RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

M. Sc. (SEMESTER PATTERN)

SUBJECT: MICROBIOLOGY

M. Sc. FIRST YEAR

SEMESTER -I

CURRICULUM (CBCS)

Effective progressively from June 2019

Rajarshi Shahu Mahavidyalaya, Latur
Program: M.Sc Microbiology
Curriculum: (CBCS)
M. Sc. Part-I

Semester	Course code	Title of the Course	Hours/ Wk	Marks		Credits
				In Sem	End Sem	
SEM-I	P-MIB-151	Microbial physiology	04	40	60	4
	P-MIB-152	Advances in Virology	04	40	60	4
	P-MIB-153	Food, and Dairy microbiology	04	40	60	4
	P-MIB-154	Bioinstrumentation **(Elective)**	04	40	60	4
	P-MIB-155	Seminar based on theory papers	01	25		1
	P-MIB-156	Lab. Course-I (Microbial physiology)	04	20	30	2
	P-MIB-157	Lab. Course-II (Virology)	04	20	30	2
	P-MIB-158	Lab. Course-III (Food, and Dairy microbiology)	04	20	30	2
	P-MIB-159	Lab. Course-IV(Bioinstrumentation)	04	20	30	2
	TOTAL			625		25
SEM-II	P-MIB-251	Microbial Metabolism	04	40	60	4
	P-MIB-252	Microbial Genetics	04	40	60	4
	P-MIB-253	Enzymology	04	40	60	4
	P-MIB-254	Bioprocess Engineering **(Elective)**	04	40	60	4
	P-MIB-255	Seminar based on theory Papers	01	25		1
	P-MIB-256	Lab. Course-V(Microbial Metabolism)	04	20	30	2
	P-MIB-257	Lab. Course-VI(Microbial Genetics)	04	20	30	2
	P-MIB-258	Lab. Course-VII(Enzymology)	04	20	30	2
	P-MIB-259	Lab. Course-VIII(Bioprocess Engineering)	04	50	30	2
	TOTAL			625		25

Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)
M.Sc Microbiology

1.Introduction:

In synchronization with the highly progressing developments in higher education and research, Rajarshi Shahu Mahavidyalaya (Autonomous), Latur has decided to introduce the regular Credit Based Semester System Post-graduate programme in Microbiology from academic.

Year 2019-2020. These are stimulating times in microbiology, consequently, a draft of syllabus was designed for M.Sc. microbiology programme that will meet the requirements of innovative, skill based and career oriented education. The syllabus also caters for the student's need for various competitive examinations in related fields in India and abroad.

2.Learning Objectives of the Program:

The Board of Studies in Microbiology of this autonomous college designed the programme envisioning the following objectives.

1) To promote a clear, complete and advanced mastery in the discipline of Microbiology.
2) To provide basic ideology of biological sciences with special reference to Microbiology and its related branches. To direct the students to explore the details of life forms at cellular and molecular level.
3) To encourage students' motivation and enthusiasm and to help them not only to appreciate the beauty of microbial life forms, their interactions with biotic and abiotic factors and their varied metabolic capabilities.
4) To inspire the students to explore the wonderful properties of microbial life in goodwill of sustainable development and protection of human life and environment.
5) To develop problem solving skills in students and encourage them to carry out innovative research projects thereby inculcating in them the spirit of knowledge creation.
6) To enable students to develop employable skills concurrently with an understanding of theoretical foundations and practical techniques required in R & D, quality control, regulatory function in various industries

3.Programme specific Outcomes:

The Masters in Microbiology Program will address the increasing need for skilled scientific manpower with an understanding of research ethics involving microorganisms to contribute to application, advancement and impartment of knowledge in the field of

microbiology and molecular biology globally. The laboratory training will empower them to prepare for careers in broad range fields.

M.Sc. Microbiology student will acquire:

1) Knowledge about various methodological and analytic approaches that are used within the specialization.
2) Knowledge of the leading edge in a chosen specialized area of Microbiology, based on own research experience from a master's project and literature survey.
3) Aptitude to compete in national level competitive exams such as NET-JRF or GATE or International exams and can pursue career in higher studies.
4) A better theoretical and practical insight into methods used to obtain the knowledge of microbiology with respect to microbial physiology and metabolism, molecular genetics, biosynthesis of proteins, enzymology, microbial pathogenicity, environmental and agricultural microbiology, genetic engineering and microbial technology.
5) The practical skills to demonstrate the use of equipments, technologies and standard operating procedures common to microbiology.
6) Ability to apply the scientific method and hypothesis testing in the design and execution of experiments, hypothesis generation, collection and analysis of data, and interpretation and presentation of results.
7) Talent to critically evaluate and predict the technological, ethical, social and environmental impacts associated with the microbiological activities and their by acknowledges health, safety and environment (HSE) issues in handling chemicals and microbiological materials.
8) Skill to communicate scientific outcomes to the general public and experts by writing well structured reports; through scientific publications and posters, and by Oral presentations.

4.Employability

- Skilled manpower suitable for academic and research institutions as technicians.
- Suitable for different government and non-governmental and private companies
- Skilled students who can do PhD and contribute to field of Microbiology

5. Duration of the Course:	Two years.
6. Eligibility for the Course:	B.Sc. Microbiology or on of the optional subject should be Microbiology at B.Sc. Level.
7. Intake Capacity:	30
8. Fees for Course:	As per University/College rules.
9. Admission / Selection procedure:	Admission by merit through Registration
10. Standard of Passing:	As per BOE Norms.
11. Nature of question paper with scheme of marking:	As per BOE Norms.
13. List of book recommended:	Included in syllabus.
15. Rules and regulations and ordinance if any:	As per UGC/University/College rules
16. Medium of the language:	English

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

M. Sc. First Year
Semester I
MICROBIOLOGY
PAPER I – MICROBIAL PHYSIOLOGY
COURSE CODE: P-MIB-151

Maximum Marks: 100(Credit:4) Periods: 45

Course Objectives:

- Understand Metabolic diversity , phototrophy and chemolithotrophy.
- Understand Bacterial respiration
- Understand electron transport chain and modes of energy generation .
- Understand structure and organization of membrane and permeation
- Understand bacterial sporulation.

Course outcome: After successful completion of course students are able to

- Describe and compare chemolithotrophic and phototrophic bacteria.
- Understand in depth principle and mechanism of aerobic and anaerobic respiration in microorganisms.
- Describe methods to study diffusion of solutes in bacteria.
- Know process of sporulation in bacteria

Unit – 1: Bacterial Chemolithotrops and Phototrophs (12L)

1.1 Physiological groups of Chemolithotrops,
a. Ammonia oxidation by members of genus Nitro groups, Nitrate oxidation by nitro group of genera
b. Oxidation of molecular hydrogen by *Hydrogenomonas* species
c. Ferrous and sulfur/sulfide oxidation by *Thiobacillus* species.
1.2 Photosynthesis
a. Photosynthetic microorganisms and Photosynthetic pigments
b. Generation of reducing power by cyclic and non cyclic photophosphorylation,
c. Electron transport chain in photosynthetic Bacteria
d. Carbon dioxide fixation pathways

Unit-- 2: Bacterial Respiration (12L)

2.1 Bacterial aerobic respiration
a. Components of electron transport chain
b. free energy changes and electron transport
c. Oxidative phosphorylation and its theories of ATP formation
d. Inhibition of electron transport chain,
2.2 Electron transport chain in some heterotrophic bacteria

2.3 Mechanism of oxygen toxicity, Catalase, Super oxide dismutase.
2.4 Bacterial anaerobic respiration
a. Introduction
b. Electron transport chain in some anaerobic bacteria
c. Nitrate, Carbonate and Sulfate as electron acceptors.

Unit --3: Bacterial Permeation (11L)

3.1 Structure and organization of membrane (Glyco-conjugants and Proteins in membrane system),
3.2 Methods to study diffusion of solutes in bacteria
a. Passive diffusion
b. Facilitated diffusion
c. Different mechanisms of active transport: Proton motive force, PTS
3.3 Role of permeases in transport, Different permeases in *E.Coli*,
3.4 Transport of amino acids and Inorganic ions in microorganisms and their mechanisms.

Unit -- 4: Bacterial Sporulation (10L)

4.1 Sporulating bacteria and Molecular architecture of spores,
4.2 Induction and stages of Sporulation
4.3 Influence of different factors on sporulation.
4.4 Cytological and macromolecular changes during sporulation, Heat resistance and sporulation.

REFERENCES

1. *Advances in Microbial Physiology*, by A. H. Rose. Academic Press. New York.
2. *Applied microbial physiology: A practical Approach* by P. Rhodes & P. Stansbury (1997), IRL Press, New York.
3. *Bacterial physiology and Metabolism* by Byung Hong Kim & Geoffrey Michael Gadd (2008), Cambridge University Press.
4. *Brocks Biology of Microorganisms* (Eleventh Edition) by Michael T. Madigan, John M. Martinko (2006), Pearson Prentice Hall.
5. *Microbial physiology and metabolism* by D. R. Caldwell (1995) Brown Publisher.
6. *Microbial physiology* by A. G. Moat, J. W. Foster & M. P. Spector (1999), Wiley.
7. *Prokaryotic Development* by V. W. Burn & I. J. Shimkots (2000). ASM. Press.
8. *The Bacteria*. Volume by I.C. Gunsalus and Rogery Stainer. Academic Press.

Lab. Course-1
MICROBIAL PHYSIOLOGY
(Course Code: P-MIB-156)

Marks 50 (Credit: 02) Hours 45

Course objectives

- Study isolation of chemolithotrophic and photosynthetic bacteria
- Understand effect of different parameters on spore germination

Course Outcomes

After successful completion of lab course students will be

- Apply knowledge for research in bacteriology
- Design experiments to study different physiological groups of bacteria.

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1. Isolation of photosynthetic bacteria.
2. Glucose uptake by *E. coli / Sacchromyces cerevisiae* [Active and Passive diffusion].
3. Effect of UV, pH, disinfectants, chemicals and heavy metal ions on spore germination of *Bacillus* sp.
4. Determination of Iron Oxidation Rate of *Thiobacillus ferrooxidans.*
5. Determination of Sulfur Oxidation Rate of *Thiobacillus thiooxidans.*
6. Enrichment and cultivation of chemolithotropis bacteria.
7. Estimation of calcium ions present in sporulating bacteria by EDTA method.
8. Demonstration of utilization of sugars by oxidation and fermentation techniques.

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

M. Sc. First Year
Semester I
MICROBIOLOGY
PAPER II – ADVANCES IN VIROLOGY
COURSE CODE: P-MIB-152

Maximum Marks: 100(Credit:4) Periods: 45

COURSE OBJECTIVE

The course aims to provide knowledge to the student related to virology and the methodological tools

- Study classification of viruses virus evolution and emergence of new viruse
- Understand the ultra structure and life cycle of viruses .
- Methods used for cultivation and assay of viruses
- Understand mechanism of replication of viruses
- Understand the pathogenesis of viral infections
- Understand prevention and control of viral diseases ,approach to the therapeutic strategies in virus infection ,preparation of vaccines, antiviral drugs.

COURSE OUTCOMES

- At the end of the course the student will be able to describe the basic steps in virus replication and disease.
- The general characteristics of viruses of viruses.
- The structure of viruses and their replicative cycle.
- Prevention and control of viral diseases.
- The student will be able to evaluate problems in modern Virology including areas of virus biology, pathogenesis, and disease control.

Unit 1: Classification, Cultivation and Detection of Viruses (12L)

1.1Definitive properties and classification of viruses

a. Cataloging of Viruses-International Committee onTaxonomy of viruses (ICTV),
b. Structure based classification,
c. Baltimore classification and Homes classification,
d. LHT system of classification, Morphology and Ultra structure of Viruses.

1.2Cultivation of Viruses

a. Introduction,
b. Cell culture, Embryonated egg and Laboratory animals

1.3Detection of viruses in the host

a. Measurement of infectious units,
b. Measurement of virus particles and their components

1.4One step growth cycle and Assay of viruses,

a. Physical (Electron microscopy)
b. Chemical methods (Protein and Nucleic acid studies)
c. Infectivity assay

Unit 2: Multiplication of Viruses (11L)

2.1Introduction,

2.2 Architecture of cell surfaces, Interaction of viruses with cell receptors, Uptake of macromolecules by cells, Mechanism of virus entry into cells, Transport of viral genome into the cell nucleus.

2.3Genomic replication of Viruses (DNA/RNA), mRNA production by animal viruses, Mechanism of RNA synthesis, Transcription mechanism and Post transcriptional processing,

2.4Translation of viral protein, Assembly, Exit and Maturation of progeny virions

2.5Multiplication of bacteriophages

Unit 3: Viral Pathogenesis (11L)

3.1Host and virus factors involved in pathogenesis, Patterns of infection,

3.2Pathogenesis of animal viruses (Adenovirus, Herpes virus, Hepatitis virus, Picorna virus, Poxivirus and Orthomyxovirus)

3.3Pathogenesis of plant viruses (TMV) and Insect viruses (NPV)

3.4Host cell transformation by viruses and oncogenesis of DNA and RNA viruses

Unit 4: Prevention and Control of Viruses (11L)

4.1Introduction

4.2 Viral vaccines, Preparation of viral vaccines, New vaccine technology,

4.3Antiviral drugs

4.4Virus evolution and Emergence of new viruses.

REFERENCE:

1. *An Introduction to Viruses* by S. B. Biswas & Amita Biswas (2009), Vikas Publishing House PVT LTD.
2. *Applied Virology Research: New Diagnostic Procedures* by Edouard Kurstak, R. G. Marusyk, F. A. Murphy (1984), Academic press Inc.
3. *Brocks Biology of Microorganisms* (Eleventh Edition) by Michael T. Madigan, John M. Martinko (2006), Pearson Prentice Hall.
4. *Clinical Virology Manual* by Steven C. Specter, Richard L. Hodinka, Danny L. Wiedbrauk, Stephen A. Young (2009), ASM Press.
5. *Introduction to Modern Virology 4 Th Edition* by N. J. Dimmock & S. B. Primrose (1994), Blackwell Scientific publications, Oxford.
6. *Notes on Medical Virology, 10 Th Edition* by Morag C. Timbury (1994).
7. *Principles of Virology: Molecular Biology, Pathogenesis and Control* by S. J. Flint, L. W. Enquist, V. R. Racaniello, A. M. Skalkaj (2009), ASM Press, Washington.
8. *Principles* of *Molecular Virology* (4th edn.), Edward Arnold & A. J. Cann (2005). Academic Press, London.
9. *Text Book on principles of bacteriology, Virology and Immunology* by Topley and Wilsons (1995).
10. *Virology 3rd Edition* by H. F. Conrat, P.C. Kimball and J.A. Levy (1994). Prentice Hall, Englewood Cliff, New Jersey.

11.*Virology;RenatoDulbeccoandHaroldS.Ginsberg,Fourthedition*
,J.B.LippincottCompany,US

Lab. Course-II
ADVANCES IN VIROLOGY
(Course Code: P-MIB-157)

Marks 50(Credit: 02) Hours 45

Course Objectives

Learning objectives of the Lab course are

- Understand methods used for isolation of viruses.
- Understand and design experiments to study growth of viruses, transduction and plant diseases .

Course outcomes

After successful completion of course student will be able to

- Isolate , cultivate and characterize viruses.
- Understand transduction.
- Diagnose plant diseases.

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1. Isolation of coliphage by plaque formation assay.
2. One-step growth curve for determination of virus titre.
3. Induction of lambda lysogen by UV radiations.
4. Studies on Specialized transduction.
5. Isolation of lambda DNA and their characterization.
6. Amplification of lambda DNA by PCR.
7. Cultivation and assay of virus using embryonated eggs and tissue culture Technique.
8. Study of symptoms of plant viruses by simple detached leaf technique.

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

M. Sc. First Year
Semester I
MICROBIOLOGY
PAPER II – FOOD AND DAIRY MICROBIOLOGY
COURSE CODE: P-MIB-153

Maximum Marks: 100(Credit:4) Periods: 45

Learning Objectives

- To distinguish the significance of microorganisms in food production and food spoilage
- To bestow knowledge about food preservation principles and methods
- To make aware about food born infections and intoxications and control measures to prohibit them
- To understand the concepts of quality assurance in food and regulations emphasized about it.

Learning Outcomes

The students will

- Understand biochemical activities, production and preservation of various commonly used foods
- Understand the general principles of underlying food spoilage and food preservation
- Able to explain abut food born diseases and the Government regulatory practices& policies laid down for food safety to the society
- Explain the beneficial role of microorganisms and their enzymes in modern food production industries.

Unit – 1 Industrial Food fermentations (12L)

1.1Starter cultures
1.2Biochemical activities, production and preservation of the following foods

a. Soy sauce fermentation by Moulds
b. Fermented vegetables – Saurkraut
c. Fermented Meat – Sausages
d. Production and application of SCP
e. Cheese
f. Fermented milk products (acidophilus milk, yoghurt)
g. Pickles and Indian fermented foods (Dosa, Idli)

Unit – 2 Food spoilage and preservation **(12L)**

2.1 General types of microbial food spoilage
2.2 Factors affecting food spoilage
2.3 Spoilage of: fruits, vegetables, milk products, Egg, poultry, fish and meat products
2.4 Basic principles of food preservation
a. Radiations - UV, Gamma and microwave
b. Temperature
c. Chemical preservatives
d. Naturally occurring antimicrobials

Unit –3 Quality assurances in foods **(11L)**

3.1 Food borne infections and intoxications
a. Bacterial : Clostridium, Staphylococcus, Listeria.
b. Mycotoxins in food: Aflatoxin and Rubratoxin
c. Phycotoxins in food
3.2 Quality assurance:
a. Microbiological quality standards of food.
b. Government regulatory practices and policies: FSSAI, FDA, EPA, HACCP, ISI, AGMARK.

Unit - 4 Advanced Food Microbiology **(10L)**

4.1Applications of microbial enzymes in food and dairy industry
a. Protease
b. Lipases,
c. Amylases,
d. Pectinase
4.2Probiotics and their applications
4.3Production of Mushroom and spirulina
4.4Genetically modified foods
4.5 Utilization of byproduct
a. Dairy Industry - Whey
b. Sugar Industry – Molasses

References

1. *Food Microbiology. 2nd Edition* By Adams
2. *Basic Food Microbiology* by Banwart George J.
3. *Food Microbiology*: Fundamentals and Frontiers by Dolle
4. *Biotechnology*: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi
5. *Fundamentals of Dairy Microbiology* by Prajapati.
6. *Essentials of Food Microbiology*. Edited by John Garbult. Arnold International Students Edition
7. *Microbiology of Fermented Foods*. Volume II and I. Brian J.Wood. Elsiever Applied Science Publication
8. *Microbiology of Foods* by John C. Ayres. J. Orwin Mundt. William E. Sandinee. W. H. Freeman and Co.
9. *Dairy Microbiology* by Robinson. Volume II and I
10. *Food Microbiology:* Fundamentals and Frontiers. 2nd Edition by Michaell P. Doyle, Larry R. Beuchat and Thomas I. Montville (Eds.), ASM Publications
11. *Bacterial Pathogenesis A Molecular Approach. 2 nd Edition.* 2001 by Abigail A.Salyers and Dixie D. Whitt. ASM Publications

12. *Advances in Applied Microbiology* by D. Pearlman, Academic Press.

Lab. Course-III
FOOD AND DAIRY MICTOBIOLOGY
(Course Code: P-MIB-158)

Marks 50(Credit: 02) Hours 45

Learning Objectives:

To understand and exercise production of various microbial food products

To understand and exercise isolation of food poisoning bacteria

Learning Outcomes

The students able to acquire industrially employable knowledge of microbial food production techniques

1. Production and estimation of lactic acid by *Lactobacillus* Sp. or *Streptococcus* Sp.
2. Extraction and estimation of diacetyl
3. Sauerkraut fermentation
4. Isolation of food poisoning bacteria from contaminated foods, Dairy products
5. Production of Mushroom / *Spirulina*
6. Preservation of potato/onion by UV radiation
7. Production of fermented milk by Lactobacillus acidophilus.
8. Rapid analytical techniques in food quality control using microbial Biosensors

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RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

M. Sc. First Year
Semester I
MICROBIOLOGY
PAPER II – BIOINSTRUMENTATION
COURSE CODE: P-MIB-154
(ELECTIVE)

Maximum Marks: 100(Credit:4) Periods: 45

Course Objectives:

- To introduce the basic concept and practices of biosafety in microbiology laboratory
- To provide knowledge about principle, working and applications of various chromatography, analytical, spectroscopic and radio isotopic techniques

Learning Outcomes:

The students able to

- Explain the various separation techniques and its instrumentation
- Define and explain various fundamentals of spectroscopy, qualitative and quantitative analysis and characterize functionalities of biomolecules by using spectroscopic techniques.
- Describe the principle and working of various radiation detectors.

Unit – 1 : Laboratory techniques (10L)

1.1Biosafety in microbiological laboratories
   a. General safety measures
   b. Personal protection
   c. Chemical and Biological hazards
   d. Spillage and Waste disposal, First aid

1.2Theory, Principle, Working and Applications of
   a. pH meter
   b. Laminar Air Flow

1.3Efficacy testing protocols for
   a. Autoclave,
   b. pH meter
   c. Laminar Air Flow.

1.4Centrifuge machine types and Centrifugation
   a. Differential
   b. Rate zonal
   c Isopycnic

d. Density gradient,

1.5 Rotor types and Ultra centrifugation.

Unit 2: Chromatography Techniques **(12L)**

2.1Theory, Principle, Apparatus, Methods and Applications of

a. Paper Chromatography
b. Thin Layer Chromatography (TLC)
c. HPTLC
d. Gel Filtration Chromatography
e. Ion Exchange Chromatography
f. Affinity Chromatography
g. Gas Chromatography, and
h. HPLC.

Unit III: Electrophoretic Techniques **(11L)**

3.1Theory, Principle, Apparatus, Methods and Applications of

a. Paper Electrophoresis,
b. PolyAcrylamide Gel Electrophoresis (PAGE),
c. Agarose Gel Electrophoresis.

3.2 Principle and Applications of

a. Iso-electric Focusing
b. Immuno Electrophoresis
c. Enzyme-Linked Immunosorbant Assay (ELISA)

3.4 Blotting Techniques

a. Southern Blotting
b. Northern Blotting
c. Western Blotting.

Unit IV: Spectroscopic and Radio-isotopic Techniques **(12L)**

4.1 Principle, Working, Instrumentation and Applications of

a. UV/Vis spectroscopy,
b. IR spectroscopy,
c. Atomic absorption spectroscopy,
d. NMR spectroscopy,
e. Mass spectroscopy,

4.2 Introduction to radioisotopes and their biological applications

4.3 Principles and Applications of

a. Geiger Muller (GM) counter
b. Solid and Liquid scintillation counter
c. Autoradiography
d. Radioimmunoassay (RIA)

REERENCES

1. *Biochemistry.* 6th Edition by Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Freeman, New York.
2. *Biophysics: An Introduction* by Cotterill, R. M. J. (2002). John Wiley & Sons, England.
3. *Principles of protein X-ray crystallography* by Drenth, J. (2007). 3rd Ed. Springer, Germany.
4. *Biochemistry.* 3rd edition by Garrett, R. H. and Grisham, C. M. (2004). Brooks/Cole, Publishing Company, California.
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Laboratory Press, New York.
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NewYork and Narosa Publishing House, Delhi.
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University Press.
11. *Methods in Modern Biophysics by* Nalting B. and B. Nalting (2003) Springer Verlag
12. *Computational Analysis of Biochemical Systems by* Voit E. O. (2000) Cambridge University
Press.
13. *Physical Biochemistry: Applications to Biochemistry and Molecular Biology* by Freilder, Freeman, San. Francisco, 1976
14. *Biochemical Techniques: Theory and Practice* by Robyt, John F.; White, Bernard J. Waveland Press, Inc., U.S.A. Published: 1990.
15. *Principles of Instrumental Analysis* by Douglas A. Skoog, F. James Holler, Timothy A. Nieman: (Saunders Golden Sunburst Series) published by Wadsworth Pub Co. 2007
16. *Biophysical chemistry. Principles and techniques* by Upadhyay A, Upadhyay K, Nath N:. Himalaya Publishing House, Mumbai.1997.
17. *Brocks Biology of Microorganisms* (Eleventh Edition) by Michael T. Madigan, John M. Martinko (2006), Pearson Prentice Hall.

Lab. Course-IV
BIOINSTRUMENTATION
(Course Code: P-MIB-15)

Marks 50 (Credit: 02) Hours 45

Course Objectives:

- To provide practices of biosafety in microbiology laboratory
- To provide hands on of various instrumental techniques used in microbiological analysis

Learning Outcomes:

- The students acquire expertise in various analytical techniques used in research and industries in the field of microbiology

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1. Efficacy testing of autoclave employing chemical and biological autoclave indicators.
2. Standardization of pH meter using standard buffers.
3. Studies on pH titration curves of amino acids/acetic acid and determination of pKa values and Handerson-Hasselbach equation.
4. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC and Paper Chromatography.
5. Study of UV absorption spectra of macromolecules (protein, nucleic acid, bacterial pigments).
6. Paper Electrophoresis of proteins.
7. Separation of Proteins/Nucleic acids by gel electrophoresis.
8. Density gradient centrifugation.

LIST OF INSTRUMENTS

Sr.no.	Equipments / Instruments	Unit
1.	Shaker 24x24	01
2.	VDRL shaker	01
3.	Autoclav	03
4.	Incubator	02
5.	Water bath	01
6.	Photocolorimeter	02
7.	Spectrophotometer	01
8.	Warming table	01
9.	Heating mantle	01
10.	TLC kit	01
11.	Rough balance	01
12.	Electronic balance	02
13.	One pan balance	01
14.	Distillation plant(steel)	01
15.	Microscope with oil emulsion objective	14
16.	Slide projector Automatic	01
17.	Haemocytometer	09
18.	Haemoglobinometer	09
19.	Air compressor with motor (Apollo)	01
20.	Micrometer slide	02
21.	Hot plate	01
22.	Homogenater	01
23.	Godrej Refrigetor 1.Model no.280 litre (30 DY) 2.Model no.230 litre (24AC)	 01 01
24.	Colony counter digital	
25.	Orbital shaking incubator (CIS-24)with voltage stabilizer	
26.	Cooling centrifuge (C-24 BL) with voltage stabilizer	
27.	Deluxe laboratory centrifuge (R-8C)	01
28.	Laminar air flow microfilt(microfilt make)	01

Sr.no.	Equipments / Instruments	Unit
29.	Hot air oven	01
30.	Electrophoresis kit	01
31.	Magnetic stirrer	01
32.	Vortex mixture	01
33.	UV chamber	01
34.	Paper chromatography Assembly	01
35.	Refrigetor kelvinator	01
36.	pH meter	01
37.	Bottle washing machine	01
38.	Soxhalet accelerator	01
39.	Vacuum pump	01
40.	Pipette washing machine	01
41.	ESR assembly	01
42.	Seitz filter assembly	01
43.	Micropipette	05
44.	Lab research microscope (microne)	03
45.	Metzes optik monocular microscope model METZ_777	02
46.	Digital photoelectric meter (systronics) make type 112	01
47.	Anaerobic jar (kumar make)	
48.	Vacuum cleaner.Eureks forbes make trendly model	01
49.	Electronics balance contech model CA-124 ,0.1 mg to 120 gm	01
50.	Distillation unit (Bhanu make)	01
51.	Anaerobic jar (kumar make)	01
52.	Lab Fermenter 5 lit capacity make (DYNA biotech)	01