MANNAR THIRUMALAI NAICKER COLLEGE

PASUMALAI, MADURAI– 625 004

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited with 'A' Grade by NAAC)

B.Sc., Microbiology

SYLLABUS AND REGULATIONS

UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)
(For those who joined during 2019-2020 and after)

Eligibility for Admission

Candidates should have passed the Higher Secondary Examination conducted by the board of Higher Secondary Education, Government of Tamil Nadu or equivalent examination conducted by other states of India with Science as one of the subjects in Higher Secondary Education.

Duration of the Course

The students shall undergo the prescribed B.Sc (Microbiology) course of study for a period of three academic years (six semesters).

Subject of Study

Part I: Tamil

Part II: English

Part III:

1. Core Subjects
2. Allied Subjects
3. Electives

Part IV:

1. Non Major Electives
2. Skill Based Subjects
3. Environmental Studies
4. Value Education

PartV:Extension activities

The scheme of Examination

The components for continuous internal assessment are:

Two tests and their average	--	15 marks
Seminar /Group discussion	--	05 marks
Assignment	--	05 marks

Total	--	25 marks

Pattern of the question paper (Summative Examinations)
(For Part I, Part II, Part III, NME & Skilled Paper in Part IV)

The question paper may have 3 parts.
Duration of the Summative Examinations is 3 hours

Part –A			
Ten questions (answer all)	10 x01	=	10 Marks
(Two questions from each unit)			
Part –B			
Five questions (eitheror choice)	05 x 07	=	35 Marks
(One question from each unit)			
Part –C			
Answer any threeout of five	03 x 10	=	30 Marks
(One question from each unit)			---
Total			75 Marks

Question paper pattern
(For part IV – Environmental Studies and Value Education only)

Part –A			
Five questions (eitheror choice)	5 x 06	=	30 marks
Part –B			
Answer any threeout of five	3 x 15	=	45 marks

Total			75 marks

Note: No unit shall be omitted; not more than two question from each unit

Pattern of the Question paper (Internal)

Part –A		
Six questions (answer all)	6 x01=	06 Marks
Part –B		
Two questions (eitheror choice)	2 x 07=	14 Marks
Part –C		
Answer any one out of two	1 x 10 =	10 Marks

Total		30 Marks

Pattern of the Question paper for Environmental Studies & Value Education only) (Internal)

Part –A

Four questions (eitheror choice)	4 x05=	20 Marks
Part –B		
One question (eitheror choice)	1 x 10=	10 Marks

Total		30 Marks

Minimum Marks for a Pass

40% of the aggregate (Internal +Summative Examinations).

No separate pass minimum for the Internal Examinations.

27 marks out of 75 is the pass minimum for the Summative Examinations.

DEPARTMENT OF MICROBIOLOGY (SFW)

Program Outcomes (PO):

PO1: Graduates will acquire adequate knowledge and leadership skills for a successful Career in the microbiology concept such as medical, industrial, environmental, genetics, agriculture, food and others.

PO2: Graduates will acquire key practical skills and competencies in demonstrating the laboratory as well as outside.

PO3: Graduates will develop and presents ideas logically and effectively using multiple modalities to enhance dissemination of knowledge and collaboration with diverse individuals, groups, and populations through best practices of microbiology.

PO4: Graduates will develop partnerships over time that allows effective functioning of in teams, and fosters open communication, mutual respect, and shared decision-making to achieve quality outcomes.

PO5: Graduates will demonstrate behaviors consistent with the legal and ethical framework with enormous responsibility to serve the society.

Program Specific Outcomes (PSO):

Students who graduate with a Bachelor of Science in Microbiology will

PSO1: Acquire knowledge on fundamentals of Microbiology.

PSO2: Understand on historical perspective of Microbiology, different types and structure of microbes and scope of various branches of Microbiology.

PSO3: Gain Knowledge on growth of Microbes and microbial metabolism and get to know about the microbes in environment.

PSO4: Grasp the fundamental concepts on gene transfer mechanisms in microbes, gene replications and receive elaborate knowledge on mutation and better understanding about gene regulation and various advanced techniques in Molecular Biology.

PSO5: Realize the application and productions of vermicompost and bioinoculants and understand the soil microorganisms and biogeochemical cycles prevail in environment.

PSO6: Gain insight on cells and organs of the immune system and Understand on various immunological reactions, techniques and autoimmune diseases.

PSO7: Be proficient on biomolecules and receive elaborate knowledge on genetic material in prokaryotes, mutations which are of importance for applying the knowledge in research.

PSO8: Assimilate technical skills on microbial genetics and molecular biology.

PSO9: Realize the application oriented aspects of Microbiology in mushroom cultivation.

PSO10: Understand the concepts on agriculture microbiology and able to know about global environmental problems.

Course pattern

Study Component	**I Sem**	**II Sem**	**III Sem**	**IV Sem**	**V Sem**	**VI Sem**	**Total Hours**	**Total Credit**	**No. of course**	**Total marks**
Part – I Tamil	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –II English	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –III										
Core subjects Core Practical Core elective Internship Project	5(5) 3(2)	5(5) 3(2)	5(5) 3(2)	5(5) 3(2)	5(5) 5(5) 3(2) 3(2) 5(4) 7(6)	6(6) 6(6) 5(4) 5(4) 6(5)	88	77	19	1900
Allied Subject-I Allied practical- I	4(4) 2(0)	4(4) 2(1)					12	9	3	300
Allied Subject-II Allied practical –II			4(4) 2(0)	4(4) 2(1)			12	9	3	300
Part-IV										
Skill Based Subjects	2(2)	2(2)	2(2)	2(2)	2(2)	2(2)	12	12	6	600
Environmental studies / Value Education	2(2)	2(2)					04	4	2	200
Non Major Elective			2(2)	2(2)			04	4	2	200
Part V										
Extension Activities				0(1)			00	1	1	100
Total	**30 (21)**	**30 (22)**	**30 (21)**	**30 (23)**	**30 (26)**	**30 (27)**	**180**	**140**	**44**	**4400**

SEMESTER –I							
Subject code	**Subjects**	**No. of Courses**	**Hours / week**	**Credits**	**Maximum Marks**		
					Int.	**Ext**	**Total**
18UTAG11	**Part –I Tamil** தற்காலகவிதையும் உரைநடையும்	1	6	3	25	75	100
18UENG11	**Part –II English Subject** English-I: Exploring Language Through Literature-I	1	6	3	25	75	100
19UMBC11	**Part –III Core Subject** Fundamentals of Microbiology	1	5	4	25	75	100
19UMBCP1	Fundamentals of Microbiology – Practical	1	3	2	40	60	100
19UMBA11	**Part –III Allied Subject** Biochemistry	1	4	4	25	75	100
19UMBAP1	Biochemistry and Cell Biology - Practical	--	2	0	--	--	--
19UMBS11	**Part –IV Skill Subject** Bio Instrumentation	1	2	2	25	75	100
18UEVG11	**Part –IV Mandatory Subject** Environmental Studies	1	2	2	25	75	100
	Total	**7**	**30**	**20**	**190**	**510**	**700**

SEMESTER – II							
Subject code	**Subjects**	**No. of Courses**	**Hours / week**	**Credits**	**Maximum Marks**		
					Int.	**Ext**	**Total**
18UTAG21	**Part –I Tamil** பக்தி இலக்கியமும் நாடகமும்	1	6	3	25	75	100
18UENG21	**Part –II English Subject** English-II: Exploring Language Through Literature-II	1	6	3	25	75	100
19UMBC21	**Part –III Core Subject** Microbial Physiology	1	5	5	25	75	100
19UMBCP2	Microbial Physiology -Practical	1	3	2	40	60	100
19UMBA21	**Part –III Allied Subject** Cell Biology	1	4	4	25	75	100
19UMBAP1	Biochemistry and Cell Biology - Practical	1	2	1	40	60	100
19UMBS21	**Part –IV Skill based Subject** Mushroom cultivation	1	2	2	25	75	100
18UVLG21	**Part –IV Mandatory Subject** Value Education	1	2	2	25	75	100
	Total	**8**	**30**	**22**	**230**	**570**	**800**

SEMESTER – III

Subject code	Subjects	No. of Courses	Hours / week	Credits	Maximum Marks		
					Int.	Ext	Total
18UTAG31	**Part –I Tamil** காப்பிய இலக்கியமும் சிறுகதையும்	1	6	3	25	75	100
18UENG31	**Part –II English Subject** Exploring Language Through Literature –III	1	6	3	25	75	100
19UMBC31	**Part –III Core Subject** Microbial Genetics	1	5	5	25	75	100
19UMBCP3	Microbial Genetics– Practical	1	3	2	40	60	100
19UMBA31	**Part –III Allied Subject** Molecular Biology	1	4	4	25	75	100
19UMBAP2	Molecular Biology & Immunology - Practical	--	2	0	--	--	--
19UMBS31	**Part –IV Skill Subject** Vermitechnology	1	2	2	25	75	100
19UMBN31	**Part –IV Non Major Elective** Microbes in human welfare	1	2	2	25	75	100
	Total	**7**	**30**	**21**	**190**	**510**	**700**

SEMESTER – IV							
Subject code	**Subjects**	**No. of Courses**	**Hours / week**	**Credits**	**Maximum Marks**		
					Int.	**Ext**	**Total**
18UTAG41	**Part –I Tamil** பழந்தமிழ் இலக்கியமும் புதினமும்	1	6	3	25	75	100
18UENG41	**Part –II English Subject** Exploring Language Through Literature –IV	1	6	3	25	75	100
19UMBC41	**Part –III Core Subject** Agriculture and Environmental Microbiology	1	5	5	25	75	100
19UMBCP4	Agriculture and Environmental Microbiology– Practical	1	3	2	40	60	100
19UMBA41	**Part –III Allied Subject** Immunology	1	4	4	25	75	100
19UMBAP2	Molecular Biology and Immunology - Practical	1	2	1	40	60	100
19UMBS41	**Part –IV Skill Subject** Bioinoculants technology	1	2	2	25	75	100
19UMBN41	**Part –IV Non Major Elective** Elemental concepts of Microbiology	1	2	2	25	75	100
18UEAG40 to 18UEAG49	**Part - V** Extension activities	1	0	1	100	--	100
	Total	**9**	**30**	**23**	**330**	**570**	**900**

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DEPARTMENT OF MICROBIOLOGY
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Class	**: B.Sc (Microbiology)**	**Part III**	**: Core**
Semester	**: III**	**Hours**	**: 05**
Subject Code	**:19UMBC31**	**Credits**	**: 05**

MICROBIAL GENETICS

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Describe genetics of microbes, gene transfer, transposition, bacterial gene expression, plasmids, mutation, DNA damage and DNA repair (K_1& K_2).

CO2: Identify gene transfer mechanism, regulation of bacterial gene expression and recombination (K_3).

CO3: Classify transposition, plasmid and mutation mechanisms (K_4).

CO4: Justify direct repair, excision repair, mismatch repair, recombination repair and SOS repairwith their mechanisms (K_5).

CO5: Illustrate the experiments on genetic material of famous scientist (K_6).

UNIT – I

DNA: Genetic material – experiment of Griffith, Avery, MacLeod and McCarty, Harshey and Chase; RNA:Genetic material – Gierer and Schramm experiments.

UNIT –II

Gene transfer mechanism in bacteria - Transformation, Conjugation and Transduction (Generalized and Specialized); Transposition: Transposable elements in prokaryotes – insertion sequences – composite & non-composite transposons – replicative & non-replicative transposition.

UNIT-III

Regulation of bacterial gene expression – lac operon – trp operon – attenuation – two component regulatory system; homologous recombination – Holiday model; Plasmid – size and copy number – conjugation & compatibility – classification - amplification.

UNIT IV

Mutation: spontaneous and induced mutations, Point mutation and chromosomal mutations, base pair changes, frame shift mutation and mismatch; DNA damage: lesions, dimerization, AP sites, oxidative damage, alkylation and genotoxic effects.

UNIT V

DNA repair: Direct repair – photoreactivation and dealkylation, excision repair –base excision and nucleotide excision, mismatch repair, recombination repair and SOS repair.

Text Book:

1. David R Hyde. 2010, Genetics and Molecular biology. Special Indian edition, Tata McGraw Hill P.Ltd, New Delhi.

Reference Books:

1. Maloy S.R,Cronan Jr. J.E, Freifelder D. 1994, Microbial genetics, Jones and Barlett publishers.
2. Lodish H, Baltimore Daerk A,Zipsury S.L,MarsudaisaP,Darnel J. 1995, Molecular cell biology.
3. Brown T.A. 1998, Molecular Biology Lab; Gene Analysis, Academic Press, London.
4. Krebs J.E, Goldstein E.S, Kilpatrick S.T. 2011,Lewin's Genes X, Jones and Bartlettpublishers.

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Class	**: B.Sc (Microbiology)**	**Part IV**	**: Core**
Semester	**: III**	**Hours**	**: 3**
Subject Code	**: 19UMBCP3**	**Credits**	**: 2**

MICROBIAL GENETICS - PRACTICAL

Course outcomes
On successful completion of the course, the learners should be able to

CO1: Enumerate streptomycin resistant mutant, auxotrophic mutant, Lac^- and Lac^+ colonies (K_1).
CO2: Illustrate the streptomycin resistant mutant, auxotrophic mutant, Lac^- and Lac^+ colonies (K_2).
CO3: Identify the *E.coli* strains for UV sensitivity (K_3).
CO4: Analyze replica plating (K_4).
CO5: Interpretbacterial conjugation (K_5).

1. Isolation of streptomycin resistant mutant by gradient plate method.
2. Isolation of auxotrophic mutants by replica plating.
3. UV sensitivity of *E.coli*.
4. Calculation of percentage killing of *E.coli* after UV irradiation.
5. Phenotypic checking of the given auxotroph.
6. Competent cell preparation.
7. Isolation of Lac^- and Lac^+ colonies
8. Uninterrupted bacterial conjugation.
9. Isolation of phage.
10. Demonstration of bacterial transformation.

Reference Books:

1. Malov S.R. 1990, Experimental Techniques in Bacterial Genetics, Jones and Bartlett Publishers, Boston.
2. Ausubel F.M, Roger B, Robert E.Kingston, David A. Moore, Seidman J.G, John A. Smith and Kelvin S. 1992, Short Protocols in Molecular Biology, Third Edition, John Wiley & Sons Inc, New York.
3. Kannan N. 2003, Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers, Panima Publishing Co, New Delhi.

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Class	**: B.Sc (Microbiology)**	**Part III**	**: Allied**
Semester	**: III**	**Hours**	**: 4**
Subject Code	**:19UMBA31**	**Credits**	**: 4**

MOLECULAR BIOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: RecognizeDNA, RNA and genetic code(K_1).

CO2: Describethe structure of DNA and RNA, Chargaff's principles, DNA supercoiling Wobblehypothesis, Meselson and Stahl experiment, rolling circular model of replication, geneticcode and molecular techniques (K_2).

CO3: Demonstrate the structure of DNA and RNA, DNA replication, transcription, translation and molecular techniques (K_3).

CO4: Compare DNA with RNA, prokaryotic and eukaryotic DNAreplication, prokaryotic transcription with eukaryotic transcription and prokaryotic translation with eukaryotic translation(K_4).

CO5: Conclude post transcription and post translation modification(K_5).

UNIT – I

Structure of DNA: Single stranded and double stranded (Watson and Crick model) - Chargaff's principles – DNA supercoiling.RNA: structure – characteristics – codon & anti-codon recognition and Wobble hypothesis.

UNIT –II

DNA replication – semiconservative – Meselson and Stahl experiment – prokaryotic and eukaryotic DNA replication – initiation, elongation and termination.Rolling circular model of replication.

UNIT-III

Transcription: Prokaryotic transcription – RNA polymerase – initiation, elongation and termination. Eukaryotic transcription – initiation, elongation and termination. Post transcriptional modifications.

UNIT IV

Translation: Prokaryotic translation – initiation, elongation and termination. Eukaryotic translation– initiation, elongation and termination. Post translational modification.

UNIT V

Genetic code; Codon - Anti-codon.Molecular techniques; DNA finger printing - DNA Microarray - Gene Mapping and Protein Micro array.

Text Book:

1. Frifelder D. 2000, Molecular Biology,Second edition,Narosa Publishing House, New Delhi.
2. Verma P.S and Agarwal V.K. 2016, Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd**.**

Reference Books:

1. Lodish H, Baltimore DaerkA,Zipsury S.L,Marsudaisa P, Darnel J. 1995, Molecular cell biology.
2. De Roberties E.D.P and E.M.F.De Roberties. 2011, Cell and Molecular Biology, Eighth edition, Lippincott Williams & Wilkins, Pheladelphia.
3. Gardner, Simon andSnustad, Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

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Class	**: B.Sc (Microbiology)**	**Part IV**	**: Allied**
Semester	**: III & IV**	**Hours**	**: 2**
Subject Code	**: 19UMBAP2**	**Credits**	**: --**

MOLECULAR BIOLOGY AND IMMUNOLOGY - PRACTICAL

Course outcomes
On successful completion of the course, the learners should be able to

CO1: Describe the isolation techniques in DNA & RNA(K_1).
CO2: Determine blood grouping and Rh typing(K_3).
CO3: Illustrate bacterial transduction (K_4).
CO4: Deduct total count and differential count in blood cells(K_5).
CO5: Preparedouble immunodiffusion and radial immunodiffusiontest(K_6).

1. Gel Electrophoresis
2. Isolation of chromosomal DNA from bacteria
3. Estimation of DNA by spectrophotometric method.
4. Isolation of plasmid DNA from bacteria.
5. Isolation of RNA from plant cells.
6. Blood grouping and Rh typing.
7. Examination of blood cells – Total count.
8. Examination of blood cells – Differential count.
9. Agglutination reaction
10. Ouchterlonydouble immunodiffusion test.
11. Single radial immunodiffusion.
12. Dot blot.

Reference Books:

1. Ausubel F.M, Roger B, Robert E. Kingston, David A. Moore, Seidman J.G, John A. Smith and Kelvin S. 1992. Short Protocols in Molecular Biology, Third Edition, John Wiley & Sons Inc., New York.
2. RajamanickamC.2001, Experimental protocols in basic molecular biology, Osho Scientific Publications, Madurai.
3. Annadurai B. 2008, Immunology and Immunotechnology, First edition, S.Chand& Company Ltd,New Delhi.
4. Kannan N. 1996, Laboratory Manual in General Microbiology, First edition, Palani Paramount Publications, Palani.

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Class	**: B.Sc (Microbiology)**	**Part IV**	**: Skill**
Semester	**: III**	**Hours**	**: 2**
Subject Code	**: 19UMBS31**	**Credits**	**: 2**

VERMITECHNOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Elaborate vermiculture and its concept, vermiculture, vermicast, vermiwash, factors affecting vermicomposting, earthworm pests, parasites and pathogens(K_2).

CO2: Identify the role of earthworms in soil fertility and its application in agriculture and various fields(K_3).

CO3: Classify earthworm and vermicomposting methods (K_4).

CO4: Justify the problems in vermicultureand its remedies (K_5).

CO5: Designharvesting of vermicompost(K_6).

UNIT – I

Definition and concepts of vermiculture.Earthworm classification – morphology and anatomy.

UNIT –II

Types of vermicomposting – role of earthworms in soil fertility – vermiculture – vermicast – vermitechnology and its applications.

UNIT-III

Vermicomposting materials, vermicomposting methods (small scale and large scale) and Factors affecting vermicomposting (pH, moisture and temperature).

UNIT IV

Harvesting of vermicompost – quality, properties and advantages over chemical fertilizers.Vermiwash and its application.

UNIT V

Earthworm pests, parasites and pathogens.Problems in vermiculture and remedial solution.Application of vermicomposting in agriculture.Uses of earthworms in food and medicine.

Text Book:

1. Gupta P.K. 2008, Vermicomposting for sustainable agriculture,Second edition, Agrobios.

Reference Books:

1. IsmailS.A. 1997, Vermitechnology:The biology of Earthworm. Orient Longman.
2. Ranganathan L.S. 2006, Vermicomposting technology - from soil health to human health.
3. Edwards C.A, and Bother, B. 1996, Biology of Earthworms, Chapman Hall Publ. Co, London.
4. Talashikar S.C. 2008, Earthworms in Agriculture, Agrobios.

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Class	**: UG**	**Part IV**	**: NME**
Semester	**: III**	**Hours**	**: 2**
Subject Code	**:19UMBN31**	**Credits**	**: 2**

MICROBES IN HUMAN WELFARE

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Outline the contributions of Louis Pasteur, Robert Koch and Edward Jenner (K_2).

CO2: Discover the role of microbes in household products, industrial products,sewage treatment, agriculture and in biogas production (K_3).

CO3: Infer the microbial activity in household products, industrial products,sewage treatment, agriculture and in biogas production (K_4).

CO4: Evaluate the microbial benefits in household products, industrial products and in agriculture (K_5).

CO5: Formulate the biogas productionand the microbial activity in sewage treatment(K_6).

UNIT – I

Microbiology: Definition and history – contributions of Louis Pasteur, Robert Koch and Edward Jenner.

UNIT –II

Role of microbes in household products: *Saccharomyces*, *Lactobacillus*, *Agaricus*and *Spirulina.*

UNIT-III

Role of microbes in industrial products – fermented beverages – antibiotics(Penicillin production)-chemicals and enzymes(Insulin production).

UNIT IV

Role of microbes in Agriculture: Biocontrol agent – *Bacillus thuringiensis*and biofertilizer–*Azospirillum.*

UNIT V

Role of microbes in sewage treatment: primary treatment, secondary treatment– aerobic and anaerobic(trickling filter,activated sludge and oxidation pond)treatment.Role of microbes in biogas production.

Text Book:

Dubey R.C and Maheswari D.K. 2005, A Text book of Microbiology, S.Chand& Company Ltd, New Delhi.

Reference Books:

1. FraziesW.C and Westhoff D.C. 1988, Food microbiology, Fourth edition, McGraw Hill.
2. SubbaRao N.S. 1995, Soil Microorganisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.
3. Hugo W.B, Russell A.D.Pharmaceutical Microbiology, Fourthedition, Blackwell scientific publications / Oxford.
4. Powar C.B and Daginawala H.F. 2005, General Microbiology, Volume I & II, Eighth edition, Himalaya Publishing House, Mumbai.

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Class	**: B.Sc (Microbiology)**	**Part IV**	**: Core**
Semester	**: IV**	**Hours**	**: 5**
Subject Code	**: 19UMBC41**	**Credits**	**: 5**

AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Relate the importance of soil microorganisms and soil fertility and rhizosphere microorganisms and its importance(K_1).

CO2: Discuss the phyllosphere microorganisms, plant-microbe and microbe-microbe interactions in soil, biogeochemical cycles, nitrogen fixers, plant diseases, microbial pesticides and microbiology of air, water and sewage(K_2).

CO3: Identify the soil, rhizosphere and phyllosphere microorganisms, nitrogen fixers, bacterial, fungal and viral diseases in plants (K_3).

CO4: Analyze the microbes in air, water and sewage (K_4).

CO5: Design sewage treatment (K_5).

UNIT – I

Distributionand importance of soil microorganisms in soil fertility – factors affecting the activities of soil microoraganisms;Rhizosphere microorganisms and its importance;Phyllosphere microorganisms; plant-microbe and microbe-microbe interactions in soil.

UNIT –II

Biogeochemical cycles- carbon, nitrogen, phosphorus and sulphur Cycle; Nitrogen fixers – root nodule formation – nitrogenase,hydrogenase – biochemistry of nitrogen fixation.

UNIT-III

Plant diseases(mode of entry of pathogens, symptoms, disease cycle and control measures) Bacterial disease –angular leaf spot of Cotton, Fungal disease - blast disease of paddy and Viral disease- bunchy top of banana.Microbial pesticides- types and applications- *Pseudomonas fluorescens* and NPV.

UNIT IV

Microbiology of air – microbes in aerosol – assessment of quality of air- air sanitation – air borne diseases and their control measures. Microbiology of water: potability of water, indicator organisms, microbial assessment of water quality,water purification, water borne diseases and their control measures. Pollutants - bioremediation.

UNIT V

Microbiology of sewage – chemical and biochemical characteristics of sewage – BOD and COD – sewage treatment- physical, chemical and biological – aerobic and anaerobic(trickling filter,activated sludge and oxidation pond)treatment- disposable of wastes.

Text Books:

1. SubbaRao N.S. 2000, Soil Microorganisms and Plant Growth, Third Edition, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

2. AtlasR.A&BarthaR.2000, Microbial Ecology, Fundamentals and Application, Benjamin Cummings, New York.

Reference Books:

1. Rangaswami G and Bagyaraj D.J. 2002, Agricultural Microbiology, Second edition, PHILearning (P) Ltd., New Delhi.
2. Sharma, P.D. 2001, Plant Pathology, First edition. Rastogi Publications.
3. Mitchell R. 1974, Introduction to Environmental Microbiology, Prentice Gall Inc., Englewood Cliffs.

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DEPARTMENT OF MICROBIOLOGY
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Class	**: B.Sc (Microbiology)**	**Part IV**	**: Core**
Semester	**: IV**	**Hours**	**: 3**
Subject Code	**: 19UMBCP4**	**Credits**	**: 2**

AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY- PRACTICAL

Course outcomes
On successful completion of the course, the learners should be able to

CO1: Enumerate bacteria from soil, water, air, leguminous plant and diseased plants (K_1).
CO2: Demonstrate water analysis (K_2).
CO3: Identify the isolation techniques of Azotobacter, rhizobium andPhosphobacteria (K_3).
CO4: Deduct microbes from air and water (K_4).
CO5: Prepare biofertilizer(K_5).

1. Isolation of microorganisms from soil (Bacteria,Actinomycetes and Fungi).
2. Isolation of free-living nitrogen fixers –*Azotobacter*
3. Isolation of *Rhizobium* from Legume nodule.
4. Isolation of Phosphobacteria from soil.
5. Isolation of microbes from crops infected with bacterial diseases.
6. Water analysis by MPN technique.
7. Microbial assessments of air quality – open plate method.
8. Isolation and counting of coliforms from water.
9. Demonstration on different biofertilizers types, formulation and application methods.
10. Visit to biofertilizers and biopesticides unit to understand about the Unit operation procedures.

Reference Books:

1. DubeyR.C and MaheswariD.K. 2002, Practical Microbiology, S.Chand Ltd
2. Christon J. Hurst, Ronald L. Crawford, Manual of environmental microbiology, Second edition,ASM Press.
3. Aneja K.R. 2003, Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International.
4. Cappuccino J.G, Sherman S. 2002, Microbiology. A Laboratory Manual Benjamin Cummings Publishing Company.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF MICROBIOLOGY
(For those who joined in 2019-2020 and after)

Class	**: B.Sc (Microbiology)**	**Part IV**	**: Allied**
Semester	**: IV**	**Hours**	**: 4**
Subject Code	**: 19UMBA41**	**Credits**	**: 4**

IMMUNOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Describe the history of immunology, types of immunity, immune cells, immune organs, antigen, antibody, monoclonal antibodies, MHC, Complement system, hypersensitivityreactions and autoimmune diseases(K_1).

CO2: Classify the types of immunity, antigen and antibody, classical and alternative pathways of complement system and antibody mediated and cell mediated hypersensitivity reactions (K_2).

CO3: Identify immune cells, immune organs, antigen, antibody, antigen – antibody interactions hypersensitivityreactions and autoimmune diseases (K_3).

CO4: Categorize the properties of immune cells, immune organs, antigen and antibody (K_4).

CO5: Evaluate the role of immunoglobulins in immunity (K_5).

UNIT – I

History of immunology; Immune organs – bone marrow, thymus, lymph node, spleen, GALT and MALT. Structure, function and properties of immune cells – T cell, B cell, NK cell, macrophage, neutrophil, eosinophil, basophil, mast cell and dendritic cell;

UNIT –II

Types of immunity – innate and acquired immunity – humoral and cell mediated immunity. Immune tolerance.

UNIT-III

Antigens: properties (epitope, adjuvants) – chemical nature – types – immunogen – hapten and determinants of antigenicity. Antibodies: immunoglobulins – structure – types and properties. Monoclonal antibodies – hybridoma technology.

UNIT IV

Antigen-antibody interaction – agglutination, precipitation, RIA, ELISA and Immunoelectrophoresis. MHC – antigen processing and presentation. Complement system – classical and alternative pathways.

UNIT V

Hypersensitivity reactions – antibody mediated (Type I, II & III) and cellmediated (Type IV). Transplantation immunology,Autoimmune diseases – types and mechanisms.

Text Book:

1. Janis Kuby. 1993,Immunology,Second edition, W.HFrumen and company, New York.

Reference Books:

1. Roitt, I.M. 1991, Essentials of Immunology, Seventh edition, Blackwell Scientific Publications.
2. Kannan I. 2007, Immunology, First edition, MJPPublishers, Chennai.
3. Ian R. Tizard. 1995, Immunology: An Introduction, Fourth edition, Saunders College Publishing.
4. Chakravarthy, A.K. (1996) – Immunology, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF MICROBIOLOGY
(For those who joined in 2019-2020 and after)

Class	**: B.Sc (Microbiology)**	**Part IV**	**: Allied**
Semester	**: III & IV**	**Hours**	**: 2**
Subject Code	**: 19UMBAP2**	**Credits**	**: 1**

MOLECULAR BIOLOGY AND IMMUNOLOGY - PRACTICAL

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Describe the isolation techniques in DNA & RNA (K_1).
CO2: Determine blood grouping and Rh typing (K_3).
CO3: Illustrate bacterial transduction (K_4).
CO4: Deduct total count and differential count in blood cells (K_5).
CO5: Preparedouble immunodiffusion and radial immunodiffusiontest (K_6).

1. Gel Electrophoresis
2. Isolation of chromosomal DNA from bacteria
3. Estimation of DNA by spectrophotometric method.
4. Isolation of plasmid DNA from bacteria.
5. Isolation of RNA from plant cells.
6. Blood grouping and Rh typing.
7. Examination of blood cells – Total count.
8. Examination of blood cells – Differential count.
9. Agglutination reaction
10. Ouchterlony double immunodiffusion test.
11. Single radial immunodiffusion.
12. Dot blot.

Reference Books:

1. Ausubel F.M, Roger B, Robert E. Kingston, David A. Moore, Seidman J.G, John A. Smith and Kelvin S. 1992. Short Protocols in Molecular Biology, Third Edition, John Wiley & Sons Inc., New York.
2. RajamanickamC.2001, Experimental protocols in basic molecular biology, Osho Scientific Publications, Madurai.
3. Annadurai B. 2008, Immunology and Immunotechnology, First edition, S.Chand& Company Ltd,New Delhi.
4. Kannan N. 1996, Laboratory Manual in General Microbiology, First edition, Palani Paramount Publications, Palani.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF MICROBIOLOGY
(For those who joined in 2019-2020 and after)

Class	**: B.Sc (Microbiology)**	**Part IV**	**: Skill**
Semester	**: IV**	**Hours**	**: 2**
Subject Code	**: 19UMBS41**	**Credits**	**: 2**

BIOINOCULATS TECHNOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Describe about the importance of bioinoculants, biofertilizers, biomanures and biopesticides (K_1).

CO2: Identify symbiotic N_2 fixers, non-symbiotic N_2 fixers, Phosphate solubilizing microbes andbiocontrol agents of bacteria and fungi (K_3).

CO3: Distinguishsymbiotic and non-symbiotic nitrogen fixers (K_4).

CO4: Assess the quality control of bioinoculants (K_5).

CO5: Prepare inoculums forbiofertilizers, biomanures and biopesticides (K_6).

UNIT – I

Bioinoculants – definition – various types – biofertilizers, biomanures and biopesticides - and their importance in sustainable agriculture.Symbiotic N_2 fixers – *Rhizobium* – isolation, characterization, inoculums production and field application.

UNIT –II

Non-Symbiotic N_2 fixers – *Azospirillum* – Associated N_2 fixer – *Azotobacter* – isolation, characterization, mass inoculum production and field application.

UNIT-III

Symbiotic N_2 fixers – *Cyanobacteria, Rhizobium,Azolla* – isolation, characterization, mass multiplication and field application.

UNIT IV

Phosphate solubilizing microbes – isolation, characterization, mass inoculum production and field application.Phosphate solubilizationmechanism,Vesiculararbuscularmycorrhizae (VAM)

UNIT V

Biocontrol agents – bacteria and fungi – *Bacillus thurengiensis*&*Trichodermaviridae*.Mass production of biopesticides.Quality controlling in bioinoculants.

Text Book:

1. SubbaRao N.S. 1988, Biofertilizers in Agriculture and forestry, Oxford and IBH Publishing Co, Ltd., New Delhi.

Reference Books:

1. Mahendra K. Rai. 2005, Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
2. SubbaRao N.S. 1995, Soil microorganisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd,NewDelhi.
3. Kannaiyan S. 2003, Bioetchnology of Biofertilizers, CHIPS, Texas.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF MICROBIOLOGY
(For those who joined in 2019-2020 and after)

Class	**: UG**	**Part IV**	**: NME**
Semester	**: IV**	**Hours**	**: 2**
Subject Code	**: 19UMBN41**	**Credits**	**: 2**

ELEMENTAL CONCEPTS OF MICROBIOLOGY

Course outcomes

On successful completion of the course, the learners should be able to

CO1: Label the parts of microscope, autoclave, laminar air flow chamber, incubator, bacterial cell, DNA and RNA(K_1).

CO2: classifyprokaryotes and eukaryotes, DNA and RNA, physical and chemical methods of sterilization, sterilization and disinfectant, antigen and antibody and humoral and cell mediated immunity(K_2).

CO3: prepare different types of media (K_3).

CO4: contrast different methods of staining and sterilization(K_4).

CO5: interpret the staining, organization of bacterial cell, DNA, RNA, sterilization, disinfectant,media preparation, pure culture techniques, nutrition, different phases of growth andgrowth curve of bacteria,humoralimmunity, cell mediated immunity, *S.aureus*,*Candida*,HIV and malaria (K_5).

UNIT – I

Microscope and its application, autoclave, laminar air flow chamber,incubator, Staining and its importance.

UNIT –II

Prokaryotes and Eukaryotes.Structure and organization of bacterial cell.Structure and function of DNA and RNA.

UNIT-III

Sterilization: methods of sterilization – physical and chemical methods; Disinfectant – definition and ideal characteristics.

UNIT IV

Media preparation, pure culture techniques, nutrition, different phases of growth and growth curve of bacteria.

UNIT V

Bacteria – *S.typhi*,Fungi – *Candida*, Virus – Hepatitis and Parasite – Malaria.

Reference Books:

1. Michael J PelczarJ.R, Chan E.C.S and Kreig N.R. 2006, Microbiology, Fifth edition, Tata McGraw-Hill INC. New York.
2. Richard A Goldsby, Thomas J Kindt. Barbara A Osborne. 2000, Kuby Immunology, Fourth edition, W H Freeman and company, New York.
3. Jawetz, Melnick, &Adelberg's. 2013, Medical Microbiology, Twenty-sixth edition, McGraw-Hill.
4. Patel A.H. 2005, Industrial microbiology, Mac Millan India Ltd., Chennai.
5. SubbaRao N.S. 2004, Soil Microbiology, Fourth edition, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.