

Distribution of credits for B.Sc. Microbiology (optional)

Under Faculty of Science

B. Sc. Syllabus structure

Semester Pattern effective from June 2016

Subject: Microbiology

Semester	Paper No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluatio	Marks of Semester	Total Marks	Credits
I	CCMB I (Section A)	Introductory Microbiology (PI)	03	45	10	40	50	2
	CCMB I (Section B)	Microbiological Techniques (PII)	03	45	10	40	50	2
II	CCMB II (Section A)	Basic Microbiology & Bio-molecules (PIII)	03	45	10	40	50	2
	CCMB II (Section B)	Microbial Physiology (PIV)	03	45	10	40	50	2
	CCMBP I [CCMB I & II (Section A & B)]	Practical's based on Section A & Section B of CCMB I & CCMB II (PV)	04	20 Practical	20	80	100	4

Total credits semester I and II: 12

III	CCMB III (Section A)	Applied Microbiology (P-VI)	03	45	10	40	50	2
	CCMB III (Section B)	Immunology(P-VII)	03	45	10	40	50	2
	CCMBP II [CCMB III & IV (Section A)]	Practical's based on P-VI & P-VIII (P-X)	04		10	40	50	2
	CCMBP II [CCMB III & IV (Section B)]	SEC I (1 Skill/ optional)			15×3 = 45	-	-	(02)*
IV	CCMB IV (Section A)	Food, Soil Microbiology and Microbial Ecology(P-VIII)	03	45	10	40	50	2
	CCMB IV (Section B)	Medical microbiology (P-IX)	03	45	10	40	50	2
	CCMBP III [CCMB III & IV (Section B)]	Practical's based on P-VII & P-IX (P-XI)	04	10 practical	10	40	50	2
	CCMBP III [CCMB III & IV (Section B)]	SEC II (1 Skill / optional)			15×3 = 45	-	-	(02)*
Total credits semester III and IV								12(04)*

Semester	Course No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
V	DECMB I (Section A)	Microbial Genetics (P-XII)	03	45	10	40	50	2
	DECMB I [(Section B) Elective]	Microbial Metabolism (P-XIII)	03	45	10	40	50	2
	DECCMBP I [DECMB I & II (Section A)]	Practical's based on P- XII & PXIV(P-XVI)	04	10 Practical	10	40	50	2
	DECMBP II [DECMB I& IV (Section B)]	SEC III (1 Skill/ optional)			15×3 = 45	-	-	(02)*
VI	DECMB II (Section A)	Molecular Biology(P-XIV)	03	45	10	40	50	2
	DECMB II [(Section B) Elective]	Industrial Microbiology (P- XV)	03	45	10	40	50	2
	DECMBP II) [DECMB I & II (Section B)]	Practical's based on P- XIII & P-XIV (P- XVII)	04	10 Practical	10	40	50	2
	DECMBP II(Section B)	SEC IV (Project))			50	-	50	(2)*
Total credits semester V and VI								12(04)*

B. Sc. First year (Semester - I)
Semester Pattern effective from -2016
MICROBIOLOGY
CCMB I (Section A)
INTRODUCTORY MICROBIOLOGY (P-I)

Credits: 02 (Marks: 50)

Periods: 45

UNIT I: Scope of Microbiology

Periods: 08

- 1.1 Definition and concept.
- 1.2 Types of microorganisms.
- 1.3 Distribution of microorganisms in nature.
- 1.4 Beneficial & Harmful role of microorganisms in Agriculture, Human & Animal health, Industries and Genetic engineering with suitable examples.

UNIT II: Historical Developments In Microbiology

Periods: 15

- 2.1 Early observation of microorganisms.
- 2.2 Controversy over spontaneous generation - Contribution of different scientists.
- 2.3 Recognition of microbial role in diseases - Koch's postulates and contribution of Louis Pasteur and Edward Jenner.
- 2.4 Recognition of microbial role in fermentation.
- 2.5 Discovery of pure culture concept.
- 2.7 Aseptic surgery.

UNIT III: General characters of microorganisms

Periods: 12

- 3.1 The eukaryotic cell: Algae, Fungi and Lichens.
- 3.2 Prokaryotic cell: Archaeobacteria, Bacteria and Actinomycetes.
- 3.3 Difference between Eukaryotic and Prokaryotic cell.
- 3.4 General characters of viruses
- 3.5 General characters of Protozoa

UNIT IV: Taxonomy of Microbes

Periods: 10

- 4.1 Microbial Classification and Nomenclature
 - a) Taxonomic groups.
 - b) Goals of classification.
- 4.2 General methods of classifying bacteria: Intuitive method, Numerical taxonomy and Genetic relatedness.
- 4.3 Nomenclature of bacteria.
- 4.4 Introduction to Bergey's Manual of Bacteriology (9th edition).

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. First year (Semester- I)

Semester Pattern effective from June -2016

Microbiology

CCMB I (Section B)

MICROBIOLOGICAL TECHNIQUES (P-II)

Credits: 02 (Marks: 50)

Periods: 45

UNIT I: Bioinstrumentation

Periods: 12

- i) Microscopy: Definition of Magnification, Resolving power, Depth of focus, Focal length, Angular aperture and Numerical aperture.
- ii) Objectives (Low, High, oil immersion) and oculars function.
- iii) Condensers: Abbes, Cardioids, Parabolic and their functions.
- iv) Principle, construction using ray diagram and applications of compound microscope:
- v) Electron microscope (SEM and TEM).

UNIT II: Microbial Staining Techniques

Periods: 10

2.1 Definition: Stain, Dye, Acidic stain, Basic stain, Auxochrome, Chromophore, Mordent, Chromogen, Leuco compound, Natural stain, Flurochrome, Decolouring agent and Counter stain.

2.2. Theories of Staining.

2.3. Principles, mechanism, procedure and observation of:

- a) Simple staining: Monochrome & Negative staining
- b) Differential staining: Gram's & Acid fast staining
- c) Structural staining: Cell wall & PHB staining.

UNIT III - Sterilization Techniques

Periods: 13

3.1 Definition of Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Viricide, Bacteriostatic and Bactericidal agent.

3.2 Chemical Disinfectants: Properties of ideal disinfectant, Chemical Agents: Phenol and Phenolic compounds, Alcohols, Gaseous sterilizing Agents: Formaldehyde, Ethylene oxide and β -Propiolactone.

3.3 Evaluation of disinfectant (Phenol coefficient).

3.4 Sterilization by Physical Agent a) Moist Heat: Boiling, Tyndallization, Pasteurization and Steam under pressure (Autoclave). Dry heat: Flaming, Incineration and Hot air oven. b) Radiation: Ionising and Non-ionising radiations. c) Filtration and Types of filters (Concept with e.g. stiz filter).

UNIT IV: Bacterial Cultivation and Maintenances

Periods: 10

4.1 Cultivation of Bacteria a) Media used, Properties of good culture media. b) Definition, Concept, use and different types of culture media: Synthetic, Non-synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium.

4.2 Buffers in culture medium.

4.3 Anaerobic cultivation: Media and methods of anaerobic cultivation

4.4 Pure culture Techniques. a) Definition and Significance of pure culture b) Methods of isolation of pure culture: Streak plate, Pour plate, Spread plate and Single cell isolation.

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. First year (Semester – II)

Semester Pattern effective from June -2016

Microbiology

CCMB II (Section A)

BASIC MICROBIOLOGY & BIOMOLECULES (P-III)

Credits: 02 (Marks: 50)

Periods: 45

UNIT I: Ultra structure of bacterial cell

Periods: 15

1.1 Basic concepts of shape, arrangement, and size of prokaryotes cells, Importance of cell shape, cell size in rods and cocci.

1.2 Structure, Chemical composition and function of following:

- a) Capsule and slimes
- b) Cell wall and cytoplasmic membranes
- c) Flagella and Motility, fimbriae and pili
- d) Nuclear material, Plasmids, Mesosomes and Ribosome
- e) Reserve materials and other cellular inclusions.

UNIT II: The viruses: Distribution and structure

Periods: 10

2.1 Viruses

2.2 Bacterial viruses (Bacteriophages)

2.3 Multiplication of Virulent phage: The lytic cycle

2.4 The development of temperate phages: Lysogeny

2.5 Classification of viruses (LHT system)

2.6 Distribution and structure of HIV

2.7 Enlist plant animal and human viral diseases with their causative agents

UNIT III: Biomolecules

Periods: 10

3.1 Carbohydrates

- a) Definition and classification
- b) Triose, Pentose, Hexose (Examples)
- c) Disaccharides:- Glycoside linkage (Lactose, Maltose and Sucrose)
- d) Oligosaccharides:- Trisaccharides (Raffinose)
- e) Polysaccharides:- Homo and Heteropolysaccharides
- f) Biological Significance of carbohydrates

3.2 Lipids

- a) Definition and Classification
- b) Types of lipids
 - i. Simple lipids:- Triglycerides
 - ii. Conjugated lipids:- Phosphatidic acid, Phospholipids and cholesterol
- c) Biological importance of lipids

UNIT IV: Informational & Functional Biomolecules

Periods: 10

4.1 Nucleic acids

- a) Ribose and Deoxyribose sugars, Nitrogen bases, Nucleosides and Nucleotides
- b) DNA:- Properties, Structure and Functions
- c) RNA:- Properties, Structure and Functions

4.2 Proteins

- a) Definition and classification
- b) Peptide bonds
- c) Enzymes
- d) Biological Significance of proteins

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. First year (Semester – II)

Semester Pattern effective from June -2016

MICROBIOLOGY

CCMB II (Section B)

MICROBIAL PHYSIOLOGY (P-IV)

Credits: 02 (Marks: 50)

Periods: 45

UNIT I: Microbial Nutrition

- 1.1 Concept of microbial nutrition
- 1.2 The common nutrient requirements (Basic Nutritional requirements of Microorganisms /macronutrient and micronutrient)
- 1.3 Requirement for C, H, O and Electron with their significance
- 1.4 Requirements for N, P and S with their significance
- 1.5 Growth factors
- 1.6 Nutritional categories of microorganisms on the basis of carbon and energy source.

UNIT II: Permeation (in brief)

Periods: 12

- 2.1 Passive diffusion
- 2.2 Facilitated diffusion
- 2.3 Active transport mechanism
- 2.4 Group translocation
- 2.5 Uptake of amino acids and sugars (as examples)

UNIT III: Reproduction and Growth

Periods: 15

- 3.1 Concept of growth
- 3.2 Microbial Reproduction: Binary fission, budding.
- 3.3 Bacterial growth: Definition, growth curve – Phases of growth, Growth Kinetics, Generation time, Methods of measurement of growth, different types of culture system: Batch culture system, Continuous culture system (Chemostat and Turbidostat).
- 3.4 Factors affecting growth-Temperature, pH, Osmotic pressure and Nutrients.

UNIT IV Bacterial Sporulation

Periods: 08

- 3.1 Bacterial Sporulation- Structure of endospore, Endospore formation (Stages) in *Bacillus*, Spore germination, Significance of Ca-dipicolinate (DPA) and soluble Proteins (SASP),

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. First year

Semester Pattern effective from June -2016

MICROBIOLOGY

Practical Paper: CCMBP-I (P-V)

(Annual practical Based on [CCMB I & II (Section A & B)])

(Practical syllabus requires **four periods per batch per week for 2 consecutive days** B.Sc. First year practical includes studies of growth of microorganisms and life activities of Microorganisms. These studies need two consecutive days for completion of practical.)

Credits: 04 (Marks: 100)

- 1) Microscopy- Different parts of compound microscope. Use and care of compound microscope
- 2) Construction, Operation and utility of laboratory equipments. (any Six)
 - a) Autoclave
 - b) Hot air oven
 - c) Incubator
 - d) pH meter
 - e) High speed centrifuge
 - f) Colorimeter/Spectrophotometer
 - g) Anaerobic jar
 - h) Bacterial filters
 - i) Laminar air flow
- 3) Staining
 - a. Simple staining: Monochrome, Negative
 - b. Differential : Gram's staining
 - c. Structural staining:
 - i. Cell wall staining (Chance's method)
 - ii. PHB staining (Burdon's method.)
- 4) Hanging drop technique.
- 5) Micrometry
- 6) Preparation of culture media
 - a) Nutrient broth and Agar
 - b) MacConkey's Broth and Agar
 - c) Sugar Media
- 7) Isolation of bacteria from mixed culture
 - a) Streak plate method
 - b) Spread plate method
 - c) Pour plate method
- 8) Effect of physical and chemical agents on growth of bacteria
 - a) pH
 - b) Temperature
 - c) U.V. rays
 - d) Antibiotics
- 9) Qualitative tests for
 - a) Carbohydrates: Benedict's test
 - b) Protein: Biuret test
 - c) Nucleic acid: Diphenylamine test (DPA) for DNA and Orcinol test for RNA.
- 10) Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.
- 11) Study of Bacterial Growth curve.

Books Recommended

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi.
2. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
3. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
4. A textbook of Microbiology by Dubey R.C. and D. K, Maheshwary, S Chand and Co. New Delhi.
5. Fundamentals of Microbiology by Frobisher, Hinsdill, Crabtree, Goodheart:: W.B. Saunders Company, U.S.A. Toppan Company Ltd., Japan.
6. General Virology by Luria
7. Elementary Microbiology (Fundamentals of Microbiology) Vol. II, Modi H.A.: Ekta Prakashan, Nadiad, Gujrat
8. Modern Microbiology by Parasher Y.K. Campas Books International, New Delhi.
9. Elements of Microbiology by Pelczar Michael J. Jr./E.C.S Chan, McGraw, Hill International Book Company, New Delhi.
10. Microbiology: Concepts and applications by Pelczar Michael J., Jr. E.C.S Chan, Noel R. Krieg: - McGraw Hill Inc.
11. Microbiology by Pelczar Michael J., Reid R.D. and Chan E.C.S. Tata McGraw hill publishing Co. Ltd., New Delhi.
12. General microbiology Vol I and II by Powar C. B. and Daginawala H.I. Himalaya publishing house, Bombay.
13. Microbiology by Prescott L.M. Harley J.P. and Klein Donald A., W. M. C. Brown publishers.
14. Microbiology: Fundamentals and Applications by Purohit S.S. Agro-Botanical publishers Bikaner, India.
15. Microbiology- Fundamentals and applications by R.A. Atlas
16. Microbiology by Singh R.P., Kalyani Publication.
17. General Microbiology by Stanier Roger Y., Adelberg Edward A. Ingraham Johan L. Prentice-Hall, Englewood Cliffs, New Jersey, Publishing Co. Ltd., New Delhi.
18. Introduction to Microbiology by Tauro P, Kapoor K.K., Yadav K.S. Wiley Eastern Ltd., New Delhi.
19. Microbiology: an Introduction by Tortora G.J. Funke B. and Case Christine L, The Benjamin Publishing Co. New York.
20. Microbiology by Yadav Manju, Discovery Publishing House,
21. Introduction to Microbial Techniques by Gunasekaran
22. Handbook of microbiological media, Hi-media.
23. Practical Microbiology by Dubey and Maheshwari.
24. General Microbiology: Seventh edition by Hans G Schlegel, Cambridge University Press.

