



MUSLIM ARTS COLLEGE

(Autonomous)

(Accredited by NAAC with B+ grade & Affiliated to Manonmaniam Sundaranar University,
Tirunelveli; Recognized US 2(f) 12 (B) of UGC Act.)

Thiruvithancode, Kanyakumari District, Tamil Nadu - 629174.

DEPARTMENT OF MICROBIOLOGY

CBCS SYLLABUS

Learning Outcome-based Curriculum Framework for

MICROBIOLOGY (M.Sc.)

*Applicable for students admitted from June 2026 as per the Resolutions of the Academic Council Meeting held
on 01.06.2026*

Vision

- To develop skilled professionals in microbiology with strong knowledge of microorganisms and their impact on society, contributing to research, healthcare, and biotechnology through innovation and ethical practices.

Mission

- To provide comprehensive education in microbiology
- To develop practical skills through laboratory training
- To encourage critical thinking and scientific research
- To promote ethical values and social responsibility
- To prepare students for careers in healthcare, research, and industry

Academic and Professional Attributes of the Graduates

1. **Advanced Knowledge in Microbiology**
Demonstrate comprehensive knowledge of microbiology, including microbial physiology, genetics, immunology, molecular biology, environmental microbiology, industrial microbiology, medical microbiology, and biotechnology.
2. **Scientific and Analytical Skills**
Apply scientific principles, analytical reasoning, and evidence-based approaches to investigate microbiological problems and interpret experimental data accurately.
3. **Laboratory Competence**
Perform advanced microbiological, molecular, biochemical, and bioinformatics techniques while adhering to laboratory safety, quality assurance, and standard operating procedures.
4. **Research and Innovation**
Design, conduct, analyze, and communicate independent and collaborative research, contributing innovative solutions to microbiological, environmental, agricultural, healthcare, and industrial challenges.
5. **Communication and Scientific Documentation**
Communicate scientific concepts, research findings, and technical information effectively through oral presentations, scientific writing, publications, and digital platforms.
6. **Ethics and Professional Responsibility**
Demonstrate ethical conduct, biosafety, biosecurity, environmental responsibility, and professional integrity in research, laboratory practice, and community engagement.
7. **Leadership and Teamwork**
Exhibit leadership qualities, interpersonal skills, and collaborative abilities while working effectively in multidisciplinary research, healthcare, academic, and industrial environments.
8. **Entrepreneurship and Industrial Readiness**
Develop professional competencies for employment and entrepreneurship in microbiology-related sectors including healthcare, pharmaceuticals, food industries, biotechnology, environmental management, diagnostics, and quality control.
9. **Global Perspective and Sustainable Development**
Appreciate the role of microorganisms in global health, biodiversity, environmental sustainability, climate resilience, and the achievement of Sustainable Development Goals (SDGs).

10. Lifelong Learning and Professional Development

Engage in continuous learning, adopt emerging technologies, pursue higher education, professional certifications, and contribute to advancements in microbiological sciences.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of the M.Sc. Microbiology Degree Programme, graduates are expected to	Mapping with Mission
PEO1	Demonstrate advanced knowledge and technical competence in microbiology, molecular biology, immunology, biotechnology, and allied disciplines for higher education, research, and professional practice.	M1 & M2
PEO2	Apply scientific principles, laboratory skills, and research methodologies to investigate, analyze, and solve microbiological problems in healthcare, agriculture, environmental management, and industrial sectors.	M2, M3 & M5
PEO3	Exhibit ethical values, biosafety practices, leadership, teamwork, and effective scientific communication while contributing responsibly to society and the scientific community.	M4 & M5
PEO4	Engage in lifelong learning, innovation, entrepreneurship, and continuous professional development to adapt to emerging trends and technologies in microbiology and biotechnology.	M3, M5 & M6

Programme Outcomes (POs)

POs	Upon completion of the M.Sc. Microbiology Degree Programme, students will be able to	Mapping with PEOs
PO1: Advanced Disciplinary Knowledge	Demonstrate comprehensive knowledge of microbiology, molecular biology, microbial genetics, immunology, biotechnology, and allied biological sciences.	PEO1
PO2: Critical Thinking and Scientific Analysis	Critically analyze microbiological concepts, interpret scientific data, and apply analytical reasoning to address complex biological problems.	PEO1, PEO2
PO3: Research and Problem Solving	Design and conduct experiments, apply appropriate research methodologies, analyze results, and develop innovative solutions to microbiological and biotechnological challenges.	PEO2, PEO4
PO4: Laboratory and Technical Competence	Demonstrate proficiency in advanced microbiological, molecular, biochemical, and bioinformatics techniques while following laboratory safety and quality standards.	PEO1, PEO2
PO5: Scientific	Communicate scientific information effectively	PEO3

Communication	through technical writing, presentations, publications, and digital platforms for academic and professional audiences.	
PO6: Ethics and Professional Responsibility	Apply ethical principles, biosafety, biosecurity, environmental responsibility, and professional integrity in research, industry, and healthcare practices.	PEO3
PO7: Leadership and Teamwork	Function effectively as an individual and as a member or leader of multidisciplinary teams, demonstrating leadership, collaboration, and interpersonal skills.	PEO3, PEO4
PO8: Entrepreneurship and Industrial Readiness	Apply microbiological knowledge and technical skills in healthcare, pharmaceuticals, food industries, agriculture, environmental management, diagnostics, quality control, and entrepreneurial ventures.	PEO2, PEO4
PO9: Lifelong Learning	Pursue continuous learning, adapt to emerging technologies, and engage in professional development to meet evolving scientific and societal needs.	PEO4
PO10: Environment and Sustainability	Apply microbiological principles to promote environmental conservation, public health, sustainable development, and societal well-being through responsible scientific practices.	PEO2, PEO3, PEO4

Programme Specific Outcomes (PSOs)

PSOs	Upon completion of the M.Sc. Microbiology Degree Programme, students will be able to:	Mapping with POs
PSO1	Demonstrate advanced knowledge of microbiology, microbial physiology, molecular biology, microbial genetics, immunology, environmental microbiology, industrial microbiology, and biotechnology to understand microbial diversity and their applications.	PO1, PO2, PO4
PSO2	Apply advanced laboratory techniques, molecular tools, bioinformatics, and modern analytical methods for the identification, characterization, cultivation, and control of microorganisms in research and industrial settings.	PO2, PO3, PO4, PO8
PSO3	Design and execute independent research projects by applying appropriate experimental methodologies, statistical analysis, scientific documentation, and interpretation of microbiological data.	PO3, PO5, PO9
PSO4	Develop innovative and sustainable solutions to challenges in healthcare, pharmaceuticals, food safety, agriculture, environmental management, and biotechnology while adhering to ethical, biosafety, and biosecurity practices.	PO3, PO6, PO8, PO10
PSO5	Demonstrate leadership, entrepreneurship, effective scientific communication, teamwork, and professional competence for successful careers in academia, research organizations, healthcare, biotechnology industries, diagnostics, and public sectors.	PO5, PO6, PO7, PO8, PO9

PSO6	Apply microbiological knowledge to address global health issues, environmental sustainability, antimicrobial resistance, and emerging infectious diseases through responsible scientific practices and lifelong learning.	PO2, PO6, PO9, PO10
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Mapping of Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

POs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1: Advanced Disciplinary Knowledge	3	2	2	2	2	2
PO2: Critical Thinking and Scientific Analysis	3	3	2	3	2	3
PO3: Research and Problem Solving	2	3	3	3	2	2
PO4: Laboratory and Technical Competence	3	3	2	2	2	2
PO5: Scientific Communication	2	2	3	2	3	2
PO6: Ethics and Professional Responsibility	2	2	2	3	3	3
PO7: Leadership and Teamwork	1	2	2	2	3	2
PO8: Entrepreneurship and Industrial Readiness	2	3	2	3	3	2
PO9: Lifelong Learning	2	2	3	2	3	3
PO10: Environment and Sustainability	2	2	2	3	2	3

●3 – High Correlation ●2 – Moderate Correlation ●1 – Low Correlation

COURSES OFFERED

SEMESTER I

Part	Course Code	Title of the Course	Credits	Hours / Week
Core Course -I	NMMB11	General Microbiology and Microbial Diversity	5	6
Core Course - II	NMMB12	Microbial Physiology	5	6
Core Course - PI	NMMBP1	General Microbiology, Microbial Diversity and Microbial Physiology	4	6
Elective Course - I	NEMB11	Forensic Science	3	6
Elective Course - II	NEMB11	Health and Hygiene	3	6
Total			20	30

SEMESTER I

CORE COURSE I: GENERAL MICROBIOLOGY AND MICROBIAL DIVERSITY

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMMB11	Core	Y	Y	-	-	5	6	25	75	100

Learning Objectives

The course aims to:

1. Acquire knowledge on the principles of different types of microscopes and their applications.
2. Explain various pure culture techniques and discuss sterilization methods.
3. Exemplify, isolate and cultivate microalgae from diverse environmental sources.
4. Compare and contrast the structure of bacteria and fungi. Illustrate nutritional requirements and growth in bacteria.
5. Discuss the importance and conservation of microbial diversity.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Examine various microbes employing the microscopic techniques learnt. Measure and compare the size of microbes.	K5
CO2	Create aseptic conditions by following good laboratory practices.	K6
CO3	Identify and cultivate the algae understanding their habitat. Analyze the morphology, classify and propagate depending on its economic importance.	K2
CO4	Differentiate and appreciate the anatomy of various microbes. Plan the growth of microbes for different environmental conditions.	K4
CO5	Categorize and cultivate a variety of extremophiles following standard protocols for industrial applications.	K4

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Units	Contents	No. of Hours
I	History and Scope of Microbiology. Microscopy – Principles and applications. Types of Microscopes - Bright field, Dark-field, Phase-contrast, Fluorescence microscope, Transmission electron microscope (TEM) and Scanning electron microscope (SEM). Sample preparation for SEM & TEM. Atomic force, Confocal microscope. Micrometry – Stage, Ocular and its applications.	18

II	Microbial techniques - Safety guidelines in Microbiology Laboratories. Sterilization, Disinfection and its validation. Staining methods – Simple, Differential and Special staining. Automated Microbial identification systems - Pure cultures techniques – Cultivation of Anaerobic organisms. Maintenance and preservation of pure cultures. Culture collection centres - National and International.	18
III	Algae - Distribution, morphology, classification, reproduction and economic importance. Isolation of algae from soil and water. Media and methods used for culturing algae, Strain selection and large-scale cultivation. Life cycle - Chlamydomonas, Volvox Spirogyra (Green algae), Nostoc (Cyanobacteria) Ectocarpus, Sargassum (Brown algae), Polysiphonia, Batrachospermum (Red algae).	18
IV	Bacterial Structure, properties and biosynthesis of cellular components – Cell wall. Actinomycetes and Fungi - Distribution, morphology, classification, reproduction and economic importance. Sporulation. Growth and nutrition - Nutritional requirements, Growth curve, Kinetics of growth, Batch culture, Synchronous growth, Measurement of growth and factors affecting growth.	18
V	Biodiversity - Introduction to microbial biodiversity – Thermophiles - Classification, Thermophilic Archaeobacteria and its applications. Methanogens - Classification, Habitats, applications. Alkaliphiles and Acidophiles - Classification, discovery basin, its cell wall and membrane. Barophiles - Classification and its applications. Halophiles - Classification, discovery basin, cell walls and membranes – purple membrane, compatible solutes. Microbial stress response Osmoadaptation / halotolerance - Applications of halophiles.	18
	Total	90

S. No.	Text Book
1	Kanunga R. (2017). Ananthanarayanan and Panicker's Text book of Microbiology.(10th Edition). Universities Press (India) Pvt. Ltd.
2	Chan E.C.S., Pelczar M. J. Jr. and Krieg N. R. (2010). Microbiology. (5th Edition). Mc.Graw Hill. Inc, New York.
3	Prescott L. M., Harley J. P. and Klein D. A. (2004). Microbiology. (6th Edition). McGraw - Hill company, New York.
4	White D. Drummond J. and Fuqua C. (2011). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, Oxford, New York.
5	Dubey R.C. and Maheshwari D. K. (2009). Textbook of Microbiology. S. Chand, Limited.

S. No.	Reference Books
1	Tortora G. J., Funke B. R. and Case C. L. (2015). Microbiology: An Introduction (12th Edition).Pearson, London, United Kingdom.

2	Webster J. and Weber R.W.S. (2007). Introduction to Fungi. (3rd Edition). Cambridge University Press, Cambridge.
3	Schaechter M. and Leaderberg J. (2004). The Desk encyclopedia of Microbiology. Elsevier Academic Press, California.
4	Ingraham, J.L. and Ingraham, C.A. (2000) Introduction to Microbiology. (2nd Edition). Books / Cole Thomson Learning, UK.
5	Madigan M. T., Bender K.S., Buckley D. H. Sattley W. M. and Stahl (2018) Brock Biology of Microorganisms. (15th Edition). Pearson.

S. No.	Web Resources
1	http://sciencenetlinks.com/tools/microbeworld
2	https://www.microbes.info/
3	https://www.asmscience.org/VisualLibrary
4	https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=404
5	https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	2	1	2	2	2
CO2	2	3	3	3	2	3	2	2	2	2
CO3	3	3	2	2	2	2	2	3	2	3
CO4	3	3	3	3	2	2	2	2	2	2
CO5	3	3	3	2	2	3	2	3	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	2	2	2
CO3	3	3	2	3	2	3
CO4	3	3	3	2	2	2
CO5	3	3	3	3	3	3
Weightage	15	15	13	12	11	12
Weighted Percentage of Course Contribution to PSOs	3.0	3.0	2.6	2.4	2.2	2.4

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR - SEMESTER I**CORE II - MICROBIAL PHYSIOLOGY**

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMMB12	Core	Y	Y	-	-	5	6	25	75	100

Learning Objectives

The course aims to:

1. Illustrate Bacterial nutrition and their utilization.
2. Discuss cultivation methods and factors related to microbial growth.
3. Demonstrate concepts of microbial metabolism.
4. Impart the fundamentals and importance of biosynthetic pathways.
5. Discuss the methods involved in Photosynthesis.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Apply knowledge about nutritional requirement, modes of nutrient transport in microorganisms to various disciplines of Microbiology.	K3
CO2	Analyse microbial growth, factors influencing growth and its measurement techniques for applications in various industries.	K4
CO3	Compare various metabolic pathways and discuss the properties and functions of enzymes.	K5
CO4	Apply anaerobic respiration and biosynthetic pathways to enhance/control microbial growth.	K3
CO5	Assimilate methods involved in microbial photosynthesis and bioluminescence.	K5

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Units	Contents	No. of Hours
I	Nutrition – Nutritional requirements and types in bacteria – Phototrophs, Chemotrophs, Autotrophs and Heterotrophs. Nutrient transport mechanisms- Passive diffusion, Facilitated diffusion, Active transport, Group translocation and Specific transport system.	18
II	Microbial growth – Growth curve and Measurement of Growth – Cell Number and Cell Mass and metabolic activity. Batch, Continuous, Synchronous and Asynchronous cultures, Factors affecting growth.	18
III	Enzymes – properties, functions and regulation. Basic concepts of metabolism, Oxidation – reduction reactions, Energy generation by anaerobic metabolism – Glycolysis, Pentose Phosphate pathway, ED pathway, Fermentation. Energy generation by Aerobic metabolism - TCA cycle, Glyoxylate pathway and Electron Transport chain,	18

	Mechanism of ATP synthesis – Chemiosmosis, Pasteur effect. Metabolism of lipids- β oxidation.	
IV	Anaerobic Respiration. Nitrogen, Sulphur, Iron and Hydrogen Oxidation. Methanogenesis. Biosynthesis – Gluconeogenesis, Peptidoglycan synthesis, Amino acids, Purines, Pyrimidines Fattyacids, Triglycerides, Phospholipids and Sterols.	18
V	Photosynthesis – process, antenna of light-harvesting pigments, Photochemical reaction centers, Photosynthetic Electron Transport Chain-Cyclic and Non-cyclic. Oxygenic and Anoxygenic Photosynthesis. Calvin-Benson cycle. Bioluminescence - Process and application.	18
	Total	90

S. No.	Text Book
1	Stanier R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (2010). General Microbiology. 5th Edn. Macmilan education Ltd. London.
2	Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubugue.
3	Moat, A.G. and Foster, J.W. (2003). Microbial Physiology.4th Edn. John Wiley and Sons, New York.
4	Doelle, H.W. (1975) Bacterial Metabolism, 2nd Edn. Academic Press, London.
5	Caldwell, D.R (2000) Microbial physiology and metabolism, 2nd Edn. Star publishing, Belmont, California.

S. No.	Reference Books
1	Salle. A.J. (1992). Fundamental Principles of Bacteriology. 7th edn. McGraw Hill Inc.New York.
2	Madigan, M.T., Martinko, J.M., & ParkerJ. (2000). Brock Biology of Microorganisms. 9th Edn. Prentice Hall International, Inc, London.
3	Ingraham, J.L., & Ingraham, C.A. (2000). Introduction to Microbiology. 2nd Edn. Brook /Cole. Singapore.
4	Gottschalk, G. (1986). Bacterial Metabolism.2nd Edn. Springer-Verlag, New York.
5	Rose, A.H. (1976). An Introduction to Microbial Physiology. 3rd Edn. Plenum, New York.

S. No.	Web Sources
1	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/
2	https://www.lamission.edu/lifesciences/lecturenote/mic20/Chap06Growth.pdf
3	https://www.tandfonline.com/doi/abs/10.3109/07388558409082583?journalCode=ibty20
4	https://www.sciencedirect.com/topics/neuroscience/microbial-respiration
5	https://www.britannica.com/science/photosynthesis

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	2	1	2	2	2
CO2	3	3	3	3	2	2	2	3	2	2
CO3	3	3	3	2	3	2	2	2	3	2
CO4	3	3	3	3	2	3	2	3	2	2
CO5	3	3	2	2	3	2	2	2	2	3

3 – Strong, 2 – Medium, 1 – Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	2	2
CO4	3	3	3	3	3	2
CO5	3	2	3	2	2	3
Weightage	15	14	14	12	11	11
Weighted Percentage of Course Contribution to PSOs	3.0	2.8	2.8	2.4	2.2	2.2

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR - SEMESTER I

CORE COURSE PI- GENERAL MICROBIOLOGY, MICROBIAL DIVERSITY AND MICROBIAL PHYSIOLOGY

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMMBP1	Core	-	-	Y	Y	4	6	25	75	100

Learning Objectives

The course aims to:

1. Gain knowledge on the fundamentals, handling and applications of microscopy.
2. Provide fundamental skills in sterilization methods. Identify microbes by different staining methods.
3. Prepare media for bacterial growth. Analyze microbial enzymes.
4. Perform plating techniques and methods involved in microbial preservation.
5. Measure bacterial growths, identify optimal growth parameters, cultivate bacteria, and perform antibiotic sensitivity.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Apply microscopic techniques and staining methods in the identification and differentiation of microbes.	K2
CO2	Apply the knowledge on the sterilization of glass wares and media by different methods and measurement of cell growth.	K5
CO3	Prepare media for bacterial growth. Analyze microbial enzymes.	K2
CO4	Pertain plating techniques and methods involved in microbial preservation.	K4
CO5	Analyze microbial growth, optimal growth parameters, cultivate bacteria, and perform antibiotic sensitivity.	K2

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Microscopic Techniques: Light microscopy: Hay infusion broth. Wet mount to show different types of microbes, hanging drop. Micrometry. Dark field microscopy – Motility of Spirochetes. Washing and cleaning of glass wares: Sterilization methods: moist heat, dry heat, and filtration. Quality control check for each method.	18
II	Staining techniques - Simple staining, Gram's staining, Acid fast staining, Meta chromatic granule staining, Spore, Capsule, Flagella.	18
III	Media Preparation: Preparation of liquid, solid and semisolid media. Agar deeps, slants, plates. Preparation of basal, enriched, selective and enrichment media. Preparation of Biochemical test media, media to demonstrate enzymatic activities.	18
IV	Purification and maintenance of microbes. Streak plate, pours plate, and slide culture technique. Aseptic transfer. Direct counts – Total cell count, Turbidometry. Viable count - pour plate, spread plate	18
V	Bacterial growth curve. Effect of physical and chemical factors on growth. Anaerobic culture methods.	18
	Total	90

S. No.	Text Books
1	Dubey R.C. and Maheshwari D. K. (2010). Practical Microbiology. S. Chand.
2	Cappuccino, J. and Sherman, N. (2002). Microbiology: A Laboratory Manual, (6th Edition). Pearson Education, Publication, New Delhi.
3	Cullimore D. R. (2010). Practical Atlas for Bacterial Identification. (2nd Edition). Taylor & Francis.
4	Moat, A.G. Foster, J.W. and Spector, M. P (2002) Microbial Physiology, 4th Edn. Wiley - Liss, New York.
5	Dawes, I. W. and Sutherland, I. W (1992) Microbial physiology, 2nd Edn. Blackwell Scientific Publications, London.
S. No.	Reference Works
1	Collee J. G., Fraser A.G. Marmion B. P. and Simmons A. (1996). Mackie & McCartney Practical Medical Microbiology. (14th Edition). Elsevier, New Delhi.
2	Stanier R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (2010). General Microbiology. 5th Edn. Macmillan education Ltd. London.
3	Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubuque.
4	Gottschalk, G. (1986). Bacterial Metabolism. 2nd Edn. Springer-Verlag, New York.
5	Rose, A.H. (1976). An Introduction to Microbial Physiology. 3rd Edn. Plenum, New York.

S. No.	Web Sources (URL)
1	http://textbookofbacteriology.net/
2	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149666/
3	http://sciencenetlinks.com/tools/microbeworld
4	https://www.microbes.info/
5	https://www.asmscience.org/VisualLibrary

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	2	1	2	2	2
CO2	3	3	3	3	2	3	2	2	2	2
CO3	3	3	3	2	2	2	2	3	2	2
CO4	3	3	3	3	2	3	2	3	2	2
CO5	3	3	3	3	3	2	2	3	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	2	2	2
CO3	3	3	3	2	2	2
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	3
Weightage	15	15	14	12	12	11
Weighted Percentage of Course Contribution to PSOs	3.0	3.0	2.8	2.4	2.4	2.2

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

SEMESTER I
ELECTIVE COURSE-I (EC-I)
FORENSIC SCIENCE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NEMB11	Elective -I	Y	Y	-	-	3	6	25	75	100

Learning Objectives

The course aims to:

1. Understand the Scope, need and learn the tools and techniques in forensic science.
2. Comprehend organizational setup of a forensic science laboratory.
3. Identify and examine body fluids for identification.
4. Extract DNA from blood samples for investigation.
5. Recognize medico legal post mortem procedures and their importance.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Identify the scope and need of forensic science in the present scenario.	K2
CO2	Plan for the organizational setup and functioning of forensic science laboratories.	K3
CO3	Analyze the biological samples found at the crime scene.	K3
CO4	Perform extraction and identification of DNA obtained from body fluids.	K4
CO5	Discuss the concept of forensic toxicology.	K3

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Forensic Science - Definition, history and development of forensic science. Scope and need of forensic science in present scenario. Branches of forensic science. Tools and techniques of forensic science. Duties of a forensic scientist.	18

II	Forensic science laboratories - Organizational setup of a forensic science laboratory. Central and State level laboratories in India. Mobile forensic science laboratory and its functions. Forensic microbiology - Types and identification of microbial organisms of forensic significance.	18
III	Forensic serology - Definition, identification and examination of body fluids - Blood, semen, saliva, sweat and urine. Forensic examination and identification of hair and fibre.	18
IV	DNA profiling - Introduction, history of DNA typing. Extraction of DNA from blood samples - Organic and Inorganic extraction methods. DNA fingerprinting - RFLP, PCR, STR. DNA testing in disputed paternity.	18
V	Forensic toxicology - Introduction and concept of forensic toxicology. Medico legal post mortem and their examination. Poisons - Types of poisons and their mode of action.	18
	Total	90

S. No.	Text Book
1	Nanda B. B. and Tewari R. K. (2001) Forensic Science in India: A Vision for the Twenty First Century. Select Publishers, New Delhi. ISBN- 10:8190113526 / ISBN-13:9788190113526.
2	James S. H. and Nordby, J. J. (2015) Forensic Science: An Introduction to Scientific and Investigative Techniques. (5th Edition). CRC Press. ISBN-10:9781439853832 / ISBN-13:978-1439853832.
3	Li R. (2015) Forensic Biology. (2nd Edition). CRC Press, New York. ISBN-13:978-1-4398-8972-5.
4	Sharma B.R (2020) Forensic science in criminal investigation and trials. (6th Edition)Universal Press.
5	Richard Saferstein (2017). Criminalistics- An introduction to Forensic Science. (12th Edition).Pearson Press.

S. No.	Reference Books
1	Nordby J. J. (2000). Dead Reckoning. The Art of Forensic Detection- CRC Press, New York. ISBN:0-8493-8122-3.
2	Saferstein R. and Hall A. B. (2020). Forensic Science Hand book, Vol. I, (3rd Edition). CRC Press, New York. ISBN-10:1498720196.
3	Lincoln, P.J. and Thomson, J. (1998). (2nd Edition). Forensic DNA Profiling Protocols. Vol. 98. Humana Press. ISBN: 978-0-89603-443-3.
4	Val McDermid (2014). Forensics. (2nd Edition). ISBN 9780802125156.
5	Vincent J. DiMaio., Dominick DiMaio. (2001). Forensic Pathology (2nd Edition). CRC Press.

S. No.	Web Resources
1	http://clsjournal.ascls.org/content/25/2/114
2	https://www.ncbi.nlm.nih.gov/books/NBK234877/
3	https://www.elsevier.com/books/microbial-forensics/budowle/978-0-12-382006-8
4	https://www.researchgate.net/publication/289542469_Methods_in_microbial_forensics
5	https://cisac.fsi.stanford.edu/events/microbial_forensics

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	1	1	2	1	1	2	1
CO2	2	2	3	2	1	2	2	2	2	1
CO3	2	3	3	3	2	2	1	2	3	2
CO4	2	3	3	3	2	2	2	3	3	2
CO5	2	2	2	2	2	3	2	2	2	3

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	1	2	1
CO2	2	3	2	2	2	1
CO3	2	3	3	2	3	2
CO4	2	3	3	3	3	2
CO5	2	2	2	3	2	3
Weightage	10	13	11	11	12	9
Weighted Percentage of Course Contribution to PSOs	2.0	2.6	2.2	2.2	2.4	1.8

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR – SEMESTER I
ELECTIVE COURSE-II: HEALTH AND HYGIENE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
NEMB11	Elective -II	Y	Y	-	-	3	6	25	75	100

Learning Objectives

The course aims to:

1. Acquire knowledge on hygiene and live healthy.
2. Provide insights on health laws for food safety and hygiene.
3. Explain health, physical exercises and their importance.
4. Illustrate mental hygiene and involved in mental hygiene.
5. Describe the various health and health education programmes by the government.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Explain the concepts of hygiene, health, and healthy living practices.	K1
CO2	Describe the importance of nutrition, environmental hygiene, ventilation, lighting, and food safety laws.	K2
CO3	Apply principles of personal hygiene and healthy lifestyle practices to prevent diseases and harmful addictions.	K3
CO4	Analyze the importance of mental hygiene and emotional well-being across different stages of life.	K4
CO5	Illustrate government health programmes and the role of health education in promoting community health.	K3

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Unit	Contents	No. of Hours
I	Hygiene and Healthy Living Introduction to hygiene and healthful live. Factors affecting health, health habits and practices. Recognizing positive & negative practices in the community. Scientific principles related to health.	18
II	Nutrition and Health Nutrition and Health – Balanced diet, Food surveillance, food Fortification, adulteration and preventive measures. Health laws for food safety. Environmental and housing hygiene. Ventilation and lighting.	18
III	Awareness on Physical Health Physical health, physical exercises and their importance – Walking, jogging, yoga and meditation, stress relief. International control of health, WHO. Personal hygiene, Sun bathing, Colon Hygiene. Health destroying habits and addictions - Pan, supari, ganja, drinking, smoking, tea and coffee.	18
IV	Mental Hygiene Mental hygiene - factors responsible, developmental tasks, basic needs, emotional stability. Mental hygiene and health in infancy, early childhood, adolescence, adulthood and old age. Mental health occupational hazards.	18
V	Health Programme and Health Education Health programme and health education – Malaria control, Tuberculosis control, AIDS control programmes and Immunization Programmes. Family planning, Reproductive and Child health programmes (RCH).	18
	Total	90

S. No.	Text Books
1	Bamji M. S., Krishnaswamy K. and Brahman G. N. V. (2019). Textbook of Human Nutrition. (4th Edition). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2	Swaminathan (1995) Food & Nutrition (Vol I) (2nd Edition). The Bangalore Printing & Publishing Co Ltd., Bangalore.
3	Paniker J. C. K. and Ananthanarayan R. (2017). Textbook of Microbiology. (10th Edition). Universities Press (India) Pvt. Ltd
4	Lindsay Dingwall (2010). Personal Hygiene Care. Print ISBN:9781405163071 Online ISBN:9781444318708 DOI:10.1002 / 9781444318708
5	Walter C. C. Pakes (1900). The Science of Hygiene: a Text-book of Laboratory Practice. (London: Methuen and Co.,).

S. No.	Reference Books
1	Khader V. (2000) Food, Nutrition and Health, Kalyan Publishers, New Delhi.
2	Srilakshmi, B. (2010) Food Science, (5th Edition) New Age International Ltd., New Delhi.
3	Dubey R.C. and Maheshwari D. K. (2010). Practical Microbiology. S. Chand.
4	Park K. 2007, Park's text book of Preventive and Social Medicine, Banarsidas Bhanot publishers, India.
5	Srilakshmi, 2002, Dietetics, New Age Publications, India.

S. No.	Web Resources
1	Health and Hygiene - Personal Hygiene, Community Hygiene and Diseases (vedantu.com) Chapter-32.pdf (nios.ac.in)
2	Menstrual Health and Hygiene Guide Student Health and Counseling Services (ucdavis.edu)
3	https://nap.nationalacademies.org/read/11756/chapter/13
4	http://ecoursesonline.iasri.res.in/mod/page/view.php?id=112325

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	1	2	1	1	1
CO2	3	3	2	2	2	2	2	2	2	2
CO3	3	3	3	2	2	3	2	2	3	2
CO4	2	3	2	3	2	2	2	2	3	2
CO5	2	2	3	3	2	2	2	2	2	1

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PSO	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	3	2
CO3	3	3	3
CO4	2	3	2
CO5	2	2	3
Weightage	13	13	11
Weighted percentage of Course Contribution to PSOs	2.6	2.6	2.2

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation