



RANI CHANNAMMA UNIVERSITY

BELAGAVI

THE COURSE STRUCTURE & SYLLABUS OF UNDER GRADUATE

BACHELOR OF SCIENCE

MICROBIOLOGY

1ST TO 6TH Semesters

w.e.f.

**Academic Year 2020-21 and Onwards
Under**

CHOICE BASED CREDIT SYSTEM (CBCS)

**CHOICE BASED CREDIT SYSTEM [CBCS]
B.Sc. Program with Optional Subject: Microbiology**

(With effect from the academic year 2020-21 onwards)								
Sem	Part	Paper Code	Title of the Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
I	Part – 1 DSC	MCBDSCT1.1	General Microbiology	4	20	80	100	3
		MCBDSCP1.1	Practicals-1	3	10	40	50	1
	Total: Hours / Credits			7			150	4
II	Part – 1 DSC	MCBDSCT2.1	Microbiological Techniques	4	20	80	100	3
		MCBDSCP2.1	Practicals-2	3	10	40	50	1
	Total: Hours / Credits			7			150	4

(With effect from the academic year 2021-22 onwards)

Sem	Part	Paper Code	Title of the Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
III	Part – 1	MCBDSCT3.1	Microbial Physiology and Genetics	4	20	80	100	3
	DSC	MCBDSCP3.1	Practicals-3	3	10	40	50	1
	Part – 2 SEC	MCBSECT3.2	Microbial quality control in Food and Pharmaceutical Industries	2	10	40	50	2
	Total: Hours / Credits			9			200	6
IV	Part – 1	MCBDSCT4.1	Molecular biology and Genetic Engineering	4	20	80	100	3
	DSC	MCBDSCP4.1	Practicals-4	3	10	40	50	1
	Part – 2 SEC	MCBSECT4.2	Microbial Diagnostic in health clinics	2	10	40	50	2
	Total: Hours / Credits			9			200	6

**CHOICE BASED CREDIT SYSTEM [CBCS]
B.Sc. Program with Optional Subject: Microbiology**

(With effect from the academic year 2022-23 onwards)								
Sem	Part	Paper Code	Title of Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
V	Part – 1 DSE	MCM DSET5.1	Environmental Microbiology	4	20	80	100	3
		MCBDSEP5.1	Practical-5	3	10	40	50	1
		MCBDSET5.2A (Elective I)	Soil and agricultural microbiology	4	20	80	100	3
		MCBDSEP5.2A (Elective I)	Practicals-5A	3	10	40	50	1
		MCBDSET5.2B (Elective II)	Microbes in Sustainable agriculture and development	4	20	80	100	3
		MCBDSEP5.2B (Elective II)	Practicals-5B	3	10	40	50	1
	Part – 2 SEC	MCBSECT5.3	Biofertilizers and Biopesticides	3	10	40	50	2
	Total: Hours / Credits			17			350	10

Note: Students have to choose either Elective-I or Elective-II

VI	Part – 1 DSE	MCBDSET6.1	Food and industrial Microbiology	4	20	80	100	3
		MCBDSEP6.1	Practicals-6	3	10	40	50	1
		MCBDSET6.2A (Elective III)	Immunology and Medicinal Microbiology	4	20	80	100	3
		MCBDSEP6.2A (Elective III)	Practicals-6A	3	10	40	50	1
		MCBDSET6.2B (Elective IV)	Instrumentation and Biotechniques (Theory)	4	20	80	100	3
		MCBDSEP6.2B (Elective IV)	Practicals-6B	3	10	40	50	1
	Part – 2 SEC	MCBSECT6.3	Management of Human Microbial diseases	3	10	40	50	2
	Total: Hours / Credits			17			350	10

Note: Students have to choose either Elective-III or Elective-IV

T: Theory, P: Practical, CC/EA: Co-curricular/Extension Activities. AECC: Ability Enhancement Compulsory Course, DSC: Discipline Specific Course. DSE: Discipline Specific Elective, SEC: Skill Enhancement Course).

Note: Duration of examinations is 03 h for 80 Marks theory and 02 h for 40 marks theory. For practicals, duration of examination is 03 h.

Schema of Evaluation for Practical Examination

	Particulars	Marks Allotted
1	Experimental preparation involving the following *	30
2	Journal (record) assessment	05
3	Oral performance (Viva-voce)	05
Total		40
*	Brief description & tabulation	04
	Basic Diagrams	04
	Preparation of required solutions and Experimental set-up	04
	Record of observation and performance of experiment	10
	Calculation including drawing graph	06
	Accuracy of result with unit	02

Question Paper pattern
First Semester B.Sc. Degree Examination, December 2020
(CBCS Scheme-2020-21: Regular)

Microbiology

MCBDSCT 1.1: General Microbiology

Time: 3 Hours

Max. Marks: 80

Q. No. I. Answer any TEN of the following

2X10= 20 Marks

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)
- 10)
- 11)
- 12)

Q. NO. II. Answer the following questions

5X3=15 Marks

- a)
 - b)
 - c)
- OR
- d)

Q. No. III. Answer the following questions

5x3= 15 Marks

- a)
 - b)
 - c)
- OR
- d)

Q. No. IV. Answer the following questions

5x3=15 Marks

- a)
 - b)
 - c)
- OR
- d)

Q. No. V. Answer the following questions

5x3=15 Marks

- a)
 - b)
 - c)
- OR
- d)

Question Paper pattern
First Semester B.Sc. Degree Examination, December 2020
(CBCS Scheme-2020-21: Regular)
Microbiology

CHESECT 3.2: Title of the Paper

Time: 3 Hours

Max. Marks: 40

Q. No. I. Answer any **FIVE** of the following

2X5= 20 Marks

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Q. NO. II Answer the following questions

5X3=15 Marks

- a)
 - b)
 - c)
- OR
- d)

Q. No. III. Answer the following questions

5x3= 15 Marks

- a)
 - b)
 - c)
- OR
- d)

Instruction to set the DSC/DSE question paper.

- Question number 1 has 12 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any ten questions.
- Question number II are from unit I.
- Question number III are from unit II.
- Question number IV are from unit III
- Question number V are from unit IV.

Instruction to set the SEC question paper.

- Question number 1 has 6 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any five questions.
- Question number I is from unit I.
- Question number II is from unit II.

First Semester B.Sc. (Microbiology)

Paper Code: MCBDSCT1.1
Teaching Hours: 4 H / Week
Total hours:60

Paper Title: General Microbiology
Marks: Th-80+IA-20
Credits :3

Unit– 1 **15 hours**

Introduction

Microbes and origin of life, History, Scope, Branches. Contribution of Scientist to the field of microbiology. Antony Van Leeuwenhoek, Edward Jenner, Lazan Spallanzani, Louis Pasteur, Joseph listyer, Robert Koch, Alexander Fleming and Iwanowsky. Heakels three kingdom of classification, Whittaker’s Five kingdom of classification. Different trends in classification of Microorganisms. Principles and methods of classification.

Unit-2 **15 hours**

Microbial structure and Organization

Size, shape, arrangement, cell wall, cell membrane, ultra-structure of cell organelles. General characters, Classification, Morphology, Cultivation, Reproduction and significance of: i) Rickettsia ii) Chlamydia iii) Mycoplasma iv) Actinomycetes.

Unit-3 **15 hours**

Composition of 3- domain of organisms

Structure of Archae, Bacteria, Eukarya

Unit-4 **15 hours**

Distribution of microorganisms in air, water, soil and their significances, **Viruses** -Early developments of virology, Principles of viral taxonomy, General structure and properties of viruses -Bacteriophage (T4) Plant viruses (TMV) Animal viruses (Herpes Virus). Prions and Viriods – Nature and significance.

REFERENCES:

1. Atlas. R.M. “Microbiology- Fundamental and Applications” Mac Millian Publishing company New York.
2. Cappuccino J.C. And Sherman. N-1999 Microbiology- A laboratory manual, AdelsonWessey.
3. Colowod, D 1999, “Microbial Diversity” Academic Press.
4. Edward Aleam T.1997 “Fundamentals of Microbiology”-5thEdn, Adilson Wesely Longaman Inc. New York.
5. Madigan M.T. and Martinoko J.M. and Parker, J-1997 “Biology of Microbiology” “8thedn, Mc Graw Hill Inc New York.
6. Powar and Daginwala-1994 “Microbiology” –Vol. I and II Himalaya Publication, New York.
7. Salle. A.J. “Fundamentals Principles of Bacteriology” Tata Mc Graw Hill Publication Company Ltd. New Delhi.
8. Sullia S.B and Shantaram S.1998” General Microbiology” Oxford and IBH Publishing Co Pvt. Ltd. New Delhi.

First Semester B.Sc. (Microbiology)

Paper Code: MCBDSCP 1.1

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-1

Marks: Th-40+IA-10

Credits: 1

1. Laboratory Safety: General rules and regulations.
2. Study of compound microscope- Construction, working, principle, care to be taken while using the microscope. Use of oil immersion objective
3. Study of aseptic techniques-preparation of cotton plugs for test tubes and pipettes, wrapping of Petri-plates and pipettes, transfer of media and inoculums.
4. Study of Bacterial motility by hanging drop method.
5. Counting of Yeast cells And Fungal Spores by Haemocytometer.
6. Isolation of microorganisms from Air, water and Soils and studying their characteristics.
7. Micrometer.

Second Semester B.Sc. (Microbiology)

Paper Code: MCBDSCT 2.1

Paper Title: Microbiological Techniques

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits :3

Unit-I

15 hours

Microscopy & Instruments

Principles of Microscopy- resolving power, numerical aperture, working distance and magnification. 2. Principles of photomicrography. 3. Working principles and applications of a) Dark field microscope b) Phase contrast microscope c) Fluorescence Microscope e) Electron Microscopy- TEM and SEM. Working principles of Centrifuge, pH meter, Colorimeter and Spectrophotometer and their applications.

Unit -II

15 hours

Sterilization

- A) Physical methods and their mode of action.
- i) Heat
 - a) Dry heat-Hot air Oven
 - b) Incineration
 - c) Moist heat-Autoclave and Pressure cooker.
 - d) Tyndallizations (Fractional Sterilization)
 - ii) Filtrations-Types of filters and laminar air flow.
 - iii) Radiation methods-UV and Gamma Radiations.
- B) Chemical methods:
- a) Definitions of terms-Disinfectants, Antiseptics Sanitizers.
 - b) Microbicides- Bactericides, Viricides, Fungicides & Sporicides, Microbiostatic, Bacteriostatic and fungi biostatics agents.
 - c) Use and mode of action- Alcohol, Aldehydes, Halogens, Phenols Heavy metal, Detergents: Quaternary ammonium compounds.

Unit-III

15 hours

Culturing of microorganisms: Culture media-Synthetic and non-synthetic-solid, liquid and semisolid media, Special Media-Enriched, Selective, Transport, Differential media. Methods of isolation of bacteria, fungi- Serial dilution, pour plate, Spread plate and Streak plate. Different methods for maintenance of pure culture. Cultivation of anaerobic bacteria- Anaerobic jars method.

Unit -IV

15 hours

Strains and Staining Techniques

Principles and types of stains- Preparation of bacterial stains for light microscopy. Fixation, Simple staining(Positive and Negative),Differential staining(Gram staining and acid fast staining), Structural staining(capsule and endospore staining).

REFERENCES:

1. Aneja K.R, Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.
2. Atlas.R.M. "Microbiology- Fundamental and Applications" Mac Millian Publishing company New York.
3. Benson Harold. J. "Microbial Applications" WCB Mc Millian Publishing Co, New York.
4. Bhattacharya, "Experiments with Microorganisms"-Emkay Publishers.
5. Colwod. D 1997 "Microbial Diversity" Johan Wiley.
6. Cooper, D 1997:"The tools of Biochemistry" Johan Wiley and sons.
7. Pelechzar M.J. and Chand ECS and Kreig NR- 1982 "Microbiology" Tata Mc Graw Hill Book Co. New York.
8. Salle. A.J. "Fundamentals Principles of Bacteriology" Tata McGraw Hill Publishing Company Ltd. New Delhi.
9. Stainer. R.Y. and Ingraham J.L. "General Microbiology" Prentice Hall of India Pvt. Ltd, New Delhi.
10. SulliaS.B. and Shantaram S 1998" General Microbiology" oxford and IBH Publishing Co Pvt. Ltd. New Delhi.
11. Sunderrajan "Tools and Techniques of Microbiology"- Anmol Publications.

Second Semester B.Sc. (Microbiology)

Paper Code: MCBDSCP 2.1

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-2

Marks: Th-40+IA-10

Credits : 1

1. Study of microscope. Structure and working principle of Light microscope.
2. Preparation of the culture media: Broth, Semisolid and solid. Pour plate, Streak plate and Spread plate techniques.
3. Isolation and Enumeration of microorganisms using serial Dilution techniques.
4. Staining methods simple staining, Gram staining, Acid fast staining and structural stains.
5. Demonstration of slides culture techniques of Fungi.
6. Demonstration of laboratory instruments: Autoclave, Hot air Oven, Incubator, Centrifuge, Spectrophotometer and pH meter.

Third Semester B.Sc. (Microbiology)

Paper Code: MCBDSCT 3.1

Paper Title: Microbial Physiology and Genetics

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits: 3

Unit-I

15 hours

Biomolecules, Enzymes, Microbial Nutrition, Photosynthesis

Classification and importance of Carbohydrates, Proteins & Lipids. Nomenclature, classification, properties, mechanism of action and factors affecting enzyme activity, competitive and non-competitive inhibition and allosteric enzymes, cofactors, coenzymes, Ribozymes and their importance, clinical importance of enzymes. Nutritional requirements, modes of nutrition- Phototrophs, chemotrophs, methanotrophs, organotrophs and saprotrophs. Types of bacterial photosynthesis, photosynthetic pigments, factors affecting rate of photosynthesis. Light & Dark reactions, Comparison of Photosynthesis in green plants & bacteria.

Unit II

15 hours

Bio-energetic, Microbial Growth

Laws of thermodynamics, Free energy, ATP and its production. Other high-energy compounds, oxidation and reduction reaction. Glycolysis, Outline of TCA cycle, ETP, oxidative phosphorylation, oxidation (alpha and Omega oxidation pathway), anaerobic respiration, Lactic & acetic acid fermentation. Growth rate, generation time and growth curve-phases of growth and their significance. Physical and chemical factors affecting growth. Measurement of growth by cell number and cell mass.

Unit III

15 hours

Introduction to Genetics, Bacterial genome & Recombination.

Genomic organization in Prokaryotes & Eukaryotes. Chemical composition of DNA and RNA, Watson and Crick model of DNA, Types of DNA and RNA-A, B, H, Z. Super coiling of DNA, Extra chromosomal DNA. Basic properties of the genomes of bacteria, DNA replication in E.coli, Rolling circle & Q structure, Genetic code dictionary. Requirements of recombination, Molecular basis, genetic analysis of recombination. Transformation, Conjugation and Transduction with examples.

Unit –IV

15 hours

Mutation, Transposon

Nature and types, Mutagenic agents and molecular basis of mutation DNA damage & repair mechanism. Oncogenes and cancer - Mutation - its types, transforming viruses carrying oncogenes - Retroviral oncogenes - Immortalization & transformation.

Transposable elements -Discovery, classification, examples, applications.

REFERENCES:

1. Wolfgang. K. Joklik (1995) Zinssers Microbiology. Mc Graw-Hill companies.1294pp.
2. Stanley. R. alloy, David Freifelder, And John. E.Crona. (1994).Microbial Genetics (2nd Ed). Jone sand Bartlett Publishers.
3. Larry Snyder Wendy Champness. (1997) Molecular Genetics of Bacteria.ASM Pree. 672pp.
4. Alcamo, I.E. Laboratory Fundamental of Microbiology 2001. Jones and Bartlett Publishers.
5. Microbial Genetics. Maloy et.Al.1994. Jones and Bartlett Publishers.
6. Molecular Genetics of bacteria. J.W. Dale 1994. John Wiley & Sons.
7. Modern Microbial genetics.1991. Streips &Yasbin. Nile. Ltd.
8. Atlas, R.M. "Microbiology- Fundamental and Applications" Mac Millian Publishing company New York.
9. Cappucino, J.C., Shermani, N.1999. Microbiology- A laboratory manual, Adelson Wesley.
10. Colowod, D 1999, "Microbial Diversity" Academic Press.
11. Edward Aleam T.1997 "Fundamentals of Microbiology" -5thEdn, Adilson Wesely Longaman Inc. New York.
12. Aneja K.R, Experiments in Microbiology, Plant pathology, Tissue culture And Mushroom Cultivation, New age International, New Delhi.
13. Brown, T.A. 1998 "Genetics- A molecular Approach" 3rdedn.

Third Semester B.Sc. (Microbiology)

Paper Code: MCBDSCP 3.1

Paper Title: Practicals-3

Teaching Hours: 3 H / Week

Marks: Th-40+IA-10

Total hours: 45

Credits: 1

1. Qualitative test for the detection of the macromolecules. Glucose- Benedict's test, Fehling's test.

Protein – Biuret test, Ninhydrin test. Lipids- Emulsification and solubility test.

2. Determination of growth curve for fungi by colony diameter method.
3. Biochemical test for the identification of bacteria:
 - a) IMViC
 - b) Fermentation of Glucose, Sucrose and Lactose- acid & gas production.
 - c) Starch Hydrolysis
 - d) Gelatin Hydrolysis
 - e) Catalase test
4. Colorimetric estimation of Sugars by DNS method.
5. Colorimetric estimation of Proteins by biuret method.
6. Effect of PH and Temperature on bacterial growth.
7. Transformation-Griffiths experiment and Mechanisms. Transduction generalized & specialized.
8. Demonstration of Chromatographic Separation of amino acid.

Third Semester B.Sc. (Microbiology) Skill Enhancement Course

Paper Code: MCBSECT 3.2

Paper Title: Microbial Quality Control
in Food and Pharmaceutical Industries

Teaching Hours: 3 H / Week

Marks: Th-40+IA-10

Total hours: 30

Credits : 2

Unit 1

15 hours

Microbiological Laboratory and Safe Practices, Determining Microbes in Food.

Good laboratory practices - Good laboratory practices, Good microbiological practices. Bio-safety cabinets – Working of bio-safety cabinets, using protective clothing, Discarding bio-hazardous waste – Methodology of Disinfection, Autoclaving & Incineration. Culture and microscopic methods - Standard plate count, most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products.

Unit 2

15 hours

Pathogenic Microorganisms in Food & Water, HACCP for Food Safety and Microbial Standards

Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar. Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centers (COB, 10 min Resazurin assay). Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations. Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water

SUGGESTED READING

1. Harrigan, W.F. (1998). Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
2. Garg, N., Garg, K.L., Mukerji, K.G. (2010). Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Jay, J.M., Loessner, M.J., Golden, D.A. (2005). Modern Food Microbiology.

Fourth Semester B.Sc. (Microbiology)

Paper Code: MCBDSCT 4.1

Paper Title: Molecular Biology and Genetic Engineering

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits :3

Unit I

15 hours

Molecular basis of life, Transcription & Translation in Prokaryotes and Eukaryotes

An introduction, Experiment proof of DNA and RNA as genetic material. DNA damage and Repair. Causes of DNA damage, Repair mechanisms (Photoreactivation, Excision repair, Mismatch repair & SOS repair). Process of transcription, transcription Factor, Post transcriptional modification in prokaryotes and Eukaryotes. Initiation, elongation and termination of protein synthesis, translational factors in prokaryotes and eukaryotes.

Unit II

15 hours

Regulation of Gene expression

Regulation of Gene expression in prokaryotes. The operon concept, Induction and repression, The lac operon. Tryptophan operon, catabolic repression and Attenuation. Eukaryotes (Galactose metabolism in Yeast). Gene organization and expression in mitochondria and chloroplasts.

Unit III

15 hours

Introduction and scope of genetic engineering

Tools of genetic engineering. Modifying enzymes: Restriction enzymes, ligases, Methylases.

- a. Cloning vehicles: Naturally occurring plasmids, cloning plasmids (PBR322 and PUC18), Viruses as cloning vehicle (DNA, M13), Hybrid vectors (cosmids, YAC).
- b. Cloning hosts: Ecoli.

In vitro construction of r-DNA molecules: Isolation of DNA from bacteria (gene of interest) and isolation of vector DNA (Bacteria).

- a. Cutting of DNA molecules: Physical methods, enzymatic methods and joining of DNA molecules: Homopolymertails, Linkers, adapters.
- b. Transformation of r-DNA into target host organisms: Calcium chloride mediated gene transfer, Agro bacterium mediated DNA transfer, Electroporation and Microinjection.
- c. Screening and selection of recombinant host cells: Insertional inactivation. In situ colony / DNA hybridization and immunological techniques.
- d. Gene libraries: Genomic DNA & c-DNA cloning techniques.
- e. DNA finger printing and its applications.

Unit IV

15 hours

Applications of Genetic Engineering, Biotechnology programmes and regulations

Medicine-Gene therapy, Agriculture-Nif gene. Potential hazards and safe guards of genetic engineering. Molecular Techniques: a) Electrophoresis b) Blotting techniques c) PCR and its

applications d) RFLP. Role of international organizations in Biotechnology, Governmental regulations of recombinant DNA research for disposal of Bio-hazardous material, Patenting of Bio-technological processes products and patent laws.

REFERENCES:

1. Brown, T. A. 1998 "Genetics- A molecular approach" 3rd edn. Stanley Thornes Ltd. U.K.
2. Colwell, D 1999 "Microbial Diversity" Academic Press.
3. Davis R.W.W Botstein, D and Rogeness, J.R. (1980): "A manual for Genetic Engineering" Cold Spring Harbor Laboratory. Cold Spring Harbor New York.
4. Dr Robertis, EDP and De Robertis E.M.S. 1988 "Cell and Molecular Biology" Lea and Leigler Philadelphia K.M. Vakghese Co.
5. Gerald Karp "Cell Biology" McGraw Hill Book Co. New York.
6. Gillor. B.R. And Pasternak. J.J. 1994. "Molecular Biotechnology Principles and Applications of Recombinant DNA American Society for Microbiology, Washington DC.
7. Nichol, D S F 1994 "An introduction to Genetic Engineering "Cambridge University Press.
8. Peters P 1993 "A Guide to Genetic Engineering" Dubuque Iowa WMC Brown.
9. Rigbu, P.W.J 1987 "Genetic Engineering- VI Academic Press Inc, Florida, USA.
10. Salle. A.J., "Fundamentals Principles of Bacteriology" Tata McGraw Hill Publishing Company Ltd. New Delhi..
11. Smith "Molecular Biology "Faber and Faber Publications.
12. Stainer, R.Y. Ingraham J.L. "General Microbiology" Prentice Hall of India Pvt. Ltd., New Delhi.
13. Watson James D "Recombinant DNA "Scientific American Books", New York.

Fourth Semester B.Sc. (Microbiology)

Paper Code: MCBDSCP 4.1

Teaching Hours: 3 H / Week

Total hours:45

Paper Title: practicals-4

Marks: Th-40+IA-10

Credits:1

1. Preparations of Buffer-Citrate and Phosphate.
2. Preparation of RNA by orcinol method.
3. Extraction and estimation of DNA by Diphenylamine method.
4. Extraction and estimation of protein form animal/ plant source by salt precipitation and organic solvent method.
5. Restriction Digestion of DNA.
6. In vitro DNA ligation.
7. Study of DNA finger printing (chart).
8. Study of gene cloning(chart)
 - a. PBR322
 - b. PUC18 and 19
 - c. SV40
 - d. Bacteriophages

Selection of recombinants by replica plate Techniques

Fourth Semester B.Sc. (Microbiology) Skill Enhancement Course

Paper Code: MCBSEC 4.2
Teaching Hours: 4 H / Week
Total hours: 30

Paper Title: Microbial Diagnosis in Health Clinics
Marks: Th-80+IA-20
Credits : 2

Unit 1

15 hours

Importance of Diagnosis of Diseases, Clinical Samples, Microscopic Examination and Culture

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis. How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required.

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria. Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

Unit 2

15 hours

Serological and Molecular Methods, Testing for Antibiotic Sensitivity in Bacteria

Serological Methods - Agglutination, ELISA, immune fluorescence, Nucleic acid-based methods -PCR, Nucleic acid probes. Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method. Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method.

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.
5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical.

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 5.1

Paper Title: Environmental Microbiology

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits :3

Unit I

15 hours

Introduction: Aerobiology

Air pollution- Sources, Types, Effects, Control. Ozone Layer Depletion. Micro flora of indoor & outdoor environment, Factors affecting air micro flora, management of airborne microbes. Techniques of trapping airborne Microorganisms: Gravity Slide, Petri plate exposure, liquid impingement, Sieve device & Filtration. Air borne Diseases. Control of airborne microorganisms.

Unit II

15 hours

Aquatic Microbiology

Water pollution- Sources, Types, Effects, Control. Water borne diseases–Jaundice, Cholera, Amoebic dysentery. Biological indicators of water pollution. Determination of sanitary quality of water: SPC tests for Coli Forms, MPN, IMViC reactions, membrane filter technique.

Unit III

15 hours

Microbiology of waste water

Introduction: Sources of waste water-(Domestic, Agricultural, Industrial).Physical, Chemical & Microbiological characteristics of waste water. Waste water treatment –Municipal waste water treatment- Primary (Screening, Coagulation, Sedimentation) Secondary (Trickling Filter, Activated sludge process, Osmosis, Oxidation pond) Tertiary (Reverse Ion exchange method & Dialysis). Waste as a resource (Organic compost): Biogas production and Composting.

Unit IV

15 hours

Bioleaching & Bioremediation

Scope of bioleaching, Organisms involved economic importance Mechanism of bioleaching of Cu and Fe. Role of microbes in abatement of heavy metal Pollution. Different microbial groups in bioremediation of environment. Biodegradation of Petroleum (Hydrocarbon), Pesticides (2, 4-D & DDT).

Note: Visit to water treatment plant / Sewage treatment plant. Report should be written and submitted along with practical record.

REFERENCES

1. Alexander, M. "Introduction to Soil Microbiology" Wiley Eastern Ltd., New Delhi.
2. Colowd. D., 1999. "Microbial Diversity" Academic press.
3. Hurst, G.H., "Environmental Microbiology" ASM Press Washington D.C.
4. Pelzer, M.J., Chan, E.C.S and Krieg, N.R.- 1982 "Microbiology" Tata McGraw Hill Book Co. New York.
5. Prescott. Lansing, M., Harley John P and Klein Donald, A "Microbiology" WBC. McGraw Hill New York.
6. Ralph Mitchell 1995 "Environmental Microbiology" Wiley and Sons. New York.
7. Salle. A.J. "Fundamental Principles of Bacteriology" Tata McGraw Hill Publishing Company Ltd. New Delhi.
8. Sha D.S. And S.K. Dwivedi. Environmental Microbiology and Biotechnology, New Age Publishers.
9. Stenier R. Y. Ingra ham J.L. "General Microbiology" Prentice Hall of India Pvt. Ltd. New Delhi.
10. Subbarao. N.A. "Soil microorganisms and Plant growth "Oxford and IBH publications co. New Delhi.

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCB DSEP 5.1

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-5

Marks: Th-40+IA-10

Credits: 1

1. Microscopic observation of different water samples.
2. Bacterial examination of water.
 - a) Test for Coli forms
 - b) Determination of MPN of Coliforms.
3. Estimation of solids in sewage.
4. Isolation & enumeration of microorganisms from different water samples by Serial dilution & pour plate method.
5. Estimation of dissolved oxygen in water sample.
6. Demonstration of sewage treatment plants- Trickling filter, Imhoff tank, Septic tank.
7. Display of photographs of water purification process-(Baffles flocculator, Clarifier, Sand filter, chlorinometer and chloroscope).

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 5.2A

Paper Title: Soil and Agriculture Microbiology

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits :3

Unit I-

15 hours

Microbiology of Soil

Introduction: Types, soil profile, physical and chemical characters. Soil Microorganisms: Bacteria, Fungi, Actinomycetes, Algae, Protozoa and viruses. Role of Microorganisms in soil process: Biogeochemical Cycles- Carbon, Nitrogen, Sulphur and Phosphorous. Rhizosphere micro flora and its role in the rhizosphere. Role of microorganisms in composting and humus formation. Interactions among microorganisms and Plants.

Unit II

15 hours

Microorganisms in Agriculture

Nitrogen fixing - Azotobacter, Rhizobium, and Azospirillum. b. Phosphate Solubilizing Microorganisms. c. Biochemistry of symbiotic and non-symbiotic nitrogen fixation. d. Mass production of bioinoculants (Rhizobium, Azotobacter, Azospirillum and Cyanobacteria) mode of applications and merits e. Biopesticides: Types Bacterial (*Bacillus thuringiensis*), Fungal (Trichoderma) mode of action factors influencing and target pests.

Unit III

15 hours

Microbes as Plant Pathogens

A brief account of the causative agents, Symptoms and control of the following plant diseases- Bacterial (*Xanthomonas citri*), Fungal (Puccinia, Plasmopara, Cercospora), Mycoplasma (Sandal spike, Grassyshoot), Viruses (TMV, Tomato leaf curl). Hemipterans and Their Role as Vectors of Bacterial Plant Pathogens.

Unit IV

15 hours

Mushroom-Culture Techniques

Edible and non-edible mushroom, Cultivation of button mushroom, Pests and diseases of Edible, mushrooms, Economics of mushroom cultivation.

REFERENCES:

1. Alexander, M. "Introduction to Soil Microbiology", Wiley Estern Ltd., New Delhi.
2. Brock. T.D. "Principles and microbial ecology". Prentice Flaial publishing company Philadelphia.
3. Colowd. D. 1999 "Microbial Diversity". Academic press.
4. Metrotra, R.S. "Plant pathology" Tata Mc Graw Hill Publication, New Delhi.
5. Pleczar, M.J Chan, E.C.S. and Krieg, N.R.-1982 " Microbiology" Tata MaGraw Hill Book Co. New York.
6. Prescott. Lansing, M. ,Harley John P and Klein Donald, A " Microbiology" WBC. McGraw Hill New York.
7. Rangaswamy, G. 1996 Diseases of crop in India. 3rd end. Prantice Hall of India Pvt. Ltd. New Delhi.
8. Salle. A.J. "Fundamental Principles of Bacteriology" Tata McGraw Hill Publishing Company Ltd.New Delhi.
9. Sha D.S. and S.K. Dwived Environmental Microbiology and Biotechnology, New Age Publishers.
10. Steward W.D.P Nitrogen Fixation in Plants. The Althione Press London.
11. Subbarao. M.S.1986 "Soil microorganisms and plant growth "3rdedn. Oxford & IBM Publication Co.New Delhi.

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCB DSEP 5.2A

Teaching Hours: 4 H / Week

Total hours: 45

Paper Title: Practicals-5A

Marks: Th-40+IA-10

Credits : 1

1. Isolation and enumeration of bacteria and fungi from Rhizosphere and Rhizoplane.
2. Isolation of Rhizobium from Legume or root nodules.
3. Isolation of Azotobacter from soil.
4. Isolation and identification of *Xanthomonas citri* from infected sample.
5. Study of plant pathogens- Tikka disease, sandal spike, Tomato leaf curl.
6. Isolation of Phosphate solubilizing bacteria from soil.

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 5.2B

Paper Title: Biofertilizers and Biopesticides

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours: 60

Credits :3

Unit 1

15 Hours

Biofertilizers, Non - Symbiotic Nitrogen Fixers

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N₂ fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants. *Frankia* - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis. Cyanobacteria, *Azolla*- Isolation, characterization, mass multiplication, Role in rice cultivation, Cropresponse, field application. Free living *Azospirillum*, *Azotobacter*- free isolation, characteristics, mass inoculums, production and field application.

Unit 2

15 Hours

Mycorrhizal Biofertilizers, Bioinsecticides

Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculums production of VAM, field applications of Ectomycorrhizae and VAM. General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, *Bacillus thuringiensis*, production, Field applications, Viruses – cultivation and field applications.

Suggested Readings

1. Kannaiyan, S. (2003). Bioethnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. NewYork.
3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt.Ltd. NewDelhi.
5. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG
6. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.

Fifth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 5.2B

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-5B

Marks: Th-40+IA-10

Credits: 1

1. Study soil profile.
2. Study microflora of different types of soils.
3. *Rhizobium* as soil inoculants characteristics and field application.
4. *Azotobacteras* soil inoculants characteristics and field application.
5. Design and functioning of a biogas plant.
6. Isolation of cellulose degrading organisms.

1. SUGGESTED READINGS

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,
2. Singh RS. (1998). Plant Diseases Management. 7th edition. Oxford & IBH, New Delhi.
3. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press.
4. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4thedition. Benjamin/Cummings Science Publishing, USA.
5. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA.
7. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
8. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
9. Altman A (1998). Agriculture Biotechnology, 1st edition, Marcel decker Inc.
10. Mahendra K. Rai (2005). Hand Book of Microbial Biofertilizers, The Haworth Press, Inc. New York.
11. Reddy, S.M. et. al. (2002). Bioinoculants for Sustainable Agriculture and Forestry, Scientific Publishers.
12. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG.

Fifth Semester B.Sc. (Microbiology) Skill Enhancement Course

Paper Code: MCBSECT 5.3

Paper Title: Biofertilizers and Biopesticides

Teaching Hours: 3 H / Week

Marks: Th-40+IA-10

Total hours: 30

Credits : 2

Unit 1

15 Hours

Biofertilizers, Non - Symbiotic Nitrogen Fixers

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N₂ fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants. Frankia - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis. Cyanobacteria, *Azolla*- Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application. Free living *Azospirillum*, *Azotobacter*- free isolation, characteristics, mass inoculums, production and field application.

Unit 2 Mycorrhizal Biofertilizers, Bioinsecticides

15 Hours

Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculums production of VAM, field applications of Ectomycorrhizae and VAM. General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, *Bacillus thuringiensis*, production, Field applications, Viruses – cultivation and field applications.

Suggested Readings

1. Kannaiyan, S. (2003). Bioethnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. New Delhi.
5. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG
6. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.

Sixth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 6.1
Teaching Hours: 4 H / Week
Total hours:60

Paper Title: Food and Industrial Microbiology
Marks: Th-80+IA-20
Credits: 3

Unit I

15 hours

Food and Microorganisms, Fermented foods

Food as a substrate for microorganisms and sources of contamination of food.

Food Spoilage and Poisoning: Spoilage of canned foods, cereals, Fruits, vegetables, meat and fish. Food sanitation and control. Food sanitation and control. Soya sauce, olives, idly, butter milk, Yoghurt, cheese and Kefir Food preservation. Principles of food preservation, physical and chemical methods. Asepsis, removal of microorganism anaerobic conditions, high temperature- low temperature, drying and food additives – Canning.

Unit –II

15hours

Microbiology of Milk

Sources of milk contamination, methods to detect microbial spoilage by SPC, Reductase test, Biochemical changes of milk souring, Gassy fermentation, Proteolysis, Lipolysis, Ropiness, Phosphatase test, Clot on Boiling test. Starter culture and its role. Methods of Preservation of milk and milk Products. Food bore disease – food borne infections and intoxication – laboratory testing – preventing measures - food sanitation.

Unit –III

15hours

Introduction to Industrial Microbiology, Industrial fermentation process

History, scope and development of industrial microbiology, Isolation and screening of industrially important microorganisms. Strain improvement methods. Batch, Continuous, surface, submerged and solid-state fermentation. Media components and formulation: Crude media components, anti-foam agents, precursors, inducers, inhibitors and buffering agents. Sterilization of media and raw materials maintenance of sterility at critical points during fermentation Inoculums preparation.

Unit –IV

15 hours

Process parameters, Fermentors & Down Stream processing

Aeration, Agitation, Temperature regulation, Foam regulation and pH regulation. Basic structure, construction and various types- Typical stirred aeriated fermentor, Tower fermentor and Bubble cap fermentor. Precipitation, Filtration, centrifugation, distillation, Cell disruption, solvent recovery, drying and crystallization. Industrial production of chemicals, Minerals, Petroleum. Alcohol, Lactic acid, Penicillin. Role of microorganisms for production and recovery of minerals and petroleum.

REFERENCE:

1. Banwart.G.J. 1987 “Basic Food Microbiology” CBS Publishers and Distributors New Delhi.
2. Betty C. Hobbs “ Food Microbiology” Arnold- Heinamann Publishing Private Ltd. New Delhi.
3. Casida, Jr.L.E. (1996)Industrial Microbiology New Age International Publishers New Delhi.
4. Colwod. D. 1999 “Microbial Diversity” Academic Press.
5. Frazier and Westhoff“ Food Microbiology” Tata Mc Graw Hill Publication co.Ltd. New Delhi.
6. Hammer B.W. and Babal “Dairy Microbiology” Prentice Hall incorporate. Londn.
7. Jay.J.M. “Modern Food Microbiology” CBS Publishers and Distrbutors. New York.
8. Peleczar, M.J.Chan.E.C.S. and Krieg, N.R.- 1982 “Microbiology” Tata Magraw Hill Book co. New York.
9. Prescott. Lansing.M., Harely John. P and Klein Donald, A “ Microbiology” WCB Mc Graw Hill New York.
10. Reed. G. 1982 “ Industrial Microbiology” MacMillan Publications Ltd. Wisconsin.
11. Ribonson R.T. 1990 “Dairy Microbiology Elsevier Application Dienes London.
12. Salle. A.J. “Fundamental Principles of Bacteriology” Tata McGraw Hill Publishing Company Ltd.New Delhi.
13. Stanier, R.Y. Ingraham J.L “General Microbiology” Prentice Hall of India Pvt Ltd. New Delhi.
14. Vernam A.H. and Evans. M.G. “Foodborne Pathogens” Wolfe Publishing House. London.
15. Waites Michael J. Morgan Neil L. Rockey John S. and Gray Higton, “Industrial Microbiology- An Introduction “Blackwell Science, Delhi.

Sixth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 6.1

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-6

Marks: Th-40+IA-10

Credits: 1

1. Isolation and identification of microbes from infected fruits, vegetables and cereals.
2. Isolation and identification of microorganisms from curd, idli, butter & stored foods- Jams, Jellies, sauce and pickles.
3. Bacterical examination of milk by SPC & DMC method.
4. Methylene Blue Reduction test (MBRT) for quality assessment of milk.
5. Estimation of fat content in milk by Gerber's methods.
6. Estimation of Lactose in Milk.
7. Estimation of Lactic acid from curd samples.
8. Observation of industrially important microorganisms.
9. Production of Wine from grapes.
10. Estimation of alcohol content.
11. Preparation of banana juice by pectinase.
12. Production and estimation of citric acid by titrimetric method.
13. Study of different types of fermentation (Charts).

Note: Visit to Industries / Research laboratories Dairy industries. Distilleries, Pharmaceuticals and Pathological laboratories. A report on the visit should be written and submitted with practical record.

Sixth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 6.2A

Paper Title: Immunology and Medical Microbiology

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours:60

Credits :3

Unit –I

15 hours

Introduction to immunology

Immunity -Types-Natural, Acquired, Active &Passive. **Cells**, Tissues and Organ involved in immune system. **Antigens** Nature& types, Factors influencing antigenicity **Antibodies**. Structure, types, Properties& functions of immunoglobulins. **Antigen & Antibody reactions** Agglutination, Precipitation, Complement Fixation test, Neutralization test, Opsonization. Gel-diffusion techniques, Immuno electrophoresis, Labelled Antibodies-RIA, ELISA and Immuno Fluorescent Techniques.

Unit –II

15 hours

Immune response& Complement System

CML, MHC, AMI, Immunological memory and immunological tolerance. Properties, Components, Pathways and Functions. Hypersensitivity reactions & vaccines.

Unit III

15 hour

Introduction to Medical microbiology, Pathogens

History and development of medical microbiology. Normal Flora of human body. Infection. Types, Modes of Transmission and port of entry. **Pathogens** Morphology, Cultural and biochemical characteristics, classification, resistance, Pathogenesis, Clinical symptoms, laboratory diagnosis, epidemiology, prophylaxis and treatment of the following.

- a. Bacterial diseases- Tuberculosis, Cholera, Typhoid and Syphilis.
- b. Viral diseases- Hepatitis, Poliomyelitis and AIDS.
- c. Protozoan diseases- Malaria
- d. Trichomonas & Amoebiosis.

Unit –IV Antibiotics

15 hours

General characteristics and types of antibiotics, mode of action of Penicillin, Streptomycin & Chloramphenicol. Zoonotic diseases and their control; Hospital acquired infections and their control; Hospital waste disposal; Ethical committee and their functions.

REFERENCE:

1. Clark. W.R. “The Experimental foundations of Modern Immunology (1991): John Wiley and Sons. Inc.
2. Mackie &McCartney-Medical Microbiology-14th Ed.
3. Vol.1: Microbial infections.

4. Vol. 2: Practical Medical Microbiology: 1996 Churchill. Livingstone London.
5. Bailey & Scott's Diagnostic Microbiology.
6. Ellen Jo Baron, Lance R. Peterson. Sydney M. Feingold^{9th} Ed. 1994 Moseby.
7. Franklin, T.J. Snow G/A. Biochemistry of Antimicrobial Action: (1981): Chapman and Hall New York.
8. Roitt, I.M: Essential Immunology (1995): Blackwell Scientific Publication. Oxford.
9. Roth, J.A. (1985): Virulence Mechanism of Bacterial Pathogens. American Society for Microbiology, Washington D.C.
10. Smit, C.G.C. "Epidemiology and infections" (1976): Medowfief Press Ltd. Shildon, England.
11. Stiehm. F. (1980): Immunological Disorders in infants and Childerne" (1980): W.B. Saunders & Co., Philadelphia.
12. Stites, D.P. Stobo J.D. Feudenberg, H.H. Wells, J.V Basic and Clinical Immunology, (1984): Lange Medical Publications, Los Altos., Clifornia.
13. Todd. I.R. (1990): Lecture Notes in immunology, Blackwell Scientific Publications Ltd. Oxford.
14. Rolt I.M. Brostoff and Male 2nd ,3rd ,4th ed. 1989, 1994,1995 Immunology-Gower Medical Publishing Co.,
15. Fundamental Immunology- W.E. Paul. 1989, Raven Press, New York.
16. 16.Fundamentals of immunology –R.M. Coleman, M.F. Lombord and R.E. Sicard (1992)-2nd Brown Publishers.
17. Immunology-D.M. Weir and Steward 7th Ed. (1993).

• **Sixth Semester B.Sc. (Microbiology)**

Paper Code: MCB DSEP 6.2A

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practicals-6A

Marks: Th-40+IA-10

Credits: 1

1. Isolation and identification of microorganisms from ear, nose, throat and sputum (Growth on blood agar, chocolate agar, MacConkey agar, Nutrient agar)
2. Isolation and identification of microorganisms from clinical sample- Urine (Growth in alkaline peptone water, blood agar, MacConkey agar).
 - a. Semi quantitative estimation of C+V
 - b. Chemical analysis of urine crystal identification of sugar and protein.
3. Blood grouping and calculation of allelic frequencies.
4. Differential count of WBC.
5. Coagulase test.
6. WIDAL test.
7. VDRL Test.
8. Study of Pathogenic Microorganisms Slides.

Sixth Semester B.Sc. (Microbiology)

Paper Code: MCBDSSET 6.2B

Paper Title: Instrumentation and Biotechniques

Teaching Hours: 4 H / Week

Marks: Th-80+IA-20

Total hours: 60

Credits:3

Unit 1

15 hours

Microscopy: Brightfield and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

Spectrophotometry: Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry.

Unit 2

15 hours

Chromatography

Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection. Gel filtration chromatography, ion-exchange chromatography and affinity chromatography, GLC, HPLC.

Unit 3

15hours

Electrophoresis

Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gelelectrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.

Unit 4

15 hours

Centrifugation

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.

Sixth Semester B.Sc. (Microbiology)

Paper Code: MCBDSEP6.2B

Teaching Hours: 3 H / Week

Total hours: 45

Paper Title: Practical-6B

Marks: Th-40+IA-10

Credits: 1

SEMESTER VI

TOTAL HOURS: 60

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Ray diagrams of phase contrast microscopy and Electron microscopy.
3. Separation of mixtures by paper / thin layer chromatography.
4. Demonstration of column packing in any form of column chromatography.
5. Separation of protein mixtures by any form of chromatography.
6. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
7. Determination of λ_{\max} for an unknown sample and calculation of extinction coefficient.
8. Separation of components of a given mixture using a laboratory scale centrifuge.
9. Understanding density gradient centrifugation with the help of pictures.

SUGGESTED READINGS

1. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
3. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein's Microbiology. 9thEd., McGraw Hill.
4. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
5. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.
6. Cooper G.M. and Hausman R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington D.C., Sinauer Associates, MA.
7. Nigam A and Ayyagari A. 2007. Lab Manual in Biochemistry, Immunology and
8. Biotechnology. Tata McGraw Hill.

Sixth Semester B.Sc. (Microbiology) Skill Enhancement Course

Paper Code: MCBDSSET 6.3

Paper Title: Management of Human Microbial Diseases

Teaching Hours: 3 H / Week

Marks: Th-40+IA-10

Total hours:30

Credits:2

Unit 1

15 hours

Human Diseases, Microbial diseases

Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections .Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, skin diseases, eye diseases, urinary tract diseases, study of recent outbreaks of human diseases (SARS/Swine flu/Ebola) – causes, spread and control, Mosquito borne disease – Types and prevention.

Unit 2

15 hours

Therapeutics of Microbial diseases, Prevention of Microbial Diseases

Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides. Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains.

Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART. General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors. **Vaccines:** Importance, types, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.

Suggested Readings

1. Ananthan Rayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology.9th edition. McGraw Hill Higher Education
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition.
