PGPR and its role in agriculture – Direct mechanism and Indirect mechanism; Nitrogen fixation by bacteria; Isolation, Characterization (Microscopic, Cultural and Biochemical), Mass multiplication and Field application of Nitrogen fixing bacteria (*Rhizobium* sp., *Frankia* sp., *Azotobacter* sp., *Azospirillum* sp. and *Gluconacetobacter* sp.).

Unit – III

Phosphate solubilization – Phosphate solubilizing microorganisms, Mechanism of Phosphate solubilization and Screening of Phosphate solubilizing efficiency; Algal Biofertilizers – Isolation and Mass multiplication of Blue Green Algae, Mass multiplication of *Azolla*, *Azolla* – *Anabaena* symbiosis, Heterocyst and its importance in N₂ fixation.

Unit – IV

Mycorrhizal Bioinoculants – Significance, Types and Benefits; Arbuscular Mycorrhiza (AM) fungi – Taxonomy of AM fungi, Isolation of AM fungi, Assessment of AM colonization in roots, Culturing of AM fungi, Mass inoculum production, Field applications; Role of AM fungi in agriculture.

Unit – V

Host-parasite relationship in plants; Plant disease control agents (*Bacillus subtilis*, *Pseudomonas fluorescens* & *Trichoderma* sp.); Biopesticides – Entomopathogenic bacteria (*Bacillus thuringiensis*); Entomopathogenic fungi (*Beauveria bassiana*, *Isaria fumosorosea*, *Lecanicillium* sp. & *Metarhizium anisopliae*); Entomopathogenic virus (Cydia pomonella granulosis virus - CpGv); Current Research Thoughts in Bioinoculant Technology.

Text Books

- 1) Vijaya Ramesh, K. 2008. Environmental Microbiology, MJP Publishers, Chennai, India.
- 2) Subba Rao N.S. 1999. Soil Microbiology, 4th Edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
- 3) Saranraj, P and P. Sivasakthivelan. 2020. Textbook of Microbial Inoculants Technology. JPS Scientific Publications, India.

References

- 1) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 2) Atlas, R.M and R. Bartha. 1998. Microbial Ecology. Fundamentals and Applications, 4th Edition, Red Wood City. C.A. Benjamin.
- 3) Bagyaraj, D. J and G. Rangasamy. 2002. Agricultural Microbiology, 2nd Edition, Prentice Hall, India.
- 4) Mahendra K. Rai. 2005. Hand book of Microbial Biofertilizers, The Haworth Press, Inc. New York.

Semester – IV

3 Hours

3 Credits

MICROBIAL GENETICS

Objectives

- To make the students to understand the Genetics of microorganisms.
- To focus on the basic principles of Cloning vectors.
- To gain knowledge on Gene transfer mechanism.
- To explain the Mutation and its types.
- To study the recent advances in Microbial genetic principles for strong foundation.

Course Outcomes

The application of Microbial Genetics has completely transformed the Microbiology field with new possibilities ranging from the treatment of human diseases to the development of new forms of crops. It also looks set to be the most promising and exciting science of the next few decades.

Course Outcome (CO)	Description	Cognitive level (K level)
CO-1	Analyze and understand the basic principles of DNA and RNA.	K2, K4
CO-2	Evaluate the role of Chromosomes and its functions.	K5
CO-3	Apply the principles of Vectors in Gene Cloning.	K3
CO-4	Development of concepts on Transposable elements and Bacteriophages.	K6
CO-5	Better understanding of Gene transfer mechanism and its types.	K2
CO-6	Describe the Mutation types, Mutant detection, Mutant selection and Carcinogenicity testing	K1

Mapping of CO with PO and PSO

C O	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Score s of COs
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	PS O 6	PS O 7	PS O 8	PSO 9	
1	3	2	2	3	3	2	3	2	3	3	2	3	3	3	2	2	2.5
2	3	2	3	3	2	3	2	2	2	2	3	3	2	2	3	2	2.4
3	1	2	2	3	2	2	3	3	1	3	2	2	2	2	3	3	2.2
4	3	3	2	2	2	2	1	2	3	2	3	3	2	3	3	2	2.3
5	2	2	3	1	3	2	2	2	2	1	2	2	3	2	2	2	2.0
6	3	3	1	2	3	2	3	3	2	3	2	3	2	3	2	3	2.5
Mean Overall Score																2.3	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Genetics – History and Scope; Genotype and Phenotype; DNA – Structure and forms; DNA & RNA as a genetic material; Organization of Gene; Chromosomes – Structure, Types and Functions; Chromosome theory of inheritance; Chromosomal aberrations.

Unit – II

Transposons - IS elements, Composite transposons, Simple transposition, Replicative transposition, Conjugative transposons; Mechanism of Transposition; Bacteriophages – Structure, Lytic and Lysogenic cycle; Application of Bacteriophages in Genetics.

Unit – III

Plasmids – Structure, Characteristics, Types, Replication, Plasmid copy number, Partitioning and Segregative stability of Plasmids, Incompatibility of Plasmids, Isolation of Plasmids, Purification of Plasmid DNA and Desirable properties of Plasmid vector; Application of Plasmids in Genetics.

Unit – IV

Genetic recombination in Bacteria – Conjugation, Transformation and Transduction; Conjugation in Archaea; Mapping the Genome – *Escherichia coli* and Bacteriophages.

Unit – V

Genetic code; Mutation - Mutagens and Mutagenesis; Spontaneous Mutation; Induced Mutation and Point Mutation – Silent Mutation, Missense Mutation, Non-sense Mutation and Frameshift Mutation; Mutant detection, Mutant selection and Carcinogenicity testing; Current Research Thoughts in Microbial Genetics.

Text Books

- 1) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 2) Freifelder, D. 2008. Molecular Biology, 2nd Edition, Narose Book Distributors Pvt. Ltd., New Delhi, India.
- 3) Maloy, S. R., J. E. Cronan and D. Freifelder. 2001. Microbial Genetics, 2nd Edition, Narose Book Distributors Pvt. Ltd., New Delhi, India.

References

- 1) Gardner, E. J., M. J. Simmons and D. P. Snustad. 2005. Principles of Genetics, 8th Edition, John Wiley and Sons, New York.
- 2) Klug, W. S and M. R. Cummings. 2001. Essentials of Genetics, 4th Edition, Prentice Hall, New Jersey.
- 3) Chatterjee, N and Rana Shinde. 2012. Textbook of Medical Biochemistry, 8th Edition, Jaypee publication, New Delhi, India.
- 4) Weaver, R. F. 2008. Molecular Biology, 5th Edition, McGraw Hill, New York.

Semester – IV

3 Hours

3 Credits

MAIN PRACTICAL – IV

- 1) Isolation and purification of Nitrogen fixing bacteria – *Rhizobium* sp., *Azotobacter* sp. and *Azospirillum* sp.
- 2) Mass production of Biocontrol agents – *Bacillus subtilis* and *Pseudomonas fluorescens*, *Trichoderma viride* and *Beauveria bassiana*.
- 3) Mass cultivation of *Azolla*.
- 4) Assessment of AM colonization in roots.
- 5) Different formulations of Bioinoculants.
- 6) Method of application and Quality control.