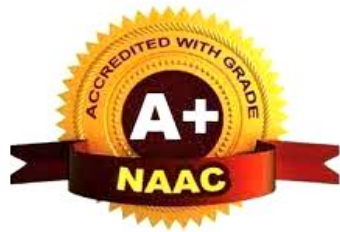




**Centre of Research for Development
P. G. Centre of Microbiology
University of Kashmir
Srinagar-190 006 J & K, India**



The New National Education Policy (NEP), 2020

Syllabus B. Sc. Microbiology

(Pursuant to inclusion as major subjects/ disciplines)

GENERAL COURSE OUTLINE

Course structure:

Syllabus for 1st and 2nd semester for one major/ minor (4+2) and one Introductory Multidisciplinary Course of 3 credit (1st to 3rd semester) at undergraduate level of Microbiology discipline

Semester	Course/ Paper Category	Credits	Course Code	Course Name	Hours/ Week	
					Lecture	Practical*
First	Major/ Minor	4 + 2	MIC-22-101-MJ/MN	Fundamentals of Microbiology	4	4
Second	Major/ Minor	4 +2	MIC-22-201-MJ/MN	Microbiological Techniques	4	4
First to Third	Introductory Multidisciplinary Course	3	MIC-22-301-IMC	Applied Microbiology	3	-

* For practical class contact hours are twice the theory course.

Course Description: First Semester

Course type: Major/ Minor

Course code: MIC-22-101-MJ/MN

Course title: Fundamentals of Microbiology

Course credits: 4 + 2

Course objectives:

- The course has been designed to give a basic understanding of the fundamental aspects of microbiology from historical development of the branch of microbiology
- The students will be introduced to the microbial world, the structure and significance of bacteria, fungi, algae, protozoa and viruses
- This course contains two basic lab practices and calculation needed for preparation of various reagents and buffers
- This course will enable students to understand working principles of different laboratory equipment's
- The students will learn different sterilization methods, preparation of culture media and pure culture techniques

Credit-1: History and Scope of Microbiology

1. 1. Historical development of Microbiology-Theory of spontaneous generation, Biogenesis and Abiogenesis
1. 2. Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner
1. 3. Contributions of Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky and Elie Metchnikoff
1. 4. Fields and scope of microbiology
1. 5. Golden era of microbiology

Credit-2: Prokaryotes

2. 1. Ultra structure of prokaryotic cell: bacterial and archaeal - cell wall and cell membrane
2. 2. Components external to cell wall - capsule, slime, s-layer, pili, fimbriae, flagella; structure, motility, chemotaxis
2. 3. Cytoplasmic matrix - Cytoskeleton, ribosome, inclusion granules: Composition and function.
2. 4. Bacterial nuclear material and Extra Chromosomal material
2. 5. Reproduction in bacteria

Credit-3: Eukaryotes

3. 1. Ultra structure of eukaryotic cell: Types of cells; Structure and function of organelles: cell wall, cell membrane, flagella, cytoplasmic matrix, cytoskeleton and endoplasmic reticulum
3. 2. Structure and function of organelles: Golgi complex, peroxisomes, lysosomes, vesicles, ribosomes, mitochondria, chloroplast and nucleus
3. 3. Structure, composition and reproduction of fungi.
3. 4. Structure, composition and reproduction of Algae
3. 5. Structure, composition and reproduction of Protozoa

Credit-4: Viruses and Virus Related Structures

- 4.1. Introduction to Virology
- 4.2. General characteristics of viruses
- 4.3. Structure and composition of viruses
- 4.4. Replication of viruses (overview)
- 4.5. Sub viral particles: Satellite Viruses, Virusoids, Viroids, and Prions

Credit-5: Practical I

- 5.1. Biosafety levels in microbiology laboratory
- 5.2. Understandings of biochemical calculations: molarity, normality, percent solution and ppm
- 5.3. Preparation of buffers and pH measurements
- 5.4. Study the parts, working principle and uses of Compound Microscope, Autoclaves and Hot air oven
- 5.5. Study the parts, working principle and uses of laminar air flow and Incubator

Credit-6: Practical II

- 6.1. Sterilization techniques: physical and chemical
- 6.2. Culture media and their preparation
- 6.3. Perform culture techniques: Streaking method, pour plate and spread plate method:CFU Count
- 6.4. Isolation of bacteria from water sample
- 6.5. Staining techniques - Simple and Gram staining

Learning outcome:

- Students will be familiarized with the history of development of science of microbiology.
- The students will develop the concept of the basic microbiology including the occurrence, cell structure and reproduction of various microbes.
- Students will be able to perform various biochemical calculation, sterilization techniques and purification of microbial cultures.
- Students will acquire knowledge about different microbiology laboratory equipment's and media preparations

Recommended books:

1. Brock Biology of Microorganisms by Madigan and Martinko, 14th edition, Pearson Education International.
2. Prescott's Microbiology by Joanne Willey, Linda Sherwood and Christopher J. Woolverton, 11th edition, McGraw Hill Publisher Companies, Inc
3. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology by Andreas Hofmann, 8th edition, Cambridge University Press.
4. Microbiology by Michael J. Pelczar JR, E.C. S. Chan, Noel R. Krieg, 5th edition, McGraw Hill Publisher Companies, Inc.
5. The Cell: A Molecular Approach by Geoffrey M. Cooper, Robert E. Hausman, 6th edition, Sinauer Associates Inc.
6. Microbiology: A Laboratory Manual by James Cappuccino and Chad T. Welsh 11th Global Edition, Pearson Benjamin Cummings Publishers.
7. Practical Microbiology by D K Maheshwari and R C Dubey, 3rd edition, S Chand & Company Publishers.
8. Laboratory Fundamentals of Microbiology by Jeffrey C. Pommerville 12th edition, Jones and Bartlet Publishers.

Course Description: Second Semester

Course type: Major/Minor

Course code: MIC-22-201-MJ/MN

Course title: Microbiological Techniques

Course credits: 4 + 2

Course Objectives:

- This course is framed to acquaint students with different culture media and important techniques involved in the culturing, purification and preservation of microbes.
- Course will make students familiar with principles and procedures involved in sterilization, staining and microscopy.
- This course shall deal with microscopic examination of bacteria and fungi as well as gram staining
- This course is framed to familiarize students with isolation of yeast and mold from food samples
- Students will also have hands on different biochemical tests, protease assay and antibiotic sensitivity assay

Credit-1 Culture media

1. 1. Culture media: Classification, composition, preparation and utility
1. 2. Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media, anaerobic media (with examples)
1. 3. Microbial nutrient requirements (micro and macro), factors affecting microbial growth
1. 4. Classification of microorganisms based on nutritional requirements.
1. 5. Bacterial growth curve and application

Credit-2: Sterilization and preservation techniques

2. 1. Sterilization: Principles and methods of physical sterilization (moist heat, dry heat, filtration, tyndallization, radiations); Pasteurization
2. 2. Principles and methods of chemical sterilization (alcohols, aldehydes, phenols, halogens and hypochlorites)
2. 3. Preservation and maintenance methods of microbial cultures (slant culture, stab culture, soil culture, mineral oil overlaying, refrigeration, glycerol preservation, cryopreservation, lyophilization)
2. 4. Different biosafety levels in a microbiology laboratory
2. 5. National and international Culture Collection Centers

Credit-3 Culture techniques

3. 1. Collection of samples, processing of samples, serial dilution
3. 2. Isolation methods: Spread plate method, streak plate method, pour plate method, swab culture
3. 3. Enumeration methods of microorganisms: CFU, optical density, MacFarlands scale, Total viable count, Direct microscopic count
3. 4. Observation of morphological characteristics of microbial colonies.
3. 5. Safety measures undertaken during culturing of microorganisms.

Credit-4: Microscopy and staining techniques

4. 1. Microscope and their classification
4. 2. Working principle, construction and operation of simple and compound microscopes.
4. 3. Stains, staining and their mechanism
4. 4. Staining methods: Introduction and principle - Simple, Differential-Gram staining. acid fast staining, capsule staining, endospore and flagella staining.
4. 5. Principle and working of electron microscope (elementary idea)

Credit-5: Practical I

- 5.1. Microscopic examination of bacteria.
- 5.2. Microscopic examination of fungi
- 5.3. Performing endospore staining of bacteria
- 5.4. Perform biochemical tests: catalase, oxidase and urease test
- 5.5. Isolation of yeast and mold from food samples

Credit-6: Practical II

- 6.1. Performing Capsule staining of bacteria
- 6.2. Performing Flagellar staining of bacteria
- 6.3. Motility by hanging drop method.
- 6.4. Antibiotic sensitivity assay
- 6.5. Qualitative assay of amylase

Learning outcomes:

- Students will be well equipped with the microbiological techniques including sterilization, culturing, microscopy, staining and microbial culture preservation techniques.
- At the end of the course students will own significant familiarity about biosafety and biosafety levels in microbiology laboratory
- Students will be able to perform isolation, morphological and biochemical characterization of bacteria and fungi
- Students can perform Antibiotic sensitivity assay and qualitative amylase assay

Recommended books:

1. Prescott's Microbiology by Joanne Willey, Linda Sherwood and Christopher J. Woolverton, 11th edition, McGraw Hill Publisher Companies, Inc
2. Microbiology by Michael J. Pelczar JR, E.C. S. Chan, Noel R. Krieg, 5th edn, McGraw Hill Publisher Companies, Inc.
3. Brock Biology of Microorganisms by Madigan and Martinko, 14th edition, Pearson Education International
4. A Textbook of Microbiology by Dubey, R.C. and Maheshwari, D.K. S, 4th edition, Chand & Company Ltd
5. Text book of Microbiology by Ananthanarayan and Paniker's, 12th edition, Reba Kanungo, Universities Press.
6. Microbiology: A Laboratory Manual by James Cappuccino and Chad T. Welsh 11th Global Edition, Pearson Benjamin Cummings Publishers.
7. Practical Microbiology by D K Maheshwari and R C Dubey, 3rd edition, S Chand & Company Publishers.
8. Laboratory Fundamentals of Microbiology by Jeffrey C. Pommerville 12th edition, Jones and Bartlett Publishers.

Course Description: First to Third Semester

Course type: Introductory Multidisciplinary Course

Course code: MIC-22-301IMC

Course title: Applied Microbiology

Course credits: 3

Credit-1: Credit-2: Introductory Microbiology

1. 1. Historical development and scope of Microbiology
1. 2. General characteristics and economic importance of Bacteria
1. 3. General characteristics and economic importance of Fungi
1. 4. General characteristics and economic importance of Algae
1. 5. General characteristics and economic importance Archaeobacteria

Credit-2: Agricultural and Environmental Microbiology

- 2.1. Introduction of agricultural and environmental Microbiology
- 2.2. Biofertilizers and Bio pesticides: types and applications
- 2.3. Municipal solid waste management: role of microorganisms
- 2.4. Waste water treatment
- 2.5. Microbial remediation

Credit-3: Food and Dairy Microbiology

- 3.1. Food and dairy microbiology: factors influencing microbial growth in foods
- 3.2. Sources of food contamination. Microbial spoilage of food products (fruits, meat, cereals, milk and milk products).
- 3.3. Principles of food preservation. Methods of food preservation: high temperature, low temperature, canning, freezing, dehydration, chemical and bio-preservatives
- 3.4. Microorganisms as food: single cell protein and probiotics
- 3.5. Fermented dairy products: yoghurt, kefir, sauerkraut, cheese and their health benefits

Learning outcomes:

- Students will understand basic microbiology and the role of microbes in agriculture sector and industries
- Large scale production of microbes and microbial products will be learned by students
- Students will be able to understand the use of microbes in food and dairy sectors

Recommended books:

1. Aneja K.R., Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New age International, New Delhi.
2. Betty C. Hobbs, Food Microbiology, Arnold-Heinemann Publishing Private
3. Frazier and Washhoff, Food Microbiology, Tata McGraw- Hill Publishing C
4. Pelczar M.J., Chan E.C.S. and Krieg N.R., Microbiology, McGraw Hill Book Company, New York.
5. Prescott Lansing M., Harley John P. and Klein Donald A., Microbiology, WCB McGraw- Hill, New York.
6. Lehninger Principles of Biochemistry by Nelson DL and Cox MM, 8th edition, W.H. Freeman and Company.