

Solapur University, Solapur



Faculty of Science

B.Sc.Part- III

(Sem-V&VI)

Microbiology

General Structure as per

Credit and Grading System

(June, 2016)

Solapur University, Solapur

Faculty of Science

Credit and Grading System

(W.e.f. June, 2016)

- **Title of the Course:** B.Sc.- Part III
- **Subject :** Microbiology
- **The Credit and Grading System :**
-

With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing under graduate degree, Solapur University has implemented Credit and grading system of Evaluation at Undergraduate level.

Credit is a numerical value that indicates student's work load (Lectures, Lab work, Seminars, Tutorials, Field work, etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into Credits. As per present norms, there are 4 contact hours per paper (subject) per week which works out to be 60 contact hours per paper (subject) per semester.

In Solapur University, for B. Sc.-III, there are 8 papers of the subject and Compulsory English paper. For B. Sc.-III, there are 12 contact hours for 4 papers of the subject per week. Therefore, total 3 contact hours per week for each paper. Each subject has 90 contact hours, which are transformed into 12 credits. As there are 4 contact hours per week for Compulsory English, 4 credits shall be assigned for Environmental Studies.

Moreover, the grading system of evaluation is introduced for B. Sc. course, wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 30 marks and University Evaluation for 70 marks. It is 70 + 30 pattern of evaluation. It is applicable for theory and practical as well. The details regarding this evaluation system are as under.

- **Conversion of marks into Grades :**

A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade points is given below.

Sr. No	Range of Marks	Grade	Grade Point
1.	80-100	O	10
2.	70-79	A+	9
3.	60-69	A	8
4.	55-59	B+	7
5.	50-54	B	6
6.	45-49	C+	5
7.	40-44	C	4
8.	<39	FC	0 (Failed in Term Exam)
9.	<39	FR	0 (Failed in Internal Assesment)

1. Grade Point Average at the end of the Semester (SGPA)

$$(G_1 \times C_1) + (G_2 \times C_2) + \dots$$

$$\text{SGPA} = \frac{\dots}{\Sigma C_i}$$

$$\Sigma C_i$$

(ΣC_i - The total number of credits offered by the student during a semester)

2. Cumulative Grade Point Average (CGPA)

$$(G_1 \times C_1) + (G_2 \times C_2) + \dots$$

$$\text{CGPA} = \frac{\dots}{\Sigma C_i}$$

$$\Sigma C_i$$

(ΣC_i - the total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. Final Grade Point Average (FGPA) will be calculated in the similar manner for the total number of credits offered for completion of the said course.

Where: C_i : Credits allocated for the i th course

G_i : Grade point scored in i th paper (Subject)

4. Conversion of average grade points into grades:

SGPA/CGPA/FGPA	Letter Grade
9.5 – 10	O
8.5 -9.49	A+
7.5 – 8. 49	A
6.5 – 7.49	B+
5.5 – 6. 49	B
4.5 – 5. 49	C+
4.0 – 4. 49	C
< 3.99	FC /F
	FR

Solapur University, Solapur
Faculty of Science
Credit System Structure for B.Sc.III Microbiology
Semester V

Class	Sem	Subject	No. of Papers/ practicals	Hrs/Week			Paper Marks	UA	CA	Credits	Total credits *
				L	T	P					
B.Sc.III	V										
		English	-	-	-	-	-	-	-	-	-
		Microbiology	Paper IX	3	-	-	100	70	30	3	
		Microbiology	Paper X	3			100	70	30	3	
		Microbiology	Paper XI	3	-	-	100	70	30	3	
		Microbiology	Paper XII	3	-	-	100	70	30	3	
Grand Total				12			400	280	120	12	12

* Total credits excluding Compulsory English

Abbreviations: L: lectures, T: Tutorials, P: Practicals; UA: University Assessment by End Semester Examination; CA: College assessment by Internal Continuous Examination

UA (University Assessment): University Theory paper shall be of 70 marks for 2.30 hrs duration

CA (College Assessment): The internal examination for Theory and Practical course.

Solapur University, Solapur
Faculty of Science
Credit System Structure for B.Sc.III Microbiology
Semester VI

Class	Sem	Subject	No. of Papers/ practicals	Hrs/Week			Paper Marks	UA	CA	Credi ts	Total credits *
				L	T	P					
B.Sc.III	VI										
		English	-	-	-	-	-	-	-	-	-
		Microbiology	Paper XIII	3	-	-	100	70	30	3	
		Microbiology	Paper XIV	3			100	70	30	3	
		Microbiology	Paper XV	3	-	-	100	70	30	3	
		Microbiology	Paper XVI	3			100	70	30	3	12
B.Sc.III											
		Microbiology	Practical I	-	-	5	100	70	30	5	
		Microbiology	Practical II	-	-	5	100	70	30	5	
		Microbiology	Practical III	-	-	5	100	70	30	5	
		Microbiology	Practical IV	-	-	5	100	70	30	5	20
Total							800	560	240	32	32
Grand Total	V& VI						1200	840	360		44

* Total credits excluding Compulsory English

Abbreviations: L: lectures, T: Tutorials, P: Practicals; UA: University Assessment by End Semester Examination; CA: College assessment by Internal Continuous Examination

UA (University Assessment): University Theory paper shall be of 70 marks for 3.0 hrs duration

CA (College Assessment): The internal examination for theory and Practical course.

General Guidelines for Credit and Grading System

B.Sc.III

1. The University follows Semester system
2. An academic year shall consist of two semesters
3. Each B.Sc. course shall consist of three years i.e. six semesters
4. Compulsory English shall remain a compulsory paper for B.Sc.Part- III students in both Semesters.
4. B.Sc.Part-III shall consist of two semesters: Semester V and Semester VI.

In semester –V, there will be four theory papers of 100 marks each for the subject. Similarly, in semester VI there will be four theory papers of 100 marks each for the subject and English paper compulsory for every student in each semester.

The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below. For B.Sc.Part III Sem V & VI the internal assessment will be based on Unit tests, Home assignment, viva, practical, Project Work etc as given below. Practical examination of 400 marks for 4 practical courses shall be conducted at the end of VIth semester. The practical examination of 400 marks shall consist of 280 marks for University practical assessment and 120 marks for college internal assessment.

For University practical examination, there shall be appointment of two examiners. Both examiners shall be external and both be appointed by the University. The internal practical assessment shall be done as per scheme given below.

5. Scheme of evaluation:

As per the norms of the grading system of evaluation, out of 100 Marks, the candidate has to appear for College internal assessment of 30 marks and external evaluation (University Assessment) of 70 marks. Assessment scheme is given below.

Semester - V:

Theory: (100 marks)

University Examination (70 Marks): No. of Theory papers: 4 Papers/Subject and Compulsory English (Total 5 Papers)

Internal Continuous Assessment (30 Marks):

Scheme of Marking: 20 Marks: Internal Test

10 Marks: Home assignment/Tutorials/Seminars/ Group discussion/ Viva/Field visit/Industry visit.

Semester - VI: (100 marks)

Theory:

University Examination (70 Marks): No of Theory papers: 4 Papers/Subject and Compulsory English (Total 5 Papers)

Internal Continuous Assessment (30 Marks):

Scheme of Marking: 20 Marks: Internal Test

10 Marks: Home assignment/Tutorials/ Seminars/ Group discussion/ Viva/ Field visit/Industry visit.

Practical Examination:

University Examination (280 Marks): No of Practicals: 4 Practicals /Subject

Internal Continuous Assessment (120 Marks):

Scheme of Marking: 80 Marks: Internal Test on any four practicals, 40 Marks: Lab Journal/viva, attendance, attitude etc.

6. Passing Standard

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secures less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper (subject) and shall be required to reappear for respective paper. A student who failed in University Examination (Theory) & passed in internal assessment of a same paper (subject) shall be given FC Grade. Such student will have to appear for University Examination only. A student who fails in Internal Assessment and passed in University examination (Theory) shall be given FR Grade. Such student will have to appear for both University examination as well as internal assessment. In case of Annual Pattern/Old Semester Pattern Students/candidates from the mark scheme the candidates shall appear for the same 70 marks paper of the external examination and his performance shall be scaled to 100 marks

Solapur University
Solapur

B.Sc.III-(Sem-V & VI)
Microbiology
CGPA Syllabus
June 2016

B.SC.III (MICROBIOLOGY) COURSE STRUCTURE:

Paper No	Title of the paper	Theory	Contact Hrs	Credits
	Semester- V			
Paper IX	Virology, Extremophiles and Bioinformatics	Theory	45	3
Paper X	Industrial Microbiology	Theory	45	3
Paper XI	Agricultural Microbiology	Theory	45	3
Paper XII	Immunology	Theory	45	3
	Semester- VI			
Paper XIII	Microbial Genetics	Theory	45	3
Paper XIV	Microbial Biochemistry	Theory	45	3
Paper XV	Environmental Microbiology	Theory	45	3
Paper XVI	Medical Microbiology	Theory	45	3
	Practical Courses			
	Practical I	Practical	75	5
	Practical II	Practical	75	5
	Practical III	Practical	75	5
	Practical IV	Practical	75	5
	Study Tour			

SOLAPUR UNIVERSITY, SOLAPUR
B.Sc.III - MICROBIOLOGY CGPA SYLLABUS

Semester V

Paper IX: Virology, Extremophiles and Bioinformatics

Total Credits: 3

Contact hrs: 45

Unit I Classification of Viruses (9)

- A. Viral classification, LHT system and as per international committee
- B. Purification, Isolation, cultivation, and enumeration of viruses

Unit II Reproduction of bacteriophages (9)

- A. One step growth experiment
- B. Reproduction of ds DNA/ ss DNA / RNA bacteriophages
- C. Temperate phages and lysogeny of λ phages

Unit III Animal Viruses (9)

Reproduction of Animal viruses: Adeno viruses and Influenza viruses

- A. (i) Oncogenic Viruses- Types of Oncogenic viruses, DNA and RNA viruses, (ii) Types of cancer, Characteristics of cancerous cells, (iii) Hypotheses of Cancer: Somatic mutation, Viral gene and Defective immunity

Unit IV Extremophiles: (9)

General characteristics and their role in respective extreme environments-
Acidophiles, Alkalophiles, Thermophiles, Psychrophiles, Barophiles and Osmophiles

Unit V Bioinformatics (9)

- A. Introduction to Bioinformatics. Use of bioinformatics in major research areas
- B. Introduction to major bioinformatics resources on Internet: National Centre for Biotechnology Information (NCBI), DDBJ, EMBL.
- C) Protein data bank (PDB) and Nucleic acid sequence database (GenBank)
- D) The Basic Local Alignment Search Tool (BLAST)

References:

1. Bergey's Manual of Determinative Bacteriology- Breed and Buchanan
2. General microbiology – Stanier
3. General microbiology – Pawar and Daginawala Vol I and II
4. Genetics of bacteria and their viruses – William Hays
5. Virology – Biswas
6. Introduction of Bioinformatics – Affwood, T.K.
7. Bioinformatics by Shalini Suri
8. Virology – Luria
9. Physiology and Biochemistry of Extremophiles by Charles Gerday and Nicolas Glansdorff (2007)
10. <http://www.ncbi.nlm.nih.gov/>
11. Prescott, Harley and Klein's Microbiology, Willey Sherwood Woolverton, McGraw – Hill International Edition, (2008)

Paper X: Industrial Microbiology

Total Credits: 3
Contact hrs: 45

- Unit I Food and dairy Microbiology** (7)
- A. Food as a substrate for microorganisms
 - B. Food Fermentations – i) Idli ii) Bread
 - C. Fermented dairy products: i) Cheese ii) curd iii) Yogurt
- Unit II Fermentation media** (7)
- A. Types of media – crude, synthetic, inoculums, production, maintenance, assay, screening, media.
 - B. Raw materials used for designing of fermentation media.
 - C. Sterilization of fermentation media.
- Unit III Production alcoholic beverages** (8)
- A. Grape wine – Definition, types, production of White table wine, Red table wine,
 - B. Post fermentation spoilage of wines: Microbial and non microbial spoilage of wines
 - C. Beer – Definition, types, production of Lager beer and Ales Beer.
- Unit IV Industrial production of** (13)
- A. Streptomycin
 - B. Lysine
 - C. Biofertilisers (Azo and Rhizo) production and applications.
 - D. rDNA products – Insulin, Interferon
 - E. Bioinsecticides. (*Bacillus thuriangiensis*)
- Unit V Downstream processing and quality control:** (10)
- A) Downstream processing:**
Filtration, Cross flow filtration, Flocculation, Whole broth processing
Solvent extraction, Concentration, Centrifugation, Crystallization,
Distillation, Adsorption elution, Precipitation and Chromatography
 - B) Quality control in fermentation industry:** Test for sterility, pyrogenicity, allergy,
carcinogenicity, toxicity for Pharmaceutical and health care and food products

References

1. Principles of fermentation technology – Whitkar and Stanbury
2. Dairy Technology – Sukumar De
3. Pharmaceutical Microbiology – Huggo
4. Biochemistry – Fox and Nelson
5. Industrial Microbiology – Prescott and Dunn
6. Microbial technology – Pepler
7. Food Microbiology – R.C. Dubey, D.K. Mahashwari
8. Advances in Biotechnology – S.W. Jogdand.
9. Textbook of Biotechnology – R.C. Dubey,
10. Biotechnology – B.D. Singh
11. Industrial Microbiology – Casida
12. Industrial Microbiology – Patel A.H.

Paper XI: Agricultural Microbiology

Total Credits: 3
Contact hrs: 45

Unit I Soil Microbiology (7)

- A. Introduction - Definition, approaches to soil microbiology,
- B. Soil as an ecosystem
- C. Soil formation, structure and properties
- D. Soil microorganisms, types and their role

Unit II Role of microorganisms in (9)

- A. Carbon cycle
- B. Nitrogen cycle
- C. Sulphur cycle
- D. Phosphorous cycle

Unit III Composting: (13)

Compost production with reference to organic waste, types of microorganisms, aeration, C:N:P ratio, moisture content, temperature, pH, and period of composting

- A. Green manure
- B. Farm yard manure
- C. Town compost
- D. Vermicompost
- E. Biodegradation of Cellulose, hemicelluloses, Lignin, and Pesticides

Unit IV Plant pathology (9)

- A. Common symptoms produced by plant pathogens
- B. Modes of transmission of Plant diseases: Oily spots on pomegranate – *Xanthomonas aoxynopodis*, white smut of sugarcane, soft rot of potato
- C. Control measures of plant diseases

Unit V Applications of Biotechnology in Agriculture (7)

References

1. Soil Microbiology – Subbarao, N.S.
2. Microbial dynamics and diversity – Desy Staley
3. Biology of Microorganisms – Brock, Parker, Madigen, 9th edition
4. Agricultural Microbiology- Bagyaraj and Ghosh
5. Plant Diseases- Singh R.S.
6. Soil Microbiology – Alexander.

Paper XII: Immunology

Total Credits: 3

Contact hrs: 45

Unit I Complement system

(5)

- A. Components of complement and their properties,
- B. Activation of complement –classical and alternate pathway
- C. Biological effects of complement

Unit II Major Histocompatibility complex

(12)

- A. Organization of MHC genes in man, Classes of MHC molecules – structure and their role, Types of graph and their rejection, HLA typing.
- B. Natural and acquired immunity
 - a) Humoral (antibody) mediated response –Cells involved and mechanism
 - b) Cell mediated – cells involved, mechanism; cytokines and their role

Unit III Antibody production

(8)

- A) Mechanism of antibody production, Burnet clonal selection theory
- B) **Monoclonal antibodies** – i) Production (hybridoma technology) ii) Applications of Monoclonal antibodies in Diagnosis, Research and Treatment

Unit IV A) Immunological tolerance and Autoimmunity

(12)

- A. **Immunological tolerance** : Mechanism of immunological tolerance
- B. **Autoimmunity** : Types of of Autoimmune diseases- a) Hemocytolytic b) Organ Specific (Graves disease, Myasthenia gravis) c) Non organ specific (S.L.E., R.A.)
- C. **Hypersensitivity**
Immediate and delayed type hypersensitivity
Anaphylaxis, Atopy; Arthus reaction, Serum sickness, contact dermatitis, Allergy of infection

Unit V Immunoematology:

(8)

- A. ABO blood group system
- B. Rh blood group system
- C. Blood transfusion reaction and its complications

References

1. Essentials of Immunology Roitt Evan, Brostoff J. Male D. (1993) 6th Edition.
2. Immunology - Kuby J. (1996) - W.H. Freeman and Co.
3. Immunology – Fudenberg
4. Medical Microbiology - Davis and Dulbecco
5. Parasitology – Chattergii
6. Medical laboratory technology – Ramnaik Sood
7. Diagnostic Microbiology – Bailey's and Scotts
8. Immunology – a problem approach by Wood, Hood and Weison
9. Medical Bacteriology – Dey and Dey
10. Handbook of Immunology- G.P. Talwar (1983) Vikas Publishing Pvt. Ltd

Semester VI

Paper XIII: Microbial Genetics

Total Credits:3
Contact hrs: 45

Unit I: Basic concepts of microbial genetics (9)

- A) Structural organization of *Escherichia coli* chromosome, folded fiber model
- B) Replication of DNA: Enzymes involved and mechanisms of replication
- C) Transcription: RNA polymerase enzyme, process and post transcriptional modification
- D) Operon concept – Lac Operon

Unit II: Effect of mutation in bacteria (10)

- A) Effect of mutation on translation
- B) Effect of mutation on phenotypes
- C) Time course of phenotypic expression
- D) Selection, detection & adaptation of mutants

Unit III: Genetic complementation (6)

- A) Mutation in bacteriophages
- B) Cis-trans test

Unit IV: Genetic engineering and Protein engineering (12)

- A) Introduction, Tools and Techniques of Genetic engineering
- B) Applications of Genetic engineering
- C) Protein Engineering – concept and applications

Unit V : Techniques in molecular biology (8)

- A) Electrophoresis of DNA.
- B) DNA sequencing – Maxam and Gilbert's method
- C) DNA finger printing- method and applications

References:

1. General microbiology – Stanier
2. General microbiology – Pawar and Dagainawala Vol I and II
3. Biochemistry – Lehninger
4. Molecular Biology of Gene – J.D. Watson
5. Recombinant DNA – J.D. Watson
6. Microbiology - Davis
7. Biochemistry - Purohit
9. Genetics of bacteria and their viruses – William Hays

Paper XIV: Microbial Biochemistry

Total Credits:3

Contact hrs: 45

Unit I Enzyme, Enzyme kinetics and regulation (12)

A) Enzymes:

- (i) Definition, properties, structure, specificity, mechanism of action (Lock and key model, induced fit hypothesis)
- (ii) Allosteric enzymes – Definition, Two models explaining mechanism of action (Sequential and Concerted)
- (iii) Ribosymes and Isozymes
- iv) Factors affecting catalytic efficiency of enzymes
 - i) Proximity, orientation ii) Strain and distortion iii) Acid base catalysis iv) Covalent catalysis

B) Enzyme kinetics – Derivation of Michaelis Menten equation, Significance of K_m and V_{max}

C) Regulation of enzyme synthesis

- i) Positive control – Arabinose Operon ii) End product repression – Tryptophan Operon
- iii) Catabolite repression

Unit II Extraction, purification and assay of enzymes (6)

A) Cell disruption and homogenization of membrane bound enzymes, Extraction

B) Purification of enzymes on the basis of - i) Molecular size ii) Solubility

iii) Electric charge iv) Adsorption characteristics) Biological affinity

C) Immobilization of enzymes – Methods and applications

D) Assay of enzymes (enzyme unit, enzyme activity, Specific activity)

Unit III Assimilation of: (7)

- A. Carbon
- B. Nitrogen – N_2 and NH_3 (GOGAT)
- C. Sulphur

Unit IV Bioenergetics:

A) Metabolic Pathways (8)

- i) Glyoxylate bypass
- ii) PP Pathway
- iii) ED pathway
- iv) Phosphoketolase pathway
- v) Bioluminescence

B) Pyruvate as key metabolite in Carbohydrate metabolism

Unit V Biosynthesis of: (12)

A) Nucleotides B) Protein C) Peptidoglycan

References:

1. Molecular Biology of Gene – J.D. Watson
2. Principles and techniques of Practical Biochemistry – K. Wilsons J.Walkar.
3. Analytical Chemistry – Robert B. Dilts
4. Chromatographic methods by Braithwaite and White
5. Outline of Biochemistry – Cohn and Stump
6. Biochemistry – West and Todd Russel
7. Biochemistry – Lehninger
8. Enzymes – Dixon and Web
9. Biological chemistry – Mahler and Cordes
10. Nature of Enzymology – R.L. Foster
11. Microbial technology – Peppler
12. Biochemistry – A problem approach by Wood, Hood and Weison

Paper XV: Environmental Microbiology

Total Credits: 3

Contact hrs: 45

Unit I Air microbiology (8)

- A) Microorganisms in air – Launching, transport and deposition of aerosols, survival of microorganisms in air
- B) Significance of microorganisms in air (extramural and intramural)
- C) Methods to study air borne microorganisms. Sampling, qualitative and quantitative methods.
- D) Bioaerosol control (ventilation, filtration, biocidal control, UV gaseous (quarantine)
- E) Sources, types, effects, control of air pollution.
Depletion of ozone layer (causes, impact and control)
- F) Biological safety
- G) Germ free animal and Gnotobiology

Unit II A) Marine microbiology and Fresh water ecosystem (9)

- A. Microorganisms in marine water, methods to study aquatic microorganisms. Characteristics of marine environment, types of organisms and their role.
- B. Fresh water ecosystem : Eutrophication, Types of fresh water bodies a) Classification of lakes
b) Sources c) Consequences d) Control

Unit III Microbiology of potable water: Definition of potable water, (9)

Standard for potability, Municipal water purification process, Microorganisms as Bioindicators of fecal pollution, Routine bacteriological analysis of water.

Unit IV Environmental impact assessment: (9)

- A) Waste water assessment and management, types of wastes, chemical assessment, microflora, BOD, COD, treatment and disposal of waste water.
- B) Assessment and management of pollutants – toxic elements, their sources and effects and bioremediation (Lead, mercury, arsenic and radioactive substances)
- C) i) Environmental standards ii) Environmental legislations iii) Environmental education and awareness

Unit V A) Geomicrobiology and Industrial waste management (9)

- A. **Geomicrobiology** : Introduction, Microorganisms involved, Biochemistry of microbial leaching, Commercial leaching – slope, heap, in situ leaching, Leaching of Iron, Copper and Uranium, Oil recovery: Methods – primary, secondary, and microbially enhanced, Biotechnological solution of oil recovery
- B. **Industrial waste treatment** : Characteristics and treatment of wastes from different industries, – paper and pulp, sugar and distillery, textile, and dairy industries, Treatment of Biomedical waste

References:

1. Physiology and Biochemistry of Extremophiles- Charles Gerday and Nicolas Glansdorff
2. Environmental Microbiology – Maier
3. Microbial ecology – Fundamentals and applications - Atlas and Bartha
4. Microbial dynamics and diversity – Desy Staley
5. Biology of Microorganisms – Brock, Parker, Madigen, 9th edition
6. Microbiology – Prescott and Harley, 5th edition

Paper XVI: Medical Microbiology

Total Credits:3
Contact hrs: 45

- Unit I : Microbial pathogenicity and hospital infection** (5)
A) Pathogenicity of viruses, fungi and protozoa and bacteria
B) Hospital infection – factors contributing, common types, diagnosis and prophylaxis
- Unit II Bacterial diseases** (11)
(Morphological, cultural and biochemical characters, antigenic structures, modes of transmission, pathogenesis, symptoms, laboratory diagnosis, prophylaxis and treatment of following diseases)
1. *Pseudomonas aeruginosa* 2. *Mycobacterium leprae* 3. *Helicobacter pylori*
4. *Treponema pallidum* 5. *Clostridium perfringens* 6. *Mycobacterium tuberculosis*
7. *Vibrio cholera*
- Unit III Viral Diseases** (11)
(Morphology, cultural and biochemical characters, antigenic structures, modes of transmission, pathogenesis, symptoms, laboratory diagnosis, prophylaxis and treatment of following diseases)
1. Herpes (Simplex) 2. Rabies 3. Hepatitis A and B 4. AIDS 5. Swine flu 6. Ebola
- Unit IV Fungal, Protozoan Diseases and Biological Warfare** (7)
A. Candidiasis
B. Malaria
C. Biological warfare –Use of biological agents - bacteria, viruses, or other disease-causing agents as biological weapons
- Unit V Chemotherapy** (11)
A) Antimicrobial Drugs
B) Properties of ideal Antimicrobial drugs
C) Mode of action of following antimicrobial drugs:
i. **Acting on Cell Wall:** Penicillin, Bacitracin, Vancomycin,
ii. **Acting on Protein Synthesis:** Streptomycin, Chloramphenicol,
iii. **Acting on nucleic acid synthesis:** quinolones, rifampicin
iv. **Drugs Acting on folic acid synthesis:** Sulphonamide, Trimethoprim,
v. **Antiviral drug:** Azidothymidine,
vi. **Antifungal Drugs:** Amphotericin, Nystatin
D) Methods of antibiotic sensitivity testing : i) Disc diffusion ii) MIC determination
E) Mechanisms of drug resistance
- References:**
1. Pharmaceutical Microbiology – Huggo
2. Text book of Medical Microbiology – Ananthnarayan
3. Review of Medical Microbiology – Jawetz et al
4. Microbiology – Zinsser
5. Medical Microbiology – Cruickshank
6. Medical Microbiology - Davis and Dulbecco
7. Parasitology – Chattergii
8. Medical laboratory technology – Ramnaik Sood
9. Diagnostic Microbiology – Bailey’s and Scotts
10. Medical Bacteriology – Dey and Dey

PRACTICAL COURSE

Practical I:

Total Credits: 5

Contact hrs: 75

1. Isolation of DNA from bacteria by J. Marmur's method
2. Electrophoretic separation of DNA
3. Isolation of coliphages from sewage
4. One step growth curve
5. Determination of dose of U.V. by UV survival curve
7. Isolation of Lac negative mutants of *E.coli* by visual detection method.
8. Isolation of Streptomycin resistant mutants by gradient plate technique.
9. Isolation of Vitamin B12 requiring (auxotrophic) mutants by replica plate technique.
10. Diauxic growth curve of Escherichia coli (glucose and lactose).
11. Browsing of National Centre for Biotechnology Information (NCBI), DDBJ and EMBL websites.
12. Exploring protein sequence database (PDB) and GenBank and BLAST.

Practical II:

Total Credits: 5

Contact hrs: 75

1. Examination of milk **i) DMC ii) Quantitative analysis of milk** by SPC (using nutrient agar)
2. Phosphatase Test (qualitative)
3. Bioassay of Vitamin B₁₂
4. Bioassay of Penicillin
5. Production of wine by using Jaggery medium by *S. cerevisiae* - examination of pH, colour, taste.
6. Estimation of alcohol by using K₂Cr₂O₇
7. Sterility testing of media and pharmaceutical products
8. Immobilization of enzyme by using Sodium alginate
9. Thin layer chromatography- amino acid
10. Amylase assay (iodometric method)
11. Isolation of Lactic acid Bacteria (MRS Medium)
12. Estimation of Citric acid by titration method

Practical III:

Total Credits: 5

Contact hrs: 75

1. Isolation of **Azotobacter** from soil. (Identification up to genus level)
2. Isolation of **Rhizobium** from root nodules.
3. Isolation of **Phosphate solubilising** bacteria from soil.
4. Isolation of **Xanthomonas** from infected plant material
5. SPC of market **Biofertilizers**.
6. Estimation of available nitrogen from soil.
7. Estimation of available phosphorous from soil (Stannous chloride method)
8. Estimation of Calcium and Magnesium from soil (EDTA method)
9. Determination of organic carbon contents of soil (Walkley and Black method)
10. Microbiological analysis Drinking water: Presumptive, Confirmed and Completed test.
11. Determination of potability of water by MPN.
12. Waste water analysis: Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD)

Practical IV:

Total Credits: 5

Contact hrs: 75

1. Preparation of Tri sugar iron agar (TSI) medium slants and study of biochemical reactions on (TSI) slant.
2. Determination of minimum inhibitory concentration (MIC).of penicillin on *S.aureus*.
3. Antibiotic sensitivity test (by disc diffusion method)
4. Study of determination of effectiveness of antiseptic agents (– tincture iodine, 3% H₂O₂, 70% alcohol, 5% chlorine bleach) against selected organisms (*Escherichia coli*, *Staphylococcus aureus*, *Bacillus*) by disc diffusion method
5. Isolation of pathogen from clinical sample *Pseudomonas aeruginosa*
6. Isolation of pathogen from clinical sample *Klebsiella pneumoniae*
7. Isolation of pathogen from clinical sample *Acinetobacter baumannii*
8. Widal test (quantitative test), RA test, Pregnancy test
9. Haematology – RBC count, WBC count, differential WBC count, Erythrocyte sedimentation rate (ESR) , Hemoglobin estimation and demonstration of malarial parasite.
10. Urine analysis : Microscopic examination – pus cells, RBC, bacteria, crystals. Chemical examination – glucose (benedict’s method, protein (acetic acid), bile salt (sulphur method), Bile pigment (Fauchet’s method) ketone bodies (Rothera’s test)
11. Immunodiffusion test.
12. Study of synergistic action of antibiotics

Practical Examination

A) The university practical examination will be conducted on four (4) consecutive days for not less than 6 hours on each day of the practical examination. The practical examination shall be conducted by the two external examiners appointed by the University.

B) Each candidate must produce a certificate from the Head of the Department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic council on the recommendation of Board of studies and has recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journal at the time of practical examination. Candidate has to visit two places of Microbiological interest (Pharmaceutical industry, Dairy, Research institutes etc) and submit the report of their visit at the time of examination. The report should be duly certified by the Head of the Department.

Distribution of Marks for practical examination

For practical I, II, III, IV each.

- 1) One major experiment: 30 marks
- 2) Two minor experiment: 15 marks each
- 3) Journal: 5 marks

Total marks:

Practical I:	65 Marks
Practical II:	65 Marks
Practical III:	65 Marks
Practical IV:	65 Marks
Tour Report :	20 Marks
Total Marks:	280

Practical wise distribution of marks

Practical – I

A) Major Experiments: (any one) (30)

- i) Isolation of coli phages/ Mutants
- ii) Electrophoresis separation of DNA

B) Minor experiments: (any two) (30)

Diauxic growth / one step growth curve / Isolation of chromosomal DNA
Minimum lethal dose of U.V. by survival curve /Browsing of data banks (NCBI/ EBI/DDBJ)

C) Journal: (05)

Practical II

A) Major Experiments: (any One) (30)

Bioassay of Penicillin / Vitamin B₁₂ / Amylase assay
/ SPC of milk / Isolation of Lactic acid bacteria

B) Minor experiments: (any two) (30)

Direct microscopic count of milk / Phosphatase test (qualitative)/ TLC of amino acids
/ Immobilization of enzymes /Estimation of citric acid by titration/ alcohol by K₂Cr₂O₇

C) Journal: (05)

Practical III

A) Major Experiments: (any One) (30)

- i) Isolation& identification of *Azotobacter/Rhizobium/Xanthomonas*
- ii) BOD of sewage sample
- iii) Estimation of nitrogen from soil

B) Minor experiments: (any two) (30)

COD of sewage sample / Estimation of calcium/ Magnesium/ Organic carbon of soil/ Determination
of MPN of given sample / Confirmed and Completed test / Isolation of phosphate Solubilizing
bacteria

C) Journal: (05)

Practical – IV

A) Major Experiments: (any One) (30)

- i) Isolation and identification of:

Pseudomonas aeruginosa/ Klebsiella pneumoniae/ Acinetobacter baumannii

B) Minor experiments: (any Two) (30)

Determination of Antibiotic sensitivity to common pathogens / Determination of MIC of Penicillin
for *S.aureus* / Determination of effectiveness of Antiseptic agents / Widal Test / Differential count
of blood / Microscopic Examination of urine sample / Chemical Examination of Urine for
glucose/ Protein/ bile salt/ Bile pigment / Ketone bodies / ESR of blood sample / Hb estimation
of blood sample/ RA test / Pregnancy test

C) Journal: (05)

Study tour report and Viva: (20)

List of the Minimum equipments and related requirements for B.Sc – III

- 1) Replica plating units for genetics experiments: Two
- 2) Rotary shaker for fermentation experiments: One
- 3) Centrifuge (High speed): One
- 4) Hot plate: One
- 5) Hot air oven: One
- 6) Bacteriological incubator: One
- 7) Spectrophotometer: One
- 8) Research Microscope: one for each student
- 9) Haemocytometer: Two
- 10) Haemoglobinometer: Two
- 11) ESR stands and tubes: Two
- 12) Separate room for fine instruments of size 10'×15' feet dimension
- 13) A separate culture room of at least 10'×10' feet dimension
- 14) Electrophoresis assembly: One
- 15) Laminar air flow cabinet: One
- 16) Distillation assembly: One (Glass)
- 17) Reflux assembly: Four
- 18) Serological water bath: One
- 19) Colony counter: One
- 20) Refrigerator: One
- 21) TLC UNIT: One
- 22) Hand Refractometer
- 23) Computer with Internet facilities and printer: One
- 24) Micropipette: One
- 25) Anaerobic Jar: One
- 26) Heating Mantle: One
- 27) UV Chamber