



ALAGAPPA UNIVERSITY

(A State University Established in 1985)
Karaikudi - 630003, Tamil Nadu, India



2017 Accredited with A+ Grade by NAAC (CGPA : 3.84)	2018 MHRD Govt. of India Graded as Category - 1 & Granted Autonomy	2018 UGC University Grants Commission Swachh Campus Rank : 4	2019 NATIONAL INSTITUTIONAL RANKING FRAMEWORK Rank : 28	2019 India Rank : 20 BRICS Rank : 104 Asia Rank : 216
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DEPARTMENT OF MICROBIOLOGY



M.Sc., MICROBIOLOGY

[Choice Based Credit System (CBCS)]

[For the candidates admitted from the academic year 2019 -2020]

1. a. Programme General Objectives

The benefits that man can derive from the activities of microbes are immense. Medical microbiology, Agricultural microbiology, Environmental microbiology, Industrial microbiology, Microbial biotechnology and all branches of microbiology tell us how microbes involved in various human endeavours. Microbiology is giving a helping hand to improve the quality of life.

Creation of new genetically engineered microbes using the technique of Recombinant DNA may help us to produce new drugs, produce disease resistant animals and crop plants etc. Some microbes may also help us to check pollution as for example bacteria that can feed on oil spill.

As research tools, to enquire into the fundamental processes of life microbes have rendered great service. They can be cultured, life histories can be studied in a short time and the results obtained can be interpreted for higher forms of life (including human beings) also, as the genetic material is same.

From the discussion above, it must be abundantly clear that microbiology has become increasingly important to human society. It (Microbiology) has emerged as one of the most important branches of life sciences. As microbes practically affect all the activities of our life like, food, clothing, shelter, health hygiene etc., so also microbiology has made vast progressive strides in all these fields in little less than a century to improve the quality of our life.

Hence our task is to introduce the M.Sc. programme in Microbiology to educate the undergraduate students in the captivating fields. With rigorous and comprehensive in approach, this syllabus presents essential contents in a detailed, clear and direct way. This programme is offered under Choice Based Credit System (CBCS). The CBCS enables the students to select variety courses as per his interest and requirement. The programme is structured in such a way to impart more knowledge in science, in particular in Microbiology.

b. Programme Specific Objectives

1. To acquire knowledge on the basics of microbiology
2. To make the students understanding on fundamental interaction of the microbes with other biological and non biological elements.
3. To understand the rationale in the field of Applied Microbiology
4. To enable the students technically sound in the Microbial Techniques
5. To prepare the students to do research on the Recent Trends in Microbiology
6. To make them expert in the field of Applied Microbiology

c. Programme Outcome

After successful completion of this course the student will be able to,

1. Become expertise in the field of microbiology both in theoretical and practical aspect.
2. Will receive elaborate knowledge in the field of Microbiology, Biochemistry, Microbial genetics, Molecular biology, Food, Agricultural, Environmental, Medical and applied Microbiology
3. Will be capable of carrying out any Microbiology related tasks in Industries, Medical labs, Research labs and etc.

A postgraduate degree in microbiology prepares the students for a career in research. It is important to start to think about your plans after your master's or PhD so that you can make the most of the ever-increasing options available to postgraduate students.

II. Eligibility for Admission

A candidate who has passed Bachelor's Degree in Biological Sciences (Microbiology, Biochemistry, Biotechnology, Botany, Zoology, Bioinformatics, Agricultural / Veterinary / Fisheries Sciences / Pharmacy) degree with at least 50% of marks and 45% marks for SC/ST candidates as main course of study of any university accepted by the syndicate as equivalent thereto, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the M.Sc. Degree in Microbiology of this University after a course of study of two academic years.

III. Duration of the Course

The course for the degree of Master of Science in Microbiology shall consist of two academic years divided in to four semesters. Each Semester consists of 90 working days.

IV. Course of Study: M.Sc. Microbiology

V. Teaching Methodologies

- Participation of students is essential; they are informed previously about the topic of the lecture.
- In the beginning of the lecture, the teacher inquiries about students' expectation and sets objectives of the lecture.
- Some important points of the previous lecture are asked about.
- Students ask about non-clear points and the teacher joins the previous with the new lecture.
- Teacher proposes some simple problems to be solved by students currently during the lecture.
- At the end, a summary of the content is presented by 2 or 3 students followed by organized summary by the teacher.

VI. Attendance:

Educators and students have recognized for a long-time attendance is of critical importance to student achievement. Generally minimum attendance to be eligible to take end-semester-examination is 80%.

VII. Punctuality:

Punctuality is an essential element in achieving success. Therefore, anyone arriving after daily roll-call (about 5 minutes after the class begins) will be marked absent. A valid excuse for being absent from class shall be a medical or a personal emergency acceptable at the discretion of the Dean/Chairman/Head of the Dept.

VIII. Class Participation:

Class participation and interaction helps to form a complete educational experience. However, class participation and interaction is to be relevant to course content and context. Deviant behavior may lead to dismissal or suspension.

IX. Submission of Assignments:

When submitting any assignments, **your name, your student Register number, course number and date of submission** should be clearly written on every page and all pages should be stapled together. The timely submission of assignments is an essence of personal discipline and will contribute towards forming a person's professional responsibility.

X. Preparedness:

Students are expected to have read and be able to discuss the assigned chapter before attending the lecture. In addition, students should be prepared to discuss homework problems.

XI. Academic Dishonesty:

Academic work produced using dishonest methods has no value. Academic dishonesty also includes copying - verbatim or otherwise, and plagiarism i.e., the use of an author's ideas, statements, or approaches without crediting the source. A clear indication of academic dishonesty will result in a grade of "F" being assigned to that particular piece of work.

Seminar	Assignment	CIA Test I	CIA Test II
During specific semester of the subject deliberated	During specific semester of the subject deliberated	During specific semester of the subject deliberated	During specific semester of the subject deliberated

XII. Examinations:

Assessment & Evaluation: "Assessment and evaluation are essential components of teaching and learning systems. Student evaluation is takes place based on exams, assignments, seminars and class participation.

The examination shall be three hours duration to each course at the end of each semester. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination.

Practical examinations for M.Sc. course in Microbiology will be conducted in first three semesters.

(a) Distribution of marks for examinations:

Theory:

Components of Internal Assessment (Max. Marks 25)

Written Test	: 15 marks
Assignment	: 05 marks
Seminar	: 05 marks
Internal Minimum	: 10
External Minimum	: 30
(Max. 75 marks)	
Internal + External pass Minimum	: 50

Practical:

Internal 25; External -75	
Internal Minimum	: 10
External Minimum	: 30
Internal+External Minimum	: 50

(b) Question Paper Pattern – Theory

M.Sc. Microbiology

Sub Code:

Course title

(2019-20 onwards)

Time: 3 Hours

Max. Marks - 75

PART A

(10 x 2 = 20 marks)

Answer all questions. All questions carry equal marks.

1. from UNIT I
2. from UNIT I
3. from UNIT II
4. from UNIT II
5. from UNIT III
6. from UNIT III
7. from UNIT IV
8. from UNIT IV
9. from UNIT V
10. from UNIT V

PART B

(5 x 5 = 25 marks)

Answer all questions either (a) or (b)

11. (a) or (b) from UNIT I
12. (a) or (b) from UNIT II
13. (a) or (b) from UNIT III
14. (a) or (b) from UNIT IV
15. (a) or (b) from UNIT V

PART C

(3 X 10 = 30

marks)

Answer any three questions.

16. from UNIT I
17. from UNIT II
18. from UNIT III
19. from UNIT IV
20. from UNIT V

(c) Question Paper Pattern – Practical - Time: 6 Hours

Questions	Marks
1. Major Experiment (Write up – 15; Work -10)	25
2. Minor Experiment (Write up – 10; Work -10)	20
3. Spotters (Two)	10
4. Viva-voce	15
5. Record	5
Total	75

XIII. Project Work

Project work Internal	–	75 Marks	}
Project work External	–	75 Marks- Average of 75	
Viva-Voce	–	25 Marks	
Total	–	100 Marks	

(a) Plan of Work:

The student should prepare plan of work under the supervision of guide for the dissertation, get the approval of the guide and should be submitted to the university during the fourth semester of their study. The duration of the dissertation research shall be a minimum of three months in the fourth semester.

(b) Project Work outside the Department:

In case the student stays away for work from the Department for more than one month, specific approval of the university should be obtained.

(c) No. of copies/distribution of project work:

The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the Department library and one copy is to be submitted to the guide and one copy can be held by the student.

(d) Format to be followed:

The format/certificate for dissertation to be submitted by the students is given below:

Format for the preparation of project work:

- (a) Title page
- (b) Bonafide Certificate
- (c) Acknowledgement
- (d) Table of contents

CONTENTS

Chapter No.	TITLE	Page No.
1.	Introduction	
2	Review of Literature	
3.	Materials and Methods	
4.	Results	
5.	Discussion	
6.	Summary	
7.	References	

Format of the Title Page:

TITLE OF THE PROJECT

A Dissertation Submitted to the Alagappa University, Karaikudi -630 003 in Partial Fulfilment of
the Requirement for the Award of Degree of

MASTER OF SCIENCE IN MICROBIOLOGY

By
Students Name
Register Number
Supervisor:

University Emblem
Department of Microbiology
Alagappa University
Karaikudi – 630 003
Month and Year

Format of Declaration of the Candidate:

Name and class of the student

DECLARATION

I hereby declare that the Project entitled _____ submitted to Alagappa University for the award of the degree of Master of Science in Microbiology is my original work and that it has not been previously formed the basis for the award of any degree, diploma/associate ship or any other similar title of any other University or Institution.

Signature of the Student

Format of the Certificate:

CERTIFICATE

This is to certify that the project entitled -----
-----submitted in partial fulfilment of the requirement of the degree of Master of Science in
Microbiology to the Alagappa University, Karaikudi is a record of bonafide research work carried out
by -----under my supervision and guidance and that no part of the project has been
submitted for the award of any degree or diploma.

Signature of HOD

Place:

Date:

Signature of Guide

XIV. Village Extension Programme (VEP)

The Sivagangai and Ramnad districts are very backward districts, where a majority of the people lives in poverty. The rural mass is economically and educationally backward. Thus, the aim of introducing Village Extension Programme (VEP) is to extend outreach programs in environmental awareness, hygiene and health to the rural masses of this region.

The students in their third semester have to visit our department adopted village and can arrange various programme to educate the rural masses in the following areas for three days. A minimum of two faculty members can accompany the students and guide them.

1. Environmental awareness
2. Hygiene and Health

This course is a compulsory one for all the M.Sc. Microbiology students of Department of Microbiology, Alagappa University. Students will be awarded TWO credits apart from the minimum credits of 90 to be earned for the M.Sc. programme.

XV. Classification of Successful Candidates

P.G. Programme

MARKS	GRADE POINT	CGPA	LETTER GRADE	Description
96 and above 91 – 95	10 9.5	9.51 and above 9.01 – 9.50	S+ S	First Class - Exemplary
86 – 90 81 – 85 76 – 80	9.0 8.5 8.0	8.51 – 9.00 8.01 – 8.50 7.51 – 8.00	D++ D+ D	First Class – Distinction
71 – 75 66 – 70 61 – 65	7.5 7.0 6.5	7.01 – 7.50 6.51 – 7.00 6.01 – 6.50	A++ A+ A	First Class
56 – 60 50 – 55	6.0 5.5	5.51 – 6.00 5.00 – 5.50	B C	Second Class
Below 50	-	Below 5.00	F	Fail
			AA	Absent

Passing Minimum: 50%, P: Pass, ESE: End Semester Examination, CIA: Continuous Internal Assessment

$$GPA = \frac{\Sigma (CDT * GPT)}{\Sigma CDT}$$

Where: CDT = No. of credits of major allied and elective courses

GPT = Grade Point (obtained by dividing the percentage of marks scored by 10)

Note: Extra Grade Points and Marks are not considered for GPA and Total Marks Calculations.

	<u>Category (CGY)</u>
CGY – Category	1. Theory (Core)
CDT – Credit	2. Practical (Core)
GRD – Grade	3. Inter-disciplinary – Theory
GPT – Grade Point	4. Inter-disciplinary – Practical
GPA – Grade Point Average	5. Elective / Optional
CGPA – Cumulative Grade Point Average	6. Comprehensive Viva / Seminar
	7. Extension Programmes
	8. Project and Viva – Voce

XVI Maximum Duration for the Completion of the Course

The maximum duration for completion of M.Sc. Degree in Microbiology Programme shall not exceed ten semesters.

XVII. Syllabus-

XVIII. Syllabus - M. Sc., Microbiology

M. Sc., Microbiology

Semester – I						
Course Code	Course Title	Contact Hrs / Week	Credits	Marks I	Marks E	Total
530101	CC I - General Microbiology	6	5	25	75	100
530102	CC II - Microbial Biochemistry	6	5	25	75	100
530103	CC III - Microbial Physiology	5	5	25	75	100
530104	CC IV - Lab in General Microbiology, Microbial Biochemistry and Microbial Physiology	8	4	25	75	100
530501/ 530502	EC I- Molecular Biology/ EC II- Microbial Diversity and Taxonomy	4	4	25	75	100
	Library	1	-	-	-	-
Total		30	23	125	375	500
Semester – II						
530201	CC V - Microbial Genetics	5	5	25	75	100
530202	CC VI - r DNA Technology	5	5	25	75	100
530203	CC VII - Food Microbiology	5	5	25	75	100
530204	CC VIII - Lab in Microbial Genetics, r DNA Technology and Food Microbiology	8	4	25	75	100
530503/ 530504	EC III- Agriculture and Environmental Microbiology/ EC IV- Microbial Ecology.	4	4	25	75	100
	NME-I (course to be chosen from other department)	3	2	25	75	100
MOOCs	SLC*-I	-	EC	-	-	-
Total		30	25+ EC	150	450	600
Semester – III						
530301	CC IX - Medical Microbiology	5	5	25	75	100
530302	CC X - Immunobiology	5	5	25	75	100
530303	CC XI – Industrial Microbiology	5	5	25	75	100
530304	CC XII –Lab in Medical Microbiology, Immunobiology and Industrial Microbiology	8	4	25	75	100
530505/ 530506	EC V- Algal Biotechnology/ EC VI- Microbial Technology	4	4	25	75	100
	NME-II (course to be chosen from other department)	3	2	25	75	100
MOOCs	SLC*-II	-	EC	-	-	-
Total		30	25+ EC	150	450	600
Semester – IV						
530401	CC XIII - Extremophiles	6	5	25	75	100
530999	CC XIV- Project Report and Viva voce	24	12	25	75	100
Total		30	17	50	150	200
Total for All Semesters		120	90+ EC	475	1425	1900

Non-Major Electives Course (NME) (For II Semester) - To be chosen by other PG degree students:

Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks I	Max Marks E	Total
Molecular Biology	3	2	30	25	75	100
Agriculture and Environmental Microbiology	3	2	30	25	75	100

Non-Major Electives Course (NME) (For III Semester) - To be chosen by other PG degree students:

Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks I	Max Marks E	Total
Microbial Ecology	3	2	30	25	75	100
Microbial Technology	3	2	30	25	75	100

CC:

Core Course, EC: Elective Course, NME: Non-Major Electives Course and SLC: Self Learning Course (MOOCs).

*Credits earned through Self Learning Courses (SLC) (MOOCs) shall be transferred in the credit plan of the program as extra credits.

Semester - I			
Course code: 530101	General Microbiology	Credits:5	Hours: 6
Objectives	<ul style="list-style-type: none"> ➤ To inculcate knowledge on the fundamentals of microorganisms ➤ To learn the structural organization, morphology and reproduction of microbes ➤ To know the principles of Microscopy and advancements in Microscopy. 		
Unit -I	History and Scope of Microbiology – Generation theory – Contribution of Leuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, Waksman and John Tyndall. Classification of microorganisms - Haeckel's three kingdom concept, Whittaker's five kingdom concept, Carl Woes three domain system, Principles of microbial taxonomy. Bacterial classification (outline) according to Bergey's manual of systemic Bacteriology.		
Unit-II	Ultra structure of bacteria: Morphological types, Cell wall of Gram negative, Gram positive bacteria and halophiles. Cell wall synthesis. Capsule composition and function. Cell membranes in Eubacteria, archaeobacteria and cyanobacteria, Cell membrane functions. Periplasmic space. Structure and function of flagella, cilia and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Reserve food materials – polyhydroxybutyrate, polyphosphates, cyanophycin and sulphur inclusions. Bacterial endospores: Structure, biochemistry and genetics of sporulation. General account on Mycoplasma and Actinobacteria.		
Unit III	Algae, Fungi and Protozoa: General characteristics, Classification, Structure and Reproduction of Algae: Chlorophyta (Green algae), Diatoms, Rhodophyta (Red algae), Fungi: Cell wall – chemical composition and functions, membranes and their functions, nutritional strategies of fungi. Structure and life cycle of fungi Ascomycetes (<i>Aspergillus</i>), Zygomycetes (<i>Mucor</i>), Basidiomycetes (<i>Agaricus</i>) and Protozoa		
Unit IV	Viruses: Discovery, distinctive properties, morphology and ultra-structure of Virus, Classification, Cultivation and Purification assay of virus. Bacteriophages - structural organization and life cycle - lytic, lysogenic. Viral related agents - viroid and prion.		
Unit V	Types of media and Microscopy: Types of growth media (natural, synthetic, complex, enriched and selective media). Preservation and Maintenance of Microbial Cultures: Routine methods, liquid nitrogen preservation, freeze-drying (lyophilization) and etc. Principle and application of bright field, dark field, phase contrast, fluorescence, electron microscope- TEM and SEM, Polarized Microscope and Confocal Microscopy.		
Reference and Textbooks:-			
<p>Atlas, R.A., & Bartha, R., (2000). <i>Microbial Ecology, Fundamentals and Application</i>. New York: Benjamin Cummings.</p> <p>Aneja, K.R. (2008). <i>A textbook of basic and applied microbiology</i>. New Age International.</p> <p>Baker. (2012). <i>BIOS Instant Notes in Microbiology</i> (4th ed). Taylor & Francis.</p> <p>Heritage, (2012). <i>Introductory microbiology</i>, Cambridge: Cambridge University Press</p> <p>Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms</i> (12th ed). New Jersey: Prentice Hall.</p> <p>Pelczar, M.J., Schan, E.C. and Kreig, N.R. (2010). <i>Microbiology: An Application Based Approach</i>. Tata McGraw Hill Education Private Limited.</p> <p>Prescott, Joanne Willey, Linda Sherwood, & Christopher, J.W., (2017). <i>Microbiology</i> (10th ed). New York: McGraw Hill.</p> <p>Stanier, R.Y., Ingraham, J. L., Wheelis, M.L., & Painter, R.R., (1986). <i>General Microbiology</i> (5th ed). London: Macmillan.</p> <p>Stryer, L. (2019). <i>Biochemistry</i> (9th ed). New York: W.H. Freeman and Company.</p> <p>Tortora G.J., Funke, B.R. and Case, C.L. (2009). <i>Microbiology</i> (9th ed). Noida: Dorling Kindersely (India) Pvt. Ltd.</p>			
Outcomes	<ul style="list-style-type: none"> ➤ Knowledge on historical perspectives of Microbiology ➤ Basic knowledge on different structure of microbes ➤ Ideas on different type of microscope 		

Name of the Course Teacher: T. Kavitha

Semester - I			
Course code: 530102	Microbial Biochemistry	Credits:4	Hours/week: 6
Objectives	<ul style="list-style-type: none"> ➤ To know the structural organization of bio-molecules ➤ To learn the characteristics of nucleic acids, enzymes and vitamins ➤ To acquire knowledge on secondary metabolites 		
Unit -I	<p>Carbohydrates: Classification, Structure and properties of monosaccharides and disaccharides. polysaccharides - starch, cellulose, agar- agar and peptidoglycan. Metabolism and its regulation: Gluconeogenesis, glycolysis, kreb's cycle, pentose phosphate pathway or hexose mono phosphate shunt, glyoxylate cycle and Entner Doudroff pathway.</p>		
Unit-II	<p>Amino acid and proteins: Classification based on structure, polarity, biological importance and reactivity. Physical properties and chemical reaction. Biosynthesis and degradation of amino acids– an overall view. Protein: Classification, physical and chemical properties. Structure – Primary (peptide conformation, N- and C- terminal, peptide cleavage), Secondary (α-helix, sheet, random coil, Ramachandran plot), Tertiary and Quaternary structures of proteins.</p>		
Unit III	<p>Lipids and fatty acids: Classification, structure, properties and functions. Phospholipid and cholesterol synthesis in <i>E.coli</i>. Metabolism - α, β and γ oxidation of fatty acids and lipid peroxidation Nucleic acids: Structure, synthesis (de novo and salvage) and degradation of purines and pyrimidines.</p>		
Unit IV	<p>Enzymes and Vitamins: Classification, chemical nature and properties. Factors affecting enzyme activity, Active site, Enzyme inhibition- Reversible, irreversible, allosteric inhibition, enzyme specificity, co-enzymes, Mechanism of enzyme action- Lock and key model, induced fit theory. Isozyme, ribozyme and abzyme. Vitamins – Properties of Vitamins. Vitamins as Co – factors and Co – enzymes.</p>		
Unit V	<p>Secondary Metabolites: Antibiotics – Classification based upon mode of action. Biosynthesis and regulation of penicillin and streptomycin. Microbial pigments – Biosynthesis of Chlorophyll. Microbial Toxins – <i>Salmonella</i> toxin, Cholera toxin, Botulism toxin and Aflatoxin.</p>		
References and Textbooks:			
Chen, C., Yaming XI. (2017). <i>Biochemistry</i> , Medtech Publisher			
Devlin, T.M. (1982). Devlin: <i>Textbook of Biochemistry</i> – With Clinical Correlations, John Wiley & Sons.			
Donald Voet and Judith G. Voet, (2011). <i>Biochemistry (3rd ed)</i> . John Wiley and Sons, Inc. New York.			
Lehninger A.L. (2015). <i>Biochemistry</i> , Kalyani Publishers			
Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms (12th ed)</i> . New Jerry: Prentice Hall.			
Moat, A.G. and Foster, W. (2002). <i>Microbial Physiology (4th ed)</i> . New York: John Wiley and Sons.			
Satyanarayana, U. and Chakrapani, U. (2013). <i>Biochemistry (4th ed)</i> . Kolkata: Book and Allied Pvt. Ltd.			
Sriharsha, S.N. (2018). <i>Industrial Biochemistry</i> , Akshaya Publication.			
Stryer, L. (2010). <i>Biochemistry (7th ed)</i> . New York: W.H. Freeman and Company.			
Veer Bala Rastogi, K.R. Aneja, (2017). <i>Principles of Biochemistry (5th ed)</i> . Bengaluru: Medtech.			
Outcomes	<ul style="list-style-type: none"> ➤ Knowledge on metabolism of biomolecules ➤ General Information about nucleic acids, enzymes and vitamins ➤ Clear idea on secondary metabolites and their biosynthetic pathways. 		

Name of the Course Teacher: Dr. T. Sathiamoorthi

Semester - I			
Course code: 530103	Microbial Physiology	Credits:5	Hours: 5
Objectives	<ul style="list-style-type: none"> ➤ To develop a sufficient background to students about the growth of Microbes ➤ To learn about the microbial metabolism ➤ To acquire knowledge on microbial stress response 		
Unit –I	Growth of Bacteria: Phases of growth. Growth kinetics - batch culture, continuous culture and synchronous culture - induction of synchrony. Factors affecting growth - nutrition, aeration, temperature and pH. Physiological adaptation to extreme environmental conditions. Nutritional types and metabolic diversity - types based on carbon, energy and electron sources.		
Unit-II	Bacterial Photosynthesis: Historical background. General types of microbial photosynthesis - oxygenic and anoxygenic. Structure of photosynthetic pigments – chlorophylls, bacteriochlorophyll, carotenoids and phycobilins. Photosynthetic bacteria - green sulphur and purple. Mechanism of photosynthesis - non-cyclic and cyclic electron transport. Photo phosphorylation. Carbon assimilation - Calvin, reverse citric acid cycle and hydroxyl propionate cycle.		
Unit III	Nitrogen metabolism: Nitrogen cycle - ammonification, nitrification, denitrification and nitrogen fixation. Nitrogenase enzyme, physiology of nitrogen fixation in symbiotic and free-living bacteria. Genetics of nitrogen fixation, acetylene reduction assay. Transamination and deamination.		
Unit IV	Microbial stress responses - osmotic stress and osmoregulation; aerobic to anaerobic transitions; oxidative stress; pH stress; acid tolerance; thermal stress, heat shock response; nutrient stress and starvation stress. Fermentative pathways in specific group of microbes: alcoholic, lactic acid, formic, mixed, propionic, butyric, butanol, butanediol fermentation. Anaerobic respiration.		
Unit V	Bioenergetics: Principles and laws of thermodynamics. Coupling of chemical reactions - TCA cycle, electron transport chain, and chemiosmotic theory of Mitchell. Bio membranes: Fluid mosaic model, transport across membrane - diffusion, osmosis, active transport and group translocation.		
Reference and Textbooks:-			
<p>Atlas, R.M. (1995). <i>Principles of Microbiology</i>. New York: Macmillan Publish Company.</p> <p>Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms</i> (12th ed). New Jerry: Prentice Hall.</p> <p>Moat, A.G. and Foster, W.(2002). <i>Microbial Physiology</i> (4th ed). New York: John Wiley and Sons.</p> <p>Postgate, J. (1998). <i>Nitrogen Fixation</i> (3rd ed). Cambridge: Cambridge University Press.</p> <p>Prescott, Joanne Willey, Linda Sherwood, Christopher J. and Woolverton. (2017). <i>Microbiology</i> (10th ed). New York: McGraw Hill.</p> <p>Rustogi, M. (2016). <i>Bacterial Metabolism</i>, Bengaluru: Medtec Publisher</p> <p>Satyanarayana, U. and Chakrapani, U. (2013). <i>Biochemistry</i> (4th ed). Kolkata: Book and Allied Pvt. Ltd.</p> <p>Srivastava, M.L. (2008). <i>Microbial Biochemistry</i>. New Delhi: Narosa Publishing House.</p> <p>Stryer, L. (2019). <i>Biochemistry</i> (9th ed). New York: W.H. Freeman and Company.</p> <p>Subbarao, N.S. (2017). <i>Soil Microbiology</i>. Bengaluru: Medtec Publisher.</p>			
Outcomes	<ul style="list-style-type: none"> ➤ Knowledge on growth of Microbes ➤ General Information about the microbial metabolism ➤ Clear idea on energy production in microbial cell. 		

Name of the Course Teacher: Dr. A. Arun

Semester - I			
Course code: 530104	Lab in General Microbiology, Microbial Biochemistry and Microbial Physiology	Credits:4	Hours: 8
Objectives	<ul style="list-style-type: none"> ➤ To familiarize on basic microbiology techniques ➤ To learn the basic microbial biochemistry methods ➤ To know about the effect of environmental conditions on microbes 		
<ol style="list-style-type: none"> 1. Principle and methods of sterilization 2. Preparation of media: nutrient broth, nutrient agar plate, soft agar. 3. Pure culture techniques: streak plate, spread plate and pour plate. 4. Motility determination – Hanging drop method. 5. Isolation and enumeration of bacteria from different environmental samples. 6. Enumeration of bacteria - viable count (plate count) and total count (Haemocytometer count) 7. Direct microscopic observation of fungal spores and mycelium 8. Staining method: simple, negative, Gram's staining and spore staining. 9. Determination of microbial size by micrometry 10. Fungal slide culture. 11. Measurement of growth rate and generation time by turbidometry method. 12. pH metry - Preparation of buffer 13. UV visible spectrophotometry - Wavelength scan. 14. Chromatography <ul style="list-style-type: none"> - Paper chromatography – circular. - Thin layer chromatography - separation of amino acid. 15. Carbohydrates:Quantitative estimation of glucose and glycogen from bacterial and yeast cell. 16. Protein:Quantitative estimation of protein from bacterial yeast cell. 17. Enzyme:Estimation of alkaline phosphatase activity. 18. Environmental factor: <ul style="list-style-type: none"> - Effect of temperature on bacterial growth. - Effect of pH on bacterial growth. 19. Physiological groupings of bacteria. <ul style="list-style-type: none"> - Isolation of saccharophilic microorganisms (starch hydrolysis). - Proteolytic activity of microorganisms (casein and gelatin hydrolysis). - Lipolytic activity of microorganisms. 20. Utilization of Unusual compounds: <ul style="list-style-type: none"> - Microbial degradation of azodyes 21. Bioenergetics. <ul style="list-style-type: none"> - Cytochrome oxidase assay. - Catalase assay. 22. Nitrogen metabolism. <ul style="list-style-type: none"> - Nitrate reduction test. 			
Reference and Textbooks:-			
Aneja, K.R. (2003). <i>Experiments in Microbiology: Plant Pathology and Tissue Culture</i> , New Delhi: Wishwa Prakashan.			
Aneja, K.N. (2018). <i>Lab Manual of Microbiology and Biotechnology</i> , Medtec Publisher			
Cappuccino, J.H. and Sherman, N. (2014). <i>Microbiology – A Lab Manual (10th ed)</i> . Singapore: The Benjamin Publishing Company.			
David, T. Plummer, (1992). <i>An introduction to practical Biochemistry (3rd ed)</i> . New Delhi: Tata McGraw Hill publishing Com. Ltd.			
Gunasekaran, P. (1995). <i>Laboratory Manual in Microbiology</i> . New Delhi: New Age International (P) Ltd. Publishers.			
Jayaraman, J. (1981). <i>Laboratory Manual in Biochemistry</i> . New Delhi: New Age International (Pvt.) Ltd. Publishers.			
Gold man, E and Green, H.(2008) . Practical handbook of microbiology. CRC press			
Palanivel, P. (2009). <i>Laboratory Manual for Analytical Biochemistry & Separation Techniques</i> . (4 th			

<p>ed). School of Biotechnology, Madurai Kamaraj University, Madurai.</p> <p>Reddy, C. A., Beveridge, T. J., Breznak, J. A., Marzluf, G. A., Schmidt, T. M., & Snyder L. R. (2007). <i>Methods for General and Molecular Microbiology (3rd ed)</i>. Washington: American Society for Microbiology.</p> <p>Trivedi, R. (2016). <i>Practical Mannual in Microbial Physiology and Industrial Microbiology</i>. New Delhi: SSDN Publishers.</p>	
Outcomes	<ul style="list-style-type: none"> ➤ Expertise in basic techniques of microbiology and biochemistry. ➤ Knowledge in the analysis and estimation of bio – molecules. ➤ Able to carry out microbial techniques.

Name of the Course Teacher: Dr. T. Kavitha

Semester - I			
Course code: 530501	Molecular Biology	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To extend the knowledge on the structure and functions of genetic materials ➤ To focus on genome organization, transcription and translation process in prokaryotes. ➤ To understand the principles of oncogenes 		
Unit –I	Discovery of DNA. Molecular basis of DNA as genetic material. Structure of DNA – A, B and Z form. Forms of DNA – DNA heteroduplex, circular, super helical DNA, twisted circle. Properties of DNA - denaturation, renaturation, melting curve, hyperchromicity. Structure of RNA. Types of RNA - tRNA, mRNA and rRNA.		
Unit-II	Replication of DNA - semi conservative mode, Meselson - Stahl experiment. Enzymology of DNA replication - DNA polymerase I, II and III; topoisomerase I and II; helicase; primase and gyrase. Molecular mechanism of DNA replication. Replication fork, origin and okazaki fragments. Types of replication - circular and theta.		
Unit III	Transcription process in Prokaryotes: Initiation - promoters, upstream and downstream sequences, transcription factors; Elongation - RNA polymerase, sub units; Termination - Rho dependent and Rho independent; nus A protein and antitermination. RNA processing (post transcriptional modifications), inhibitors of transcription. Reverse transcription.		
Unit IV	Genetic code: Elucidation of triplet code, code characteristics and codon dictionary. Reading frames, sense and nonsense code. Degeneracy - wobble hypothesis, universality of genetic code. Process of translation in prokaryotes: Initiation and Termination. Role of rRNA in protein synthesis. Post translational modifications - post translational transport. signal hypothesis.		
Unit V	Tumor viruses and oncogenes: Transformed cells, detection of integral viral DNA, structure of integral viral DNA. Protein kinase and transformation by retro viruses. Cellular counterpart of src. Carcinogens. Activation of oncogenes. Oncogenic proteins - protein kinases, growth factors, ras protein. Transformation protein in DNA viruses.		
Reference and Textbooks:-			
Benjamin Lewin. (2007). <i>Genes XI</i> . New York: Oxford University Press.			
Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. (2008). <i>Molecular Biology of the Cell (5th ed)</i> . Garland Science.			
David Freifelder. D. (2008). <i>Microbial Genetics (18th ed)</i> . NewDelhi: Narosa Publishing House.			
Freifelder, D. (2000). <i>Molecular Biology (2nd ed)</i> . NewDelhi: Narosa Publishing house.			
Jeyanthi, G.P. (2009). <i>Molecular Biology</i> . Chennai: MJP Publishers.			
Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A. M. (2013). <i>Molecular Biology of the Gene (17th ed)</i> . Tokyo: The Benjamin Cummings Publishing Company Inc.			
Veer Bala Rastogi. (2016). <i>Principles of molecular biology</i> . Medtech Publishers.			
Russel, P. (2009). <i>Genetics: A Molecular Approach</i> . India: Pearson Education.			
Stanley R. Maloy, John E.C. and Freifelder, D. (2008). <i>Microbial Genetics</i> . New Delhi: Narosa Publishing House.			
Stryer, L. (2019). <i>Biochemistry (9th ed)</i> . New York: W.H. Freeman and Company.			
Outcomes	<ul style="list-style-type: none"> ➤ Receive elaborate knowledge on nucleic acids ➤ Better understanding of gene expressions ➤ Get thorough knowledge on tumour viruses and oncogenes 		

Name of the Course Teacher: Dr. A. Arun

Semester - I			
Course code: 530502	Microbial Diversity and Taxonomy	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To understand the ubiquitous nature of microbes ➤ To give basic knowledge on extremophiles ➤ To provide knowledge on characteristics of Microbes. 		
Unit -I	Discovery of microbial world: History, scope and relevance of microbiology. Current thoughts on microbial evolution including the origin of life. Introduction to microbial biodiversity – distribution, abundance, ecological niche of bacterial, archaeal and Eukaryal. Prokaryotic diversity: The archaea – phylogenetic overview. Euryarcheota – extremely halophilic archaea, taxonomy and physiology of halophilic archaea. Methane producing archaea: methanogens – diversity and physiology. Thermo plasmatales–thermo plasma. Hyper thermophilic euryarcheota: <i>Thermo coccales</i> and <i>Methano pyrus</i> .		
Unit-II	Crenarcheota: Habitat and energy metabolism, cold dwelling microbes (arctic and antarctic regions), hyperthermophiles – terrestrial, volcanic habitats –sulfolobales and thermo proteales. Evolution and life at high temperature – heat stability of biomolecules, DNA stability, lipid stability. Limits to microbial existence.		
Unit III	Systematics, occurrence, diversity, characteristic features and significance : Spirochaetes - aerobic / microaerophilic motile, helical / vibrioid - non motile gram negative curved bacteria - gram negative aerobic rod and cocci - facultative anaerobic gram negative rod - anaerobic gram negative straight, curved & helical rods - sulfur reducing bacteria - anaerobic gram negative cocci - rickettsias and chlamydias – mycoplasmas - endosymbionts.		
Unit IV	Diversity- characteristic features and significance: Major Characteristics used in taxonomy. Gram positive cocci - endospore forming; Gram positive rod and cocci-regular; non-sporing; gram positive rod – Irregular, non-sporing– Mycobacteria – <i>Nocardio formis</i> . Anoxygenic phototrophic bacteria, oxygenic photosynthetic bacteria, Nitrogen fixers, Nitrifying / Denitrifying bacteria. Aerobic chemo lithotrophic bacteria – budding and appendaged bacteria, sheathed bacteria, non-photosynthetic bacteria - Myxobacteria – Archea bacteria.		
Unit V	Diversity, characteristic features and significance: Nocardioform actinomycetes – actinomycetes with multilocular sporangia – actinoplanets – Streptomyces and related genera – Maduromycetes – Micromonospora - Thermonospora and related genera – Thermoactinomycetes – other genera. Fungi (general structure, nutrition and reproduction); Diversity of endo and ecto mycorrhizal fungi. Biology of arbuscular mycorrhizal fungi: signalling, penetration and colonization inside roots. Culturing and benefits, recent advances in the field of mycorrhiza. Algae: ultra-structure of algal cell, nutrition, algal reproduction.		
Reference and Textbooks:-			
Atlas, R.M. (2000). <i>Microbiology Fundamentals and Application</i> , New York: Macmillan Publishing Company.			
Booth, S.J. (2009). <i>Microbiology: Pearls of Wisdom</i> , Jones and Bartlett Publishers.			
Dubey, R.C. and Maheswari, D.K. (2013). <i>A text book of Microbiology</i> (Revised). New Delhi: S. Chand and Company Ltd.			
Kreig, N.R. (1984). <i>Bergeys Manual of Systematic Bacteriology Vol I: Sneath, P.H.A., Ed 1986, Vol II: Staley, J.T. Ed., 1989. Vol III, William, S.T., Ed., 1989, Vol IV.</i> Baltimore: William and William.			
Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms (12th ed)</i> . New Jersey: Prentice Hall.			
Nina Parker, Mark Schneegurt, Anh-Hue Thi Tu, Brian M. Forster, Philip Lister. (2016). <i>Microbiology</i> . Washington: American Society for Microbiology.			
Pelczar, M.J., Schan, E.C. and Kreig, N.R. (2010). <i>Microbiology – An application based approach (5th ed)</i> . New Delhi: Tata McGraw Hill Publishing Company Limited.			

<p>Prescott, Joanne Willey, Linda Sherwood, Christopher J. Woolverton. (2017). <i>Microbiology (10th ed)</i>. New York: McGraw Hill.</p> <p>Schlegel, H.G. (1995). <i>General Microbiology (7th ed)</i>. Cambridge: Cambridge Univeristy Press.</p> <p>Tortora G.J., Funke, B.R.and Case, C.L. (2010). <i>Microbiology, (10th ed)</i>. Noida: San Francisco, CA Pearson Benjamin Cummings, Dorling Kindersely (India) Pvt. Ltd.</p>	
Outcomes	<ul style="list-style-type: none"> ➤ Students able to differentiate various groups of Microbes ➤ Get knowledge on adaptability of extremophiles ➤ Knowledge about microbial taxonomy.

Name of the Course Teacher: Dr. T. Kavitha

Semester - II			
Course code: 530201	Microbial Genetics	Credits:5	Hours: 5
Objectives	<ul style="list-style-type: none"> ➤ To extend the knowledge on molecular basis of mutation at microbial level ➤ To focus on gene regulation and expression mechanisms ➤ To understand the principle role of plasmids and gene transfer methods 		
Unit –I	Origin of mutation. Biochemical basis of mutation: Spontaneous mutation – random and non – adaptive mutation. mutation rates. Origin of spontaneous mutation – isolation of mutants. Selection of bacterial variation: Direct - fluctuation test, indirect - replica plating. Mutagenesis and mutagenic agents. Detection of mutagen - Ames test, <i>in vitro</i> mutagenesis. Molecular basis of mutation.		
Unit-II	DNA damage and repair: DNA damages, hit theory, UV radiation. DNA repair: post irradiation effects on survival levels - photo reactivation, liquid holding recovery. Biochemical repair mechanism: excision, recombination and SOS repair.		
Unit III	Gene concept - regulation of bacterial gene expression. Lactose system - coordinate regulation, Lac components, positive and negative regulation, catabolite repression. Tryptophan operon – regulation and attenuation. Arabinose operon and its regulation.		
Unit IV	Plasmids: Types of plasmids - F, R and Col plasmids. Properties of plasmids – sex factors, drug resistant, colicinogenic, <i>Agrobacterium</i> Ti and broad host range plasmid. Detection and purification of plasmid DNA. Transfer of plasmid DNA. Replication of plasmid. Control of copy number, plasmid amplification, curing and incompatibility.		
Unit V	Gene transfer and recombination: Transformation. Conjugation. Transduction: DNA generalized and specialized transduction, Recombination: Types - homologous or general, site specific and random recombination, general recombination between homologous DNA- Holliday model, double strand model of general recombination, enzymes involved in recombination rec - proteins.		
Reference and Textbooks:-			
<p>Benjamin Lewin. (2007). <i>Genes XI</i>. New York: Oxford University Press.</p> <p>Cummings, M.R., Klug, W.S. (1995). <i>Essentials of Genetics (9th ed)</i>. Pearson Publisher.</p> <p>David Freifelder. D. (2008). <i>Microbial Genetics (18th ed)</i>. New Delhi: Narosa Publishing House.</p> <p>Freifelder, D. (2000). <i>Molecular Biology (2nd ed)</i>. New Delhi: Narosa Publishing house.</p> <p>Glick, B.K. and Pasternak, J.J. (2010). <i>Molecular Biotechnology: Principles and Applications of Recombinant DNA (4th ed)</i> Washington: ASM Press.</p> <p>Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A. M. (2013). <i>Molecular Biology of the Gene (17th ed)</i>. Tokyo: The Benjamin Cummings Publishing Company Inc.</p> <p>Sambamurty, A. V. S. S. (2007). <i>Molecular Genetics</i>. Narosa Publication.</p> <p>Sanders, M.F. and Bowman, J.L. (2018). <i>Genetic Analysis: An Integrated Approach</i>. Pearson Publisher.</p> <p>Stanley R. Maloy, John E.C. and Freifelder, D. (2008). <i>Microbial Genetics</i>. New Delhi: Narosa Publishing House.</p> <p>Stryer, L. (2019). <i>Biochemistry (9th ed)</i>. New York: W.H. Freeman and Company.</p>			
Outcomes	<ul style="list-style-type: none"> ➤ Receive elaborate knowledge on mutation ➤ Better understanding about gene regulation ➤ Get thorough knowledge on gene transfer mechanisms in microbes. 		

Name of the Course Teacher: Dr. A. Arun

Semester - II			
Course code: 530202	r DNA technology	Credits:5	Hours: 5
Objectives	<ul style="list-style-type: none"> ➤ To learn about the various enzymes involved in r DNA Technology ➤ To know the principles of c DNA construction and amplification methods. ➤ Making aware of synthesis of recombinant products 		
Unit -I	DNA modifying enzymes : Polymerases, restriction endonucleases, polynucleotide kinase, terminal deoxy nucleotidyl transferase, DNase, Methylase, phosphatases, ligases. cloning vectors – plasmids, cosmids, phasmids, phagemids, expression vectors, plasmid vectors – p ^{BR} 322 and p ^{UC} 18, integrating shuttle vector –YAC vectors, viral vector – SV 40 and adeno virus. Lac Z promoter – expression system – Lambda, PL / PR Promoter, T ⁷ promoter, Sp6 promoter, SV – 40 promoter, CaMV 35s promoter.		
Unit-II	Cloning methodologies : α complementation, sticky and blunt end cloning. Cloning from mRNA – synthesis of cDNA, cloning cDNA– cDNA library. Cloning from genomic DNA – genomic library. Shot gun cloning. Screening of recombinant – phenotypic expression of characters – Blotting techniques – western, northern and southern. Mapping of human genes – Human genome project.		
Unit III	PCR : gene amplification, primer designing, optimization, variation in the PCR (RAPD, RFLP, RACE, RT-PCR) DNA sequencing – Sanger – Coulsen’s method, Maxam Gilbert’s method, automated sequencing and micro array.		
Unit IV	Cloning : human insulin, interferon in <i>E.coli</i> . Recombinant vaccine development – HBs Ag in yeast. Cloning for commercial production of antibiotics (Penicillin). Bio steroid transformation. Production of biopolymers – Xanthumgum. Melanin biosynthesis in <i>E.coli</i> , adhesive biopolymer in yeast.		
Unit V	Gene silencing and antisense technology : Types and mechanism of gene silencing. Genetic factors of silencing, formation of antisense mRNA, inhibition of gene expression by antisense RNA. Gene silencing in crop plants: tomato. Si RNA and disease control. Plant genetic engineering: Ti plasmid, CaMV vector, Direct DNA delivery methods – micro projectile bombardment, microinjection, electroporation. liposome mediated gene transfer and DNA/calcium phosphate co-precipitate method. Gene therapy		
Reference and Textbooks:-			
Brown, T.A. (2006). <i>Gene Cloning and DNA Analysis: An Introduction (5th ed)</i> . Oxford: Blackwell Publishing.			
Glick, B.K. and Pasternak, J.J. (2010). <i>Molecular Biotechnology: Principles and Applications of Recombinat DNA (4th ed)</i> . Washington: ASM Press.			
Hammong, J., Mc Garvey, P. and Springer, V.Y. (2000). <i>Plant Biotechnology</i> .			
Lewin, B. (2000). <i>Genes VII</i> , UK: Oxford University Press.			
Primrose, S.B. and Twyman, R.M. (2016). <i>Principles of Gene manipulation and Genomics (18th ed)</i> . UK: Blackwell publishing.			
Stryer, L. (2019). <i>Biochemistry (9th ed)</i> . New York: W.H. Freeman and Company.			
Susan, R.B.(2008). <i>Biotechnology</i> , New Delhi: Cengage Learning Pvt. Ltd.			
Thieman, W.J. and Palladino, M.A. (2009). <i>Introduction to Biotechnology</i> , Noida: Dorling Kindersley India Pvt. Ltd.			
Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A. M. (2013). <i>Molecular Biology of the Gene (7th ed)</i> . Tokyo: The Benjamin Cummings Publishing Company Inc.			
Veer Bala Rastogi, (2016). <i>Principles of molecular biology</i> . Medtech Publishers			
Outcomes	<ul style="list-style-type: none"> ➤ Students come out with basic ideas on cloning vehicle ➤ Enable them to know about c DNA and amplification products. ➤ Familiar in the construction of recombinant DNA. 		

Name of the Course Teacher: Dr. T. Kavitha

Semester - II			
Course code: 530203	Food Microbiology	Credits:5	Hours/week: 5
Objectives	<ul style="list-style-type: none"> ➤ To learn about food spoilage factors ➤ To know the preservation methods ➤ To make aware of food borne disease 		
Unit -I	History and development of Food microbiology Role, and Significance of Microorganisms in Foods, Outline of food spoilage and preservation, Food safety and microbiological Quality Assurance. Micro-organisms and Food Materials-Diversity of Habitat, Micro-organisms in the Atmosphere - Airborne Bacteria, Airborne Fungi, Micro-organisms of Soil, Micro-organisms of Water, Micro-organisms of Plants, Micro-organisms of Animal Origin.		
Unit-II	Factors Affecting the Growth and Survival of Micro-organisms in Foods. - Microbial Growth, Intrinsic Factors- Nutrient Content, pH and Buffering Capacity, Redox Potential, Antimicrobial Barriers and Constituents, Water Activity and Extrinsic Factors - Relative Humidity, Temperature and Gaseous Atmosphere		
Unit III	Microbiology of Food Preservation - Heat Processing, Irradiation, High-pressure Processing – Pascalization, Low-temperature Storage and Chemical Preservatives. Aseptic Packaging, Mano-thermo-sonication, Microbiological quality standards of food, FDA, HACCP, ISI, AGMARK.		
Unit IV	Production of fermented dairy products: Cheese, yoghurt, butter milk, sour cream Fermented vegetables; Sauerkraut, pickles, olives and soy sauce. Fermented meat and Fermented Indian foods.		
Unit V	Microbial spoilage of food: Fruit and vegetables. Spoilage of cereal and cereal products – cereal grains, and bread. Spoilage of meat and meat products – Bacon and Ham. Spoilage of milk and milk products – butter and frozen desserts. Spoilage of canned foods. Food borne diseases – indicators of pathogens and food poisoning.		
Reference and Textbooks:-			
Adams, M.R. and Moss, M.O. (2008). <i>Food Microbiology</i> . UK: RSC Publishing, Cambridge.			
Aneja, K.N. (2018). <i>Modern Food Microbiology</i> , Medtec Publisher.			
Bhatnagar, R. (2017). <i>Food Microbiology</i> , Crescent Publishing Corporation.			
Blackburn C. de W. (2006), <i>Food spoilage microorganisms</i> . UK: Woodhead Publishing, Cambridge			
Deak, T. and Beuchat, L.R. (1996). <i>Hand Book of Food Spoilage yeasts</i> , CRC			
Dick M. (2017). <i>Food Microbiology An Introduction</i> (2 nd ed). Bengaluru: Medtech.			
Frazier, W.C., and Westhoff, D.C. (1988). <i>Food Microbiology</i> (Reprint 1995). New Delhi: Tata McGraw Hill Publishing Ltd.			
Jay J.M. (2000). <i>Modern Food Microbiology</i> (6 th ed). New York: Chapman & Hall.			
Prescott, L.M., Harley, J.P. and Helin, D.A. (2008). <i>Microbiology</i> (5 th ed). New York: McGraw Hill.			
Foster W. M. <i>Food Microbiology</i> , CBS Publication			
Outcomes	<ul style="list-style-type: none"> ➤ Better understanding of cause of microbes in food spoilage ➤ Get information regarding food preservation techniques ➤ Enable them to work food fermentation industries 		

Name of the Course Teacher: Dr. T. Sathiamoorthi

Semester - II			
Course code: 530204	Lab in Microbial Genetics, r DNA technology and Food	Credits: 4	Hours: 8
Objectives	<ul style="list-style-type: none"> ➤ To impart knowledge on the isolation and estimation of nucleic acids ➤ To practice the students in rDNA technology ➤ To make them expert in food Microbiology 		
<ol style="list-style-type: none"> 1. Isolation of genomic DNA from bacteria. 2. Isolation of genomic DNA from yeast. 3. Isolation of plasmid DNA from bacteria. 4. Extraction of total RNA from bacteria and yeast 5. Estimation of nucleic acids <ol style="list-style-type: none"> a) UV - VIS spectrophotometer analysis. b) Analysis of nucleic acids by agarose gel electrophoresis. 6. Detection of proteins by SDS-PAGE. 7. Determination percentage of killing of bacterial cells by UV rays. 8. Plotting of UV survival curve. 9. Reversion of auxotroph. 10. Isolation of streptomycin resistant mutants using gradient plate technique. 11. AMES test. 12. Isolation of auxotrophic mutant. 13. Uninterrupted bacterial conjugation. 14. Isolation of phage from septic tank. 15. P1 Transduction. 16. Isolation of p^{BR} 322/ p bluescript by alkaline detergent method - A miniprep procedure 17. Recovery of DNA from gels. 18. Acrylamide gel electrophoresis and silver staining of digested plasmid. 19. Cloning of DNA fragment in p^{BR}322/pbluescript – insertion inactivation/ blue white selection. 20. Viable count of bacteria in milk. 21. Methylene Blue Dye reduction test. 22. Resazurin dye reduction test. 23. Phosphatase test. 24. Litmus milk reactions. 25. Potability analysis of drinking water. 			
Reference and Textbooks:-			
<p>Aneja, K.R. (2003). <i>Experiments in Microbiology: Plant Pathology and Tissue Culture</i>. New Delhi: Wishwa Prakashan.</p> <p>Ausubel, F.M., Roger, B., Robert E. Kingston, David A. Moore, Seidman J.G., John A. Smith. and Kelvin, S. (1992). <i>Short Protocols in Molecular Biology</i> (3rd ed). New York: John Wiley & Sons Inc.</p> <p>Berger, S.L. and Kimmel, R. (1987). <i>Guide to Molecular Cloning Techniques</i>. New York: Academic Press, Inc.</p> <p>Brown, T.A. (1998). <i>Molecular Biology Lab Fax 11 Gene Analysis</i>. London: Academic Press.</p> <p>Cappuccino, J.H. and Sherman, N. (2007). <i>Microbiology – A Lab Manual</i> (7th ed). Singapore: The Benjamin Publishing Company.</p> <p>Malov, S.R. (1990). <i>Experimental Techniques in Bacterial Genetics</i>. Boston: Jones and Bartlett Publishers.</p> <p>Miller, J.H. (1992). <i>A Short Course in Bacterial Genetics: A Lab Manual & Hand Book for E. coli and related Bacteria</i>. Cold Spring Harbour: Cold spring Harbor Lab press.</p> <p>Palanivel, P. (2000). <i>Laboratory Manual for Analytical Biochemistry & Separation Techniques</i>. School of Biotechnology, Madurai Kamaraj University, Madurai.</p> <p>Sambrook, I., Fritsch, E.F. and Maniatis, T. (2001). <i>Molecular Cloning 1, 2, 3 - A Laboratory Manual</i> (3rd ed). USA: Cold Spring Laboratory Press.</p>			

Verma, A.S., Surajit, D and Anchal, S. (2014). <i>Laboratory Manual for Biotechnology</i> . New Delhi: S. Chand and Company Ltd.	
Outcomes	<ul style="list-style-type: none">➤ Trained in isolation of nucleic acids➤ Become familiar in rDNA technology➤ Expertise in food Microbiology

Name of the Course Teacher: Dr. A. Arun

Semester - II			
Course code:530503	Agriculture and Environmental Microbiology	Credits: 4	Hours/week: 4
Objectives	<ul style="list-style-type: none"> ➤ To create awareness on soil Microbiology ➤ To give knowledge on plant pathogen interaction and its control ➤ To inculcate on environmental microbiology 		
Unit -I	Diversity and distribution of microorganisms in soil; Soil Microflora- Bacteria, Fungi and Actinomycetes. Classification, physical, chemical properties and structure of soil. Microbial interactions - mutualism, synergism, commensalism, amensalism, parasitism, predation and competition. Microbial interactions with plants –phylosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, <i>Rhizobium</i> , <i>Frankia</i> , <i>Azospirillum</i> , <i>Azotobacter</i> , Cyanobacteria, Phospho bacteria and <i>Azolla</i> .		
Unit-II	Bacterial diseases of agricultural crops - pathogens, symptoms, control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. Plant protection – phenolics – phytoalexins and related compounds. Bioinsecticides – viral, bacterial and fungal- a brief note.		
Unit III	Bio-geo chemical cycles in soil – Carbon cycle, Nitrogen cycle – Nitrogen fixation, nitrification, de-nitrification, sulphur, iron and phosphorus cycles. Aerobiology – a brief introduction - droplet nuclei – aerosols - air borne transmission of microbes and diseases and assessment of air quality.		
Unit IV	Aquatic microbiology - factors affecting microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents. Aquatic habitats - freshwater - lakes, ponds and streams; marine habitats - estuaries, deep sea, hydrothermal vents, saltpans, coral reefs and mangroves and their microbial communities; zonation – food chain and food web.		
Unit V	Types of wastes - solid and liquid wastes. Treatment of solid wastes - Thermal Treatment: Incineration, Gasification, Pyrolysis and Open Burning- Dumps and Landfills: Sanitary landfills, Controlled dumps, Bioreactor Landfills- Biological Waste Treatment: Composting, Vermicomposting and termi composting. Treatment of liquid wastes –primary, secondary, tertiary treatment; anaerobic (methanogenesis), aerobic, trickling, activated sludge, oxidation pond. Production of biogas from waste.		
Reference and Textbooks:-			
Alexander M. (1997). <i>Introduction to soil microbiology</i> , New York: John Wiley & Sons, Inc. EcEldowney S., Hardman, D.J. and Waite, S. (1993). <i>Pollution Ecology and Biotreatment</i> . Longman Scientific Technical. Grant, W.D. and Long, P.L. (1981). <i>Environmental Microbiology</i> . Blalckie Glasgow and London. Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). Twelfth Edition, <i>Biology Microorganisms</i> , New Jerry: Prentice Hall. Mark Wheelis, (2010). <i>Principles of Modern Microbiology</i> , New Delhi: Jones & Bartlett India Pvt. Ltd. Mehrotra, R.S. (1983). <i>Plant Pathology</i> , New Delhi: Tata McGraw Hill Publishing Company Ltd. Pandey, B.P. (1997). <i>Plant Pathology (Pathogen & Plant Disease)</i> , New Delhi: S.Chand& Company Ltd. Ray Chadhuri, S.P. (1977). <i>A Manual of Virus Diseases of Tropical Plants</i> , New Delhi: MacMillan Company of India Ltd. Rengaswami, G. and Rajagopalan, S. (1973). <i>Bacterial Plant Pathology</i> . Coimbatore: Tamil Nadu Agriculture University. SubbaRao, N.S. (1995). <i>Soil Microorganisms and Plant Growth</i> (3 rd ed). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.			
Outcomes	<ul style="list-style-type: none"> ➤ Acquire knowledge on soil microbiology ➤ Understand the biogeochemical cycles prevail in environment. ➤ Able to know about principles and techniques in waste treatment. 		

Name of the Course Teacher: Dr. T. Sathiamoorthi

Semester - II			
Course code: 530504	Microbial Ecology	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To create awareness on evolutionary relationship of ecosystem ➤ To learn about individual ecosystem and its interactions. ➤ To understand the concepts of community ecology 		
Unit -I	Introduction microbial ecology:- overview, history and scope of microbial ecology. Population ecology: properties of population–density, natality and fecundity, mortality, longevity and senescence, immigration and emigration. Microbial population ecology – population growth, density dependence and independence, r and k selection. Species concept – universal, biological, phenetical, evolutionary and phylogenetic. Speciation – bacterial, mismatch repair as a speciation mechanism, rapid speciation, operons , genome economization and speciation, hypermutation, genome reduction.		
Unit-II	Concepts of microbial ecology:- definition and terminology, Ecology of individuals – study of individual microorganism, genetic individuals, ramets. ecological individual, niche. Abiotic constraints (temperature, pH, nutrient source, electron acceptor, redox , pressure and light), metapopulation, dispersal, modularity, source and sinks, population ecology of genes. Source of phenotypic and genotypic variation, gene ecology.		
Unit III	Population and spatial stability:- Uniformity of populations, adaptation, population in time. Bacterial communication : Quorum sensing – evolutionary implication of quorum sensing, cell – cell communication in bacteria, quorum sensing and evolution, disruption or manipulation of quorum sensing response, oligotrophic state of nature, starvation survival, ageing, senescence, death, dormancy or resting state and miniaturization.		
Unit IV	Microbial Interactions:- with their physical and chemical environment, Species interaction and processes: Species interaction, proliferation hypothesis. Interactions with the biotic environment: symbiosis, competition, parasitism, predation, Negative relationship – parasitism, predation, bacterial and viral interaction, microbial loop and bacteria as predators. Neutral relationship: positive relationship - metabiosis and symbiosis.		
Unit V	Community ecology:- Water communities - hydrosphere ecology of fresh water, composition and activity of fresh water microbial communities, physical and chemical factors, estuaries and marine water environment; characteristics and stratification of the ocean, composition and activity of marine microbial communities, role of microbes in the aquatic environment and lithosphere. Soil communities - introduction to soil formation, rock and minerals, soil horizon, soil texture, organic matter, chemical properties of soil, soil microbial communities. Biofilm communities, phylogenetics and community ecology.		
Reference and Textbooks:- (APA Format)			
Atlas, R.A. and Bartha, R. (2000). <i>Microbial Ecology, Fundamentals and Application</i> . New York: Benjamin Cummings.			
Dubey, R.C. and Maheswari, D.K. (2013). <i>A text book of Microbiology</i> (Revised). New Delhi: S. Chand and Company Ltd.			
Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms</i> (12 th ed)., New Jerry: Prentice Hall.			
Pelczar, M.J., Schan, E.C. and Kreig, N.R. (2010). <i>Microbiology – An application based approach</i> (5 th ed). New Delhi: Tata McGraw Hill Publishing Company Limited.			
Prescott, L.M., Harley, J.P. and Helin, D.A. (2008). <i>Microbiology</i> (9 th ed). New York: McGraw Hill.			
Saha, T.K. (2010). <i>Ecology and Environmental Biology</i> . Kolkata: Books and Allied Pvt. Ltd.			
Schlegal, H.G. (1995). <i>General Microbiology</i> (7 th ed). Cambridge: Cambridge Univeristy Press.			
Stanier, R., Lingraham, Y., Wheelis, M.L. and Painter, R.P. (1986). <i>General Microbiology</i> (5 th ed). London: Macmillan.			
Tortora G.J., Funke, B.R. and Case, C.L. (2009). <i>Microbiology</i> (9 th ed). Noida: Dorling Kindersely			

(India) Pvt. Ltd. VaunMc Arthur (2009) <i>Microbial Ecology – An Evolutionary approach</i> , Elsevier publications, Academic press.	
Outcomes	<ul style="list-style-type: none"> ➤ Better understanding of evolutionary relationship of ecosystem ➤ Get more knowledge on individual ecology ➤ Able to understand the role of microbes in ecology

Name of the Course Teacher: Dr. V. Balasubramanian

Semester - III			
Course code:530301	Medical Microbiology	Credits: 5	Hours/week: 5
Objectives	<ul style="list-style-type: none"> ➤ To inculcate on the role of normal flora and pathogenic microbes ➤ To understand the pathogenesis of various diseases ➤ To understand the various clinical microbiological techniques. 		
Unit -I	Laboratory management – Safety in containment laboratory. Rules and regulations to be followed in a microbiology laboratory. Collection, transport of clinical samples and laboratory waste disposal system. Microbiological examination of urine, blood, faeces, cerebrospinal fluid, throat swabs, sputum, pus and wound exudates. Normal flora of human systems – skin, respiratory tract, gastrointestinal tract and genitourinary tract. Nosocomial infections.		
Unit-II	Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis and prevention of infections caused by the following organisms: Gram positive cocci – <i>Staphylococci</i> , <i>Streptococci</i> . Gram negative cocci – <i>Gonococci</i> . Gram positive non-spore forming bacilli : aerobic – <i>Corynebacteria</i> and anaerobic- <i>Actinomyces</i> . Gram positive spore forming bacilli : aerobic- <i>Bacillus anthracis</i> and anaerobic <i>Clostridia</i> .		
Unit III	General characters, pathogenesis, laboratory diagnosis and control measures of: Gram negative nonspore forming bacilli : Aerobic- <i>Bordetella</i> . Small gram negative facultative anaerobic bacteria – <i>Yersinia</i> . Enteric gram negative bacilli – <i>Vibrio</i> , <i>E.coli</i> and <i>Salmonella</i> . Acid fast bacteria – <i>M. tuberculosis</i> , <i>M. leprae</i> . Cell wall less bacteria – <i>Mycoplasma</i> . Spirochaetes –Leptospirosis. Sexually transmitted diseases – Syphilis.		
Unit IV	General characteristics, pathogenesis and laboratory diagnosis and control measures of: Yeast – <i>Cryptococcus neoformans</i> . Yeast like fungus – <i>Candida spp.</i> Filamentous fungi – <i>Aspergillus</i> and <i>Penicillium</i> . Dimorphic fungi, yeast morphology, general characteristics and reproduction. – <i>Blastomyces dermatidis</i> . Classification, structure and reproduction of fungi, general characteristics of Intracellular parasites– <i>Cryptosporidium</i> and <i>Plasmodium</i> . Intralumen parasites – <i>Entamoeba histolytica</i> and <i>Ascaris lumbricoides</i> . Parasitic zoonosis– <i>Toxoplasma</i> and <i>Taenia</i>		
Unit V	Morphology, pathogenesis and laboratory diagnosis and control measures of: DNA viruses –Hepatitis B virus. RNA viruses – Flavi virus (dengue), Retrovirus – HIV. Viral zoonosis -rabies. Classification of antibiotics based on mode of action : antibacterial (Penicillin), antiviral (Amantidine), antifungal (Amphotericin) antiparasitic drugs (Quinine and Metraindazole). Infectious diseases- Definition of emerging & re-emerging diseases. Factors contributing to emergence. Examples (Chickungunya, Zika virus, H1N1 and Ebola). National programmes in prevention of infectious diseases.		
Reference and Textbooks:-			
Anathanarayan R and Jeyaram Panikers C.K. (2013). <i>Text Book of Microbiology</i> (9 th ed). New Delhi: Jain book depot.			
Arora D.R., Brij Bala Arora.(2015). <i>Textbook of Microbiology</i> . Chennai: CBS.			
Awetz Melnick and Adelberg's. (2010). <i>Medical Microbiology, 21st Century</i> . Appleton & Lange.			
Bhattacharjee R.N.(2015). <i>Introduction to Microbiology</i> (1 st ed). New Delhi: Kalyani Publishers.			
Connie R Mahon. (2010). <i>Textbook of Diagnostic Microbiology</i> (3 rd ed). Pearson.			
David Greenwood, Richard Slack, John Peutherer. (2012). <i>Medical Microbiology</i> . Churchill Livingstone.			
Jesse Russell, Ronald Cohn. (2012). <i>Medical Microbiology</i> . Book on Demand Ltd.			
Myra Wilkinson. (2011). <i>Medical Microbiology</i> . Scion Publishing Ltd			
Patrick R. Murray. (2015). <i>Medical Microbiology</i> . Elsevier			
Patrick Murray & Ken Rosenthal & Michael Pfalle. (2015). <i>Medical Microbiology</i> (8 th ed). New York: Academic Press.			
Outcomes	<ul style="list-style-type: none"> ➤ Get information about various mechanisms of infection 		

	<ul style="list-style-type: none">➤ Knowledge on clinical lab techniques➤ Acquire knowledge on control measures of diseases
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Name of the Course Teacher: Dr. T. Sathiamoorthi

Semester - III			
Course code: 530302	Immunobiology	Credits:5	Hours: 5
Objectives	<ul style="list-style-type: none"> ➤ To provide knowledge on human immunity system ➤ To understand the mechanism of antigen antibody reaction ➤ To inculcate the principles of vaccine development . 		
Unit -I	History and scope of immunology: Types of immunity: innate-components-physical, physiological defences: complement, acute phase proteins and adaptive immunity, Acquired immunity: (specific) natural, artificial, active and passive immunity. Inflammatory response; Phagocytic system- mononuclear phagocytes, macrophages, neutrophils, Natural killer cells, mast cells, basophils, and eosinophils. Physiology of immune response – humoral and cell mediated immunity. Lymphoid organs – primary and secondary. Barriers of immune system- Haematopoietic stem cells.		
Unit-II	Antigens: characteristics, types, cross reactivity, hapten, adjuvant, immunogenicity and antigenicity. Immunoglobulin – types structure and functions. Engineered antibodies. Antigen - Antibody interactions. Immuno technology – hybridoma and monoclonal antibodies.		
Unit III	Immune effector mechanisms: Cytokines – properties and functions. Complement components – classical and alternate pathways, complement activation, and complement deficiencies. Hypersensitivity – anaphylaxis, cytotoxic, immune complex deposition and cell mediated. Auto immunity – idiotype, network and autoimmune diseases. Mechanism of immune regulation – tolerance.		
Unit IV	Immunity to infectious diseases : bacterial (<i>Mycobacterium tuberculosis</i>), viral (HIV), protozoan (<i>Leishmania</i>). Vaccines: Types – inactivated, subunit, synthetic, DNA and live attenuated vaccines- Immunoinformation.		
Unit V	Transplantation immunology: Graft versus host reactions. Structure, functions of class I and class II MHC molecules, HLA typing. Principles of tumour immunology: Immunodiagnosis based on antigen and antibody interaction - precipitation, agglutination, EIA, RIA, Immunodiffusion, Immuno electrophoresis, Immunofluorescence, Immunoprecipitation, flow cytometry and immunofluorescence, ELI spot techniques.		
Reference and Textbooks:-			
Abul, K. Abbas Andrew H. H. Lichtman & Shiv Pillai. (2015). <i>Basic Immunology, Functions and Disorders of the Immune System</i> (5 th ed). Elsevier.			
Abul K. Abbas & Andrew H. Lichtman & Shiv Pillai. (2014). <i>Cellular and Molecular Immunology</i> (8 th ed). Elsevier.			
Murphy, K., & Weaver, C. (2016). <i>Janeway's immunobiology</i> (9 th ed). Garland Science.			
Jenni Punt; Sharon A Stranford; Patricia P Jones; Janis Kubly. (2013). <i>Kuby immunology</i> . New York: W.H. Freeman.			
Barbara, J. A., Regan, F. A., & Contreras, M. (Eds.). (2008). <i>Transfusion microbiology</i> . Cambridge University Press.			
Joseph, A. Bellanti. (2016). <i>Immunology IV: Clinical Applications in Health and Disease</i> . Washington, DC: Georgetown University School of Medicine.			
Day, M. J., & Schultz, R. D. (2014). <i>Veterinary immunology: principles and practice</i> . CRC Press.			
Geha, R., & Notarangelo, L. (2012). <i>Case studies in immunology: a clinical companion</i> . Garland Science.			
Rao, C. V. (2013). <i>Immunology</i> (2 nd ed). New Delhi: Narosa Publishing House.			
Coico, R., & Sunshine, G. (2015). <i>Immunology: a short course</i> . John Wiley & Sons.			
Outcomes	<ul style="list-style-type: none"> ➤ Students acquire the information about immunity development ➤ Become an eminent in immunotechnology ➤ Able to understand the immunological reactions 		

Name of the Course Teacher: T. Kavitha

Semester - III			
Course code: 530303	Industrial Microbiology	Credits:5	Hours: 5
Objectives	<ul style="list-style-type: none"> ➤ To give knowledge on strain improvement methods ➤ To learn about upstream fermentation process ➤ To understand about downstream fermentation process 		
Unit -I	An introduction to fermentation process:- Screening of industrial microbes – Detection and assay of fermentation products. Classification of fermentation types. Genetic control of fermentation. Strain selection and improvement, mutation - protoplast fusion, parasexual reproduction and recombinant DNA technique for strain development. Preservation methods of cultures.		
Unit-II	Types and design of bioreactors:- Packed / fluidized, fed, transport phenomena – mass transfer, newtonian and non – Newtonian behaviour of fluid – mass transfer coefficient, oxygen, viscosity, heat transfer and scale up. Mode of operation. Instrumentation and computer application in fermentation		
Unit III	Fermentation kinetics: Yield factors - growth rate parameters- kinetics of growth and product formation in batch, chemostat and fed batch culture. Inoculum development, media formulation, optimization methods, media sterilization, statistical design for media formulation, optimization, contour Plot. Immobilization of cells and enzymes - methods and applications.		
Unit IV	Fermentation of microbial products:- Single Cell Protein (SCP). Anaerobic fermentation (beer and wine). Aerobic fermentation (vinegar and citric acid. Antibiotic fermentation (penicillin and streptomycin). Vitamins (B12, riboflavin), Hormone (gibberellic acid, IAA). Enzyme (amylase, protease). Biogas production.		
Unit V	Downstream processing:- Cell disruption – physical and chemical methods. Precipitation. filtration- batch and continuous filters. Centrifugation - types, liquid-liquid extraction, chromatography, membrane process, drying, crystallization. Quality control and evaluation of industrial products, packaging. Fermentation economics - market potential, process cost, recovery cost.		
Reference and Textbooks:-			
Casida, L.E.J.R. (2019). <i>Industrial Microbiology</i> (2 nd ed). New Delhi: New Age International (P) Ltd., Publishers.			
Crueger, W. (2017). <i>Biotechnology: A Test Book of Industrial Microbiology</i> (3 rd ed), MEDTECH Publishers.			
El-Mansi, E. M. T., Bryce, C. F. A., Arnold L. Demain and Allman, A.R. (2012). <i>Fermentation Microbiology and Biotechnology</i> , CRC Press.			
Glick, B.R., and Patten, C.L. (2010). <i>Molecular Biotechnology Principles and Applications of Recombinant DNA</i> (4 th ed). ASM Publishers.			
Joshi, R.D. (2017). <i>Text Book of Industrial Microbiology</i> , Oxford.			
Patel A.H. (2016). <i>Industrial Microbiology</i> . (2 nd ed). New Delhi: Laxmi Publications (P) Ltd.			
Peppler, H. and Pearman, D. (1979). <i>Microbial Technology, Vol.I</i> , New York: Academic Press.			
Prescott, L.M., Harley, J.P. and Helin, D.A. (2015). <i>Microbiology</i> (5 th ed). New Delhi: McGraw Hill.			
Stanbury, P.F, Whitaker, A. and Hall, S.J. (2016). <i>Principles of Fermentation Technology</i> (3 rd ed). New Delhi: Aditya Book (P) Ltd.			
Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. (2001). <i>Industrial Microbiology: An Introduction</i> . London: Blackwell Science.			
Outcomes	<ul style="list-style-type: none"> ➤ Students will get knowledge on strain improvement ➤ Enable them to work in fermentation industry ➤ Students will get idea on upstream and downstream fermentation process 		

Name of the Course Teacher: Dr V. Balasubramanian

Semester - III			
Course code: 530304	Lab in Medical Microbiology, Immunobiology and Industrial Microbiology	Credits: 4	Hours/week: 8
Objectives	<ul style="list-style-type: none"> ➤ To provide technical knowledge on collection and processing of clinical samples ➤ To prepare them to work in clinical laboratory ➤ To learn the technique for isolation and identification of pathogen 		
<p>1. Staining methods for morphological feature of pathogenic bacteria.</p> <p style="margin-left: 20px;">A. Differential stains – Gram stain, Ziehl Neelsen’s stain for AFB</p> <p style="margin-left: 20px;">B. Cytological stains –</p> <p style="margin-left: 40px;">i) Endospore stain – <i>Bacillus, Clostridium</i></p> <p style="margin-left: 40px;">ii) Capsule stain – positive stain</p> <p style="margin-left: 20px;">C. Stain for Amoeba / Intestinal protozoa / Malarial parasites – Ironhaematoxylin stain, Leishman’s stain, Giemsa stain.</p> <p>2. Diagnostic Bacteriology : Laboratory diagnosis (isolation & identification)</p> <p style="margin-left: 20px;">i) Pyogenic infection- <i>Streptococci</i></p> <p style="margin-left: 20px;">ii) UTI infection – <i>E. coli, Proteus, Pseudomonas</i> and <i>Salmonella</i></p> <p>3. Kirby – Bauer disc diffusion technique.</p> <p>4. Antimicrobial susceptibility testing by MIC and MBC</p> <p>5. Electrophoretic separation of serum proteins.</p> <p>6. Direct agglutination to determine ABO blood grouping.</p> <p>7. Determination of differential leukocyte count.</p> <p>8. Isolation and enumeration of RBC from human blood.</p> <p>9. Demonstration of fermentation using Kuhn’s fermentation vessel.</p> <p>10. Assay of amylase from microbes.</p> <p>11. Assay of protease from microbes.</p> <p>12. Assay of cellulase from microbes.</p> <p>19. Enzyme Immobilization in sodium alginate gel.</p> <p>20. Cell immobilization in calcium alginate gel.</p> <p>21. Screening of antibiotic producing microbes.</p>			
Reference and Textbooks:			
<p><i>Baily and Scott’s Diagnostic Microbiology</i>, (2006). London: Mosby.</p> <p>Carpenter D.L.(1975). <i>Immunology and Serology</i> (3rd ed). London: W.B. Saunders Company.</p> <p><i>Collins and Lyne’s Microbiological methods</i>, (2001). New York: Arnold publishers.</p> <p>Demain, A.L, and Davis, J.E. (1999). <i>Manual of Industrial Microbiology and Biotechnology</i> (2nd ed). Washington: American Society for Microbiology.</p> <p>Hudson, L. and Hay, F.C. (1989), <i>Practical Immunology</i> (3rd ed). Oxford: Blackwell scientific Publications.</p> <p>Noel R. Rose, Herman Friedman, John L. Fahey. (1986). <i>Manual of Clinical Laboratory Immunology</i>, American Society for Microbiology.</p> <p>Lippincott Williams and Wilkins. Philadelphia, Baltimore (2006). <i>Koneman’s Color Atlas and Text book of Diagnostic Microbiology</i>.</p> <p>Patrick R. Murray, Ellen Jo Baron, James Jorgensen, Michael Pfaller, Marie Louise Landry. (2007). <i>Manual of Clinical Microbiology: 2 Volume Set</i> (9th Revised ed). American Society for Microbiology.</p> <p>Rastogi S.C. (1996). <i>Immunodiagnosics Principles and Practice</i>. New Delhi: New Age International (P) Ltd.</p> <p>Talwar, G.P. (1983). <i>A Hand Book of Practical Immunology</i>. New Delhi: Vikas Publishing House Pvt. Ltd.</p>			

Outcomes	<ul style="list-style-type: none">➤ Get practical knowledge in specimen collection and processing➤ Become technically expert which will helpful to work in clinical laboratory➤ Able to identify clinical pathogens
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Name of the Course Teacher: Dr. T. Sathiamoorthi

Semester - III			
Course code: 533505	Algal Biotechnology	Credits:4	Hours: 4
Objectives	<ol style="list-style-type: none"> 1. To learn about algal cultivation methods 2. To know the application of algae 3. To make aware of algae and pollution 		
Unit -I	General overview, occurrence and distribution of algae:- Fundamentals of algal cultivation. Culture methods - batch cultures, continuous cultures semi-continuous cultures, commercial- scale cultures, outdoor ponds, photobioreactors and culture of sessile microalgae. Quantitative determinations of algal density and growth, Growth rate and generation time determinations. Cultivation of economically important freshwater and marine algae. Algae as a source of food and fodder.		
Unit-II	Algal Biotechnology:- Application of cell fusion, tissue culture and hybridization techniques in algae. Algaegenomics. Genetic engineering of algae: construction of transformation and expression vectors, methods of gene introduction. Metabolic engineering in lipid metabolism. Phycoremediation. Role of algae in biogeochemical cycle. Microalgal biotechnological applications in nutrition, health and environment.		
Unit III	Biofuels and Biofertilizer:- Biogas, Ethanol, Diesel and Hydrogen production by algae. Seaweed fertilizer and algae as Biofertilizer.		
Unit IV	Food and nutraceuticals of Algae:- Cyanophyta, Rhodophyta, Heterokontophyta, Chlorophyta. Polysaccharides (Agar Agar, Carageenan and Alginic acid), Algae in pharmaceutical industries, Animal feed, Therapeutic supplements and toxin.		
Unit V	Algae and pollution:- Eutrophication, Algae as indicator of pollution, atmospheric algae. Harmful algae blooms (HABS). Impacts of HABs on Aquaculture- Shellfish, Finfish, Impacts of Coastal HABs on Tourism.		
Reference and Textbooks:-			
<p>Chapman, F.G. and Chapman, D.J. (1973). <i>The Algae</i>. McMillan & Co.</p> <p>Faizal Bux , Yusuf Chisti (eds). (2016). <i>Algae Biotechnology- Products and Processes</i>. Springer International Publishing Switzerland.</p> <p>Faizal Bux, Yusuf Chisti (eds.). (2018). <i>Algae Biotechnology_ Products and Processes- (Green Energy and Technology)</i> -Springer International Publishing.</p> <p>Melanie N. Johansen. (2011). <i>Microalgae_ Biotechnology, Microbiology and Energy (Marine Biology)</i> --Nova Science Pub Inc.</p> <p>Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl, Thomas Brock. (2015). <i>Brock biology of microorganisms</i>-Benjamin Cummings.</p> <p>Se-Kwon Kim. (2015). <i>Handbook of Marine Microalgae_ Biotechnology Advances</i>. Academic Press.</p> <p>Tridevi, P. C. (2001). <i>Algal Biotechnology</i>. Jaipur: Point Publisher.</p> <p>VandenHoek, C., Mann, D.G., and Jahns, H.M. (2009). <i>Algae- An introduction to Phycology</i>.</p> <p>Vashishta, B.R., Sinha, A.k., and Singh V.P. (2010). <i>Algae (Revised)</i> New Delhi: S.Chand & Company Ltd.</p> <p>Williams, K.L. (2007). <i>Endotoxins – Pyrogens, LAL Testing and Depyrogenation</i> (3rd ed). INFORMA Publishers.</p>			
Outcomes	<ul style="list-style-type: none"> ➤ Better understanding importance of algal biotechnology ➤ Get information about microalgae ➤ Enable them to work algal industries 		

Name of the Course Teacher: Dr.V. Balasubramanian

Semester - III			
Course code: 530506	Microbial Technology	Credits:4	Hours: 4
Objectives	<ul style="list-style-type: none"> ➤ To acquire knowledge on food product analysis ➤ To enable them to know about preservation of pharmaceutical products ➤ Learn to assess the microbial quality of marine foods. 		
Unit -I	Mineral water industry: Stages of mineral water production. Analysis of water quality – pH, salinity, alkalinity, dissolved oxygen, carbonates, nitrate, silicate, phosphate, COD and BOD. Determination of microbial load in water : Faecal indicator organisms - coliform bacteria, faecal enterococci, Clostridium perfringens, yeast, mould and sulphide reducing anaerobes, viruses and bacteriophages, fungi and yeasts, protozoa and helminths. Methods of mineral water quality assessment – MPN test, membrane filtration technique.		
Unit-II	Preservation of pharmaceutical Products: Chemical preservatives – raw materials – equipment – role of preservatives. Finished product tests – microbial enumeration test, tests for specified microorganisms. Sterility testing – antimicrobial effectiveness testing. Sterility assurance – biological indicators, sterilization validation process. Microbial risk assessment through HACCP plan.		
Unit III	Endotoxin test methods: gel clot assay, turbidometric assay and chromogenic methods. Biological assays - vitamin assay, antibiotic susceptibility testing-Disc diffusion and well diffusion assay and mycoplasma testing. Endotoxin activity – risk assessment in parenterals manufacture – pyrogen test – depyrogenation methods.		
Unit IV	Rapid methods for detection of microorganisms in food: conventional and automated. Application of light pulse technology – principles of light pulse generation, mode of action, equipments, application of light pulses, effect of light pulses on foods and microorganisms, advantage and limitation of light pulse treatment. Quality control in fruits and vegetable processing. Risk assessment in food industry – physical, chemical and biological hazards.		
Unit V	Assessment of microbial quality of marine foods: Conventional and recent development methods – flow cytometry, ATP estimation, radiometric, reflective colorimetry, LAL test, immunoassay, DNA based and microarray methods. Application of additives in food. Food safety and standard act for adulteration. Significance of barcode and its uses in food industry.		
Reference and Textbooks:-			
<p>Ashutosh, K. (2008). <i>Pharmaceutical Microbiology</i>. New Delhi: New Age International Publishers.</p> <p>Kevin, W. (2007). <i>Endotoxins – Pyrogens, LAL Testing and Depyrogenation</i> (3rd ed). Informa Press.</p> <p>Manivasakam, N. (2001). <i>Chemical and Microbial analysis of mineral and packaged drinking waters</i>. Coimbatore: Sakthi Book Service.</p> <p>Trivedy, R.K., Goel, P.K. and Trishal, C.L. (1987). <i>Practical methods in Ecology and Environmental science</i>. Environmental publishers.</p> <p>John A. J. Barbara, Fiona A. M. Regan, Marcela Contreras. (2008). <i>Transfusion Microbiology</i>, United Kingdom: Cambridge University Press.</p> <p>Joseph, A. Bellanti. (2016). <i>Immunology IV: Clinical Applications in Health and Disease</i>. Washington, DC: Georgetown University School of Medicine.</p> <p>Michael J. Day, Ronald D. Schultz. (2014). <i>Veterinary Immunology: Principles and Practice</i> (2nd ed). CRC Press.</p> <p>Raif Geha, Luigi Notarangelo. (2016). <i>Case Studies in Immunology. A Clinical Companion</i> (7th ed). ASM Press.</p> <p>Rao, C. V. (2013). <i>Immunology</i> (2nd ed). New Delhi: Narosa Publishing House.</p> <p>Richard Coico and Geoffrey Sunshine. (2015). <i>Immunology: A Short Course</i>, (7th ed). Wiley-Blackwell.</p>			

Outcomes	<ul style="list-style-type: none">➤ Acquire Knowledge on food product analysis➤ Impart knowledge of preservation technology.➤ Knowledge on quality analysis of marine food products
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Name of the Course Teacher: T. Kavitha

Semester - IV			
Course code: 530401	Extremophiles	Credits:5	Hours: 6
Objectives	<ul style="list-style-type: none"> ➤ To acquire knowledge on extremophiles. ➤ To enable them to know about applications of extremophiles. ➤ Learn about physiological adaptations in extremophiles. 		
Unit –I	Extremophiles: Categories of extremophiles and extremotrophs. Distribution of extremophiles and extremotrophs. Extremophiles and the origin of life. Types and diversity of thermophiles, psychrophiles, halophiles, alkaliphiles, acidophiles and barophiles.		
Unit-II	Alkaliphiles: Outline classification, Diversity in alkaline environment, soda lakes and deserts, Anaerobic alkaliphiles and alkaliphilic Poly-Extremophiles. Physiological features of alkaliphiles. Adaptive mechanisms of extreme alkaliphiles. Enzymes from alkaliphiles. Biotechnological applications of alkaliphiles.		
Unit III	Halophiles: Classification, Dead Sea, discovery basin, cell walls and membranes – Purple membrane. Osmoadaptation/halotolerance. Applications of halophiles and their extremozymes. Barophiles: Classification, high-pressure habitats, life under pressure, barophily, death under pressure.		
Unit IV	Thermophile: History of discovery of hyper thermophiles. Carbohydrate-active enzymes from hyper thermophiles. Lignocellulose converting enzymes from thermophiles. Enzymes involved in DNA amplification (e.g. Polymerases) from thermophiles: Evolution of PCR enzymes. Metalloproteins from hyper thermophiles.		
Unit V	Psychrophiles: Ecology of psychrophiles: Subglacial and permafrost environments. Taxonomy. Adaptation mechanisms of psychro tolerant bacterial pathogens. Psychrophilic enzymes Acidophiles: Physiological features, adaptation strategies, growth kinetics and enzymes of various extremophilic acidophiles.		
Reference and Textbooks:-			
Atlas, R.A. and Bartha, R. (2000). <i>Microbial Ecology: Fundamentals and Application</i> . New York: Benjamin Cummings.			
Brock, T. D. (1978). <i>Thermophilic microorganisms and life at high temperatures</i> . New York: Springer.			
Charles Gerday and Nicolas Glansdorff. (2007). <i>Physiology and Biochemistry of Extremophiles</i> . ASM Press.			
Horikoshi, K. and W. D. Grant. (1998). <i>Extremophiles-microbial life in extreme environments</i> . New York: Wiley.			
Jean-Claude Bertrand, Pierre Caumette, Philippe Lebaron, Robert Matheron, Philippe Normand, Télesphore Sime-Ngando (2011). <i>Environmental Microbiology: Fundamentals and Applications - Microbial Ecology</i> . Springer.			
Johri B.N. (2000). <i>Extremophiles</i> . New York: Springer Verlag.			
Koki Horikoshi, Garo Antranikian, Alan T. Bull, Frank T. Robb, Karl O. Stetter. (2010). <i>Extremophiles Handbook</i> . Springer.			
Om V. Singh. (2012). <i>Extremophiles-Sustainable Resources and Biotechnological Implications</i> . Wiley-Blackwell.			
Ventosa, A., Nieto, J.J. and Oren, A. (1998). <i>Biology of moderately halophilic aerobic bacteria</i> . Microbiology and Molecular Biology Reviews, 62, 504–544.			
Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms</i> (12 th ed). New Jerry: Prentice Hall.			
Outcomes	<ul style="list-style-type: none"> ➤ Acquire Knowledge on extremophiles ➤ Impart knowledge biotechnological applications of extremophiles. ➤ Knowledge about adaptations in extremophiles. 		

Name of the Course Teacher: Dr. A. Arun

Semester - IV			
Course code: 530999	Project Report and Viva voce	Credits:12	Hours: 24
Objectives	<ol style="list-style-type: none"> 1. To inculcate knowledge on research 2. To know the principles of various instruments and its application in research 3. To familiarize in identifying a problem and to solve it. 		
The students will do their research work under the research supervisor and submit their thesis.			
Outcomes	<ol style="list-style-type: none"> 1. Knowledge on research methodology 2. Basic knowledge on different instruments 3. Ideas on research review 		

Name of the Course Teacher: Research supervisor of the M.Sc candidate

Non-Major Electives Course (NME) (For II Semester) - To be chosen by other PG degree students:

Semester - II	
Course code: 530507	Molecular Biology
Credits:2	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ To extend the knowledge on the structure and functions of genetic materials ➤ To focus on genome organization, transcription and translation process in prokaryotes. ➤ To understand the principles of oncogenes
Unit –I	Discovery of DNA. Molecular basis of DNA as genetic material. Structure of DNA – A, B and Z form. Forms of DNA – DNA heteroduplex, circular, super helical DNA, twisted circle. Properties of DNA - denaturation, renaturation, melting curve, hyperchromicity. Structure of RNA. Types of RNA - tRNA, mRNA and rRNA.
Unit-II	Replication of DNA - semi conservative mode, Meselson - Stahl experiment. Enzymology of DNA replication - DNA polymerase I, II and III; topoisomerase I and II; helicase; primase and gyrase. Molecular mechanism of DNA replication. Replication fork, origin and okazaki fragments. Types of replication - circular and theta.
Unit III	Transcription process in Prokaryotes: Initiation - promoters, upstream and downstream sequences, transcription factors; Elongation - RNA polymerase, sub units; Termination - Rho dependent and Rho independent; nus A protein and antitermination. RNA processing (post transcriptional modifications), inhibitors of transcription. Reverse transcription.
Unit IV	Genetic code: Elucidation of triplet code, code characteristics and codon dictionary. Reading frames, sense and nonsense code. Degeneracy - wobble hypothesis, universality of genetic code. Process of translation in prokaryotes: Initiation and Termination. Role of rRNA in protein synthesis. Post translational modifications - post translational transport. signal hypothesis.
Unit V	Tumor viruses and oncogenes: Transformed cells, detection of integral viral DNA, structure of integral viral DNA. Protein kinase and transformation by retro viruses. Cellular counterpart of src. Carcinogens. Activation of oncogenes. Oncogenic proteins - protein kinases, growth factors, ras protein. Transformation protein in DNA viruses.
Reference and Textbooks:-	
Benjamin Lewin. (2007). <i>Genes XI</i> . New York: Oxford University Press.	
Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. (2008). <i>Molecular Biology of the Cell</i> (5 th ed). Garland Science.	
David Freifelder. D. (2008). <i>Microbial Genetics</i> (18 th ed). NewDelhi: Narosa Publishing House.	
Freifelder, D. (2000). <i>Molecular Biology</i> (2 nd ed). NewDelhi: Narosa Publishing house.	
Jeyanthi, G.P. (2009). <i>Molecular Biology</i> . Chennai: MJP Publishers.	
Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A. M. (2013). <i>Molecular Biology of the Gene</i> (17 th ed). Tokyo: The Benjamin Cummings Publishing Company Inc.	
Veer Bala Rastogi. (2016). <i>Principles of molecular biology</i> . Medtech Publishers.	
Russel, P. (2009). <i>iGenetics: A Molecular Approach</i> . India: Pearson Education.	
Stanley R. Maloy, John E.C. and Freifelder, D. (2008). <i>Microbial Genetics</i> . New Delhi: Narosa Publishing House.	
Stryer, L. (2019). <i>Biochemistry</i> (9 th ed). New York: W.H. Freeman and Company.	
Outcomes	<ul style="list-style-type: none"> ➤ Receive elaborate knowledge on nucleic acids ➤ Better understanding of gene expressions ➤ Get thorough knowledge on tumour viruses and oncogenes

Name of the Course Teacher: Dr. A. Arun

Non-Major Electives Course (NME) (For II Semester) - To be chosen by other PG degree students:

Semester - II			
Course code: 530508	Agriculture and Environmental Microbiology	Credits:2	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ To create awareness on soil Microbiology ➤ To give knowledge on plant pathogen interaction and its control ➤ To inculcate on environmental microbiology 		
Unit -I	Diversity and distribution of microorganisms in soil; Soil Microflora- Bacteria, Fungi and Actinomycetes. Classification, physical, chemical properties and structure of soil. Microbial interactions - mutualism, synergism, commensalism, amensalism, parasitism, predation and competition. Microbial interactions with plants – phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, <i>Rhizobium</i> , <i>Frankia</i> , <i>Azospirillum</i> , <i>Azotobacter</i> , Cyanobacteria, Phospho bacteria and <i>Azolla</i> .		
Unit-II	Bacterial diseases of agricultural crops - pathogens, symptoms, control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. Plant protection – phenolics – phytoalexins and related compounds. Bioinsecticides – viral, bacterial and fungal- a brief note.		
Unit III	Bio-geo chemical cycles in soil – Carbon cycle, Nitrogen cycle – Nitrogen fixation, nitrification, de-nitrification, sulphur, iron and phosphorus cycles. Aerobiology – a brief introduction - droplet nuclei – aerosols - air borne transmission of microbes and diseases and assessment of air quality.		
Unit IV	Aquatic microbiology - factors affecting microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents. Aquatic habitats - freshwater - lakes, ponds and streams; marine habitats - estuaries, deep sea, hydrothermal vents, salt pans, coral reefs and mangroves and their microbial communities; zonation – food chain and food web.		
Unit V	Types of wastes - solid and liquid wastes. Treatment of solid wastes - Thermal Treatment: Incineration, Gasification, Pyrolysis and Open Burning- Dumps and Landfills: Sanitary landfills, Controlled dumps, Bioreactor Landfills- Biological Waste Treatment: Composting, Vermicomposting and termi composting. Treatment of liquid wastes –primary, secondary, tertiary treatment; anaerobic (methanogenesis), aerobic, trickling, activated sludge, oxidation pond. Production of biogas from waste.		
Reference and Textbooks:-			
Alexander M. (1997). <i>Introduction to soil microbiology</i> , New York: John Wiley & Sons, Inc. EcEldowney S., Hardman, D.J. and Waite, S. (1993). <i>Pollution Ecology and Biotreatment</i> . Longman Scientific Technical. Grant, W.D. and Long, P.L. (1981). <i>Environmental Microbiology</i> . Blalckie Glasgow and London. Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). Twelfth Edition, <i>Biology Microorganisms</i> , New Jerry: Prentice Hall. Mark Wheelis, (2010). <i>Principles of Modern Microbiology</i> , New Delhi: Jones & Bartlett India Pvt. Ltd. Mehrotra, R.S. (1983). <i>Plant Pathology</i> , New Delhi: Tata McGraw Hill Publishing Company Ltd. Pandey, B.P. (1997). <i>Plant Pathology (Pathogen & Plant Disease)</i> , New Delhi: S.Chand& Company Ltd. Ray Chadhuri, S.P. (1977). <i>A Manual of Virus Diseases of Tropical Plants</i> , New Delhi: MacMillan Company of India Ltd. Rengaswami, G. and Rajagopalan, S. (1973). <i>Bacterial Plant Pathology</i> . Coimbatore: Tamil Nadu Agriculture University. SubbaRao, N.S. (1995). <i>Soil Microorganisms and Plant Growth</i> (3 rd ed). New Delhi: Oxford &			

IBH Publishing Co. Pvt. Ltd.	
Outcomes	<ul style="list-style-type: none">➤ Acquire knowledge on soil microbiology➤ Understand the biogeochemical cycles prevail in environment.➤ Able to know about principles and techniques in waste treatment.

Name of the Course Teacher: Dr. T. Sathiamoorthi

Non-Major Electives Course (NME) (For III Semester) - To be chosen by other PG degree students:

Semester - III			
Course code: 530509	Microbial Ecology	Credits:2	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ To create awareness on evolutionary relationship of ecosystem ➤ To learn about individual ecosystem and its interactions. ➤ To understand the concepts of community ecology 		
Unit -I	<p>Introduction microbial ecology:- overview, history and scope of microbial ecology. Population ecology: properties of population–density, natality and fecundity, mortality, longevity and senescence, immigration and emigration. Microbial population ecology – population growth, density dependence and independence, r and k selection. Species concept – universal, biological, phenetical, evolutionary and phylogenetic. Speciation – bacterial, mismatch repair as a speciation mechanism, rapid speciation, operons , genome economization and speciation, hypermutation, genome reduction.</p>		
Unit-II	<p>Concepts of microbial ecology:- definition and terminology, Ecology of individuals – study of individual microorganism, genetic individuals, ramets. ecological individual, niche. Abiotic constraints (temperature, pH, nutrient source, electron acceptor, redox , pressure and light), metapopulation, dispersal, modularity, source and sinks, population ecology of genes. Source of phenotypic and genotypic variation, gene ecology.</p>		
Unit III	<p>Population and spatial stability:- Uniformity of populations, adaptation, population in time. Bacterial communication : Quorum sensing– evolutionary implication of quorum sensing, cell – cell communication in bacteria, quorum sensing and evolution, disruption or manipulation of quorum sensing response, oligotrophic state of nature, starvation survival, ageing, senescence, death, dormancy or resting state and miniaturization.</p>		
Unit IV	<p>Microbial Interactions:- with their physical and chemical environment, Species interaction and processes: Species interaction, proliferation hypothesis. Interactions with the biotic environment: symbiosis, competition, parasitism, predation, Negative relationship – parasitism, predation, bacterial and viral interaction, microbial loop and bacteria as predators. Neutral relationship: positive relationship - metabiosis and symbiosis.</p>		
Unit V	<p>Community ecology:-Water communities - hydrosphere ecology of fresh water, composition and activity of fresh water microbial communities, physical and chemical factors, estuaries and marine water environment; characteristics and stratification of the ocean, composition and activity of marine microbial communities, role of microbes in the aquatic environment and lithosphere. Soil communities - introduction to soil formation, rock and minerals, soil horizon, soil texture, organic matter, chemical properties of soil, soil microbial communities. Biofilm communities, phylogenetics and community ecology.</p>		
Reference and Textbooks:- (APA Format)			
Atlas, R.A. and Bartha, R. (2000). <i>Microbial Ecology, Fundamentals and Application</i> . New York: Benjamin Cummings.			
Dubey, R.C. and Maheswari, D.K. (2013). <i>A text book of Microbiology</i> (Revised). New Delhi: S. Chand and Company Ltd.			
Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). <i>Biology Microorganisms</i> (12 th ed)., New Jerry: Prentice Hall.			
Pelczar, M.J., Schan, E.C. and Kreig, N.R. (2010). <i>Microbiology – An application based approach</i> (5 th ed). New Delhi: Tata McGraw Hill Publishing Company Limited.			
Prescott, L.M., Harley, J.P. and Helin, D.A. (2008). <i>Microbiology</i> (9 th ed). New York: McGraw Hill.			
Saha, T.K. (2010). <i>Ecology and Environmental Biology</i> . Kolkata: Books and Allied Pvt. Ltd.			
Schlegel, H.G. (1995). <i>General Microbiology</i> (7 th ed). Cambridge: Cambridge Univeristy Press.			
Stanier, R., Lingraham, Y., Wheelis, M.L. and Painter, R.P. (1986). <i>General Microbiology</i> (5 th ed).			

<p>London: Macmillan.</p> <p>Tortora G.J., Funke, B.R. and Case, C.L. (2009). <i>Microbiology</i> (9thed). Noida: Dorling Kindersely (India) Pvt. Ltd.</p> <p>VaunMc Arthur (2009) <i>Microbial Ecology – An Evolutionary approach</i>, Elsevier publications, Academic press.</p>	
Outcomes	<ul style="list-style-type: none"> ➤ Better understanding of evolutionary relationship of ecosystem ➤ Get more knowledge on individual ecology ➤ Able to understand the role of microbes in ecology

Name of the Course Teacher: Dr. V. Balasubramanian

Non-Major Electives Course (NME) (For III Semester) - To be chosen by other PG degree students:

Semester - III			
Course code: 530510	Microbial Technology	Credits:2	Hours: 3
Objectives	<ul style="list-style-type: none"> ➤ To acquire knowledge on food product analysis ➤ To enable them to know about preservation of pharmaceutical products ➤ Learn to assess the microbial quality of marine foods. 		
Unit -I	<p>Mineral water industry: Stages of mineral water production. Analysis of water quality – pH, salinity, alkalinity, dissolved oxygen, carbonates, nitrate, silicate, phosphate, COD and BOD. Determination of microbial load in water : Faecal indicator organisms - coliform bacteria, faecal enterococci, Clostridium perfringens, yeast, mould and sulphide reducing anaerobes, viruses and bacteriophages, fungi and yeasts, protozoa and helminths. Methods of mineral water quality assessment – MPN test, membrane filtration technique.</p>		
Unit-II	<p>Preservation of pharmaceutical Products: Chemical preservatives – raw materials – equipment – role of preservatives. Finished product tests – microbial enumeration test, tests for specified microorganisms. Sterility testing – antimicrobial effectiveness testing. Sterility assurance – biological indicators, sterilization validation process. Microbial risk assessment through HACCP plan.</p>		
Unit III	<p>Endotoxin test methods: gel clot assay, turbidometric assay and chromogenic methods. Biological assays - vitamin assay, antibiotic susceptibility testing-Disc diffusion and well diffusion assay and mycoplasma testing. Endotoxin activity – risk assessment in parenterals manufacture – pyrogen test – depyrogenation methods.</p>		
Unit IV	<p>Rapid methods for detection of microorganisms in food: conventional and automated. Application of light pulse technology – principles of light pulse generation, mode of action, equipments, application of light pulses, effect of light pulses on foods and microorganisms, advantage and limitation of light pulse treatment. Quality control in fruits and vegetable processing. Risk assessment in food industry – physical, chemical and biological hazards.</p>		
Unit V	<p>Assessment of microbial quality of marine foods: Conventional and recent development methods – flow cytometry, ATP estimation, radiometric, reflective colorimetry, LAL test, immunoassay, DNA based and microarray methods. Application of additives in food. Food safety and standard act for adulteration. Significance of barcode and its uses in food industry.</p>		

Reference and Textbooks:-

- Ashutosh, K. (2008). *Pharmaceutical Microbiology*. New Delhi: New Age International Publishers.
- Kevin, W. (2007). *Endotoxins – Pyrogens, LAL Testing and Depyrogenation* (3rd ed). Informa Press.
- Manivasakam, N. (2001). *Chemical and Microbial analysis of mineral and packaged drinking waters*. Coimbatore: Sakthi Book Service.
- Trivedy, R.K., Goel, P.K. and Trishal, C.L. (1987). *Practical methods in Ecology and Environmental science*. Environmental publishers.
- John A. J. Barbara, Fiona A. M. Regan, Marcela Contreras. (2008). *Transfusion Microbiology*, United Kingdom: Cambridge University Press.
- Joseph, A. Bellanti. (2016). *Immunology IV: Clinical Applications in Health and Disease*. Washington, DC: Georgetown University School of Medicine.

<p>Michael J. Day, Ronald D. Schultz. (2014). <i>Veterinary Immunology: Principles and Practice</i> (2nd ed). CRC Press.</p> <p>Raif Geha, Luigi Notarangelo. (2016). <i>Case Studies in Immunology. A Clinical Companion</i> (7th ed). ASM Press.</p> <p>Rao, C. V. (2013). <i>Immunology</i> (2nd ed). New Delhi: Narosa Publishing House.</p> <p>Richard Coico and Geoffrey Sunshine. (2015). <i>Immunology: A Short Course</i>, (7th ed). Wiley-Blackwell.</p>	
Outcomes	<ul style="list-style-type: none"> ➤ Acquire Knowledge on food product analysis ➤ Impart knowledge of preservation technology. ➤ Knowledge on quality analysis of marine food products

Name of the Course Teacher: T. Kavitha

CURRICULUM VITAE

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Educational qualification:

- M.Sc., M.Phil., Ph.D., PGDCA

Professional experience:

- Teaching and Research Experience: 19 Years

Honours and Awards:

- Young scientist award – DST-SERB-YSS
- Radio talk - About microbial Power generation in AIR- Madurai on 13.12.2004.
- Travel grant (Rs.1,17,383/- by DBT (DBT/CTEP/02/201600307 dated Apr 1, 016) to attend International Conference on Environmental science and Technology. Paper title: Anaerobic and subsequent photosynthetic process for biohydrogen and Bioplastic (PHB) production at Houston, US, American academy of sciences, Texas, Houston, USA; June 06-10, 2016.
- Travel grant (Rs10,000/-) by Centre for International Co-operation in Science (CICS) – (DO\LR.VTF-V\2015-16 dated 3.2.16) to attend 5th annual International Conference on sustainable energy and environmental sciences-2016 (SEES 2016) at Singapore organized by Global science and technology forum, Singapore (GSTF); 22– 23Feb, 2016.
- Dr. APJ Abdul Kalam Award for scientific excellence -2018 by Marina Labs, Chennai, Tamilnadu, India on 13.10.18.
- Travel grant (Rs1,00,000/-) by Alagappa University under RUSA 2.0 scheme to present a research paper at Sixth International Symposium Frontiers in Polymer Science organized by Elsevier Publications and Materials today at Budapest, Hungary on May 05-08th 2019.

Recent publications:

- Sivaprakash, G., Mohanrasu, K., Ananthi, V., Jothibasu, M., Nguyend, D.D., Ravindran, B., Chang, S.W., Nguyen-Tri, P., Tran, N.H., Sudhakar, M., Gurunathan, K., Arokiyaraj, S., **Arun, A.** 2019. Biodiesel production from *Ulva linza*, *Ulva tubulosa*, *Ulva fasciata*, *Ulva rigida*, *Ulva reticulata* by using Mn_2ZnO_4 heterogenous nanocatalysts. Fuel, Vol 255 (115744). ISSN: 0016-2361. (IF 5.128). <https://doi.org/10.1016/j.fuel.2019.115744>.
- Boobalan, T., Samsudeen, N., James Obeth E. S., Saravanan S, JothiBasu M, Mohanrasu K, R. Balasubramani, D. Duc Nguyene,, S. Woong Chang, Nanthi Bolan, Yiu Fai Tsangh , Leonel Ernesto Amabilis-Sosa, **Arun A.** 2019. Comparative study on *Cronobacter sakazakii* and *Pseudomonas otitidis* isolated from septic tank wastewater in microbial fuel cell for bioelectricity generation. Fuel 248: 47–55. ISSN: 0016-2361. IF 5.128. <https://doi.org/10.1016/j.fuel.2019.03.060>.
- Sivaprakash, G., Mohan, R.K., Dinesh, G.H., Ananthi, V., Boobalan, T., Jothi, B.M., Ravindran, B., Soon, W.C., Arokiyaraj, S., Ke, D., **Arun, A.** 2019. Environmental friendly synthesis of TiO_2 -ZnO nanocomposite catalyst and Silver nanomaterials for the enhanced the production of biodiesel from *Ulva lactuca* seaweed and potential antimicrobial properties against the microbial pathogens. Journal of Photochemistry and Photobiology B: Biology.

Apr; 193:118-130. ISSN: 1011-1344. **IF 4.067.**
<https://doi.org/10.1016/j.jphotobiol.2019.02.011>.

- V.Ananthi, G.Siva Prakasha, K.Mohan Rasu, K.Gangadevi, T.Boobalan, Rathinam Raja, K.Anand, M.Sudhakar, Anil Chuturgoon, **A.Arun.** (2018). Comparison of integrated sustainable biodiesel and antibacterial nano silver production by microalgal and yeast isolates. Journal of Photochemistry and Photobiology B: Biology. 186:232-242. ISSN: 1011-1344. **IF 4.067.** <https://doi.org/10.1016/j.jphotobiol.2018.07.021>.
- K.Mohanrasu, N.Premnath, G.Siva Prakash, Muniyasamy Sudhakar, T. Boobalan and **A. Arun.** (2018). Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation. Journal of Photochemistry and Photobiology B: Biology, Vol.185, (August 2018), Pages 55-65. ISSN: 1011-1344. **IF 4.067.** <https://doi.org/10.1016/j.jphotobiol.2018.05.014>.

Cumulative Impact factor: 48.316

Total Citation: 298

h- index: 7

i10- index: 7

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Educational qualification:

- M.Sc.
- Ph.D.

Professional experience:

- Teaching and Research Experience: 19 Years

Honours and Awards:

- Senior Research Fellow (1997-2000), Council of Scientific and Industrial Research, Government of India.
- DST-FAST TRACK Young Scientist (2013-2016), Department of Science and Technology, Government of India.
- UGC Raman Post Doctoral Research Fellow (2014-2015), University Grants Commission (UGC), Government of India; Auburn University, Alabama, United States of America.

Recent publications:

- Sathiya Deepika M, Thangam R, Sheena TS, Sasirekha R, Sivasubramanian S, Dinesh Babu M, Jeganathan K, **Thirumurugan R**, (2018), A novel rutin-fucoidan complex based phytotherapy for cervical cancer through achieving enhanced bioavailability and cancer cell apoptosis, *Biomedicine and Pharmacotherapy*, Vol. 109, 1181-1195, (**Impact Factor: 3.457**).
- Sathiya Deepika M, Thangam R, Sakthidhasan P, Arun S, Sivasubramanian S, **Thirumurugan R**, (2018), Combined effect of a natural flavanoid rutin from *Citrus sinensis* and conventional antibiotic gentamicin on *Pseudomonas aeruginosa* biofilm formation, *Food Control*, Vol. 90, 282-294. (**Impact Factor: 3.667**).
- Murugan C, Rayappan K, Thangam R, Bhanumathi R, Shanthi K, Vivek R, **Thirumurugan R**, Bhattacharyya A, Sivasubramanian S, Gunasekaran P, Kannan S, (2016), Combinatorial nanocarrier based drug delivery approach for amalgamation of anti-tumor agents in breast cancer cells: an improved nanomedicine strategy, *Scientific Reports*, Vol. 6, 34053. (**Impact Factor: 4.122**).
- Zhou Y, **Thirumurugan R**, Wang Q, Lee CM, Davis A, (2016), Use of dry hydrolysate from squid and scallop product supplement in plant based practical diets for Pacific white shrimp *Litopenaeus vannamei*, *Aquaculture*, Vol. 465, 53-59, (**Impact Factor: 2.710**).
- Gunaseelan K, Balaji K, Kanipandian N, Rajkumar KS, Nilmini V, **Thirumurugan R**, (2015), Biogenic synthesis and spectroscopic characterization of silver nanoparticles using leaf extract of *Indoneesiella echioides*: in vitro assessment on antioxidant, antimicrobial and cytotoxicity potential, *Applied Nanoscience*. DOI 10.1007/s13204-015-0514-7, (**Impact Factor: 2.951**).

- Senthilkumar PK, **Thirumurugan R**, Jayachitra A, Dhvani KD, Divya AA, (2015), GST M1-T1 null allele frequency patterns in geographically assorted human populations: a phylogenetic approach, PLOS ONE, 1-19 (**Impact Factor: 2.766**).
- Vignesh V, Sathiyarayanan G, Sathishkumar G, Parthiban K, Sathish-Kumaran K, **Thirumurugan R**, (2015), Formulation of iron oxide nanoparticles using exopolysaccharide: evaluation of their antibacterial and anticancer activities, RSC Advances, Vol. 5, 27794-27804. (**Impact Factor: 2.936**).

Cumulative Impact factor: 52.703

Total Citation: 651

h- index: 14

i10- index: 18

CURRICULUM VITAE

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Educational qualification:

- M.Sc.
- Ph.D.

Professional experience:

- Teaching and Research Experience: 31 Years

Honours and Awards:

- Department of Science and Technology (DST), Government of India, Scheme for Young Scientists (SYS), 1998
- Department of Biotechnology (Government of India) Overseas Associateship, Long Term, 2000.
- Department of Biotechnology (Government of India) Overseas Associateship, Short Term, 2006.

Recent publications:

- Somu C, Karuppiyah H, Sundaram J. Antiviral activity of seselin from *Aegle marmelos* against nuclear polyhedrosis virus infection in the larvae of silkworm, *Bombyx mori*. *J Ethnopharmacol* 2019;112155. doi:10.1016/J.JEP.2019.112155.
- Arumugam G, Karuppiyah H, Sreeramulu B, Paulchamy R, Sundaram J. Occurrence of natural lectin with bacterial agglutination property in the serum of lepidopteran pest, *Parasa lepida*. *Entomol Sci* 2019. doi:10.1111/ens.12360.
- Parthiban E, Arokiyaraj C, Janarthanan S, Ramanibai R. Antioxidant and GC–MS analysis of *Annona reticulata* leaves extract against unsecure free radicals. *SN Appl Sci* 2019. doi:10.1007/s42452-019-0293-y.
- Sreeramulu B, Arumugam G, Paulchamy R, Karuppiyah H, Sundaram J. β -Galactoside binding lectin from caddisfly larvae, *Stenopsyche kodaikanalensis* with selective modes of antibacterial activity: Purification and characterization. *Int J Biol Macromol* 2018. doi:10.1016/j.ijbiomac.2018.04.158.
- Murali Palraju, Ramaraj Paulchamy & Janarthanan Sundaram (2018) Population genetic structure and molecular diversity of *Leucinodes orbonalis* based on mitochondrial COI gene sequences, *Mitochondrial DNA Part A*, 29:8, 1231-1239, doi: 10.1080/24701394.2018.1436169.
- Somu C, Paulchamy R, Moorthy SM, Sundaram J. Antiviral activity of selected medicinal plants and marine seaweeds on the grasserie infected larvae of silkworm, *Bombyx mori*. *Arch Phytopathol Plant Prot* 2017. doi:10.1080/03235408.2017.1401700.
- Genetic diversity and conservation of South Indian Mayfly, *Petersula courtallensis* Sivaramakrishnan, 1984 (Ephemeroptera: Leptophlebiidae). *J Entomol Zool Stud* 2017.
- Arumugam G, Sreeramulu B, Paulchamy R, Thangavel S, Sundaram J. Purification and functional characterization of lectin with phenoloxidase activity from the hemolymph of cockroach, *Periplaneta americana*. *Arch Insect Biochem Physiol* 2017.

doi:10.1002/arch.21390.

- Dharanivasan G, Sithanatham S, Kannan M, Chitra S, Kathiravan K, Janarthanan S. Metal Oxide Nanoparticles Assisted Controlled Release of Synthetic Insect Attractant for Effective and Sustainable Trapping of Fruit Flies. *J Clust Sci* 2017. doi:10.1007/s10876-017-1215-z.

Cumulative Impact factor: 69.01

Total Citation: 530

h- index: 10

i10- index: 11

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Educational qualification:

- M.Sc.
- Ph.D.

Professional experience:

- Teaching and Research Experience: 11 Years

Recent publications:

- An, C., Li, Yulian, Lou, Y., Song, D., Wang, B., Pan, L., Ma, Z., Li, Yuesheng, 2019. Thermal analysis of crystallization and phase transition in novel polyethylene glycol grafted butene-1 copolymers. *Polymers (Basel)*. <https://doi.org/10.3390/polym11050837>
- Song, D.P., Zhao, T.H., Guidetti, G., Vignolini, S., Parker, R.M., 2019. Hierarchical Photonic Pigments via the Confined Self-Assembly of Bottlebrush Block Copolymers. *ACS Nano*. <https://doi.org/10.1021/acsnano.8b07845>
- Song, D.P., Jacucci, G., Dundar, F., Naik, A., Fei, H.F., Vignolini, S., Watkins, J.J., 2018. Photonic Resins: Designing Optical Appearance via Block Copolymer Self-Assembly. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.7b02288>
- Gai, Y., Song, D.P., Yavitt, B.M., Watkins, J.J., 2017. Polystyrene-block-poly(ethylene oxide) Bottlebrush Block Copolymer Morphology Transitions: Influence of Side Chain Length and Volume Fraction. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.6b01415>
- Lu, X., Song, D.P., Ribbe, A., Watkins, J.J., 2017. Chiral Arrangements of Au Nanoparticles with Prescribed Handedness Templated by Helical Pores in Block Copolymer Films. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.7b01364>
- Yavitt, B.M., Gai, Y., Song, D.P., Winter, H.H., Watkins, J.J., 2017. High molecular mobility and viscoelasticity of microphase-separated bottlebrush diblock copolymer melts. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.6b01471>
- Song, D.P., Gai, Y., Yavitt, B.M., Ribbe, A., Gido, S., Watkins, J.J., 2016. Structural Diversity and Phase Behavior of Brush Block Copolymer Nanocomposites. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.6b01602>
- Song, D.P., Naik, A., Li, S., Ribbe, A., Watkins, J.J., 2016. Rapid, Large-Area Synthesis of Hierarchical Nanoporous Silica Hybrid Films on Flexible Substrates. *J. Am. Chem. Soc.* <https://doi.org/10.1021/jacs.6b06947>
- Song, D.P., Shahin, S., Xie, W., Mehrovar, S., Liu, X., Li, C., Norwood, R.A., Lee, J.H., Watkins, J.J., 2016. Directed Assembly of Quantum Dots Using Brush Block Copolymers for Well-Ordered Nonlinear Optical Nanocomposites. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.6b00926>
- Gai, Y., Lin, Y., Song, D.P., Yavitt, B.M., Watkins, J.J., 2016. Strong Ligand-Block Copolymer Interactions for Incorporation of Relatively Large Nanoparticles in Ordered Composites. *Macromolecules*. <https://doi.org/10.1021/acs.macromol.5b02609>

- Mu, H., Pan, L., Song, D., Li, Y., 2015. Neutral Nickel Catalysts for Olefin Homo- and Copolymerization: Relationships between Catalyst Structures and Catalytic Properties. Chem. Rev. <https://doi.org/10.1021/cr500370f>
- Song, D.P., Li, C., Li, W., Watkins, J.J., 2016. Block copolymer nanocomposites with high refractive index contrast for one-step photonics. ACS Nano. <https://doi.org/10.1021/acsnano.5b06525>

Cumulative Impact factor: 221.44

Total Citation: 708

h- index: 15

i10- index: 21

CURRICULUM VITAE

Name: Dr. Kunyu Zhang
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Educational qualification:

- M.Sc.,
- Ph.D.,

Professional experience:

- Teaching and Research Experience: 16 Years

Recent publications:

- Chen, L., Hu, K., Sun, S.T., Jiang, H., Huang, D., Zhang, K.Y., Pan, L., Li, Y.S., 2018. Toughening Poly(lactic acid) with Imidazolium-based Elastomeric Ionomers. Chinese J. Polym. Sci. (English Ed. <https://doi.org/10.1007/s10118-018-2143-6>
- Li, Q., Hao, X., Lv, J., Ren, X., Zhang, K., Ullah, I., Feng, Y., Shi, C., Zhang, W., 2017. Mixed micelles obtained by co-assembling comb-like and grafting copolymers as gene carriers for efficient gene delivery and expression in endothelial cells. J. Mater. Chem. B. <https://doi.org/10.1039/C6TB02212J>
- Nagarajan, V., Zhang, K., Misra, M., Mohanty, A.K., 2015. Overcoming the fundamental challenges in improving the impact strength and crystallinity of PLA biocomposites: Influence of nucleating agent and mold temperature. ACS Appl. Mater. Interfaces. <https://doi.org/10.1021/acsami.5b01145>
- Zhang, K., Misra, M., Mohanty, A.K., 2014. Toughened sustainable green composites from poly(3-hydroxybutyrate-co-3-hydroxyvalerate) based ternary blends and miscanthus biofiber. ACS Sustain. Chem. Eng. <https://doi.org/10.1021/sc500353v>
- Zhang, K., Nagarajan, V., Misra, M., Mohanty, A.K., 2014. Supertoughened renewable PLA reactive multiphase blends system: Phase morphology and performance. ACS Appl. Mater. Interfaces. <https://doi.org/10.1021/am502337u>
- Zhang, K., Nagarajan, V., Zarrinbakhsh, N., Mohanty, A.K., Misra, M., 2014. Co-injection molded new green composites from biodegradable polyesters and miscanthus fibers. Macromol. Mater. Eng. <https://doi.org/10.1002/mame.201300189>

Cumulative Impact factor: 88

Total Citation: 1034

h- index: 15

i10- index: 18

CURRICULUM VITAE

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Educational qualification:

- M.Sc.,
- Ph.D.,

Professional experience:

- Teaching and Research Experience: 15 Years

Honours and Awards:

- 2018: CSIR CEO award to Project Synapse Bioplastics
- 2018: Enviropeadia: Eco-logic Innovation Silver award
- 2013: Awarded best research display for industrial sector, Bio-New Industrial Products (BioNIP), University of Guelph - Canada.
- 2011: Awarded inter-postdoc scholarship in Chemical Science at University of Pisa – Italy
- 2007-2010: Awarded International Galileo Galilei scholarship for PhD in Chemical Science, University of Pisa - Italy.
- 2004: Awarded best poster presentation in 'International Conference on Marine Expo, India.

Recent publications:

- V. Ananthi, G. Siva Prakash, K. Mohan Rasu, K. Gangadevi, T. Boobalan, Rathinam Raja, K. Anand, **M. Sudhakar**, Anil Chuturgoon, A. Arun. *Comparison of integrated sustainable biodiesel and antibacterial nano silver production by microalgal and yeast isolates*. Journal of Photochemistry and Photobiology B: Biology, 2018, 186, 232-242.
- K. Anand, V. Murugan, SM Roopan, V. Surendra, Anil A. Chuturgoon, **Sudhakar Muniyasamy**. *Degradation Treatment of 4-Nitrophenol by Moringa oleifera Synthesised GO-CeO₂ Nanoparticles as Catalyst*. Journal of Inorganic and Organometallic Polymers and Materials, 2018, 28, 2241-2248.
- K. Mohanrasu, N. Premnath, G. Siva Prakash, **M. Sudhakar**, T. Boobalan, A. Arun. *Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation*. Journal of Photochemistry & Photobiology, B: Biology, 2018, 185, 55-65.
- K. Anand, K. Kaviyarasu, **Sudhakar Muniyasamy**, SM Roopan, Anil A. Chuturgoon. *Bio-Synthesis of Silver Nanoparticles Using Agroforestry Residue and Their Catalytic Degradation for Sustainable Waste Management*. Journal of Cluster Science, 2017, 28: 2279-2291.
- M. Aruna and **Sudhakar Muniyasamy**. *Evaluation of mechanical properties of Calotropis gigantea stem fiber-reinforced composite material*, International Journal of Mechanical and Production Engineering (IJMPE) 2017, 5(2), 81-85.

- **Sudhakar Muniyasamy**, Osei Ofoseu, Maya John and Rajesh Anandjowala, *Mineralization of Poly (lactic acid)(PLA), Poly (3-hydroxybutyrate-co-valerate)(PHBV) and PLA/PHBV Blend in Compost and Soil Environments*. Journal of Renewable Materials 2016, 4 (2), 133-145.
- Asis Patnaik, MlandoMvubua, **Sudhakar Muniyasamy**, Anton Botha, Rajesh D. Anandjiwala, *Thermal and sound insulation materials from waste wool andrecycled polyester fibers and their biodegradation studies*. Energy and Buildings 2015, 92, 161-169.
- Andrew Anstey, **Sudhakar Muniyasamy**, Murali M. Reddy, Manju Misra and Amar Mohanty, *Processability and biodegradability evaluation of composites from poly (butylene succinate) (PBS) bioplastic and biofuel co-products from Ontario*. Journal of Polymer and Environment, 2014. 22 (2), 209-218.

Cumulative Impact factor: 1087

Total Citation: 1034

h- index: 12

i10- index: 14

CURRICULUM VITAE

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Educational qualification:

- M.Sc., Microbiology
- M.Phil., Biotechnology
- Ph.D., Microbiology

Professional experience:

- 15 years of Teaching Experience
- 7 years of research Experience

Honours and Awards:

- Early Career Research Award from DST/SERB

Recent publications:

- Arumugam N, Thulasinathan B, Pasubathi R, Kavitha. T, Muthuramalingam JB, Arunachalam A. Biogenesis of silver nanoparticles using selected plant leaf extract; characterization and comparative analysis of their antimicrobial activity. *Nanomed J.* 2017; 4(4): 208-217.
- Nagarajan, A., Soorangkattan, S., Kavitha. T., Thulasinathan, B., Muthuramalingam, J.B. and Alagarsamy, A. (2017) Campus-Wide Floristic Diversity of Medicinal Plants in Indian Institute of Technology-Madras (IIT-M), Chennai. *American Journal of Plant Sciences*, 8, 2995-3012.
- Kavitha,T and N. Shanmugapriya, (2016), “Screening of Rhizobacteria for PGPR and Antagonistic activities isolated from medicinal plants”, *International Journal of Current Research*, Vol. 8, Issue, 09, pp.38841-38846.

Cumulative Impact factor: ---

Total Citation: 32

h- index: 3

i10- index: 1

CURRICULUM VITAE

Name: Dr. T. Sathiamoorthi
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Educational qualification:

MSc., MPhil., Ph.D.,

Professional experience:

Four years and Two months

Honours and Awards:

UGC-RGNF

Recent publications:

- **T. Sathiamoorthi**, J. Joseph Sahayarayan, A.Arivoli. 2016. Prevalence of multi drug resistance *Campylobacter jejuni* from raw chicken meat in erode retail shop. International Journal of Current Research, 8(9):38612-38614, ISSN: 0975- 833X.
- Tariq AL, Reyaz AL, **Sathiamoorthi T.** 2016. Isolation and Identification of Antibiotic Mediated Resistant Betalactum Producing *Escherichia coli* from Urinary Tract Infected Patients in Erode District, Tamil Nadu, India. Int J Drug Dev & Res 8: 038-042. ISSN: 0975-9344.
- Arivoli Appavu, **Sathiamoorthi Thangavelu**, Satheeshkumar Muthukannan, Joseph Sahayarayan Jesudoss and Boomi Pandi. 2016. Study of water quality parameters of cauvery river water in erode region. Journal of Global Biosciences, 5(9): 4556-4567. ISSN 2320-1355.
- **T. Sathiamoorthi**, A. Arivoli, J. Joseph Sahayarayan and M. Satheesh Kumar. 2017. Antibiotic Resistance Pattern of Bacterial Pathogens Isolated From Poultry Waste in Erode, IJEP 37 (1) : 25-30. ISSN : 0253 – 7141.
- **T. Sathiamoorthi**, K. Natarajaseenivasan, P. Velmurugan, P. Prabakaran,V. Pradeepa, A. Arivoli, J. S. Sahayarayan. 2017. Prevalence of Multi Drug Resistance Asymptomatic Bacteriuria from Pregnant Women in Karaikudi, Sivagangai District, International Journal of Modern Science and Technology, 2(7):277-283. ISSN: 2456-0235.
- Joseph Sahayarayan Jesudass, Karthikeyan Kandasam, **Sathyamoorthi Thangavel** and Arivoli Appavu, Novel Anti-Streptococcal Peptide Produced by Mangrove Bacteria *Bacillus subtilis*, Int.J.Curr.Microbiol.App.Sci (2018) 7(1): 1374-1378, ISSN: 2319-7706.
- **T.Sathiamoorthi**, R. Rajesh Kumar, G. Selvakumar, A. Kanchana, N. Jasmine, P.Prabakaran. Green synthesis of silver nanoparticles using *Galinsoga parviflora* leaf extract and its antibacterial and antioxidant activities. International Journal of Microbiology, Biochemistry, and Molecular Biology. Vol. 03, No. 01, pp. 01-08, 23 July, 2018, ISSN: 2454 7557.

- **T. Sathiamoorthi**, R. Rajesh Kumar, A. Kanchana, N. Jasmine, G. Selvakumar, P. Prabakaran. characterization and biological application of silver nano particles produced from *Senna auriculata* leaf extract. International Journal of Recent Advances in Biotechnology, Vol. 02, No. 01, pp. 24-30, 26 July, 2018, ISSN: 2454 7565.

Cumulative Impact factor: -

Total Citation: 27

h- index: 2

i10- index: 1

CURRICULUM VITAE

Name: Dr. V. BALASUBRAMANIAN

Designation: Assistant Professor

Address: Department of Microbiology, Alagappa University,
Karaikudi – 630 003, Tamil Nadu, INDIA Phone: 91 4565 223685

Email: microbaalu8211@gmail.com



Educational qualification:

- M.Sc., (Microbiology)
- PhD (Marine Science Microbiology- Interdisciplinary)

Professional experience:

- Worked as Project Fellow “B” in OPMEC-CECRI, CSIR Tuticorin Unit, Tuticorin-628004, TN, India (From 20/06/2005 to 31/03/2008) Under MOEN Project
- Worked as JRF & SRF (UGC), Department of Marine Science, Bharathidasan University, Tiruchirappalli, TN, India (From 01/10/2009 to 29/01/2014)

Honours and Awards:

- “Science Academies' Summer Research Fellowship Programme for Students and Teachers 2017”. Indian Academy of Science, Bengaluru, India
- Recipient of University Grants Commission Fellowship (RGNF) New Delhi (13.10.2009 to 29.01.2014).
- Received Best Paper Award for ORAL PRESENTATION in “National Seminar on Coastal Typology” held during March 15–17, 2010 at Department of Marine Science, Bharathidasan University – 620024. Title of the Paper “BIOFOULING ON MARINE ENGINEERING ALLOYS

Recent publications:

- **Balasubramanian, V.** R. Rajaram, S. Palanichamy, G. Subramanian, K. Mathivanan, A. Pugazhendhi (2018) Lanosterol expressed bio-fouling inhibition on Gulf of Mannar coast, India. Journal of Progress in Organic Coatings (115)100–106, Elsevier, (IF-3.2)
- Mathivanan, K., R. Rajaram, **V. Balasubramanian*** and G. Annadurai, (2016), " Removal of Cd(II) and Cu(II) from Aqueous Solutions by *Pseudomonas stutzeri* KMNTT-01 Biomass. Environ. Process, (Springer, DOI 10.1007/s40710-016-0193-8).
- **Balasubramanian, V.***, R. Rajaram and P. Rajesh (2016) Antifouling Potentials of Mangrove *Rhizophora apiculata* against *Vibrio alginolyticus* strain VBM-01. Indian Journal of Geo-Marine Science, 44(10) 1654-1661 (IF-0.5), ISSN: 0379-5136.
- Mathivanan, K., R. Rajaram and **V., Balasubramanian*** (2015) Biosorption of Cd(II) and Cu(II) ions using *Lysinibacillus fusiformis* KMNTT-10: equilibrium and kinetic studies, Desalination and Water Treatment, Taylor & Francis, doi: 10.1080/19443994.2015.1129508 (IF-1.2).
- Adaysa Barik, **Balasubramanian, V**, and A. Arun (2019) Biodetoxification of heavy metals using biofilm bacteria. Book Chapter in “Environmental and Agricultural Microbiology: Advances and Applications. Scrivener Publishing, USA (Accepted).
- Adaysa Barik, **Balasubramanian, V**, and P. Rajesh (2019) Potential Antimicrobial Peptides Elucidation From the Marine Bacteria. A thematic issue on “Natural Products Chemistry and Drug Design in Journal of Cardiovascular and Hematological Agents in Medicinal Chemistry, Bentham Science Publishers (Accepted).

Cumulative Impact factor: **7.32**

Total Citation: **46**

h- index: **3**

i10- index: 1

CURRICULUM VITAE

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Designation: Assistant Professor in Microbiology
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Educational qualification:

- M.Sc.,
- Ph.D.

Professional experience: 20 Years

Honours and Awards:

- Proficiency award (Class topper) in B.Sc Zoology
- University V Rank in M.Sc Microbiology
- Qualified State level Educational Testing for Lectureship (SLET) - 2000
- Appreciation award for teaching in MSEC, Sivakasi.- 2008

Recent publications:

- Nagarajan Padmini, Antony Alex Kennedy Ajilda, Natesan Sivakumar, Indrajith Sureka, Ramasamy Senthil Kumar, **Gopal Selvakumar**. (2019). Genetic determination and characterization of extended spectrum β -lactamase producing *Escherichia coli* and *Klebsiella pneumoniae* in a tertiary care hospital, India. *Indian Journal of Biotechnology*. 18 (2): 145 - 150.
- Nagarajan Padmini, Nagasundaram Rashiya, Natesan Sivakumar, Narayanan Dhiraviam Kannan, Ramamoorthy Manjuladevi, Periyannan Rajasekar, Narayanasamy Marimuthu Prabhu, **Gopal Selvakumar**. (2019). Green Synthesis of Silver Nanoparticles from *Oxynema thaianum* ALU PBC 5 and their *in vitro* and *in vivo* Activity Against ESBL Producing MDR *Escherichia coli* and *Klebsiella pneumoniae*. *Asian journal Of Chemistry*, Vol. 31, No. 7, 1447-1453.
- A. Mathivanan, S. Ravikumar, **G. Selvakumar**. (2019). Bioprospecting of sponge and its symbionts: New tool for mosquitocidal & insecticidal metabolites. *Biocatalysis and Agricultural Biotechnology*, 19, 1878-8181.
- Ramu Satheesh Murugan, Gujuluva Hari Dinesh, Tondi Rajan Angelin Swetha, Thulasinathan Boobalan, Muthuramalingam Jothibasu, Panneer Selvam Manimaran, **Gopal Selvakumar**, Alagarsamy Arun. (2018). *Acinetobacter junii* AH4-A Potential Strain for Biohydrogen Production from Dairy Industry Anaerobic Sludge. *Journal of Pure Appl Microbiol*, 12(4), 1761-1769.
- Gujuluva Hari Dinesh, Karthik Sundaram, Kulanthaisamy Mohanrasu, Ramu Satheesh Murugan, Puthamohan Vinayaga Moorthi, Tondi Rajan Anjelin Swetha, **Gopal Selvakumar**, Alagarsamy Arun. (2018). Optimization (Substrate and pH) and Anaerobic Fermentative Hydrogen Production by Various Industrial Wastes Isolates Utilizing Biscuit Industry Waste as Substrate. *Journal of Pure and Applied Microbiology*. 12(3), 1587-1595.
- Dr. K. Kavitha, Dr. R. Rajesh Kumar, **Dr. G. Selvakumar**, Dr. T. Sathiamoorthi. (2018). Prevalence of Asymptomatic and Symptomatic Vulvovaginal Candidiasis among Pregnant Women Attending Hospitals in Vellore District, Tamilnadu, South India. *International Journal of Health Sciences and Research*. 8(9). (IF: 3.56)

- T. Sathiamoorthi, R. Rajesh Kumar, **G. Selvakumar**, A.Kanchana, N. Jasmine, P.Prabakaran. (2018). Characterization and biological application of silver nano particles produced from senna auriculata leaf extract. *International Journal of Recent Advances in Biotechnology*.2 (1), 24-30.
- T. Sathiamoorthi, R. Rajesh Kumar, **G. Selvakumar**, A.Kanchana, N. Jasmine, P.Prabakaran.(2018). Green synthesis of silver nanoparticles using galinsoga parviflora leaf extract and its antibacterial and antioxidant activities. *International Journal of Microbiology, Biochemistry and Molecular Biology*. 3(1),1-8.
- Sudha, M. Bakiyaraj, G. Saranya, A. Sivakumar, N. **Selvakumar, G.** (2018). Prospective assessment of the *Enterobacter aerogenes* PP002 in decolorization and degradation of azo dyes DB 71 and DG 28 . *Journal of Environmental Chemical Engineering*. **6 (1)**, 95-109. (IF:2.5)
- Prabakaran,P. Pradeepa,V. **Selvakumar,G.** Ravindran D. (2018). Efficacy of Enzymatic Transesterification of *Chlorococcum* sp. Algal Oils for Biodiesel Production. *Waste and Biomass valorization*. 1-9. (IF:1.337)

Cumulative Impact factor: 23.861

Total Citation: 257

h- index: 9

i10- index: 7

CURRICULUM VITAE

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Educational qualification:

- M.Sc., Microbiology

Professional experience: 1 Years

Honours and Awards:

- UG Gold Medalist from J.J.College of Arts and science, Affiliated to Bharathidasan University in 2016.
- Achieving 4th Rank in the UG Rank Examination held at Bharathidasan University in 2016.
- Achieving 2nd Rank in the Master of Science, Department of Microbiology, Alagappa University in 2018.
- Selected as a student for Merit based complete waiver of Fees during post graduate in Alagappa University.
- Selected as a student for Merit based scholarship as a rank holder in B.sc by UGC during Masters Degree in Alagappa University.

Recent publications: NIL

Cumulative Impact factor: NIL

Total Citation: NIL

h- index: NIL

i10- index: NIL