



GONDWANA UNIVERSITY

GADCHIROLI

CHOICE BASE CREDIT SYSTEM

(CBCS)

SYLLABUS FOR

B.Sc. I Sem I & II

THREE-YEARS DEGREE COURSE

IN

MICROBIOLOGY

From

Academic Year

2017-2018

GONDWANA UNIVERSITY, GADCHIROLI

CHOICE BASED CREDIT SYSTEM

FOR B.Sc. PROGRAM

MICROBIOLOGY

B.Sc.I (Sem I & II)

- There shall be two semesters in B.Sc. Part I. Each semester comprise of two theory papers, practical and internal assessment.
- The syllabus is based on six theory periods and six practical periods per week.
- Each theory paper divided into four units.
- **Scheme of examination:** It is divided into two parts- Internal assessment (collegeassessment) and external assessment (semester end examination conducted by university).

The internal assessment marks assigned to each theory paper shall be awarded on the basis of Based on Assignment, Seminar, Unit Test & overall attendance and performance of the student

- **The Semester End Examination for Microbiology course will be as follows:**
50 marks Paper I + 50 marks Paper II (External assessment- University examination)
10 marks Paper I + 10 marks Paper II (Internal assessment/College Assessment)
Total - 120 Marks Theory.
- One practical course: 30 marks
- Duration of examination for each theory paper will be 3 hours.
- The practical examination shall be of 5 hours duration for 2 days.
- Question paper will consist of five questions and each question will be of 10 marks.
- All questions will be compulsory and with internal choice.
- Fifth question will be compulsory with questions from each of the four units having equal weight age and there will be no internal choice.
- Practical examination for odd semester will be at college level and for even semester at university level with external examiner.

- The marks will be given for all examinations and they will be converted into grade points. The final grade card will have marks, credits, grades, grade points, SGPA & CGPA
- **Scheme of Teaching and Examination: B.Sc. Microbiology CBCS (Sem. I & II)**

<i>Semester</i>	Paper No	Paper code	Title of Paper	<i>Periods/week</i>	Max Marks		<i>Total Marks</i>	<i>Credit</i>	<i>Total: Th+Pract</i>
					<i>External(U.A.)</i>	<i>Internal(C.A.)</i>			
I	I	USMBT01	Fundamentals of Microbiology	03	50	10	60	2	150
	II	USMBT02	Microbial Techniques	03	50	10	60	2	
	Practical	USMBP01		06	30	-	30	2	
II	I	USMBT03	General Biochemistry	03	50	10	60	2	150
	II	USMBT04	Applied Microbiology	03	50	10	60	2	
	Practical	USMBP02		06	30	-	30	2	

QUESTION PAPER PATTERN

F.Y. B.Sc. Semester I & II

MICROBIOLOGY

Time: 3 Hours

Max. Marks: 50

Note: All questions are compulsory and carry equal marks Draw well labeled diagrams wherever necessary

- Q 1 Long answer type question from Unit I 10 Marks
OR
a) Short answer type question from Unit I 2½ Marks each
b) Short answer type question from Unit I
c) Short answer type question from Unit I
d) Short answer type question from Unit I
- Q 2 Long answer type question from Unit II 10 Marks
OR
a) Short answer type question from Unit II 2½ Marks each
b) Short answer type question from Unit II
c) Short answer type question from Unit II
d) Short answer type question from Unit II
- Q 3 Long answer type question from Unit III 10 Marks
OR
a) Short answer type question from Unit III 2½ Marks each
b) Short answer type question from Unit III
c) Short answer type question from Unit III
d) Short answer type question from Unit III
- Q 4 Long answer type question from Unit IV 10 Marks
OR
a) Short answer type question from Unit IV 2½ Marks each
b) Short answer type question from Unit IV
c) Short answer type question from Unit IV
d) Short answer type question from Unit IV
- Q 5 Solve any 10 out of 12 questions (3 questions from each unit) 10 Marks

Microbiology B. Sc. I Semester-I(CBCS)

Course Code -USMBT1	Paper - I	Marks - 50
Credit : 2		Total Hours : 48
FUNDAMENTALS OF MICROBIOLOGY		
Unit No.	Content	Hrs.
1	History and Development of Microbiology	12
	Introduction to Microbiology, Branches of Microbiology, Scope of Microbiology Development of Microbiology as a discipline with special reference to the work of following scientists: Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Martinus Beijerinck, Sergei Winogradsky, Alexander Flemming, Selman Waksman, A.M. Chakraborty, H.G. Khorana	
	Theory of Abiogenesis and Biogenesis: Aristotle's notion about spontaneous generation, John Needham experiment Biogenesis: Experiments of F. Redi, Spallanzani, Schulze and Schwann, Schroder and Von Dusch, Louis Pasteur and John Tyndall	
2	Study of Prokaryotic Cell	12
	Difference between Eukaryotic and Prokaryotic cell. Structure and functions of bacterial cell components: (a) Cell wall (b) Cytoplasmic membrane (fluid Mosaic model) (c) Capsule & Slime layer (d) Flagella (e) Nuclear material (f) Plasmids (g) 70 S Ribosome Endospore: Structure, Stages in Sporulation	
3	Microbial Taxonomy	12
	Aim, Principles and Parts of Taxonomy: General Criteria used for bacterial classification, concept of taxa, Genus, Species, Strain, Family, Order, Division, Kingdom; Various approaches of bacterial taxonomy: (Artificial, Natural & Evolutionary) Two (Linnean), Three (Haeckel), four (Stanier-Van Niel) and Five kingdom (Whittaker) concept. Methods of classification of bacteria: Intuitive method, Numerical taxonomy and Genetic relatedness (DNA base composition, DNA homology, r-RNA homology & sequencing methods). Bergey's Manual of Determinative and Systematic Bacteriology.	
4	Viruses, Archaeobacteria and Fungi	12
	Viruses - 1. General characteristics of viruses. 2. Structure of viruses. 3. Lytic Cycle of T4 Phage. 4. Lysogenic cycle of Lambda phage 5. Classification of Viruses: LHT classification. 6. Methods of cultivation of animal viruses.	
	Archaeobacteria: General characteristics, Unique characters. Groups of Archaeobacteria (Methanogens, Halophiles, Thermophiles).	
	Fungi: General characteristics, Methods of reproduction of Molds and Yeasts.	

Microbiology B. Sc. I Semester-I(CBCS)		
Credits: 2 Total Hours :48		
Course Code -USMBT2	Paper - II	Marks - 50
Credit : 2		Total Hours : 48
MICROBIAL TECHNIQUES		
Unit No.	Content	Hrs.
1	Microscopy: Definition of Magnification, Resolving power, Focal length, Focal Point, Angular Aperture and Numerical Aperture, resolving Power. Objectives lenses - Low, High and Oil immersion Principle, Construction, Working and applications of Bright field microscopy, Dark Field microscopy, Phase Contrast microscopy and Electron microscopy (TEM and SEM).	12
2	Stains and Staining Techniques	12
	Definition of stain and dye,auxochrome, chromophores, Acidic and Basic dyes; Indicator Dyes; Classification of stains, Theories of staining, Mechanism,procedure and applications of Gram staining, Acid fast staining, Negative staining, Capsule staining, Flagella staining and Endospore staining.	
3	Cultivation of bacteria	12
	Microbial Nutrition: Basic nutritional requirements, nutritional categories of microorganism based on carbon and energy source. Culture media: Components of media, types of media based on physical nature: liquid, semisolid and solid with example, natural and synthetic media, selective, differential, enriched and enrichment media. Methods of isolation of pure culture: Streak plate, Pour plate and Spread plate methods, Methods of preservation of pure cultures: Agar slant, Lyophilization (Freeze drying) Oil Sealing. Systemic study of pure culture, Stock culture collection centers in India and abroad	
4	Sterilization & Disinfection	12
	Definitions: - Sterilization, Disinfection, Antiseptic, Germicide, Microbiostatic, Microbicidal Sanitization	
	Physical agents - (a) Temperature - Dry heat, moist heat, Incineration (b) Radiation - Ionizing and Non Ionizing.(c) Filtration and Types of Filters.	
	Chemical agents- (a) Phenol & Phenolic compounds. (b) Alcohols. (c) Halogens (d) Heavy metals and their compounds (e) Aldehydes (f) Gaseous agents (g) Quaternary ammonium compounds. (h) Detergents. Characteristics of an ideal disinfectant , phenol Coefficient Experiment.	

Practicals B. Sc. I Semester –I{Based on Paper -I & II}

TOTAL HOURS: 48

CREDITS: 2

Marks: 30

1. Microbiology Good Laboratory Practices and Biosafety
- 2.* Study of principle and applications of important instruments, (Autoclave, Incubator, Hot air oven, Microscope, Anaerobic Jar, Colony counter, Membrane filter assembly, pH meter, Laminar Air Flow, Spectrophotometer).
3. Staining Techniques
 - *(a) Monochrome / Simple staining
 - (b) Negative Staining
 - *(c) Gram Staining
 - (d) Flagella Staining
 - *(e) Endospore staining
4. Preparation of Culture Media: Nutrient Broth, Nutrient agar, McConkey's agar, Starch Agar, Milk agar, Potato Dextrose agar, Baired-Parker Agar.
5. *Demonstration of presence of Microbes and their colony characters present in Air, Skin, Soil, Teeth, and Water.
6. *Isolation of pure culture by Streak plate and Spread plate methods.
7. *Enumeration of bacteria by standard plate count method.
- 8.*Study of Motility by Hanging Drop technique
9. Cultivation and Staining of Fungi.
- 10.*Antibiotic sensitivity test by Kirby-Bauer disc diffusion method
11. Oligodynamic action of heavy metals.

- Note:** i) Minimum 4 major and 4 minor experiments are compulsory
ii) Underlined experiments are considered to be major experiments
iii) Experiments with asterisks are compulsory
iv) Duration of practical examination will be 8 hours

Distribution of marks for practical examination:

One major experiment	08Marks
Two minor experiments $4 \times 2 =$	08 Marks
Spotting	04 Marks
Viva-Voce	05Marks
Practical Record	05 Marks

Total **30 marks**

Microbiology B. Sc. I Semester-II(CBCS)

Course Code - USMBT03	Paper - I	Marks - 50
Credits: 2		Total Hours :48
USMBT04 : GENERAL BIOCHEMISTRY		
Objective: To make the students to understand the fundamentals of Chemical Microbiology.		
Unit No.	Content	Hrs.
1	<p>Biochemical principles</p> <p>I. Concepts of Atom, Molecule, pH, Acids, Bases, Buffer, Solvent, Solute, Types of solutions (hypotonic, hypertonic, isotonic) and redox potential</p> <p>II. Types of Isomers and their importance in biology.</p> <p>III. Types of bonds and their importance: Electrovalent, covalent, non-covalent, Ester, Phospho-diester, Thio-ester, Peptide, Glycosides.</p>	12
2	<p>Amino Acids & Proteins</p> <p>Amino Acids: Definition, General structure and features of amino acids, amphoteric nature, List of 20 amino acids with structure.</p> <p>Classification of amino acids: based on R-group, Uncommon amino acids and Their functions.</p> <p>Proteins: Definition. Classification of Proteins, Primary, secondary, tertiary, quaternary structures of proteins (outline). Biological significance of proteins.</p>	12
3	<p>Carbohydrates & Lipids</p> <p>Carbohydrates: a] Definition and Classification. b] Monosaccharides, Triose, Tetrose, Pentose, Hexose (Examples and structures). c] Disaccharides: Glycoside Linkage (Lactose, Maltose and Sucrose). d] Oligosaccharides: Trisaccharides (Structure of raffinose). e] Polysaccharides: Homo and Heteropolysaccharides, structure of (Starch, Cellulose, Hyaluronic acid). Biological significance of carbohydrates.</p> <p>Lipids: Definition and Classification. Types of Lipids: Simple lipids-Triglycerides. Conjugated Lipids- Phospholipids, Derived lipids- Cholesterol. Biological importance of Lipids.</p>	12
4	<p>Nucleic Acids</p> <p>Nitrogenous base composition of nucleic acids, Structure of Purines, Pyrimidines, Pentose sugars (Ribose, Deoxyribose), Phosphodiester bond, Nucleosides and Nucleotides. Base composition of DNA (Chargaff's rule)</p> <p>Basic Structure of DNA (Watson-Crick model), Forms of DNA.</p> <p>RNA : Structure of m-RNA, t-RNA, r-RNA,</p>	12

Microbiology B. Sc. I Semester-II(CBCS)

Course Code - USMBT04		Paper - II	Marks - 50
Credits: 2		Total Hours : 48	
USMBT05		APPLIED MICROBIOLOGY	
Objective: To make the students to understand and aware the fundamentals of National Mission on Environmental cleanliness, health and hygiene.			
Unit No.	Content	Hrs.	
1	Air Microbiology: a. Definition and composition of air. b. Sources of microorganisms in air. c. Enumeration of microorganisms in air: Solid and liquid impingement technique (Lemons sampler, Anderson sampler) d. Room sterilization techniques (Radiation, Fumigation, Laminar air flow) e. Droplet, Aerosol, Droplet nuclei and Droplet infection, Air borne diseases (List with causative organisms)	12	
2	Water Microbiology: a. Indicators of excretal pollution. b. Collection and handling of water sample for analysis c. Bacteriological analysis of water for coliforms(MTDT, MPN) d. Identification of faecal and non-faecal coliforms by (IMViC and Eijkmann test) e. Chlorination of water (mechanism), Different methods of Chlorination f. Water borne diseases(List with causative organisms)	12	
3	Sewage Microbiology a. Definition and Types of Sewage, Composition and strength of sewage (BOD, COD, ThOD) b. Microbiology of sewage, c. General Flow Sheet of Waste Water Treatment d. Preliminary, Primary and Secondary sewage treatment methods. (Screening, Grit Removal, Septic Tank , Imhoff Tank, Trickling Filter, Activated Sludge, Oxidation Pond, Rotating Biological Contactor)	12	
4	Milk Microbiology a. Definition and composition of milk, sources of contamination of milk. b. Desirable and undesirable changes in milk. c. Milk borne diseases (List with causative organisms). d. Bacteriological examination of milk by SPC, DMC, Reductase test (MBRT), checking of pasteurization of milk by phosphatase test. e. Milk products- Cheese, Yoghurt (production)	12	

**Practical's B.Sc. I
(Semester II)
{Practical's based on Paper -I & II}**

Total Hours: 48

CREDITS: 2

Marks: 30

1. *Qualitative estimation of carbohydrate.
2. *Qualitative estimation of proteins.
3. *Qualitative estimation of lipids.
4. *Estimation of protein by Lowry method
5. *Estimation of sugar by DNS method.
6. *Estimation of DNA by Diphenylamine method
7. *Estimation of RNA by Orcinal method
8. Partial purification of protein by fractional precipitation.
9. Determination of acid value of fat.
10. *Bacteriological examination of water for potability (MTDT)
i) Presumptive (MPN) test ii) Confirmatory test iii) completed test;
11. *Identification of Coliforms by IMViC test.
12. *Determination of quality of Milk by Methylene blue reduction test.
13. *Checking of Pasteurization of milk by phosphatase test.
14. *Determination of BOD/DO of water
15. Determination of residual chlorine of water
16. Isolation and study of Air micro flora

- Note:** i) Minimum 4 major and 4 minor experiments are compulsory
ii) Underlined experiments are considered to be major experiments
iii) Experiments with asterisks are compulsory
iv) Duration of practical examination will be 8 hours

Distribution of marks for practical examination:

One major experiment	8 marks
Two minor experiments $4 \times 2 =$	8 marks
Spotting	4 marks
Viva-Voce	5 marks
Practical Record	5 marks

Total **30 marks**

Books Recommended for Theory & Practical of B.Sc. I SEM I & II

1. General Microbiology by Hans G. Schlegel.
2. General Microbiology by R.Y. Stayner.
3. Fundamentals of Microbiology by Crabtree, & Martin Frobisher.
4. Fundamentals of Bacteriology by A. J. Salle
5. A text of Microbiology by Dubey RC and Maheswari DK (2012).
6. Geeta Sumbali and Mehrotra RS (2009). Principles of Microbiology.
7. General Microbiology volume 1 and 2 by Powar CB and Daginawala H F.
8. Microbiology by Pelczar TR M J Chan ECS and Kreig N R.
9. Robert F Boyd (1984). General microbiology.
10. Microbiology by Prescott L M, J P Harley and D A Klein.
11. Introduction to Microbiology by Ingraham J.L. and Ingraham C.A
12. History of Microbiology & Microbiological Methods by A.B. Solunke, V.S. Hamde, R.S. Awasthi& P.R. Thorat,.
13. General Microbiology by Hans G. Schlegel.
14. General Microbiology by R.Y. Stayner.
15. A text of Microbiology by Dubey R.C and Maheswari D.K.
16. Manual of Methods for Pure Culture Study by A.B. Solunke, V.S. Hamde, R.S. Awasthi& P.S. Wakte.
17. Text Book of Microbial Chemistry and Physiology by P.H.Kumbhare & V. U. Thool RajaniPrakashan, Nagpur.
18. Text Book of Applied Microbiology by P.H.Kumbhare & V.U.Thool, RajaniPrakashan, Nagpur.
19. General Virology by Luria S.E.
20. A textbook of Fungi and Viruses by Dubey H.C.
21. Alcamo, Fundamentals of Microbiology
22. Experiments in Microbiology by Aneja K.R.
23. Introduction to Microbial Techniques by Gunasekaran,
24. Elementary Microbiology Vol. I & II by Modi H.A.
25. Handbook of Media, Stain and Reagents in Microbiology by Deshmukh A.M.,
26. Biology of Microorganisms by Brock T.D. and Madigan M.T.
27. Biochemistry by J.L. Jain
28. Biochemistry by Zubay
29. Principles of Biochemistry by Nelson David L and Cox Michael M. Lehninger.
30. Disinfectants and Disinfection by A.G. Young
31. Biological Stains By H.J. Conn.