Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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-: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને તથા વિભાગીય વડાશ્રીને જણાવવાનું કે, NEP - 2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર B.Sc. Microbiology Sem.-2 Major, Minor, MDC અને SEC ના અભ્યાસક્રમ સંદર્ભે માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૬/૧૨/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંકઃ૦૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૪૭ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

માઈક્રોબાયોલાજી વિષયની અભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ૦૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર NEP-2020 અંતર્ગત B.Sc. Microbiology સેમેસ્ટર–૨ નો Major, Minor, MDC અને SEC નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૬૩

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર B.Sc.Microbiology Sem.-2 Major, Minor, MDC અને SEC ના અભ્યાસક્રમ સંદર્ભે માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૬/૧૨/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંક :૦૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એસ./સાયન્સ/પરિપત્ર/૩૦૫૫૧/૨૦૨૩
તા.૦૮–૧૨–૨૦૨૩

કુલસચિવશ્રી

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રી.
..... આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University

Surat

B.Sc. (Microbiology) Semester II Syllabus

NEP

(Effective from Dec., 2023)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B. Sc. MICROBIOLOGY
Teaching & Evaluation Scheme

F. Y. B. Sc. Semester – II
MAJOR (MJ)

Course code	Course Title	Course credit	Teaching schedule Hrs./ week	External marks	Internal marks	Total marks	Duration of external exams
MB-MJ-201	Microbial Diversity	03	03	35	35	70	02
MB-MJ-202	Bacterial and Archaeal cell Structure and Function	03	03	35	35	70	02
MBP MJ 203	Practicals	02	04	30	30	60	04

MINOR (ME)-DOMAIN SPECIFIC / ELECTIVE

Paper No.	Paper Title	Course credit	Teaching schedule Hrs./ week	External marks	Internal marks	Total marks	Duration of external exams
MN-ME-201	Biophysics	02	2	25	25	50	02 hrs
MNP-ME-201	Practicals	02	4	25	25	50	04 hrs
MN-ME-202	Atypical Procaryotes	02	2	25	25	50	02 hrs
MNP-ME-202	Practicals	02	4	25	25	50	04 hrs

MULTIDISCIPLINARY COURSE (MDC)

Course Code	Course Title	Course Credit	Teaching Schedule Hrs./ week	External Marks	Internal Marks	Total Marks	Duration of external exams
MB-MDC-201	Remedies of Environment Pollution	04 (T)	04	50	50	100	2.5 hrs

SKILL ENHANCEMENT COURSE (SEC)

course code	Course Title	Course credit	Teaching schedule Hrs./ week	External marks	Internal marks	Total marks	Duration of external exams
MB-SEC-201	Conventional methods for Identification of bacteria	01	01	13	13	26	01
		01	02	12	12	24	02
MB-SEC-202	Maintenance of Laboratory Equipment	02 (T)	02	25	25	50	02 hrs

MB-MJ-201

MICROBIAL DIVERSITY

1. Course Description:

Course Code: MB-MJ-201
Course title: Microbial diversity
Course type: Major
Course Credits: 03

2. Course Overview:

Microorganisms can be studied in the form of unity and diversity. The microbial world is diverse with more than 10 million different types of microorganisms inhabiting the planet earth. This course introduces the students with various groups of microorganisms, their mode of reproduction, nutrition and their economic importance.

Course Objectives:

- ✓ To introduce microbiology different groups of microorganisms to students.
- ✓ To study structure of diverse group of organisms.
- ✓ To study their habitat, growth, reproduction and nutritional requirements of different groups of organisms.
- ✓ To learn economic importance of various groups in aspect of their role towards nature.

3. Course Content:

UNIT 1	Bacteria
1.1	Members of microbial world
1.2	Prokaryote
1.3	Bacterial diversity
1.4	Bacterial reproduction by Binary fission
1.5	Atypical bacteria (Chlamydia, Rickettsia, Mycoplasma, PPLO)

UNIT 2	Fungi
2.1	Fungal distribution
2.2	Fungal structure
2.3	Fungal reproduction
2.4	Economic importance of fungi

UNIT 3	Algae & Protozoa
3.1	Introduction
3.2	Habitat and Distribution
3.3	Structural organization of cell
3.4	Nutrition and physiology
3.5	Economic importance

4. Student Learning Outcomes:

- ✓ After studying this course student will be able to understand basics of different groups of microorganisms.
- ✓ They will learn in detail about microorganism's habitat, nutritional requirements, mode of reproduction, etc.
- ✓ They will learn the economic importance of different groups of organisms.
- ✓ They will learn the difference between prokaryotes, eukaryotes cell organization.

Recommended Learning Resources:

- Willey J., Sandman K. and Wood D., (2020), Prescott's Microbiology, 11th Edition, Mc Graw Hill, (978-1-260-57002-1).
- Modi H. A., (1996), Elementary Microbiology: An Introduction to Microbial World, Vol II, Ekta Prakashan, Nadiad.
- Pelczar, M. J., & Chan, E. C. S. (1998). Microbiology, 5th Ed., Tata-McGraw-Hill.

MJ-MB-202

BACTERIAL AND ARCHAEAL CELL STRUCTURE AND FUNCTION

1. Course Description:

Course Code: MB-MJ-202
Course title: Bacterial and archaeal cell structure and function
Course type: Major
Course Credits: 03

2. Course Overview:

Everywhere we are surrounded with lots of bacteria. They are procaryotic in nature as far as cell structure and morphology is concern, and are quite different from eukaryotes. Thus, it is important to know the detailed insights of these prokaryotic cells.

Course Objectives:

- ✓ To study size, shape, arrangements of bacterial and archaeal cells.
- ✓ To study structure and functions of internal and external cell structures of bacterial cells.
- ✓ To learn about structure and significance of procaryotic cell walls and cell membranes.

3. Course Content:

UNIT 1	Cell Morphology and Cell Inclusions
1.1	Major cell morphologies and biology
1.2	Cell size and significance of smallness
1.3	Surface area to volume ratio and its significance
1.4	Lower limits of cell size
1.5	Cell inclusions
1.6	Endospores
1.7	Gas vesicles
1.8	Ribosomes and nucleoids

UNIT 2	Cell Wall and Cytoplasmic Membrane
1.1	Cytoplasmic membrane in bacteria & archaea
1.2	The functions of cytoplasmic membrane
1.3	The cell wall of bacteria
1.4	Outer membrane of gram-negative bacteria
1.5	Cell wall of archaea

UNIT 3	Cell Surface Structures and Function
1.1	Cell surface layers, pilli, fimbriae
1.2	Flagella and motility
1.3	Gliding motility
1.4	Microbial taxes

4. <u>Student Learning Outcomes</u>:

- ✓ After studying this course student will be able to understand basics of bacterial and archaeal cell structure.
- ✓ They will learn in detail about bacterial internal and external cell structures like vesicles, inclusion granules, endospores, ribosomes, freely lying genetic material-nucleoid, locomotory organelle flagella, pilli etc.
- ✓ They will learn the detailed structures of cell wall and cell membrane including role played by them.

<u>Recommended Learning Resources</u>:

- Madigan, T, M., & Martinko, J.M. (2008). Brock Biology of Microorganisms, 12th Ed., Benjamin Cummings.
- Madigan, T, M., & Martinko, J.M. (2008). Brock Biology of Microorganisms, 14th Ed., Benjamin Cummings.
- Willey J., Sandman K. and Wood D., (2020), Prescott's Microbiology, 11th Edition, Mc Graw Hill, (978-1-260-57002-1)
- Modi H. A., (1996), Elementary Microbiology: An Introduction to Microbial World, Vol I & II Ekta Prakashan, Nadiad,
- Pelczar, M. J., & Chan, E. C. S. (1998). Microbiology, 5Ed., Tata-McGraw-Hill.

MBP MJ 203

PRACTICALS

1. Identification of economically important fungi. (9 genera) (*Aspergillus, Penicillium, Mucor, Rhizopus, Curvularia, Helminthosporium, Cunninghamella, Fusarium, Alternaria*)
2. Study of permanent slides of algae (*Volvox, Spirogyra*, Diatoms)
3. Study of permanent slides of algae Cyanobacteria (*Nostoc, Anabaena*)
4. Study of permanent slides of Protozoa (*Amoeba, Paramoecium, Euglena*).
5. Cell wall staining by Dyar's method,
6. Capsule staining by Maneval's method,
7. Spore staining by Snyder's modification of Dorner's method,
8. Cytoplasmic membrane staining (Ref: Aneja)
9. Flagella staining by Leifson's method,
10. Nucleic acid staining by Robinow's method
11. Cultivation of algae
12. Cultivation of protozoa

Recommended Learning Resources:

- Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 4th edition, New Age International Publishers.
- Cappuccino, J.G., (2016). Microbiology: A Laboratory Manual, 11th ed., Pearson Education (Singapore) Pvt. Ltd.
- Patel, R. J., & Patel, K. R., (2011). Experimental Microbiology, Vol. 2, 8th ed., Aditya.
- Patel, R. J., & Patel, K. R., (2015). Experimental Microbiology, Vol. 1, 9th ed., Aditya.

MN-ME-201

BIOPHYSICS

1. Course Description:

Course Code: MN-ME-201
Course title: Biophysics
Course type: Minor/elective
Course Credits: 02

2. Course Objective:

This interdisciplinary course introduces the basic concepts of physics and their applications in biology for better understanding of various biological processes at cellular and molecular level. This knowledge will empower the students to develop a basic understanding about the principles and concepts of Biophysics and will enable the students to develop quantitative approaches to solve physical/biological problems.

Course Learning Outcomes:

- ✓ Students will learn basic concepts of physics and apply them to study the physicochemical properties of biomolecules.
- ✓ Students will learn to investigate the light absorption properties of biomolecules through lasers.
- ✓ Students will gain knowledge about the basic concept of waves and electrostatic interaction for biomolecule perspective.

3. Course Content:

UNIT 1	General physico-chemical and quantum principles
1.1	Electronic structure of atom
1.2	Ionic bond, covalent bonds, hydrogen bonds, Vander waals forces
1.3	Electric dipoles, Polarization and induced Dipoles, Casimir interactions
1.4	Pauli exclusion principle, ionization energy, electron affinity and chemical bonding, electronegativity and strong bond
1.5	Interatomic potential for strong bonds and weak bonds, Bond energies
1.6	Thermodynamic equilibrium and laws of thermodynamics
1.7	Entropy, enthalpy, free energy, internal energy
1.8	Diffusion, osmosis, osmotic pressure, osmoregulation, surface tension

UNIT 2	Electrostatics, Waves and Lasers
1.1	Introduction to electrostatics: concept of charge in Gauss's law, line charge, surface charge, electric potential and field
1.2	Superposition principle and superposition of waves: Young's double slit interference
1.3	Diffraction: diffraction through a single slit/ double slit and grating
1.4	Resolving power, resolution of the eye
1.5	Lasers: Principle, population inversion, He-Ne Laser, characteristics of laser, Applications of lasers in medical science
1.6	Polarization of EM wave, Nicol prism, Doppler effect
1.7	Effects of vibrations in humans; physics of hearing, hearbeat

4. Student Learning Outcomes:

- ✓ Student shall gain an understanding of the physico-chemical principles of molecules and bonding.
- ✓ Student shall learn the fundaments of thermodynamics and the principle of quantum mechanics.
- ✓ Students shall get an insight of electrostatics, waves and lasers.

MNP-ME-201

PRACTICAL

1. Determination of the acceleration due to gravity using bar pendulum.
2. Determination of the frequency of an electrically maintained tuning fork by Melde's Experiment.
3. Determination of the wavelength of laser source through diffraction of (1) Single slit, (2) Double slit.
4. Determination of the coefficient of Viscosity of water by capillary flow method (Poiseuille"s method).
5. Verification of Beer Law
6. Verification of Malus law (Polarization of electromagnetic radiations)
7. Dispersion of laser beam

Recommended Learning Resources:

- David Freifelder (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology. 2nd edition. W.H. freeman and Company.
- Keith Wilson and John Walker (2005). Principles and Techniques of Biochemistry and Molecular Biology. 6th edition. Cambridge University Press.
- N. K. Bajaj (2008). The Physics of Waves and Oscillations. 5th edition. Tata McGraw Hill.
- Christopher R. Jacobs, Hayden Huang, Ronald Y. Kwon (2012). Introduction to cell mechanics and Mechanobiology 1st editon. Garland Science (Taylor & Francis Group). ISBN: 978-0-8153-4425-4.
- Principles of Biochemistry by A. L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, New Delhi, 1993.
- Biochemistry by L. Stryer, W.H. Freeman and Co., Newyork 1997.
- Conformation of Carbohydrates by V.S.R. Rao, P.K. Qasba, P.V. Balaji and R. Chandrasekaran, Harwood Academic Publishers, 1998.
- Biophysics, W. Hoppe. *et. al.*, Springer - Verlag, 1989.
- Biophysics, Pattabhi N. and Gautham, N. Narosa Publishing House, New Delhi, 2002.
- Essentials of Biophysics. Narayanan, P., New Age International (P) Ltd. Publishers, New Delhi, 2000.

MN ME 202
ATYPICAL PROCARYOTES

1. **Course Description:**
   Course Code: MN-ME-202
   Course Title: Atypical prokaryotes
   Course Type: Minor
   Course Credit: 02

2. **Course Overview:** Usually students learn in detail about typical structure and functions of prokaryotic cell. But, there are many other prokaryotic lives different than that of such typical structure. Atypical procaryotes like Rickettsia, Chlamydia, Mycoplasma, Actinomycetes, Cyanobacteria are examples of such atypical procaryotes and students will learn them here in ample detail.

   Course Objectives:

- ✓ To introduce various groups of atypical procaryotes and to learn their distribution in nature
- ✓ To learn historical perspectives, typical characteristics and importance of atypical procaryotes

3. **Course Content:**

UNIT 1	Atypical prokaryotes I
1.1	Rickettsia
1.2	Chlamydia
1.3	Mycoplasma
1.4	L-forms

UNIT 2	Atypical prokaryotes II
2.1	Bdellovibrio
2.2	Photosynthetic bacteria
2.3	Archaeobacteria
2.4	Actinomycetes

4. **Student Learning Outcomes:**

- ✓ After studying this course student will be able to understand basics groups of atypical prokaryotes like Rickettsia, Chlamydia, Mycoplasma, Actinopmycetes, Cyanobacteria, methanogens etc.
- ✓ They will come to know about discovery of atypical bacteria, how do they cause diseases, their role in ecology, fix nitrogen etc.

Recommended Learning Resources:

- Modi H. A., (1996), Elementary Microbiology, Akta Prakashan, (ISBN: 978-93-5070-1010)
- Pelczar M.J., Chan E.C.S, Craig N.R., (2010), Microbiology: An application based approach, Tata Mc Graw Hill, (ISBN: 0-07-015147-4)

MNP-ME-202
PRACTICALS

1. Preparation of media for isolation and cultivation of Actinomycetes.
2. Isolation of Cyanobacteria from soil/water.
3. Isolation of Cyanobacteria from paddy field.
4. Isolation of Actinomycetes from soil.
5. Study of permanent slides of Nostoc, Anabaena, Oscillatoria, Spirulina
6. Demonstration of Cyanobacterial symbiosis in Azolla.
7. Study of special features of:
   A. Cyanobacteria: Nostoc, Anabaena, Oscillatoria, Spirulina
   B. Actinomycetes
   C. Mycoplasma

Recommended learning resources:

- Dubey R.C. and Maheshwari D.K, (2005), practical Microbiology, S. Chand publication, (ISBN: 81-219-2153-8)

MB-MDC-201

REMEDIES TO ENVIRONMENT POLLUTION

1. Course Description:

Course Code: MB-MDC-201
Course title: Remedies to Environment Pollution
Course type: Multidisciplinary
Course Credits: 04

2. Course Overview:

There are numerous ways to pollute the environment. The causes of environmental issues can range greatly, from excessive pesticides washing into our water supply to carbon dioxide emissions damaging our atmosphere. The treatments for pollution differ depending on the type of pollution. The goal of the course is to increase student's understanding about various pollution and possible solution to prevent or prevent environment pollution.

Course Objectives:

- ✓ To understand the sources of air pollution and systems of polluted air removal.
- ✓ To understand the technologies to control different types of water pollution.
- ✓ To understand the basics of soil pollution and in situ and ex situ methods for remediation of soil pollution.

3. Course Content:

UNIT 1	Air Pollution and its Remediation
1.1	Types and Sources of Air Pollutants
1.2	Problems of air pollution
1.3	Air Pollution Control Equipment and Systems
UNIT 2	**Water Pollution and its Remediation**
2.1	Surface water and surface water pollutants
2.2	Ground water and ground water pollutants
2.3	Pollution Control Technology
UNIT 3	**Soil Pollution and its Remediation**
3.1	The Basics of Soil Pollution
3.2	Industrial Practices and Soil Contamination

UNIT 4	Remediation Techniques
4.1	Removal of Dry Particulate Matter.
4.2	Removal of Gaseous Pollutants: Stationary Sources
4.3	Removal of Gaseous Pollutants: Mobile Sources.
4.4	Pollution Control Technology: Underground Storage Tanks
4.5	Pollution Control Technology: Groundwater Remediation
4.6	Remediation of UST -Contaminated Soils
	4.6.1 In situ technologies
	4.6.2 Non-In Situ Technologies

4. Student Learning Outcomes:

- ✓ Student will gain knowledge of air pollution causes and Air Pollution Control equipment and systems.
- ✓ Student will gain knowledge of water pollutants and control technologies.
- ✓ Student will gain knowledge of soil pollution and remediation techniques for soil pollution removal.

Recommended Learning Resources:

- The Science of Environmental Pollution. Frank R. Spellman, second edition, CRC Press Taylor & Francis. ISBN: 978-1-4398-1302-7
- Pollution Causes, Effects and Control, 5th Edition, R M Harrison. RSC publication, ISBN: 978-1-84973-648-0

SKILL ENHANCEMENT COURSE

MB-SEC-201

CONVENTIONAL METHODS FOR IDENTIFICATION OF BACTERIA

1. Course Description:

Course code: MB SEC-201
Course Title: Conventional Methods for Identification of Bacteria
Course type: Skill based
Course credits: 01+01

2. Course overview and Course Objectives:

Course Overview:

This course is mainly designed to study the different isolation techniques for pure cultures as well as mixed cultures. In order to identify and classify an unknown microorganism it is first necessary to learn the characteristics of different microorganisms. Techniques included in this course helps us to do so.

Course Objectives:

- ✓ To introduce students to different isolation techniques.
- ✓ To study morphological, growth, colonial, nutritional and biochemical characteristics of different bacteria.
- ✓ To bring awareness in students about the Culture Collection Centers.
- ✓ To study how to maintain and preserve cultures.

3. Course Content:

UNIT 1	Introduction to Bacterial Cultures
1.1	Pure Culture
1.2	Mixed Culture
1.3	Origin of pure culture technique
1.4	Techniques for Isolation
	1.4.1. Streak plate
	1.4.2. Pour plate
	1.4.3. Spread plate
	1.4.4. Serial dilution
	1.4.5. Enrichment culture technique
1.5.	Single cell isolation
1.6.	Isolation of anaerobe

UNIT 2	Study of pure cultures
2.1	Morphological characterization
2.2	Cultured characterization
	2.2.1. Colony Characteristics on solid media
	2.2.2. Growth Characteristics on liquid media
	2.2.3. Growth Characteristics on agar slants
	2.2.4. Growth Characteristics on agar stabs
2.3	Nutritional requirements and Biochemical characteristics
2.4	Culture collection Centers
	2.4.1. Role of culture collection centers
	2.4.2. Worldwide status of culture collection centers
	2.4.3. Some Important culture collection centers
2.5	Maintenance and preservation of cultures

4. Students learning outcome.

- ✓ Students are introduced to different types of bacterial cultures and techniques for isolation, which is a basic requirement for a microbiology student.
- ✓ Different Pure culture characteristics are also introduced in this course which can help later to identify organisms that can be used for Medical purpose, Industrial purpose and Food technology.

Recommended Learning Resources:

- Modi H. A. (2014), A handbook of elementary microbiology, Shanti Prakashan, (ISBN: 978-93-5070-1010)
- Cappuccino J. G. (2016) Microbiology; A laboratory manual, 11th Edition. Pearson Education (Singapore) Pvt. Ltd., (ISBN : 978-9332535190)
- Tortora G.J. and Funke B.R. (2016), Microbiology an Introduction, 12th Edition Pearson (ISBN : 9781292099149)
- Pelczar, chan and Krieg (2001), Microbiology-concepts and Application, 5th Edition, McGraw-Hill, (ISBN: 9780074623206)
- Patel R. J. and Patel R. K. (2016) Experimental microbiology Volume I, 9th Edition. Aditya.

MBP-SEC-201

PRACTICALS

(1) Techniques for isolations and identification of microorganisms

a) Streak plate technique
b) Pour plate technique
c) Spread plate technique

(2) Techniques for cultivation of bacteria

a) Broth cultivation
b) Stab cultivation
c) Slant cultivation

(3) Cultivation of anaerobic bacteria

(4) Isolation of bacteria by loop dilution technique

MB-SEC-202
MAINTENANCE OF LABORATORY EQUIPMENT

1. Course Code & Title

Course code: MB-SEC-202
Course title: Maintenance of Laboratory Equipment
Course type: Skill based Course
Course credits: 02

2. Course overview and objectives:

The paper focuses on various maintenance aspects of microbiology laboratory equipment such as pH meter, weigh balance, biological safety cabinet, centrifuge, microscope, incubator.

Course Objectives:

- ✓ To study the operational principles of various instruments
- ✓ To learn about various components and controls of routine laboratory instruments
- ✓ To gain an insight of maintenance and validation of various laboratory instruments.

3. Course Content:

UNIT 1	**Basic Instruments-I**
1.1	pH meter 1.1.1 Operational principle 1.1.2 pH meter components 1.1.3 General calibration procedure 1.1.4 General maintenance
1.2	Balance 1.2.1 Operational principle 1.2.2 Components of balance 1.2.3 General calibration procedure 1.2.4 General maintenance
1.3	Centrifuge 1.3.1 Operational principle 1.3.2 Components of centrifuge 1.3.3 Routine maintenance 1.3.4 Appropriate management and storage

UNIT 2	Basic Instruments-II
2.1	Microscope 2.1.1 Operational principle 2.1.2 Potential problems with microscope 2.1.3 General maintenance of microscope 2.1.4 Cleaning of microscope and care
2.2	Biological safety cabinet 2.2.1 Operational principle 2.2.2 Use of biological safety cabinet 2.2.3 Decontamination of the cabinet 2.2.4 Routine and Specialized maintenance
2.3	Incubator 2.3.1 Operational principle 2.3.2 Incubator controls 2.3.3 Routine maintenance and use of the incubator

4. Student's Learning Outcomes:

- ✓ Students will learn about operational principles, purpose and components of instruments routinely used for buffer and microbial media preparation.
- ✓ Students will gain knowledge about operational principles, various components and general maintenance of the instrument used routinely for centrifugation and microscopic examination.
- ✓ Students will understand the process of operating and maintenance of biological safety cabinet and incubator routinely used in microbiology laboratory.

Recommended Learning Resources:

- ➢ Maintenance Manual for Laboratory Equipment, 2nd ed. (2008) World Health Organization World Health Organization & Pan American Health Organization. https://apps.who.int/iris/handle/10665/43835
- ➢ Laboratory Instruments Operations and Maintenance, Sushant Punekar (2012) Biotech Books. ISBN- 9788176222457.
- ➢ Principles of Laboratory Instruments (1993) Larry E. Schoeff, Robert Henry Williams, Mosby-Year Book. ISBN- 9780801674891