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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Fax : +91 - 261 - 2227413
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

-: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન માઈક્રોબાયોલોજી વિષય ચલાવતી સ્નાતક અને અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓને તથા ડિપાર્ટમેન્ટનાં વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૦–૨૧ અમલમાં આવનાર બી.એસસી. એન્ડ એમ.એસસી. (માઈક્રોબાયોલોજી) સેમેસ્ટર–૧ અને ૨ નો અભ્યાસક્રમ અંગે માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૦૬/૦૩/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલએ તેની તા.૩૦/૬/૨૦૨૦ ની સભાના **ઠરાવ ક્રમાંકઃ૨૭** અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૦૬/૦૩/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૦–૨૧ અમલમાં આવનાર બી.એસસી. એન્ડ એમ.એસસી. (માઈક્રોબાયોલોજી) સેમેસ્ટર–૧ અને ૨ નાં અભ્યાસક્રમ માટે તા.૧૬/૧૨/૨૦૧૯ ની સભામાં નીમેલ પેટાસમિતિએ તૈયાર કરેલ અભ્યાસક્રમમાં પેપર નંબર અને પેપરના શિર્ષક (Title) માં જરૂરી ફેરફારો કરી સર્વાનુમતે મંજૂર કરી તે મંજુર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૩૦/૦૬/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨૭

:: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિએ તેની તા.૦૬/૦૩/૨૦૨૦ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે ભલામણ કરેલવિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ મંજૂર કરેલ શૈક્ષણિક વર્ષ ૨૦૨૦–૨૧ થી અમલમાં આવનાર બી.એસસી. એન્ડ એમ.એસસી. (માઈક્રોબાયોલોજી) સેમેસ્ટર–૧ અને ૨ નાં અભ્યાસક્રમ મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૫૮૦૫/૨૦૨૦
તા. ૧૫–૦૭–૨૦૨૦

ઈ.ચા. કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન માઈક્રોબાયોલોજી વિષય ચલાવતી સ્નાતક અને અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રી.
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) Syllabus

(Effective from June, 2020)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.Sc. MICROBIOLOGY

Teaching & Evaluation Scheme

Semester – I

Paper No.	Paper Title	Theory	Practical	External	Internal	Total	Credit
		(Hrs/Wk)					
MB 101	History and scope of microbiology	2	-	50	20	140	**4**
MB 102	Fundamentals of microscopy	2	-	50	20		
MBP 103	Practicals	-	4	40	20	60	**2**

F.Y.B.SC. SEMESTER I

MB: 101 HISTORY AND SCOPE OF MICROBIOLOGY

Student Learning Objective: The main aspect of this paper is to study and understand the scope of microbiology with major groups of microorganisms, ancient history and discovery of microbial world. An aim of this paper is to present existing development of the microbiology in diversified area.

	UNIT 1	**SCOPE OF MICROBIOLOGY – I**
		Teaching Duration: 07 Lectures
1.1	An introduction to Microbiology	
1.2	Microbiology: A multifaceted Science	
1.3	Position of Microorganisms in living world	
1.4	Taxonomic status of Viruses	

	UNIT 2	**SCOPE OF MICROBIOLOGY- II**
		Teaching Duration: 07 Lectures
2.1	Major groups of Microorganisms	
2.2	Distribution of Microorganisms in nature	
2.3	Applied areas of Microbiology	

	UNIT 3	ANCIENT HISTORY OF MICROBIOLOGY
		Teaching Duration: 08 Lectures
3.1	The discovery of Microbial World and Microscope	
3.2	The spontaneous generation controversy	
3.3	Discovery of microbial effects on organic matter	
3.4	Discovery of the role of Microbes in causation of Disease	
3.5	History of Virology	

	UNIT 4	DEVELOPMENT IN MICROBIOLOGY
		Teaching Duration: 08 Lectures
4.1	Development of pure culture techniques	
4.2	Development of Foundation for immunology	
4.3	Development of Agricultural microbiology	
4.4	Development of Chemotherapy	
4.5	Development of Modern immunology	
4.6	Molecular Biology and Biotechnology	

REFERENCES:

- Modi. H. A. (2014) A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93-5070-1010)

Further Reading:

- Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition, Jones & Barlett Pvt. Ltd., **(**ISBN: 978-0-07-462320-6)
- Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)

MB 102: FUNDAMENTALS OF MICROSCOPY

Student Learning Objective: The main aspect of this paper is to study and understand the Basic principle of microscopy. It focused on different type of fundamental and advanced microscopy techniques. Also provide knowledge related to different types of dyes, staining and staining theories of bacteria.

	UNIT 1	BASIC PRINCIPLE OF MICROSCOPY
		Teaching duration: 08 lectures
1.1	General Principles of optics	
1.2	Structure of light	
1.3	Objectives – Numerical Aperture , Resolving power	
1.4	Immersion objectives - Depth of focus, Equivalent focus, Working distance of uncovered objects & covered objects, Chromatic aberrations in objectives.	
1.5	Oculars – Huygens, Compensating, Flat-field.	
1.6	Condenser	

	UNIT 2	LIGHT MICROSCOPY
		Teaching duration: 07 lectures
2.1	Bright field microscope	
2.2	Dark field microscope	
2.3	Phase contrast microscope	
2.4	Differential Interference Contrast Microscope	
2.5	Fluorescence microscope	
2.6	Confocal microscopy	

	UNIT 3	ELECTRON MICROSCOPY
		Teaching duration: 08 lectures
3.1	Transmission Electron microscope	
3.2	Scanning Electron microscope	
3.3	Electron cryotomography	
3.4	Scanning probe microscopy	
	3.4.1 Scanning tunneling microscope	
	3.4.2 Atomic force microscope	

	UNIT 4	DYES & STAINS
		Teaching duration: 07 lectures
4.1	Dyes – Acidic & Basic dyes, Chromophore, Classification of biological stains	
4.2	Staining solution – Intensifier , Mordants	
4.3	Theories of staining	
4.4	Staining of bacteria	

REFERENCES:

- Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition McGraw - Hill Education, , (ISBN: 978-981-3151-26-0)
- Salle A. J., (1984) Fundamental Principles of Bacteriology, 7th Edition,Tata McGraw – Hill, (ISBN:0-07-099-562-1)

Further Reading:

- Pelczar, Chan and Krieg, (2001), Microbiology-Concepts and Application, 5th Edition, McGraw-Hill, (ISBN: 9780074623206)

F.Y B.Sc. Microbiology
Semester I Practicals

(Time duration: 04 hours/ week)
MBP-103: Practicals

1. Study of bright field compound microscope: Components, use and care.
2. Microscopic examination of living microorganisms:
   (a) Observation of hay infusion by Wet Mount Technique.
   (b) Observation of bacterial Motility by Hanging Drop technique
3. Measurement of microorganisms (Micrometry) using Ocular and Stage Micrometer.
4. Introduction to common instruments/equipments in microbiology laboratory:
   Autoclave, Incubator, Hot air oven, Laminar air flow, Centrifuge, Bacteriological Filter, pH meter, Colorimeter, Anaerobic jar, Colony counter.
5. Observation of morphological characteristics of Yeast / Fungi / Protozoa by Dark Field and Phase Contrast Microscopy.
6. Preparation of Nutrient broth / agar medium and cultivation of bacteria.
7. pH measurement and adjustment using Lovibond / Hellige's comparator (Phenol red and Bromothymol blue disc).
8. Preparation of standard solutions:
   a) Percent solutions
   b) Part dilutions
   c) Molar solutions
   d) Normal solutions
   e) Molal solutions
   f) PPM and PPB solutions
9. Monochrome staining by Acidic and Basic dye.
10. Gram staining.
11. Acid fast staining.
12. Observation of spirochaete by negative staining.

REFERENCES:

- Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9th Edition. Aditya,
- Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
- Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition**.** Pearson Edication (Singapore) Pvt. Ltd., (ISBN: 978-9332535190)
- Aneja K.R. (2001) Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom production technology, 3rd Edition. New Age International Publishers, (ISBN: 978-9386418302)

B.Sc. MICROBIOLOGY

Teaching & Evaluation Scheme

Semester – II

Paper No.	Paper Title	Theory (Hrs/Wk)	Practical (Hrs/Wk)	External	Internal	Total	Credit
MB 201	Procaryotic and archaeal cell structure	2	-	50	20	140	**4**
MB 202	Nutrition and growth of bacteria	2	-	50	20		
MBP 203	Practicals	-	4	40	20	60	**2**

MB 201: PROCARYOTIC AND ARCHAEAL CELL STRUCTURE

Student Learning Objective: The main aspects of this paper are to describe the basic structure of typical procaryotes and archaea. It focuses on important differences in structure between bacteria and Archaea.

	UNIT 1	**CELL MORPHOLOGY & CYTOPLASMIC MEMBRANE**
		Teaching Duration: 07 Lectures
1.1	Cell Morphology	
1.2	Cell Size and the significance of being Small	
1.3	Membrane Structure	
1.4	Membrane Function	

	UNIT 2	**CELL WALL AND GENETIC ELEMENTS OF PROKARYOTES**
		Teaching Duration:08Lectures
2.1	Peptidoglycan	
2.2	LPS: The Outer Membrane	
2.3	Archaeal Cell Wall	
2.4	Nucleoid and Ribosomes	

	UNIT 3	**CELL SURFACE STRUCTURE AND INCLUSIONS**
		Teaching Duration: 07 Lectures
3.1	Cell Surface Structures	
3.2	Cell Inclusions	
3.3	Gas Vesicles	
3.4	Endospore	

	UNIT 4	MICROBIAL LOCOMOTION
		Teaching Duration: 08 Lectures
4.1 4.2 4.3	Flagella and Swimming Motility Gliding Motility Chemotaxis and Other Taxes	

REFERENCE:

- Medigan M., et al., (2015) Brock Biology of Microorganisms, 14th Edition, Pearson education Ltd., (ISBN: 978-1-292-01831-7)
- Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, (ISBN: 978-981-3151-26-0)

Further Reading:

- Pommerville J.C. (2014) Alcamo's Fundamental of Microbiology, 10th Edition , Jones & Barlett Pvt. Ltd., (ISBN: 978-0-07-462320-6)

MB 202: NUTRITION AND GROWTH OF BACTERIA

Student Learning Objective: The main objective of this paper is to understand diversified nutritional requirements of microorganisms and their cultivation using various different media. It also focuses on bacterial and archaeal reproduction, cell cycle, growth curve and effect of various environmental factors on growth of microorganisms.

	UNIT 1	BACTERIAL NUTRITION
		Teaching Duration: 07 Lectures
1.1 1.2 1.3 1.4 1.5	Common nutritional requirements Requirements of carbon, hydrogen, oxygen and electrons Nutritional types of microorganisms Requirements of Nitrogen, Phosphorus, sulphur and growth factors Uptake of nutrients	

	UNIT 2	BACTERIAL GROWTH
		Teaching Duration: 08 Lectures
2.1 2.2 2.3 2.4 2.5	Bacterial and Archaeal reproduction by binary fission Bacterial cell cycle Bacterial Growth curve Microbial population size measurement Chemostat and turbidostat for Continuous culture	

	UNIT 3	CULTIVATION OF BACTERIA
		Teaching Duration: 08 Lectures
3.1 3.2 3.3 3.4	Culture media Cultivation of aerobes and anaerobes Enrichment and isolation of pure culture Microbial growth on solid media	

	UNIT 4	ENVIRONMENTAL FACTORS AND GROWTH
		Teaching Duration: 07 Lectures
4.1 4.2 4.3 4.4 4.5 4.6	Solutes and water activity pH Temperature Oxygen concentration Pressure Radiation	

References:

- Willey J.M., Sherwood L.M. and Woolverton C.J., (2017) Prescott's Microbiology, 10th Edition, McGraw - Hill Education, **(**ISBN: 978-981-3151-26-0)
- Willey J.M., Sherwood L.M. and Woolverton C.J., (2008) Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw - Hill Education, (ISBN: 978-007-126727-4)

Further Reading:

- Pelczar, Chan and Krieg, (2001), Microbiology-Concepts and Application, 5th Edition, McGraw-Hill, **(**ISBN: 9780074623206**)**

F.Y B.Sc. Microbiology
Semester II Practicals

(Time duration: 04 hours/ week)

MBP-203: Practicals

1. Cell wall staining – Dyar's method.
2. Flagella staining – Leifson's method.
3. Cytoplasmic membrane staining by victoria blue stain.
4. Endospore staining – Snyder's modification of Dorner's method.
5. Nucleus staining- Feulgen's method.
6. Observation of capsule in bacteria by Maneval's method.
7. Metachromatic granules staining-Albert's method.
8. Techniques for Cultivation of bacteria:
   a) Broth culture
   b) Slant culture
   c) Stab culture.
9. Techniques for Isolation of bacteria:
   a) Streak plate method
   b) Pour plate method
   c) Spread plate method.
10. Influence of oxygen on growth of bacteria and Cultivation of Anaerobic bacteria (Thioglycollate medium).
11. Maintenance and preservation of bacteria.
12. Influence of Environmental factors on microbial growth:
    a) Temperature
    b) pH of media
    c) Osmotic pressure

REFERENCES:

- Patel R.J. and Patel R.K. (2016) Experimental microbiology Volume I, 9th Edition. Aditya,
- Patel R.J. and Patel R.K. (2017) Experimental microbiology Volume II, 9th Edition. Aditya,
- Cappuccino J.G. (2016) Microbiology; A Laboratory Manual, 11th Edition Pearson Edication (Singapore) Pvt. Ltd.(ISBN: 978-9332535190)
- Aneja K.R. (2001) Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom production technology, 3rd Edition, New Age International Publishers, (ISBN: 978-9386418302)

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Fax : +91 - 261 - 2227312
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

-: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની માઈક્રોબાયોલોજી વિષયનો અભ્યાસક્રમ ચલાવતી સંલગ્ન સ્નાતક અને અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓ જણાવવાનું કે, શૈક્ષણિક વર્ષ : ૨૦૨૧–૨૨ થી અમલમાં આવનાર શૈક્ષણિક વર્ષ ૨૦૨૧–૨૨ અમલમાં આવનાર બી.એસસી.સેમેસ્ટર–૩ અને ૪ તથા એમ.એસસી.સેમેસ્ટર–૩ અને ૪ (માઈક્રોબાયોલોજી) વિષયનાં અભ્યાસક્રમ અંગે ચર્ચા કરતા માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૧૭/૦૬/૨૦૨૧ની સભાનાં ઠરાવ ક્રમાંકઃ ૬ અન્વયે મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલે તેની તા.૨૫–૨૬/૦૬/૨૦૨૧ ની સભાના ઠરાવ ક્રમાંકઃ ૨૫ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ભલામણ ક્રમાંકઃ૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૧–૨૨ અમલમાં આવનાર બી.એસસી. એન્ડ એમ.એસસી. (માઈક્રોબાયોલોજી) સેમેસ્ટર–૩ અને ૪ નાં અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી તે મંજુર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

વિજ્ઞાન વિદ્યાશાખાની તા.૧૭/૦૬/૨૦૨૧ની સભાનાં ઠરાવ ક્રમાંકઃ ૬

:: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંકઃ૨ અન્વયે મંજૂર કરેલ શૈક્ષણિક વર્ષ ૨૦૨૧–૨૨ અમલમાં આવનાર બી.એસસી. & એમ.એસસી.માઈક્રોબાયોલોજી સેમેસ્ટર–૩ અને ૪ નાં અભ્યાસક્રમ મંજૂર કરી એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૨૫–૨૬/૦૬/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨૫

:: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિએ તેની તા.૧૫/૦૩/૨૦૨૧ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે ભલામણ કરેલ અને વિજ્ઞાન વિદ્યાશાખાએ તેની તા.૧૭/૦૬/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંક : ૬ અન્વયે સ્વીકારેલ શૈક્ષણિક વર્ષ ૨૦૨૧–૨૨ થી અમલમાં આવનાર બી.એસસી. & એમ.એસસી. માઈક્રોબાયોલોજી સેમેસ્ટર–૩ અને ૪ નાં અભ્યાસક્રમ મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૯૨૮૩ /૨૧
તા.૦૧–૦૭–૨૦૨૧

ઈ.ચા. કુલસચિવ

પ્રતિ,

૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની માઈક્રોબાયોલોજી વિષય ચલાવતી સંલગ્ન કોલેજોના આચાર્યશ્રીઓ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
૪) અનુસ્નાતક વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University, Surat

S.Y. B. Sc. (Microbiology) Syllabus
Semester 3 & 4

(Effective from June, 2021)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B. Sc. MICROBIOLOGY

Teaching & Evaluation Scheme
S. Y. B. Sc. Semester III

Paper No.	Paper Title	Theory (Hrs/Week)	Practical (Hrs/Week)	External	Internal	Total	Credit
MB-301	Principles of bacterial systematics	02	-	50	20	70	06
MB-302	Control of microorganisms in the environment	02	-	50	20	70	
MB-303	Virology	02	-	50	20	70	
MBP-304	Practicals	-	06	60	30	90	03
Total		**06**	**06**	**210**	90	300	09

MB 301: Principles of Bacterial Systematics

Course description

Course code: MB 301
Course title: Principles of Bacterial Systematics
Course type: Core
Course credit: 02
Course overview:
The paper explores microbial taxonomy and classification of bacteria using an evolutionary framework. Bacterial taxonomy and phylogeny gives an understanding regarding degree of prokaryotic diversity unmatched by eukaryotic unicellular and multicellular organisms.

Course Objectives

- To understand taxonomic ranks and taxonomic phlogeny
- To study classical and molecular characteristics for microbial taxonomy
- To understand Bergey's manual of systematic bacteriology
- To study arachea and its classification
- To aquire knowledge of taxonomy of proteobacteria

Course Content

	UNIT 1	Microbial Taxonomy and the Evolution of Diversity
		Teaching Duration: Lectures 07
1.1	Microbial Taxonomy	
1.2	Taxonomic Ranks	
1.3	Microbial taxonomy and phylogeny 1.3.1 Classical Characteristics 1.3.2 Molecular Characteristics: Nucleic acid hybridization, Nucleic acid base composition	
1.4	Evolutionary process and the concept of microbial species	
1.5	Bergey's Manual of systematic bacteriology	

	UNIT 2	Taxonomy of Archaea
		Teaching Duration:Lectures 07
2.1	Overview of Archaea	
2.2	Major groups of *Archaea*	
2.3	Phylum *Crenarchaeota*	
2.4	Phylum *Euryarchaeota* 2.4.1 Methanogens and Methanotrophs 2.4.2 Haloarchaea	

	UNIT 3	Taxonomy of Proteobacteria
		Teaching Duration:Lectures 08
3.1	Class *Alphaproteobacteria*: Order *Rhizobiales*	
3.2	Class *Beta Proteobacteria*: Order *Hydrogenophiales*	
3.3	Class *Gamma Proteobacteria*: Order *Enterobacteriales*	
3.4	Class Delta *Proteobacteria*: Order *Bdellovibrionales*	
3.5	Class *Epsiloneproteobacteria*	

	UNIT 4	Important groups of bacteria
		Teaching Duration:Lectures 08
4.1	Class *Bacilli*: Aerobic endospore forming bacteria	
4.2	Class *Mollicutes*	
4.3	Phylum *Cyanobacteria*	
4.4	Phylum *Spirochaetes*	
4.5	Phylum *Bacteroidetes*	

Student learning Outcome

Unit 1: Student will learn evolutionary process of microorganisms.
Student will be able to classify microorganisms based on their cultural and molecular characteristics.

Unit 2: Students will gain knowledge of the unique characteristics of archea, its adaptation

and importance.

Unit 3: Students shall understand the major classes of proteobacteria and important phyla

Unit 4: Shall enable the students to understand aerobic endospore former, bacteroidetes, Spirohaetes and cyanobacteria.

Recommended References:

- Lory, S., Perry, J. J., Gunsalus, R. P., Staley, J. T. (2007). Microbial Life. 2nd Edition, United Kingdom: Sinauer Associates. ISBN: 9780878936854, 0878936858
- Pelczar, Chan and Krieg, (1993), *Microbiology-Concepts and Application*, International Edition, McGraw-Hill. ISBN: 9780071129145
- Sherwood, L., Willey, J. M., Woolverton, C. J. (2017). Prescott'sMicrobiology. Singapore: McGraw-Hill Education.10th Edition, 2017. ISBN: 9789813151260, 9813151269.
- Tortora G.J., and Funke B.R. (2016), *Microbiology an Introduction*, 12th Ed., Pearson, ISBN: 9781292099149

MB 302: Control of Microorganisms in the environment

Course description

Course code: MB 302
Course title: Control of Microorganisms in the environment
Course type: Core
Course credit: 02
Course overview:
The paper includes the study of the control and destruction of microorganisms. It includes the physical and chemical methods to control pathogens and prevent their transmission and to reduce or eliminate microbes responsible for the contamination of food, water and other substances.

Course Objectives

- To understand the principle of controlling the presence of microorganisms.
- To study the physical agents and mechanisms used for the control.
- To learn the effect of various chemical agents used for the microbial control.
- To understand the mechanism of control of chemical agents.
- To acquire the ability to select the control agent in the environment.

Course Content

	UNIT 1	Basic Principles of Microbial Control
		Teaching Duration: Lectures 07
1.1	Terminology of Microbial Control	
1.2	Microbial Death Rates	
1.3	Action of Antimicrobial Agents	
1.4	The Selection of Microbial Control Methods	
1.5	Situational Considerations	

	UNIT 2	Mechanical and Physical Methods for Microbial Control
		Teaching Duration: Lectures 08
2.1	Filtration	
2.2	Heat Related Methods	
2.3	Refrigeration and Freezing	
2.4	Desiccation and Lyophilization	
2.5	Osmotic Pressure	
2.6	Radiation	

	UNIT 3	Chemical Methods for Microbial Control – I
		Teaching Duration: Lectures 07
3.1	Choosing a Microbicidal Chemical	
3.2	Factors Affecting Germicidal Activity of Chemicals	
3.3	The Halogens Antimicrobial Chemical	
3.4	Phenols: Its derivatives and Applications	
3.5	Alcohols	

	UNIT 4	Chemical Methods for Microbial Control - II
		Teaching Duration: Lectures 08
4.1	Hydrogen Peroxide and related Germicides	
4.2	Chemicals with Surface Action: Detergents	
4.3	Heavy Metals	
4.4	Aldehydes	
4.5	Gaseous Sterilants and Disinfectants	
4.6	Dyes	
4.7	Acid and Alkalies	

Student learning Outcome

Unit 1: Student will understand the role of microbial control in disease transmission
Students will be enabled to select the suitable microbial control agents.

Unit 2: Gain knowledge of physical and mechanical of microbial control and mode of action of each.

Unit 3: Student shall understand the major chemical agents and its microbicidal effect.

Unit 4: Shall enable the students to understand the mechanism of chemical control.

Recommended References:

- Bauman R. W., (2003), *Microbiology, Pearson/Benjamin-Cummings*, (ISBN: 0-8-53-7590-2)
- Cowan M. K. and Talaro K. P., (2006), *Microbiology: A Systems Approac*h, Mc-Graw Hill Higher Education, (ISBN: 0-07-291804-7)
- Nester E. W., Anderson D. G., Roberts Jr. C. E., Pearsall N. N. and Nester T. M., *Microbiology,* International Edition, Mc-Graw Hill Higher Education, (ISBN: 0-07-121493-3)

Further Reading:

- Pommerville J. C., (2014), *Alcamo's Fundamentals of Microbiology*, 10th edition, Jones and Bartlett Learning, (ISBN: 978-93-80853-5374-1)
- Willey J. M., Sherwood L. M. and Woolverton C. J., (2017), *Prescott's Microbiology*, 10th edition, Mc-Graw Hill Education, (ISBN: 978-981-3151-26-0)

MB 303: Virology

Course description

Course code: MB 303
Course title: Virology
Course type: Core
Course credit: 02
Course overview:

The aim of the paper is to realize the increasing importance of virology. Students shall learn the origin, basic structure of virus and its classification. It teaches the cultivation and reproduction of virus. The paper also includes the role of virus in disease as well as cancer but also a study on viruses associated with plant, animal, insects and archaeal viruses.

Course Objectives

- To give an overview of medically important virus families.
- To describe the structure, classification and cultivation of viruses.
- To understand the replication strategies of viruses.
- To study virus like infectious particles
- To study the role of virus and virus host.

Course Content

	UNIT 1	Basics of Viral Structure
		Teaching Duration: Lectures 07
1.1	Origin of Virus	
1.2	Viron Structure is defined by Capsid Symmetry or presence and absence of Envelope	
1.3	Host Range and Specificity of Virus	

	UNIT 2	Viral Taxonomy and Cultivation
		Teaching Duration:Lectures 07
2.1	Classification of Viruses	
2.2	Emerging Viruses	
2.3	Cultivation of viruses in Laboratory	

	UNIT 3	Replication of Viruses
		Teaching Duration: Lectures 08
3.1	General Characteristic of Replication	
3.2	Replication of T – even phages (Lytic cycle)	
3.3	Lysogeny	
3.4	Replication of Animal Viruses	
3.5	Latent Virus infection	

	UNIT 4	Viruses and Sub Viral Infectious Particles
		Teaching Duration: Lectures 08
4.1	Viruses and Tertotogenesis	
4.2	Viruses like Agents	
4.3	Viruses and Cancer, Human Cancer Viruses	
4.4	Plant Viruses	
4.5	Viruses of Fungi and Protist	
4.6	Insect Viruses	
4.7	Archaeal Viruses	

Student learning Outcome

Unit 1: Students shall get insights about viruses, its structure, its symmetry and origin.
Unit 2: Students shall learn about classification of virus.
Acquire knowledge of emerging viruses threatening the world.
Unit 3: Enable the students to understand virus replication.
Students shall understand the differences between lytic and lysogenic cycles.
Unit 4: Students gain insights about viruses and virus like infectious particles.
Students shall understand the role of virus in cancer.

Recommended References:

- Black, J. G. (2012). Microbiology: Principles and explorations. Hoboken, NJ: Wiley. ISBN: 9780470541098, 0470541091.
- Sherwood, L., Willey, J. M., Woolverton, C. J. (2008). Prescott's Microbiology. Singapore: McGraw-Hill Education.7th Edition and 10th edition. 2017. ISBN: 0073302082, 9780073302089 and ISBN: 9789813151260, 9813151269.

S.Y.B.Sc. Microbiology

Semester– III Practicals

(Time Duration: 06 Hours/week)

MBP 304: Practicals

1. Enumeration of bacteria by Heterotrophic plate count method (HPC)
2. Action of antiseptics and disinfectants on bacteria.
3. Effect of hand sanitizer on skin flora.
4. Lethal action of U.V. rays on bacteria
5. Lethal action of heavy metals on bacteria
6. Demonstration of lysis of bacteria by bacteriophage.
7. Determination of TDP & TDT.
8. Study of biochemical reactions.
9. Pure culture study of *Escherichia coli* and *Klebseilla mobillis* (formerly *Enterobacter aerogenes)*
10. Pure culture study of *Proteus vulgaris, Serratia marcescens* and *Pseudomonas aeruginosa.*
11. Pure culture study of *Bacillus megaterium, Bacillus subtilis, Bacillus cereus.*
12. Pure culture study of *Staphylococcus aureus, Staphylococcus epidermidis.*

References:

- 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.

B. Sc. MICROBIOLOGY

Teaching & Evaluation Scheme
S. Y. B. Sc. Semester IV

Paper No.	Paper Title	Theory	Practical	External	Internal	Total	Credit
		(Hrs/Week)					
MB-401	Biological molecules	02	-	50	20	70	06
MB-402	Mycology, Phycology and protozoology	02	-	50	20	70	
MB-403	Microbial ecosystems	02	-	50	20	70	
MBP-404	Practicals	-	06	60	30	90	03
Total		**06**	**06**	**210**	**90**	**300**	09

MB 401: Biological molecules

Course description

Course code: MB 401
Course title: Biological molecules
Course type: Core
Course credit: 02
Course overview:
The paper gives an understanding of biomolecules found in all living organisms including microbes. Students shall learn important biomolecules such as proteins, enzymes, carbohydrates, lipids and nucleic acids. They shall become aware of the structure, types and the important functions of biomolecules.

Course Objectives

- To study the structure and properties of amino acids and proteins.
- To understand classification of enzymes and enzyme activity.
- To understand types of carbohydrates and its importance.

- To gain knowledge of lipids, its structure and functions.
- To enable students to understand DNA and RNA.

Course Content

	UNIT 1	**Amino Acids, Proteins and enzymes**
		Teaching Duration:Lectures 08
1.1	Amino Acids Exist in a Three-Dimensional world	
1.2	Individual Amino Acids: Their Structures and Properties	
1.3	The Peptide Bond	
1.4	Protein Structure and Function	
1.5	Chemical nature of enzymes	
1.6	Nomenclature and classification of enzymes	
1.7	Factor affecting enzyme activity	
1.8	Isoenzymes	

	UNIT 2	**Carbohydrates**
		Teaching Duration: Lectures 07
2.1	Sugars: Their structures and stereochemistry	
2.2	Reactions of monosaccharides	
2.3	Some Important oligosaccharides	
2.4	Structures and functions of polysaccharides	

	UNIT 3	**Lipids**
		Teaching Duration: Lectures 08
3.1	Classification lipids	
3.2	Fatty acids	
3.3	Glycerol lipid	
3.4	Lipid devoid of glycerol	
3.5	Complex lipids	
3.6	Lipids and biological membranes	

	UNIT 4	**Nucleic Acid**
		Teaching Duration:Lectures 07
4.1	Levels of Structure in Nucleic Acids	
4.2	The Covalent Structure of Polynucleotides	
4.3	The Structure of DNA	
4.4	Denaturation of DNA	
4.5	Types of RNA and their Structures	

Student learning Outcome

Unit 1: Student shall understand structure of amino acids and its role in peptide bond formation.

Student shall gain knowledge about structure and functions of proteins and enzymes.

Unit 2: Enable the students to understand the stereochemistry of carbohydrates and its functions.

Unit 3: Student shall acquire knowledge about lipids, their classification and its importance.

Unit 4: Acquire knowledge of structure of nucleic acids and its denaturation.
Student shall know about RNA and its types.

Recommended References:

- Campbell, M. K., & Farrell, S. O. (2012). *Biochemistry*. Belmont, CA: Brooks/Cole, Cengage Learning. ISBN: 9780840068583 0840068581.
- Rastogi, S. C., *Biochemistry* (2015), 2nd Edi. ISBN:9788171339389.

Further reading:

- Berg and Stryer, (2007) *Biochemistry*, 6th Ed. W H Freeman pub., ISBN: 9780716746843
- Murray, R. K., Granner, D. K., Mayes, P. A., & Rodwell, V. W. (2015). *Harper Biochemistry*, 30th Edi. Appleton and Lange.
- Voet and Voet, (2008) *Fundamentals of biochemistry*, 3rd Ed, Johns Wiley & Sons, Asia ISBN: 978-0470129302

MB 402: Mycology, Phycology and protozoology

Course description

Course code: MB 402
Course title: Mycology, Phycology and protozoology
Course type: Core
Course credit: 02
Course overview:
This paper includes the study of eukaryotic microorganisms such as fungi, algae and protozoa. The student shall learn the diversity of eukaryotic microbes and its differences in terms of morphology, reproduction and cultivation. The objective of the paper is to give an understanding of the ecological and economic impact of eukaryotic microbial population.

Course Objectives

- To understand eukaryotic microorganisms and its importance.
- To study distinguishing characteristics, reproduction and cultivation of fungi.
- To understand major classes of fungi.
- To give understanding of characteristics of algae and its economic importance.
- To gain knowledge of occurrence, importance and reproduction of protozoa

Course Content

	UNIT 1	Mycology
		Teaching Duration: Lectures 07
1.1	Importance of fungi	
1.2	Distinguishing characteristics of fungi	
1.3	Morphology of fungi	
1.4	Reproduction of fungi	
1.5	Cultivation of fungi	

	UNIT 2	Classification of fungi
		Teaching Duration: Lectures 08
2.1	The Chytridiomycota	
2.2	The Zygomycota	
2.3	The Ascomycota	
2.4	The Basidiomycota	
2.5	The Microsporidia	
2.6	The Glomeromycota	

	UNIT 3	Phycology
		Teaching Duration: Lectures 08
3.1	Occurrence of algae	
3.2	Characteristics of algae	
3.3	Algae and diseases	
3.4	Biological and economic importance of algae	
3.5	Lichen	

	UNIT 4	Protozoology
		Teaching Duration: Lectures 07
4.1	Occurrence of protozoa	
4.2	Ecology of protozoa	
4.3	The importance of protozoa	
4.4	Morphology of protozoa	
4.5	Reproduction of protozoa	

Student learning Outcome

Unit 1: Enable the students to understand the structural differences of prokaryotic and eukaryotic microorganisms.
Shall understand fungal structure, reproduction, cultivation and importance.
Unit 2: Give an insight of different fungal groups and its importance.
Unit 3: Students shall learn algal ecology, its characteristic and importance.
Unit 4: Gain knowledge of occurrence, importance and reproduction of protozoa.

Recommended References:

- Pelczar M. J. and Chan E. C. S., (1998), *Microbiology*, 5th Ed., Tata-Mc Graw Hill.
- Sherwood, L., Willey, J. M., Woolverton, C. J. (2017). *Prescott Microbiology*. Singapore: McGraw-Hill Education.10th Edition, 2017. ISBN: 9789813151260, 9813151269.

Further reading:

- Tortora G.J., and Funke B.R. (2016), *Microbiology: an Introduction*, 12 Ed., Benjamin Cummings.

MB 403: Microbial ecosystems

Course description

Course code: MB 403
Course title: Microbial ecosystems
Course type: Core
Course credit: 02
Course overview:
Microbial ecology is concerned with microbial processes that occur in ecosystem. It explains how nutrient availability and environmental factors influence microbial growth in various ecosystems. Student shall understand the role of microorganisms in evolution of life and balance of ecosystem. The objective of the paper is to give an understanding of the varied microbial interactions and its impact in sustenance of ecosystem.

Course Objectives

- To understand the role of microbial evolution in ecological development.
- To learn the methods to study microbial ecology.
- To gain an understanding of biogeochemical cycling and effect of global climate change.
- To develop insight about microbial interactions.
- To understand the role of microorganisms in ecosystem.

Course Content

UNIT 1	MICROBIAL EVOLUTION AND ECOLOGY	
		Teaching Duration: Lectures 08
1.1	The origin of life	
1.2	Chemical evolution	
1.3	Cellular Evolution	
1.4	Ribosomal RNA analysis for tracing microbial evolution	
1.5	Genetic basis of evolution	

1.6	Methods in microbial ecology

	UNIT 2	BIOGEOCHEMICAL CYCLING AND GLOBAL CLIMATE CHANGE
		Teaching Duration: Lectures 08
2.1	Global Climate Change; Global Infectious Disease Change	
2.2	Biogeochemical Cycling 2.2.1 Carbon cycle 2.2.2 Nitrogen Cycle 2.2.3 Phosphorus Cycle 2.2.4 Sulfur Cycle	
2.3	Interaction between Elemental Cycles	
2.4	Global Climate Change: Biogeochemical cycling out of balance	

	UNIT 3	MICROBIAL INTERACTIONS
		Teaching Duration: Lectures 07
3.1	Mutualism	
3.2	Cooperation	
3.3	Commensalism	
3.4	Predation	
3.5	Parasitism	
3.6	Amensalism	
3.7	Competition	

	UNIT 4	MICROORGANISMS AND ECOSYSTEMS
		Teaching Duration: Lectures 07
4.1	Microorganisms in terrestrial environments 4.1.1 Soils as an important microbial habitat 4.1.2 Microbe-plant interactions	
4.2	Microorganisms in marine and freshwater ecosystems 4.2.1 Water as a microbial habitat 4.2.2 Microorganisms in marine ecosystems 4.2.3 Microorganisms in freshwater ecosystems	

Student learning Outcome

Unit 1: Shall give an insight of microbial role in evolution of life.
Shall learn methods to study evolution.
Unit 2: Give an understanding of biogeochemical cycling.
Unit 3: Students shall gain knowledge of microbial interactions and its significance.
Unit 4: Gain knowledge of distribution and role of microorganisms in different habitats and ecosystems.

Sharma

Recommended References:

- Ronald M. Atlas & Richard Bartha (2005) *Microbial Ecology: Fundamentals and Applications*, 4thEd., Pearson Education. ISBN: 81-297-0771-3.
- Wiley, J., & Sherwood, L. (2013). *Prescott, Harley, and Klein's Microbiology*, 10th Ed., McGraw-Hill Science/Engineering/Math, ISBN: 9780073402406.

Further reading:

- McArthur, J. Vaun (2006). *Microbial Ecology: An Evolutionary Approach*, Academic Press. 416 pp. ISBN 0123694914.
- Mitchell R., Gu Pelczar Ji Dang, Chan and Krieg, (1993), *Microbiology-Concepts and Application*, International Edition, McGraw-Hill.
- Tortora G.J., and Funke B.R. (2016), *Microbiology an Introduction*, 12 Ed., Benjamin Cummings.

S.Y.B.Sc. Microbiology

Semester– IV Practicals

(Time Duration: 06 Hours/week)

MBP 404: Practicals

1. Qualitative analysis of carbohydrate (Any four sugar)
2. Qualitative analysis of proteins (Any three protein)
3. Study of extracellular enzymatic activity: Amylase, Caseinase, Gelatinase, Lipase
4. Study of intracellular enzymatic activity: Deaminase, Decarboxylase, Catalase, Dehydrogenase, Oxidase.
5. Cultivation and identification of economical important fungi. (9 genera) (*Aspergillus, Penicillium, Mucor, Rhizopus, Curvularia, Helminthosporium, Cunninghamella, Fusarium*, *Alternaria*)
6. Study of permanent slides of algae (*Volvox, Spirogyra*, Diatoms)
7. Study of permanent slides of algae Cyanobacteria (*Nostoc, Anabena*)
8. Study of permanent slides of Protozoa (*Amoeba, Paramoecium, Euglena*).
9. Isolation of nonsymbiotic nitrogen fixing aerobic bacteria- *Azotobacter* spp.
10. Isolation of *Rhizobium* spp. from root nodules of legume plants.
11. Isolation and identification of Actinomycetes from soil.
12. Isolation of protozoa from soil

References:

- 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.

Re-Accredited by NAAC with 'A' Grade
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Fax : +91 - 261 - 2227312
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન માઈક્રોબાયોલોજી વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર Microbiology વિષયનાં ટી.વાય. બી.એસસી. સેમ.–૫ અને સેમ.–૬ નાં અભ્યાક્રમ અંગે માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૫/૦૨/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ ૩ અન્વયે નીચે મુજબ ભલામણ કરેલ જે વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ મંજુર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલ તા.૨૫/૨/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૧૪ થી સ્વીકારી મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૫/૦૨/૨૦૨૨ની સભાનાં ભલામણ ક્રમાંકઃ૩

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર ટી.વાય.બી.એસસી. માઈક્રોબાયોલોજી (Microbiology) સેમ.–૫ અને ૬ નો અભ્યાક્રમ મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૨૫/૦૨/૨૦૨૨ની ઠરાવ ક્રમાંકઃ ૧૪

:: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૫/૦૨/૨૦૨૨ની સભાનાં ભલામણ ક્રમાંકઃ૩ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાવતી વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ મંજુર કરી શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર ટી.વાય.બી.એસસી. માઈક્રોબાયોલોજી (Microbiology) સેમ.–૫ અને ૬ નો અભ્યાક્રમ મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./માઈક્રોબાયોલોજી/પરિપત્ર/૪૧૮૧/૨૦૨૨
તા.૦૨–૦૩–૨૦૨૨

ઈ.ચા. કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન માઈક્રોબાયોલોજી વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
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 – V Syllabus

(Effective from June, 2022)

Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 501: Principles of Bacterial Genetics

1. Course Code & Title

Course code:	MB 501
Course title:	Principles of Bacterial Genetics
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Course Objectives

This subject shall give preliminary insight into prokaryotic genetics. The subject shall provide knowledge about molecular processing and functioning of gene in bacteria.

Course Objectives

- To understand the fundamental concepts behind various molecular genetics of bacterial cells.
- To study the regulation and control of genes, genetic codes and its passage to new cells.
- To know molecular processes involved in genetic replication, translation, transcription
- To be familiar with various extra chromosomal genes.

3. Course Content

UNIT 1 GENE STRUCTURE AND REPLICATION IN PROKARYOTES

1.1 DNA as genetic material
1.2 Bacterial gene structure
1.3 Nucleic acid and protein structure
1.4 DNA replication in bacteria

UNIT 2 GENE EXPRESSION

2.1 Transcription in bacteria
2.2 The genetic code
2.3 Translation in bacteria
2.4 Protein maturation and secretion

UNIT 3 GENETIC REGULATION, MUTATION AND REPAIR

3.1 Regulation in transcription
  3.1.1 Lactose operon
  3.1.2 Tryptophan operon
3.2 Regulation of translation
3.3 Mutations: Spontaneous, induced, detection and isolation of mutants
3.4 DNA repair

UNIT 4 GENETIC RECOMBINATION

4.1 Horizontal gene transfer
4.2 Transposable elements
4.3 Bacterial conjugation
4.4 Bacterial transformation
4.5 Transduction

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Student shall learn about the chemical structural properties of DNA and protein. Along with, students shall grasp knowledge of bacterial replication and its molecular aspects.

Unit 2: Students shall gain knowledge of structural aspects of bacterial genes. Students shall get in-depth information about molecular mechanisms of passing the genetic information through transcription and translation in bacterial system.

Unit 3: Students shall understand the process involve in gene regulation and its control in prokaryotes.

Unit 4: Students shall be able to understand genetic inheritance and bacterial recombination.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2014) Prescott, Harley and Klein's Microbiology, 9th Ed., McGraw-Hill Education.
- Wiley, J. M., Sherwood, L. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10th Ed., McGraw-Hill Education.
- Russell, P. J. (2005) iGenetics: A Molecular Approach, 2nd Ed., Benjamin Cummings.
- Klug, W. S. and Cummings, M. R. (2008) Concepts of Genetics, 9th Ed., Benjamin Cummings.
- Hartl, D. L. and Jones, E. W., (2009) Genetics: Analysis of genes and genomes, 7th Ed., Jones and Bartlett publishers.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 502: Basics of Immunology

1. Course Code & Title

Course code:	MB 502
Course title:	Basics of Immunology
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This subject shall give preliminary insight in Immunology and clinical defence mechanism. The subject shall provide knowledge about various immunological diseases as well as concept of immunization.

Course Objectives

- To understand the basic mechanisms of immune system.
- To study practical aspects used in clinical immunology laboratories.
- To emphasize the importance and role of immunology for the public health as in vaccine strategies.
- To learn about the defective immune conditions and its implications.

3. Course Content

UNIT 1 INNATE HOST RESISTANCE

1.1 Innate resistance and adaptive defense

1.2 Innate barriers: Physical & Mechanical

1.3 Chemical mediators

1.4 Cells, tissues and organs of immune system

UNIT 2 ADAPTIVE IMMUNITY

2.1 Recognition and Memory

2.2 Antigens

2.3 Types of adaptive immunity

2.4 Recognition of foreignness

2.5 T cells & B cells

UNIT 3 DEFENSE MECHANISM AND IMMUNIZATION

3.1 Innate defense mechanisms

3.1.1 Phagocytosis

3.1.2 Inflammation

3.2 Adaptive defenses: Antibodies

3.3 Monoclonal antibodies and its production
3.4 Vaccines

UNIT 4 IMMUNE DEFECTS

4.1 Immune tolerance
4.2 Hypersensitivities
4.3 Autoimmune diseases
4.3.1 Organ specific autoimmune diseases
4.3.2 Systemic autoimmune diseases
4.4 Immunodeficiencies
4.5 Transplantation rejection

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall learn about the overview of the immune system and its one of the two arms, the innate or non-specific immune system.
Unit 2: The second arm of the immune system shall be introduced here which is known as adaptive or specific immune system.
Unit 3: Students shall learn the practical aspect of the immunology, wherein various laboratory techniques shall be introduced with their principles and its application as in various vaccine strategies.
Unit 4: Students shall learn about immune system failures and its consequences of uncontrolled reaction with host.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10th Ed., McGraw-Hill Education.
- Owen, J. A, Punt, J., Stranford, S. A. and Jones, P. P. (2013). Kuby Immunology, 7th Ed., W. H. Freeman and Company.
- Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I. M. (2011). Roitt's Essential Immunology, 13th Ed., Wiley-Blackwell Publishers.
- Abbas, A. K., Lichtman, A. H. and Pillai, S. (2012). Cellular and Molecular Immunology, 7th Ed., Elsevier-Saunders Publication.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 503: Microbial Metabolism

1. Course Code & Title

Course code:	MB 503
Course title:	Microbial Metabolism
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

The paper focuses on the study of metabolic processes used by bacteria for energy generation. It mainly covers the study of various chemoorganotrophic, chemolithotrophic and phototrophic metabolic processes observed in bacteria.

Course Objectives

- To develop an understanding of the basic principles and concepts of microbial metabolism.
- To learn the chemolithotrophic and phototrophic metabolic processes occurring in bacteria.
- To explore various metabolic processes leading to respiratory and fermentative metabolism of sugars in chemoorganotrophs.
- To acquire knowledge of electron transport chain and ATP synthesis in chemoorganotrophs.
- To get acquainted with metabolic processes used for catabolism of proteins, lipids and carbohydrates other than glucose.

3. Course Content

UNIT 1 INTRODUCTION TO METABOLISM

1.1 Metabolism: Important principles and concepts
1.2 ATP the major energy currency of cells
1.3 Redox reactions
1.4 Components of Electron transport chain

UNIT 2 CHEMOLITHOTROPHIC AND PHOTOTROPHIC METABOLISM

2.1 Chemolithotrophy
2.2 Phototrophy

UNIT 3 CHEMOORGANOTROPHIC METABOLISM-I

3.1 Aerobic respiration
3.2 Glucose to pyruvate: EMP, ED and PPP
3.3 Pyruvate to CO_2: TCA cycle and Glyoxylate Bypass
3.4 Electron Transport Chain and Oxidative Phosphorylation
3.5 Anaerobic Respiration
3.6 Fermentation

UNIT 4 CHEMOORGANOTROPHIC METABOLISM-II

4.1 Catabolism of Carbohydrates other than glucose
4.2 Protein and Amino acid catabolism
4.3 Lipid Catabolism
4.4 Principles governing Biosynthesis
4.5 CO_2 fixation

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall understand the basic principles and concepts of microbial metabolism.
Unit 2: Students shall gain knowledge of the energy generating mechanisms in chemolithotrophs and phototrophs.
Unit 3: Students shall become acquainted with various metabolic processes used by chemoorganotrophs for energy generation from glucose.
Unit 4: Students shall become well versed with the catabolic pathways used for utilization of proteins, lipids and carbohydrates other than glucose.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L., Woolverton, C. J. (2017). Prescott's Microbiology. 10th Ed. Singapore: McGraw-Hill Education.
- Rastogi, S., Pathak, N. (2009) Genetic Engineering, 4th Ed., Oxford University Press.
- Madigan, M. T. and Martinko, J. M. (2014). Brock Biology of Microorganisms. 14th Ed., Prentice Hall International Inc.
- Stanier, R.Y., Ingrahm, J. I., Wheelis, M. L. and Painter, P. R. (1987). General Microbiology. 5th Ed., McMillan Press.
- Atlas, R. M. (1997). Principles of Microbiology 2nd Ed., Brown Publishers.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 504: Applied Environmental Microbiology

1. Course Code & Title

Course code:	MB 504
Course title:	Applied Environmental Microbiology
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This subject give knowledge about microorganisms presents in air, water and in extreme environment. The subject further elaborates on waste water characteristics and its treatment using microbial route.

Course Objectives

- To develop an understanding of the basic principles and concepts of air microbiology.
- To learn the process for purification of drinking water and treatment process for waste water.
- To explore various biodegradation and bioremediation processes.
- To acquire knowledge of extreme environment and response of microorganisms to adapt the environment.

3. Course Content

UNIT 1 MICROBIOLOGY OF AIR

1.1 Microorganisms found in air
1.2 Number of microorganisms in air
1.3 Bio aerosols: Sampling and analysis
1.3.1 Methods of collection
1.3.2 Sampler type
1.3.3 Culture methods and microscopy
1.4 Air sanitation

UNIT 2 MICROBIOLOGY OF DOMESTIC AND WASTE WATER

2.1 Purification and Sanitary Analysis of waste Water
2.2 Waste water Treatment
2.3 Solid processing

UNIT 3 BIODEGRADATION AND BIOREMEDIATION

3.1 Biodegradation Processes
3.2 Bioremediation
3.2.1 Bioremediation of hydrocarbons
3.2.2 Bioremediation of marine oil spills

3.3 Bioaugmentation
3.4 Microbes Assisted Phytoremediation

UNIT 4 MICROBIOLOGY OF EXTREME ENVIRONMENT

4.1 Physiology, molecular adaptations of Hyperthermophiles, Acidophiles, Psychrophiles, Barophiles, Halophiles, Alkalophiles
4.2 Biotechnology of extremophiles

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall understand the presence of varied microorganism present in air, sampling and analysis of air flora and sanitization of air.

Unit 2: Students shall gain knowledge of different methods for drinking water purification and various steps for treating the waste water and finally the solid waste remains to dispose it.

Unit 3: Students shall become acquainted with various biodegradation and bioremediation process of various pollutants in environment.

Unit 4: Students shall become well versed with the adaptation and changes in the structure and metabolic pathway to survive in extreme environment as well as use of microbial enzymes of such organism in biotechnology.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L., Woolverton, C. J. (2017). Prescott's Microbiology. 10th Ed. Singapore: McGraw-Hill Education.
- Schaechter, M. (2004). The desk encyclopaedia of microbiology, 2nd Ed., Elsevier Academic Press.
- Schmidt, T. M. and Schaechter, M. (2011). Topics in ecological and environmental microbiology, 1st Ed., Elsevier Academic Press.
- Salle, A. J. (1974). Fundamental principles of microbiology, 7th Ed., Tata McGraw-Hill.
- Pelczar, M. J. & Chan, E. C. S. (1998). Microbiology, 5th Ed., McGraw Hill.
- Hurst, C. J., Crawford, R. L., Garland J. L. (2007). Manual of Environmental Microbiology, 3rd Ed., American Society for Microbiology.
- Atlas, R. M. (1997). Principles of Microbiology 2nd Ed., Brown Publishers.
- Purohit, S. S. (2008). Microbiology Fundamentals and Applications, 7th Ed., Agrobios.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 505: Food and Dairy Microbiology

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1. Course Code & Title

Course code:	MB 505
Course title:	Food and Dairy Microbiology
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

The main objective is to provide knowledge of microorganisms associated with foods and their origin. Better understanding of the microorganisms that cause disease and spoilage in foods shall lead to better ways of controlling them.

Course Objectives

- To understand intrinsic and extrinsic factors and their relationship to microbial growth.
- To understand the principles of food preservation and the role of beneficial microbes.
- To understand the role of microorganisms and food spoilage; pathogenic microorganisms, infection and intoxication as well as qualitative and quantitative microbiological analysis.
- To provide knowledge of the main microbial groups involved in the production of fermented foods.

3. Course Content

UNIT 1 FOOD MICROBIOLOGY

1.1 Food spoilage: Intrinsic and Extrinsic Factors

1.2 Methods used to control food spoilage

- 1.2.1 Filtration
- 1.2.2 Low temperature
- 1.2.3 High temperature
- 1.2.4 Water availability
- 1.2.5 Chemical based preservation
- 1.2.6 High hydrostatic pressure
- 1.2.7 Radiation
- 1.2.8 Microbial product-based inhibition
- 1.2.9 packaging

UNIT 2 DAIRY MICROBIOLOGY

2.1 Composition and nutritive value of milk

2.2 Methods of testing and gradation of milk

2.3 Preservation of milk and milk product

2.4 Cheese production

2.5 Fermented milks
2.6 Probiotics

UNIT 3 SPOILAGE OF FOOD AND DAIRY PRODUCTS

3.1 Contamination and spoilage of food
- 3.1.1 Bread
- 3.1.2 Fruits and vegetables
- 3.1.3 Heated Canned food
- 3.1.4 Milk and milk product

3.2 Microbiological examination of food
- 3.2.1 Microscopic technique
- 3.2.2 Cultural technique

3.3 Food borne disease outbreaks
3.4 Detection of food borne pathogens

UNIT 4 MICROORGANISMS AS FOOD AND FERMENTED FOODS

4.1 Single cell protein
- 4.1.1 Introduction
- 4.1.2 Advantages of producing microbial protein
- 4.1.3 Microorganisms and substrates used for production of SCP
- 4.1.4 Nutritional value of SCP
- 4.1.5 Production of algal biomass

4.2 Mushroom Culture
4.3 Other Fermented foods
4.4 Alcoholic beverages
4.5 Breads

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall learn about factors which affects the growth and adaptation of microorganisms in various environments and conditions, including sanitation practices.

Unit 2: Students shall learn about the composition of milk as a good source for microbial growth and preservation of food. Students shall learn role of microorganisms in the production of fermented milk products.

Unit 3: Students shall be able to understand spoilage of different foods by microbial activity. Students shall learn about microorganisms that cause disease and method to detect various food borne pathogens.

Unit 4: Students shall understand about different microorganisms that can be used as food and their involvement in the production of various fermented foods.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L., & Woolverton, C. J. (2017), Prescott's microbiology, 10th Ed., New York: McGraw-Hill Education.
- Frazier, W. C. and Westhoff, D. C., (2006). Food Microbiology, 4thEd., Tata Mc-Graw Hill, India.
- Sukumar, De. (2013). Outlines of Dairy Technology,1st Ed., Oxford University.

- Dubey, R. C. (2010). Textbook of Biotechnology, 1st Ed., S. Chand. Multicolor.
- Purohit, S. S. (2006). Microbiology: Fundamentals and Applications, 7th Ed., Agrobios (India).
- Pelczar, M. J. and Chan, E. C. S. (1998). Microbiology, 5th Ed., Tata-McGraw-Hill.
- Jay, J. M. (2000). Modern Food Microbiology. 6th Ed., Aspen Publishers.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MB 506: Haematology and Blood Banking

1. Course Code & Title

Course code:	MB 506
Course title:	Haematology and Blood Banking
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This paper includes the study and management of the red and white blood cells, platelets and the coagulation system. It includes the process that takes place in the lab to make sure that donated blood, or blood products, are safe before they are used in blood transfusions and other medical procedures.

Course Objectives

- To study the blood and blood components.
- To investigate and diagnose the disorders of blood, hemostasis and immune function.
- To learn the typing of blood for transfusion and testing for infectious diseases.
- To investigate the harmful responses of the body to blood transfusion and learn the collection, separation, delivery and storage of blood components.

3. Course Content

UNIT 1 INTRODUCTION TO HAEMATOLOGY

1.1 Definition and functions: Hematology and Blood
1.2 Haemopoietic system of the blood
1.3 Components of blood and their function
1.4 Processing of Blood
1.5 Types of anticoagulants and its use
1.6 Mechanism of blood coagulation: Coagulation cascade
1.7 Anaemia, leukemia and polycythemia Vera

UNIT 2 HAEMATOLOGICAL ANALYSIS

2.1 Determination of haemoglobin concentration
  2.1.1 Cyanmethaemoglobin method
  2.1.2 Sahli's method
2.2 Determination of hematocrit – PCV, Red cell indices
2.3 Blood cell counts – RBC, WBC, Platelet
2.4 Laboratory investigations of bleeding disorders
  2.4.1 Bleeding time - Duke method
  2.4.2 Whole blood clotting time - Lee and White method
  2.4.3 Prothrombin time - Quick's method

2.5 Automation in Haematology

UNIT 3 IMMUNOHAEMATOLOGY

3.1 Basic concepts of immunology and immunohaematology
3.2 ABO blood group system
3.3 ABO grouping and methods
3.4 Rhesus blood group system
3.5 Methods for Rh typing
3.6 Clinically less significant blood group systems

UNIT 4 BLOOD BANKING

4.1 Selection of blood donor
4.2 Methods of blood collection, transportation and storage of blood
4.3 Pre-transfusion test of Donor's blood
4.4 Preparation and use of blood components
4.5 Compatibility test - crossmatching

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Student shall learn about blood and blood related disorders. Shall enable the students to understand the importance of specimen collection, handling and processing in laboratory testing.

Unit 2: Gain knowledge of the principles of each test, possible causes of error, and the interpretation and clinical significance of the findings.

Unit 3: Student shall understand the reactions between antigens present on blood cells and antibodies present in plasma which is important for transfusion therapy.

Unit 4: Student shall enable the student to protect donor health and safety by collecting blood only from healthy individuals. Student shall understand the tests performed to determine if a particular unit of blood can be transfused safely into a certain patient.

5. Recommended Learning Resources

- Mukherjee, K. L. (1988). Medical Laboratory Technology, Vol 1, 2 & 3, Tata McGraw Hill Publishing.
- Ochei, J. and Kolhatkar, A. (2000). Medical Laboratory Science-Theory and Practice, Tata McGraw Hill.
- Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, 3rd Ed., Bhalani Publishing House.
- Professional guide to diagnostic tests, (2004). 1st Ed., Lippincott Shalliams & Wilkins.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

MBP-507 Practicals

1. Course Code & Title

Course code:	MBP 507
Course title:	Practicals
Course credits:	06
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	12

1) Isolation of drug resistant mutant (Gradient plate technique)
2) Isolation of pigment mutants of *Serratia marcescenes*
3) Isolation of Bacterial genomic DNA (Demo)
4) Determination of ABO and Rh blood groups (Slide method)
5) RPR- Qualitative
6) Widal test- Dreyers technique
7) Estimation of reducing sugar- Cole's method
8) Estimation of protein- Folin Lowry's method
9) Study of air microflora by settling plate technique
10) Microbiological analysis of drinking water by MPN and PA test
11) Isolation of Faecal Indicator *Enterococcus faecalis* from drinking water
12) Isolation of Bacteriophage from sewage water sample
13) Microbiological analysis of food: Aerobic Mesophilic Plate Count
14) Microbiological analysis of milk
15) Differential Count, Total count of WBC and RBC
16) Haemoglobin estimation

Recommended Learning Resources

- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed., Aditya.
- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed., Aditya.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6th Ed., Pearson Education (Singapore) Pvt. Ltd.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10th Ed., Pearson Benjamin Cummings.
- Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.

Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

GE 1: Quality Control and Quality Assurance

1. Course Code & Title

Course code:	GE 1
Course title:	Quality Control and Quality Assurance
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This subject shall provide knowledge regarding quality control and quality assurance in the field of microbiology laboratory. It shall give insights in various existing accreditation, certification and standardization of microbial processes.

Course Objectives

- The main objective is to provide knowledge of Quality Control and Management of quality control
- To provide reliable laboratory data in all types of laboratories.
- To understand how amendments can be made for clinical laboratory.
- To understand the Biosafety guidelines for microbiological laboratories.

3. Course Content

UNIT 1 TOTAL QUALITY MANAGEMENT

1.1 Introduction
1.2 Total Quality Management (TQM) Frame work
1.3 Quality Control
1.4 Internal Quality Control
1.5 Formulating Quality control charts
1.6 Various ways of maintaining Internal Quality Control

UNIT 2 ACCREDIATION AND CERTIFICATION

2.1 Accrediation and Certification
2.2 Quality council of India (QCI)
2.3 Clinical Laboratory Improvement Amendments (CLIA) of 1988 (USA)
2.4 Clinical and Laboratory Standard Institute (CLSI)

UNIT 3 MICROBIOLOGICAL HAZARD ANALYSIS AND AUDIT

3.1 Objectives 221
3.2 Planning and Management of Audits
3.3 Auditing the Microbiology Laboratory
3.4 Auditing the Manufacturing Process

UNIT 4 BIOSAFETY GUIDELINES

4.1 Microbiological Risk Assessments

4.2 Biosafety Level 1 and 2

- 4.2.1 Code of Practice
- 4.2.2 Laboratory design facilities
- 4.2.3 Laboratory Equipment
- 4.2.4 Health and Medical Surveillance
- 4.2.5 Training
- 4.2.6 Waste Handling
- 4.2.7 Chemical, Fire, Electrical, Radiation and Equipment Safety

4.3 Biosafety Level 3 and 4

- 4.3.1 Code of Practice
- 4.3.2 Laboratory design facilities
- 4.3.3 Laboratory Equipment
- 4.3.4 Health and Medical Surveillance

4.4 Biological Safety Cabinet

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Student shall learn quality management, quality assurance and formulate internal quality control charts for microbial laboratory.

Unit 2: Students shall learn certification of well-established organizations, It's criteria, rules and guidelines for accreditation.

Unit 3: Students shall learn inspection and investigation of microbiology laboratory. Also, students can study types of audits with evaluation of microbial control.

Unit 4: Students can study the policy proposed by the government to avoid risks in laboratory. Even can learn different Biosafety levels and Biosafety cabinets and organise the laboratory according to it.

5. Recommended Learning Resources

- Godkar, P. B. and Godkar, D. P. (2014). Textbook of Medical Laboratory Technology, 3rd Ed., Volume 1, Bhalani Publication House Mumbai, India.
- Baird, R. M., Hodges, N. A. and Denyer, S. P. (2006). Handbook of Microbiological Quality Control, Special Indian Ed., CRC Press.
- WHO Geneva. (2004). Laboratory Biosafty Manual, 3rd Ed., World Health Organization.
- Hewitt, S. (2003). Microbiological Assay for Pharmaceuticals Analysis: A Rational Approach, CRC Press.
- Tambwekar, S. (2009). Handbook of Quality Assurance in Laboratory Medicines, B. I. Publications.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-V

GE 2: Hazards and Precautions in Microbiology Laboratory

1. Course Code & Title

Course code:	GE 2
Course title:	Hazards and Precautions in Microbiology Laboratory
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This subject shall introduce the concept of good microbiology laboratory practices and hazards associated with it. It shall also provide in depth knowledge about safety, precaution for infection control.

Course Objectives

- To introduce the student about Common Hazards, General Factors which are responsible for Occurrence of Accidents, Decontamination and Disposal of Laboratory Waste.
- To provide knowledge about various kinds of possible hazards in microbiology laboratory so that student can learn about how to avoid them
- To teach students about good microbiological techniques and aspects like disinfection and sterilization.
- To give basic awareness about Transport of Infectious Substance and to familiarize the students with the Standard Precautions and Safety in Microbiology Laboratory.

3. Course Content

UNIT 1 HAZARDS IN LABORATORY

1.1 Microbial Hazards
1.2 Hazardous Chemicals
1.3 Additional Laboratory Hazards
1.4 Equipment and Glassware Hazards
1.5 Reporting of accident and Bio safety programme

UNIT 2 SAFETY IN LABORATORY

2.1 Safety Precautions against infection
2.2 General Factors that Contribute to the Occurrence of Accidents
2.3 Guideline for a Code of Safe Laboratory Practice
2.4 Management of laboratory waste
2.5 Safety Check list

UNIT 3 GOOD MICROBIOLOGICAL TECHNIQUES

3.1 Laboratory Techniques
3.2 Contingency Plans and Emergency Procedures
3.3 Introduction to Transport of Infectious Substance

UNIT 4 PRECAUTIONS FOR INFECTION CONTROL

4.1 Standard Precautions for Prevention and Control of Infection
4.2 Emergency First Aid
4.3 Safety Sign and Symbol for Hazards
4.4 Personal Health and Safety Measures

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: The students shall be able to understand the common laboratory hazards, reasons for occurrence of accidents. Students shall learn about guideline for safe laboratory practice. Students shall understand how to decontaminate infectious material and disposal of laboratory waste and safety check list.

Unit 2: Students shall learn about microbial hazards, hazardous chemicals, Additional laboratory hazards, equipment and glassware hazards. The students shall be able to understand the biomedical waste and its hazards.

Unit 3: Students shall understand about how to transport infectious substance. Create In depth knowledge on good microbiological techniques. Students shall be able to understand contingency plans and emergency procedures.

Unit 4: Students shall acquire knowledge of standard precautions for prevention and control of infection. The students shall be able to understand the use of emergency first aid, sign and symbol for hazards as well as personal health and safety measures.

5. Recommended Learning Resources

- WHO, (2004). Laboratory Biosafety Manual, 3rd Ed., World Health Organization.
- Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries – Part-1, 2nd Ed., Cambridge University Press.
- Singh, A. and Kaur, S. (2012). Biomedical Waste Disposal, 1st Ed., JayPee Publication.
- Fischbach, F. and Dunning, M. III. (2017). A Manual of Laboratory and Diagnostic Tests, 9th Ed., Lippincott, Shalliams & Wilkins.
- Traynor, P. L., Fredric, R. J. and Koch, M. (2002). Biosafety, Agricultural Biotechnology Support Project (ABSP), Michigan State University.
- Training Manual On Bio-Medical Waste Management for Doctors, Nurses, Nodal Officers and Waste Managers, (2018).

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Veer Narmad South Gujarat University, Surat

B.Sc. (Microbiology) Semester VI Syllabus

(Effective from June, 2022)

Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 601: Genetic Engineering

1. Course Code & Title

Course code:	MB-601
Course title:	Genetic Engineering
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This course will give knowledge of genetic engineering covering different molecular tools and techniques to manipulate microbial systems for real world applications.

Course Objectives

- To understand the fundamental concepts behind various molecular mechanisms
- To study various tool and techniques used in r-DNA technology
- To know concept of gene amplification, sequencing, cloning and transformation
- To become familiar with various gene modifications techniques and its applications

3. Course Content

UNIT 1 INTRODUCTION TO GENETIC ENGINEERING

1.1 Early development of genetics
1.2 Gene cloning, PCR and its importance
1.3 Gene manipulation techniques:
  1.3.1 Conventional breeding
  1.3.2 Protoplast fusion and cell cloning
1.4 Steps for gene cloning
1.5 Potential applications of genetic engineering

UNIT 2 TOOLS OF GENETIC ENGINEERING: ENZYMES AND VECTORS

2.1 Enzymes for gene cloning
2.2 Vectors
  2.2.1 Properties of good vector
  2.2.2 Cloning and expression vector
  2.2.3 pBR322
  2.2.4 λ phage
  2.2.5 Cosmid vectors
  2.2.6 Phagemid vectors and Phasmid vectors

2.2.7 Bacterial Artificial Chromosome vector
2.2.8 Shuttle vectors

UNIT 3 TECHNIQUES OF GENETIC ENGINEERING

3.1 Construction of cDNA library
3.2 Genomic library
3.3 Colony and Plaque hybridization
3.4 Transformation and clone selection
3.5 Insertion of phage DNA

UNIT 4 APPLICATIONS OF GENETIC ENGINEERING

4.2 Production of recombinant pharmaceuticals
4.3 Production of recombinant vaccines
4.4 Plants that make their own insecticides
4.5 DNA analysis in the identification of crime suspects

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Student will learn about early development of recombinant technologies. Along with, students will grasp outline of genetic cloning, various techniques for gene manipulation.

Unit 2: Students will gain knowledge of various enzymes and vectors used in genetic engineering. Students will get in-depth information about molecular mechanisms of enzymes and vectors involved in genetic engineering.

Unit 3: Students will understand the process involve in cDNA and genomic library construction.

Unit 4: Student will enable to understand outcome of various genetic engineered products. Student will get to know how recombinant products solve problems in medicine, forensic and agricultural field.

5. Recommended Learning Resources

- Trevan, M. D. (1987). Biotechnology: The Biological Principles, Tata-McGraw-Hill.
- Singh, B. D. (2011). Biotechnology: Expanding Horizons, 4th Ed., Kalyani Publishers.
- Brown, T. A. (2016). Gene cloning and DNA analysis: An introduction, 7th Ed., John Wiley and Sons.
- Rastogi, S. and Pathak, N. (2009). Genetic Engineering, 1st Ed., Oxford University Press.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 602: Epidemiology and Medical Microbiology

1. Course Code & Title

Course code:	MB 602
Course title:	Epidemiology and Medical Microbiology
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

The course includes the understanding of the pathogens and its virulence factors in causing an infection. It also covers the cause, spread and control of an epidemic. It includes the study of microbial diseases transmitted by air, food, water, direct through contact and vectors.

Course Objectives

- To understand the role of virulence factors in causing infectious diseases.
- To envisage the understanding of an epidemic, its cause and control and the emergence and re-emergence of infectious diseases affecting the world.
- To gain insight on the different modes of disease transmission air, food, water, vector and direct contact.
- To study the causative agents, pathogenicity, prevention and control of diseases.

3. Course Content

UNIT 1 PATHOGENICITY, INFECTIOUS DISEASE AND EPIDEMIOLOGY

1.1 Pathogenicity drives infectious disease
1.2 Virulence defines a pathogen's success
1.3 Epidemiology is an evidence-based science
1.4 Epidemiology is rooted in well-tested methods
1.5 Infectious disease is revealed through patterns within a population
1.6 Infectious diseases and pathogens are emerging and re-emerging
1.7 Health-care facilities harbor infectious agents

UNIT 2 AIR-BORNE DISEASES

2.1 Airborne transmission
2.2 Tuberculosis
2.3 Pneumonia and its types
2.4 Influenza
2.5 SARS-CoV2
2.6 Histoplasmosis
2.7 Aspergillosis

UNIT 3 CONTACT AND VECTOR BORNE DISEASES

3.1 Contact, vertical and vector-borne Transmission
3.2 Staphylococcal infections
3.3 Syphilis
3.4 Leptospirosis
3.5 AIDS
3.6 Malaria
3.7 Dengue

UNIT 4 FOOD AND WATER-BORNE DISEASES

4.1 Gastroenteritis
4.1.1 *E. coli* gastroenteritis
4.1.2 Rotavirus
4.2 Salmonellosis
4.3 Cholera
4.4 Bacterial and amoebic dysentery
4.5 Botulism
4.6 Hepatitis

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall gain knowledge of pathogenicity, virulence factors, patterns of infectious diseases. Students shall understand the rise of an epidemic, control and emerging and re-emerging diseases.

Unit 2: Students shall understand the role of air in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by air.

Unit 3: Students shall understand the role of vectors in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by vector and direct contact.

Unit 4: Students shall understand the role of food and water in transmission of infectious disease. Students shall gain insight of the causative agents, pathogenicity, prevention and control of and diseases transmitted by food and water.

5. Recommended Learning Resources

- Willey, J. M., Sherwood, L., and Woolverton, C. J. (2017). Prescott's microbiology, 10th Ed., New York: McGraw-Hill Education.
- Greenwood, D., Slack, R., and Barer, M. (2012). Medical Microbiology A Guide to Microbial Infections, 18th Ed., Churchill Livingstone, Elsevier.
- Pelczar, Chan, and Krieg (1993). Microbiology – Concepts and Application International Ed., McGraw-Hill Education.
- Ananthnarayan, R and Paniker C. K. (2009). Textbook of Microbiology, 8th Ed., Universities Press (India) Pvt. Limited.
- Ichhpujani, R. and Bhatia, R. (2002). Medical Parasitology, 3rd Ed., Jaypee.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 603: Industrial Microbiology

1. Course Code & Title

Course code: MB 603
Course title: Industrial Microbiology
Course credits: 02
Subject: Microbiology
Faculty: Science
Learning Hours/Week: 02
Course type: Core

2. Course Overview and Objectives

This course will give knowledge of the application of microbiology for industrial production of microbial products. The study of strains, media composition, fermentation conditions and the methods of product recovery.

Course Objectives

- To gain an insight on the historical development of industrial microbiology.
- To study the screening techniques for the isolation of industrial important microorganisms and its preservation. importance of various media components and its effect on the optimum production.
- To understand the designing aspects of bioreactor and types.
- To learn the various methods of product recovery from the fermentation media.

3. Course Content

UNIT 1 DEVELOPMENT IN INDUSTRIAL MICROBIOLOGY

1.1 Historical developments in fermentation technology
1.2 Component parts of fermentation process
1.3 Screening for new metabolites
1.4 Screening Techniques: Primary and Secondary
1.5 Inoculum development

UNIT 2 INDUSTRIAL STRAINS AND FERMENTATION MEDIA

2.1 Isolation of microorganism and culture collections
2.2 Industrial Strains and strain improvement
2.3 Strain stability
2.4 Fermentation media

UNIT 3 BIOREACTOR

3.1 Bioreactor
3.2 Design of Bioreactor
3.3 Bioreactor Types
3.4 Fermentation types and process

UNIT 4 DOWNSTREAM PROCESSING

4.1 Introduction
4.2 Cell harvesting
4.3 Cell disruption
4.4 Product recovery
4.5 Product development, regulation and safety

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall gain an understanding of the pre, post and present development of industrial microbiology. They shall learn the fermentation process development, screening techniques for the isolation of industrially important strains.

Unit 2: Students shall acquire the knowledge of the media components and various factors for the optimum production of microbial products on large scale.

Unit 3: Students shall learn design of fermenters and the different types of fermenters for the industrial production.

Unit 4: Students shall understand the sterilization of media and the methods of product recovery.

5. Recommended Learning Resources

- Patel, A. H. (2016). Industrial Microbiology, 2nd Ed., Trinity press; An imprint of Laxmi publications PVT. Ltd.
- Waites, M. J. (2001). Industrial microbiology: An Introduction,1st Ed., Blackwell publishing.
- Shivkumar, P. K., Joe, M. M. and Sukesh, K. (2010). An Introduction to Industrial Microbiology, S. Chand Publishers.
- Crueger, W., Crueger, A., Aneja, K. R. (2017). Crueger's Biotechnology: A textbook of Industrial Microbiology, 3rd Ed.., Medtech publisher.
- Okafor, N. (2007). Modern Industrial Microbiology and Biotechnology. Taylor and Francis, an imprint of CRC Press.
- Stanbury, P., Whitaker, A. and Hall, S. J. (2016). Principles of fermentation technology, 3rd Ed., Butterworth-Heinemann.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 604: Diagnostic Microbiology

1. Course Code & Title

Course code:	MB 604
Course title:	Diagnostic Microbiology
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This course will give knowledge of the application of microbiology in the diagnostic fields. This paper also discusses the identification and characterization methods of pathogens including the serological aspects. Study of the diverse antimicrobial agents testing them for therapeutic purposes are also included here.

Course Objectives

- To gain knowledge of clinical specimen collection, transport and processing for disease diagnosis.
- To have the concept of identification of the disease pathogen from clinical specimens and treatment of disease.
- To explain the principles and importance of diagnostic methods applied in clinical laboratory.
- To have an insight on antimicrobial therapy to cure disease and to know the treatment effectiveness as well as on concept of drug resistance.

3. Course Content

UNIT 1 INTRODUCTION TO DIAGNOSTIC MICROBIOLOGY

1.1 Collection and Transport of Specimen:
- 1.1.1 Blood
- 1.1.2 CSF
- 1.1.3 Pus
- 1.1.4 Throat and Mouth
- 1.1.5 Sputum
- 1.1.6 Urogenital
- 1.1.7 Urine
- 1.1.8 Stool

1.2 Gross Examination of Specimens

1.3 Organism Identification using phenotypic criteria

1.4 Commercial Identification Systems

UNIT 2 MOLECULAR METHODS FOR MICROBIAL IDENTIFICATION AND CHARACTERIZATION

2.1 Specimen Collection and Transport
2.2 Nucleic Acid Hybridization Methods
2.2.1 Hybridization with Signal Amplification
2.3 Amplification Methods- PCR Based
2.3.1 Real Time PCR
2.4 Amplification Methods- Non-PCR Based
2.4.1 Isothermal Amplification
2.5 Sequencing and Enzymatic Digestion of Nucleic Acids
2.6 Applications of Nucleic Acid Based Methods

UNIT 3 IMMUNOCHEMICAL METHODS AND SEROLOGIC DIAGNOSIS OF INFECTIOUS DISEASES

3.1 Principles of Immunochemical Methods Used for Organism Detection
3.2 Serodiagnosis of Infectious Diseases
3.3 Principles of Serologic Test Methods
3.4 Flow Cytometry

UNIT 4 ANTIMICROBIAL AGENTS AND SUSCEPTIBILITY TESTING

4.1 Antimicrobial Chemotherapy Evolved from Antisepsis Efforts
4.2 Antimicrobial Drugs Need to be Selectively toxic over a Range of Effectiveness
4.3 Antimicrobial Drugs
4.4 Methods for antimicrobial susceptibility testing:
4.4.1 Principles
4.4.2 Methods that directly measure antimicrobial activity: Conventional Testing Methods: Broth Dilution, Agar Dilution, Disk Diffusion
4.5 Automated Antimicrobial Susceptibility Test Systems Detection of Specific Resistance Mechanisms
4.6 Detection of Specific Resistance Mechanisms
4.6.1 Phenotypic Method-β-Lactamase Detection
4.6.2 Genotypic Methods
4.7 Special Methods for Complex Antimicrobial/Organism
4.7.1 Bactericidal Test- Minimal Bactericidal Concentration/Serum Bactericidal
4.7.2 Tests for Activity of Antimicrobial Combinations

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Student will be able to know the basic steps in collection, transport and processing of clinical specimens and will be able to have knowledge on identification and characterization of infectious agents.

Unit 2: Student will be able to understand the advanced molecular techniques and their applications in diagnostic microbiology.

Unit 3: Student will be able to explain the principles and importance of the immunochemical and serological diagnostic tests.

Unit 4: Student will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance

5. Recommended Learning Resources

- Tille, P. (2014). Bailey and Scott's diagnostic microbiology.13th Ed., Elsevier Health Sciences.
- Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2017). Prescott's Microbiology, 10th Ed., Mc-Graw Hill Education.
- Cheesbrough, M. (2005). District laboratory practice in tropical countries, Part 1 and 2. Cambridge university press.
- Ochei, J. O., and Kolhatkar, A. A. (2000). Medical Laboratory Science: Theory and Practice. McGraw Hill Education.
- Godkar, P. B. (2003). Textbook of Medical Laboratory Technology, 2 Ed., Bhalani Publishing House.
- Tang, Yi-Wei and Stratton, C. W. (2013). Advanced Techniques in Diagnostic Microbiology. New York: Springer.
- Mukherjee, K. L. (2013). Medical Laboratory Technology Vol. 1, 2 and 3, Tata McGraw-Hill Education.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 605: Microbial Products

1. Course Code & Title

Course code:	MB 605
Course title:	Microbial Products
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

The objective of this course is to introduce students about the role of microorganisms in large scale production of microbial products which would facilitate the economic growth. It provides the information about the applications and recent economical advances in the industrial utilization of microorganisms.

Course Objectives

- To understand the large-scale production of primary and secondary metabolites.
- To gain knowledge of application of microorganisms in agriculture.
- To know concept of using microorganisms as fuel and energy generation.
- To become aware of microbial enzymes and its applications.

3. Course Content

UNIT 1 MICROBIAL METABOLITES

1.1 Vitamin B12
1.2 Citric Acid
1.3 L-glutamate
1.4 Health care Products
1.5 Food additives and supplements

UNIT 2 AGRICULTURAL MICROBIAL PRODUCTS

2.1 Biofertilizers
2.2 Bioinsecticides
2.3 Biocontrol agents
2.4 Bioherbicides
2.5 Inoculant formulation

UNIT 3 BIOENERGY AND BIOMASS PRODUCTION

3.1 Bioethanol
3.2 Biogas
3.3 Hydrogen-a new fuel
3.4 Microbial Enhanced Oil Recovery
3.5 Microbial biomass production

UNIT 4 ENZYME TECHNOLOGY

4.1 Microorganisms producing enzymes
4.2 Properties of Enzymes
4.3 Methods of Enzyme production
4.4 Immobilization of Enzyme
4.5 Biosensors and Biochips

4. Course Learning Outcomes\ Students' Learning Outcomes (SLO)

Unit 1: Students shall understand the commercial production of microbial metabolites on large scale using varied microorganisms.

Unit 2: Students shall gain insight of usage of microorganisms as protein source, food supplements, soil supplements and bioinoculants.

Unit 3: Students shall acquire knowledge of using microorganisms in energy production and role of microbial enzymes in industries.

Unit 4: Students shall gain an understanding of enzymes, its industrial applications, immobilization of enzymes and it's used in biosensors and biochips.

5. Recommended Learning Resources

- Creuger, W. (2005). Biotechnology: A textbook of Industrial Microbiology, 2nd Ed., Panima, New Delhi.
- Dubey, R. C. (2010). Textbook of Biotechnology, 1st Ed., S. Chand, Multicolor.
- Patel, A. H. (2012). Industrial Microbiology. 2nd Ed., Macmillan, India.
- Shivakumar, P. K., Joe, M. M. and Sukesh, K. (2010). An Introduction to Industrial Microbiology, 1st Ed., S Chand Publications.
- Waites, M. J. (2001). Industrial Microbiology: An Introduction, 1st Ed., Blackwell publishing
- Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2014) Prescott, Harley and Klein's Microbiology, 9th Ed., McGraw-Hill Education.
- Ratledge, C. and Kristiansen, B. (2006). Basic Biotechnology, 3rd Ed., Cambridge University Press.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

MB 606: Genomics, Proteomics and Bioinformatics

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1. Course Code & Title

Course code: MB 606
Course title: Genomics, Proteomics and Bioinformatics
Course credits: 02
Subject: Microbiology
Faculty: Science
Learning Hours/Week: 02
Course type: Core

2. Course Overview and Objectives

This course will provide an idea to the student about basics of genomics, proteomics and bioinformatics. Students will learn about various sequencing techniques, fundamentals of proteomics and how to connect them with science of bioinformatics. They will also learn about biological databases, different bioinformatics tools etc.

Course Objectives

- To study DNA, gene and genome sequencing methods and genome evolution, so that we can relate biology with that of information science.
- To provide insights of proteomics and how to link proteomics with genomics.
- To learn basics of bioinformatics and its various databases.
- To study sequence retrieval, sequence alignment and various tools used in sequence alignment.

3. Course content

UNIT 1 MICROBIAL GENOMICS

1.1 DNA Sequencing Methods
1.2 Genome Sequencing
1.3 Metagenomics: Access to Uncultured Microbes

UNIT 2 MICROBIAL PROTEOMICS

2.1 Bioinformatics: Sequences to Bioinformatics
2.2 Functional Genomics: Genes to Phenotype
2.3 System Biology
2.4 Comparative Genomics

UNIT 3 BIOINFORMATICS – I

3.1 Introduction
3.2 Branches of Bioinformatics
3.3 Aim of Bioinformatics
3.4 Scope and Research Areas of Bioinformatics
3.5 Features of Biological Databases
3.6 Classification Scheme of Biological Databases

UNIT 4 BIOINFORMATICS – II

4.1 Tools for Data Retrieval
4.1.1 Tools for Web Search
4.1.2 Data Retrieval Tools
4.2 Types of Alignments
4.2.1 Global, Local and End free Space Alignment
4.2.2 Multiple Sequence Alignment
4.3 BLAST: Variants and BLAST Output Format
4.4 FASTA
4.5 Comparison of FASTA and BLAST

4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: The unit will describe the students about sequencing of DNA, genes and genomes including next generation sequencing technologies.
Unit 2: The unit will discuss how to relate genomics to proteomics and proteomics to bioinformatics.
Unit 3: The unit will introduce definition, branches, biological databases of bioinformatics to students.
Unit 4: The unit will explain how to retrieve sequences from databases and how to perform sequence alignments using sequence alignment tools.

5. Recommended Learning Resources

- Wiley, J. M., Sherwood, L. M. and Woolverton, C. J., (2017) Prescott, Harley and Klein's Microbiology, 10th Ed., McGraw-Hill Education.
- Ghosh, Z. and Mallick, B. (2009). Bioinformatics: Principles and Applications, ,1st Ed., Oxford University Press.
- Rastogi, C., Mendiratta, N. and Rastogi, P. (2008). Bioinformatics: Methods and Applications, 4th Ed. PHI learning Pvt. Ltd.
- Xiong, J. (2006). Essential Bioinformatics, 1st Ed., Cambridge University Press.
- Bosu, O. and Thukral, S. K. (2008). Bioinformatics: Databases, Tools and Algorithms, 1st Ed., Oxford university Press.
- Primrose, S. and Twyman, R. (2006). Principles of Gene Manipulation and Genomics, 7th Ed. Black well Publishing, Malden.
- Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M. and Stahl, D. A. (2018). Brock Biology of Microorganisms, 15th Global Ed., Pearson.

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Veer Narmad South Gujarat University, Surat

B. Sc. Microbiology Semester-VI

MBP 607 Practicals

1. Course Code & Title

Course code:	MBP 607
Course title:	Practicals
Course credits:	06
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	12

1) Bacteriological investigation of medical problems related to blood.
2) Bacteriological investigation of medical problems related to stool.
3) Bacteriological investigation of medical problems related to purulent exudates, wound, and abscess.
4) Bacteriological investigation of medical problems related to urine.
5) Detection of HIV/ HBsAg by rapid flow through method.
6) Screening of organic acid and amylase producers.
7) Determination of Antibiotic Susceptibility (Agar disc method) and MIC.
8) Sterility testing by direct inoculation method.
9) Fermentative production of amylase and its estimation.
10) Bioassay of penicillin.
11) Estimation of streptomycin.
12) Paper chromatography of Amino acids.
13) Physical, chemical and microscopic examination of urine.
14) Sequence retrieval for nucleic acid and proteins and BLAST analysis.
15) Screening of transformed bacterial cells by blue-white screening/ marker gene (Demonstration).
16) Study of permanent slides of four arthropod vectors (*Aedes* / *Anopheles* mosquitoes, Rat flea, Mite, Tick).

Recommended Learning Resources

- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 1, 9th Ed., Aditya.
- Patel, R. J. and Patel, R. K. (2015). Experimental Microbiology, Vol. 2, 9th Ed., Aditya.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 6th Ed., Pearson Education (Singapore) Pvt. Ltd.
- Cappuccino, J.G. and Sherman N. (2005). Microbiology: A Laboratory Manual, 10th Ed., Pearson Benjamin Cummings.
- Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, New Age International Publishers.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

GE 3: Analytical Instrumentation and Techniques

1. Course Code & Title

Course code: GE 3
Course title: Analytical Instrumentation and Techniques
Course credits: 02
Subject: Microbiology
Faculty: Science
Learning Hours/Week: 02
Course type: Core

2. Course Overview and Objectives

This course will provide a knowledge about principles and fundamental behind analytical tools utilize in microbiology laboratory. This course will provide concept of purification and characterization of biomolecules using electrophoresis, chromatography and radioisotope-based techniques.

Course Objectives

- The objective of this course is to introduce students to fundamentals of analytical instruments.
- To impart knowledge regarding advanced analytical techniques and applications in research and industries.
- To learn fundamental principles of various purification technique based on chromatography
- To know advanced radioisotopic technique in field of analytics

2. Course content

3.

UNIT 1 FUNDAMENTALS AND PERFORMANCE PARAMETER OF ANALYTICAL INSTRUMENTS

1.1 Elements of Analytical Instruments
1.2 Methods of Analysis
1.2.1 Types of Instrumental Methods
1.2.2 Classification of Analytical Instruments
1.3 Performance Requirements of Analytical Instruments
1.3.1 Errors in Chemical Analysis
1.3.2 Accuracy and Precision
1.3.3 Significant Figures
1.3.4 Signal to Noise Ratio
1.3.5 Other Performance Parameters

1.4 Instrument Calibration Techniques
1.4.1 Calibration curve method
1.4.2 Standard Addition method
1.4.3 Method of Internal standard
1.5 Validation

UNIT 2 ANALYTICAL LABORATORY INSTRUMENTS

2.1 pH Meter
2.1.1General consideration
2.1.2 Principle
2.1.3 Components
2.1.4 Ion selective electrode
2.2 Photometers and Spectrophotometers
2.2.1 Choice of Photometers
2.2.2 Important Components of Photometers and Spectrophotometers
2.2.3 Specifications of Photometers and Spectrophotometers
2.2.4 Operation of Photometers
2.2.5 Care and Maintenance
2.2.6 Selection of Filters
2.2.7 Advantages and disadvantages of Photometers
2.3 Flame Photometry
2.3.1 Functions of various parts of a Flame Photometer
2.3.2 Interference in Emission Flame Photometry
2.4 Centrifuge
2.4.1 Important components of a centrifuge
2.4.2 Principle
2.4.3 Use
2.4.4 Working of Centrifuge
2.4.5 Care and Maintenance
2.4.6 Preventive measures
2.4.7 Additional Information

UNIT 3 ANALYTICAL LABORATORY TECHNIQUES

3.1 Electrophoresis
3.1.1 Definition
3.1.2 Principle
3.1.3 Factors affecting migration of charged particles
3.1.4 Support media
3.1.5 Advantages of PAGE
3.1.6 Basic Requirement of Electrophoresis
3.1.7 General methodology
3.2 Blot Techniques
3.2.1 Southern and Northern Blot techniques
3.3 PCR
3.3.1 Sources of DNA
3.3.2 Clinical significance
3.3.3 Components of PCR
3.3.4 PCR protocol and Equipment
3.3.5 Determination of length of cDNA

3.3.6 Quality control in PCR
3.3.7 Practical application of PCR

3.4 Chromatography
3.4.1 Adsorption chromatography
3.4.2 Partition chromatography
3.4.3 Ion-exchange chromatography
3.4.4 Gel filtration chromatography
3.4.5 Various modes of chromatography

UNIT 4 RADIOISOTOPE TRACER TECHNIQUES

4.1 Atomic Structure, Stability and Radiation
4.2 Measurement and Units of Radioactivity
4.3 Autoradiography
4.3.1 Principle of autoradiography
4.3.2 Selection of Emulsion and film
4.3.3 Choice of isotopes
4.3.5 Time of exposure
4.3.6 Practical Techniques of autoradiography
4.4 Use of Radioisotopes in Biological Specimen
4.5 Safety Aspects of Radioisotopes

4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: Student will learn the fundamentals behind analytical processes as well as concept of error, calibration and validation of process.

Unit 2: Student will familiarize with various common laboratory instruments with its working principle, instrumentation and applications.

Unit 3: Students will gain knowledge about various advanced technique such as electrophoresis, chromatography, blotting and PCR.

Unit 4: Students will learn about principle, methodology and usage of radio isotopic material to analyse biological molecules.

5. Recommended Learning Resources

- Khandpur, R. S. (2006). Handbook of Analytical Instrument, 3rd Ed., McGraw Hill Education.
- Godkar, P. B. (2014). Textbook of Medical Laboratory Technology-Vol. 1, 3rd Ed., Bhalani Publishing House.
- Ghoshal, S. and Avasthi, A. S. (2018). Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., PHI Learning Private Limited.

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Veer Narmad South Gujarat University

B. Sc. Microbiology Semester-VI

GE 4: Biosafety in Microbiology Laboratory

1. Course Code & Title

Course code:	GE 4
Course title:	Biosafety in Microbiology Laboratory
Course credits:	02
Subject:	Microbiology
Faculty:	Science
Learning Hours/Week:	02
Course type:	Core

2. Course Overview and Objectives

This course will give knowledge related to risk assessment, safe handling, containment of infectious microorganisms and hazardous biological materials. It also emphasis on the need for reliable well managed district laboratories and their rational use in district health care to provide a quality laboratory service to the community.

Course Objectives

- To be familiar with the relative hazards of infective microorganisms by risk groups.
- To learn about levels of biosafety, biological safety cabinets, its usage and maintenance.
- To know organization for biosafety and the training for maintenance of biosafety.
- To be familiar with environment friendly waste management and disposal.

3. Course Content

UNIT 1 INTRODUCTION TO BIOSAFETY

1.1 Concepts of Biosafety
1.2 Importance and universal precautions recommended by NIH and CDC
1.3 Microbial risk assessment
1.4 Safe laboratory working environment
1.5 Fire safety

UNIT 2 LABORATORY BIOSECURITY

2.1 Containment and elements
2.2 Biosafety levels
2.3 Biological Safety Cabinets
2.4 Biological Safety Cabinets Air Connections
2.5 Selection of Biological Safety Cabinet
2.6 Using Biological Safety Cabinets in Laboratory

UNIT 3 SAFETY ORGANIZATION AND TRAINING

3.1 Biosafety Officer
3.2 Biosafety Committee
3.3 Engineering and Building Maintenance
3.4 Training Programmes

UNIT 4 TREATMENT AND DISPOSAL OF LABORATORY WASTE

4.1 Classification of biomedical laboratory waste
4.2 Segregation of biomedical laboratory waste
4.3 Decontamination of infectious material
4.4 Disposal of Laboratory Waste
4.2.1 Incineration
4.2.2 Landfill
4.5 Decontamination of biological safety cabinets

4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: It stresses throughout the importance of personal responsibility, risk assessment and preventing laboratory associated infections.

Unit 2: Students will learn biosecurity concepts; will be acquainted with the protective measures needed in a laboratory setting to protect workers, environment and public.

Unit 3: Students will know the basic concepts in biological safety awareness among laboratories and support staff emphasising on critical elements for an effective biosafety training programme

Unit 4: Students will learn proper waste segregation, collection, disposal and transport of health care waste. In general, they will develop awareness of environmental issues relating to health care waste.

5. Recommended Learning Resources

- Ochei, J. O., and Kolhatkar, A. A. (2000). Medical Laboratory Science: Theory and Practice. McGraw Hill Education.
- Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries – Part-1, 2nd Ed., Cambridge University Press.
- Singh, A. and Kaur, S. (2012). Biomedical Waste Disposal, 1st Ed., Jaypee Publication.
- WHO, (2004). Laboratory Biosafety Manual, 3rd Ed., World Health Organization.
- Sood, R., (2015). Concise Book of Medical Laboratory: Technology Methods and Interpretations, Jaypee Brothers.
- Training Manual on Bio-Medical Waste Management for Doctors, Nurses, Nodal Officers and Waste Managers, (2018).

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