



Course Title: Advanced Microbiology

Course Code: LS604

Credit Units: 03

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
3	0	4	0	05

Course Objectives:

Theory: To acquaint the students with various aspects of basic and applied microbiology.

Practical: To develop skills and competencies in standard microbiological laboratory techniques.

Pre-requisites: Microbiology/Life Sciences

Student Learning Outcomes: After completing the microbiology course, students will be able to

- define the basic principles of microbiology.
- develop the knowledge of microbial cell structure, growth and metabolism
- categorize microbial diversity, taxonomy and dynamics of microbial interactions with other populations.
- describe the applied aspects of microbiology.
- generate knowledge of microbiological laboratory practices and skills in the design and execution of microbiology related studies.

Course Contents/Syllabus- Theory:

	Weightage (%)
Module I: Introduction and Historical Perspective	15
Descriptors/Topics: Discovery of microbial world, controversy over spontaneous generation, concept of pure culture. Theory and practice of sterilization. Isolation of microorganisms, staining methods, microscopy, preservation of microbial cultures.	
Module II: Microbial Physiology	20
Descriptors/Topics: Cell structure and function. Microbial growth: Growth curve, growth parameters, batch and continuous cultures, diauxic and synchronous growth, enumeration of cells by direct and indirect methods, phototrophy, chemolithotrophy,	

anaerobic way of life, microbial fermentations, microbial stress responses.	
Module III: Evolutionary Microbiology and Microbial diversity+Virology	15
Descriptors/Topics: Microbial evolution and systematics, prokaryotic diversity: bacteria and archaea, eukaryotic microorganisms (structure of algae, protozoa and fungi). Classical and molecular taxonomy. Viruses and virions, growth and quantification, viral replication, viroids and prions. Bacterial, plant and animal viruses.	
Module IV: Microbial Ecology	15
Descriptors/Topics: Analysis of microbial communities (overview, phylochips and environmental genomics), microbial habitats and nutrient cycling (carbon, sulphur and nitrogen cycles). Plant-microbes, animal-microbes interactions. Bioremediation and biodegradation (petroleum and xenobiotics).	
Module V: Medical Microbiology	20
Descriptors/Topics: Normal microbiota, host pathogen interactions, epidemiology of microbial diseases, microbial toxins, microbial diseases (AIDS, influenza, tuberculosis, diphtheria, Botulism, tetanus, <i>E.coli</i> diarrhoea and hepatitis), Antibiotics, Antibiotic resistance and multi-drug resistance.	
Module VI: Applied Microbiology	15
Descriptors/Topics: Microbial enzymes of industrial interest, microbial metabolites, wine production, single cell proteins, microbial transformation of steroids, food spoilage and preservation, production of dairy products (fermented milks and cheese), role of microbes in agriculture (biofertilizers, biopesticides), Waste water treatment.	

Pedagogy for Course Delivery:

Lectures: 39
 Tutorial: 0
 Presentation/ Seminar: 4
 Class Test: 2
 Total: 45

Lab/ Practical details, if applicable:

Tutorial: 00
 Practical: 26
 Class Test: 4

Total: 30

List of Experiments:

- Laboratory safety and instrument handling. General rules and regulations. Aseptic techniques, preparation of culture media for cultivation of specific microorganisms.
- Isolation and enumeration of microorganisms from air, water and rhizosphere (actinomycetes, bacteria and fungi), serial dilution and viable plate counting methods, use of differential, selective and enriched media.
- Staining techniques: Simple staining, differential Gram staining, endospore staining, lactophenol cotton blue staining for fungi
- Growth curve measurement of bacterial population by turbidometry
- Biochemical tests: Triple Sugar Iron test (TSI), Indole test. Methyl red test. Voges proskaeur test, Citrate utilization test (IMViC), starch hydrolysis, casein hydrolysis, catalase test
- Water microbiology: presumptive, confirmed and complete test for water potability.
- Antibiotic Susceptibility Testing.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total (%)
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Class Test	Home Assignment	Presentation/Seminar	Attendance	
Weightage (%)	15	5	5	5	70

Lab/ Practical/ Studio Assessment:

Components (Drop down)	Continuous Assessment/Internal Assessment				End Term Examination			
	Performance	Lab record	viva	Attendance	Lab record	Performance	Viva	Total
Weightage (%)	10	5	10	5	10	40	20	100

Text & References:*Text*

- Prescott, Harley and Klien's Microbiology, Willey, Sherwood, Woolverton, 7th edition, 2011, McGraw Hill Higher Education, ISBN-13: **978-0073302089**
- Brock Biology of Microorganisms, Madigan, Martinko, Stahl, Clark, 13th edition, 2011, Benjamin Cummings, ISBN-13: **978-0321649638**

References

- Microbiology An Introduction, Tortora, Funke and Chase, 9th edition, 2006, Benjamin Cummings, ISBN 13: **9780321733603**
- General Microbiology, Stanier, Ingraham, Wheelis, 5th edition, 1987, MacMillan, ISBN-13: **978-0333417683**
- Ananthanarayan and Paniker's Textbook of Microbiology, Ananthanarayan and Paniker, 8th edition, 2009, Universities Press ISBN 13: **9788173716744**
- Biotechnology A textbook of Industrial Microbiology, Crueger and Crueger, 2nd edition, 1990 Sinauer Associates Inc.,U.S., ISBN 13: **9780878931316**

Text & References (Lab):

- Experiments in Microbiology, Plant Pathology and Biotechnology, Aneja KR, 4th edition, 2003, New Age International, ISBN: **9788122414943**
- Microbiology: A laboratory Manual, Cappuccino and Sherman, 7th Edition, 2004, Benjamin Cummings, ISBN 13: **9780805328363**

Any other Study Material:

- Research Papers