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 અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર Microbiology વિષયનાં M.Sc. Sem - 1નાં અભ્યાસક્રમ અંગે માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૨/૦૫/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલ તા.૦૨/૦૬/૨૦૨૨ ની સભાનાં ઠરાવ ક્રમાંકઃ૦૮ થી સ્વીકારી મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૨/૦૫/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨

:: આથી ઠરાવવામાં આવે છે કે,શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર M.Sc. માઈક્રોબાયોલોજી (Microbiology) Sem-1 નો અભ્યાસક્રમ મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૨/૦૬/૨૦૨૨ની ઠરાવ ક્રમાંકઃ ૦૮

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર Microbiology વિષયનાં M.Sc. Sem-1નાં અભ્યાસક્રમ અંગે માઈક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૨/૦૫/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ સુચન સાથે વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી Microbiology વિષયનાં M.Sc. Sem-1નાં અભ્યાસક્રમ મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./માઈક્રોબાયોલોજી/પરિપત્ર/૧૧૩૪૫/૨૦૨૨
તા.૨૩–૦૬–૨૦૨૨

ઈ.ચા. કુલસચિવ

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

Veer Narmad South Gujarat University, Surat

M.Sc. (Microbiology) Syllabus

(Effective from June, 2022)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. MICROBIOLOGY SEM I

Academic year 2022 onwards

Theory Paper/ Practical	Teaching schedule Hrs/ week	Exam schedule			Total marks	Credit
		Duration (Hrs)	Internal marks	External marks		
Theory papers:						
1: Core Paper -I (CC-1) Microbial diversity	4	3	30	70	100	4
2: Core Paper - II (CC-2) Molecular biology and genetic engineering	4	3	30	70	100	4
3: Core Paper - III (CE-1) Environmental microbiology and biofuels	4	3	30	70	100	4
Inter / multi-Disciplinary (AECC) **4: Elective Paper –1** Biophysical techniques and instrumentation **4: Elective Paper –2** Cell chemistry and molecular interactions	4	3	30	70	100	4
Practicals:						
5. Practical based on Core I, II, III & Elective paper	12	10-15	50	100	150	6
6. Skill Based elective paper / swayam/ other MOOC courses GE-1 Biosecurity and Biosafety in Public Health Laboratories	2	0	20	30	50	2

Veer Narmad South Gujarat University, Surat
Program outcome, Program specific oucome, course outcome
Program name: M. Sc. Microbiology

PO1: Master of Science in Microbiology is designed to develop students for academic and industrial excellence. The course shall enable the students to develop their career in pharmaceutical and fermentation industries. The course emphasizes on the applications of microbiology to address environmental problems and provide microbial remedial measures. The outcome of the study is the usage of knowledge in developing a sustainable environment. The major areas focused in the course is microbial diversity, environmental microbiology, molecular biology and genetic engineering, Biophysical techniques and instrumentations, biochemistry of molecules and molecular interactions, enzyme kinetics, microbial ecology and physiological adaptations, molecular pathogenesis, immunology and immunological techniques, fermentation technology, bioprocess engineering, pharmaceutical microbiology, microbial products and the applied subjects for the better understanding of the applications of microbiology.

PO2: Students shall be enabled to distinguish, differentiate, identify and classify various types of microorganisms. They shall be able to use various bioanalytical instrumentations and techniques to study various aspects of microbiology. The course shall develop capacitance to address environmental problems with microbial solutions. Students shall gain an understanding of the molecular pathogenesis of infectious diseases and advances in immunology. The study of fermentation technology and pharmaceutical microbiology shall prepare the students for various industries. The study of microbial products and the knowledge of industrial microbiology as well as microbial technology shall enable the students to envision themselves as bio entrepreneurs.

PO3: Students shall develop aptitude for research, learn to formulate hypothesis and design experiments to test the hypothesis. The research accomplished in their dissertations shall make them understand the relevance of microbiology in addressing the environmental problems and finding out microbial solutions and maintaining sustainable environment. Students shall be inclined towards research and shall learn to pursue and formulate plan of work to achieve the set objectives.

Program specific outcome:

PSO1: Student shall gain knowledge and skills aligned to microbial fermentation and microbial technology. They shall obtain polished skill set for analytical investigations related to microbial research and allied life sciences field.

PSO2: Student shall be empowered by the curriculum having theoretical, experimental and dissertation components in M.Sc. Microbiology. Multi-faceted learning approach shall provide student great chances to acumen in industrial and professional arena.

Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
MB 1001: MICROBIAL DIVERSITY

1. Course Code & Title

Course code: Core course 1
Course title: Microbial diversity
Course type: Core
Course credits: 04

2. Course overview and Course Objectives

The main aspect of this course is to study the diverse forms of microorganisms and principles underlying its classification, study of major phyla of the domain bacteria and archaea. The paper also includes the study of viruses, fungi and algae.

Course Objectives

- To study classification and identification of prokaryotic organism.
- To learn characteristics of archea and proteobacteria.
- To study structure, replication of viruses and emerging viral diseases.
- To increase understanding of classification and characterization of fungi and algae.

3. Course Content

UNIT 1	PROKARYOTIC TAXONOMY
1.1	Prokaryotic domain
1.2	Classification of prokaryotic organisms
1.3	Identification of prokaryotes
1.4	Numerical and polyphasic taxonomy
1.5	Prokaryotic systematic
1.6	Bacterial nomenclature
1.7	Taxonomic framework for prokaryotic systematic
1.8	Intellectual property of prokaryotes

UNIT 2	ARCHAEA AND PROTEOBACTERIA
2.1	The *Archaea* 2.1.1 Overview of *Archaea* 2.1.2 Phylum *Creanarchaeota,* 2.1.3 Phylum *Euarcheaeota*
2.2	The Proteobacteria 2.2.1 *Alphaproteobacteria*

	2.2.2 *Betaproteobacteria* 2.2.3 *Gammaproteobacteria* 2.2.4 *Deltaproteobacteria* 2.2.5 *Epsilonproteobacteria*

UNIT 3	VIROLOGY
3.1	Principles of virus structure
3.2	virus replication strategies
3.3	Viral conquest of the host cell
3.4	Emerging viral diseases
3.5	Viroids and prions
3.6	Plant phages: TMV
3.7	Protists viruses: Chlorella viruses
3.8	Animal viruses: HIVs and their replication
3.9	Bacteriophages: phage λ, phage Mu-1

UNIT 4	MYCOLOGY AND PHYCOLOGY
4.1	Natural classification of fungi 4.1.1 Members of kingdom Fungi 4.1.2 The species concept in fungi 4.1.3 The untrue fungi 4.1.4 Ecosystem mycology
4.2	Hyphal cell biology: Mycelium: the hyphal mode of growth, Spore germination and dormancy, The fungal lifestyle: colony formation, Mycelium growth kinetics
4.3	Fungal cell and tissue differentiation: Mycelial differentiation, Making spores
4.4	Arbuscular (AM) endomycorrhizas
4.5	Characteristics of algae 4.5.1 Structure of algal cell 4.5.2 Nutrition of algae 4.5.3 Classification of algae
4.6	Cyanobacteria 4.6.1 Ecology of Cyanobacteria 4.6.2 Classification

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

Unit 1: Students shall learn the principles of prokaryotic classification and bacterial nomenclature as well as the IPR of prokaryotes.

Unit 2: Students shall gain knowledge of few phyla of archea as well as proteobacteria

Unit 3: Students will gain an understanding of virus structure, replication as well as emerging viral diseases. They shall learn important virus of plant, animal and bacteria.

Unit 4: Students shall develop an understanding of classification and characterization of fungi, mycorrhiza, algae and cynaobacteria.

Recommended Learning Resources:

- Bergey's manual of systematic bacteriology, (2009) 2nd edition, vol 1 Springer. (ISBN; 978-0387-95041-9).
- Wiley J., Sherwood I., (2011), Prescott, Harley and Kleins Microbiology, 9th edition., Mc Graw Hill. (ISBN; 978-0073402406)
- David M. Knipe, Peter M. Howley, (2007). 5th edition., vol. 1, Fields Virology. (ISBN; 978-07817-6060-7)
- David Moore, Geoffrey Robson, Anthony Trinci, (2011) 21st century guidebook to fungi, Cambridge University Press. (ISBN; 978-0-521-18695-7)
- Robert Edward Lee, (2008) Phycology, Cambridge University Press. (ISBN; 978-0-521-14144-4).

Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
MB 1002: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

1. Course Code & Title

Course code: Core course II
Course title: Molecular biology and genetic engineering
Course type: Core
Course credits: 04

2. Course overview and Course Objectives

The course includes the study of structure of genetic material and molecular mechanisms in bacteria. It shall include the various tools and technology applied for the construction of rDNA and the applications of tools and techniques to carry out transfection in plants and animals.

Course Objectives

- To understand the structure and topology of genetic material and its replication.
- To gain an insight on the genetic code and the process of transcription and translation.
- To learn about the tools and techniques used in genetic engineering.
- To increase knowledge of varied application of rDNA technology.

3. Course Content

UNIT 1	GENOME ORGANIZATION AND REPLICATION
1.1	Nucleosomes
1.2	DNA Structure
1.3	DNA topology
1.4	RNA Structure
1.5	The replication fork
1.6	The specialization of DNA polymerases
1.7	DNA replication in prokaryotes
	1.7.1 Synthesis at the replication fork
	1.7.2 Initiation
	1.7.3 Binding and unwinding
	1.7.4 Finishing replication

UNIT 2	EXPRESSION OF THE GENOME
2.1	Transcription
	2.1.1 RNA polymerase
	2.1.2 Features of prokaryotic promoters
	2.1.3 The transcription cycle in Bacteria

2.2	Translation 2.2.1 Messenger RNA 2.2.2 Structure and role of tRNA 2.2.3 Ribosome structure 2.2.4 Genetic code 2.2.5 Initiation, elongation and termination of protein synthesis in prokaryotes

UNIT 3	TOOLS AND TECHNIQUES OF RECOMBINANT DNA TECHNOLOGY
3.1	Enzymes 3.1.1 Enzymes used in Genetic Engineering 3.1.2 Restriction Endonucleases 3.1.3 Ligation of DNA fragments using DNA Ligases
3.2	Vectors: plasmids as vectors in Genetic engineering, λ and M13 bacteriophages as cloning vehicle, phagemids, cosmids, YAC, BAC, HAC, MAC
3.3	Polymerase Chain Reaction
3.4	Construction of Genomic and cDNA libraries

UNIT 4	APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY
4.1	Nucleic acid as therapeutic agents 4.1.1 Anti-sense RNA 4.1.2 Interference RNA 4.1.3 Nucleic acid delivery
4.2.	Transfection of Plants 4.2.1 Plant Transformation with Ti plasmid 4.2.2 Ti plasmid derived vector systems 4.2.3 Plants as Bioreactors
4.3	Methods of Transgenesis in Animals 4.3.1 Retroviral Vector Method for mice 4.3.2 DNA microinjection method 4.3.3 Cre-loxP Recombination System

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

Unit 1**:** Students shall understand the structure, topology and structure of DNA and RNA. It shall also include the study of DNA replication and role of DNA polymerase in replication.

Unit 2: Students shall gain knowledge of transcription process, importance of genetic code and the process of translation.

Unit 3: Students shall learn about the various tools and techniques for rDNA technology.

Unit 4: Students shall develop an insight regarding the application of nucleic acids as therapeutic agents and the methods of plant transfection and animal transgenesis.

Recommended Learning Resources:

- Watson, J. D. et al (2017). Molecular Biology of the Gene. 7th edition., Pearson India Education Services Pvt. Ltd. (ISBN; 9780321762436)
- Glick B.R. and Patten C.L. (2017, 2018 Indian reprint). Molecular Biotechnology Principles and Applications of Recombinant DNA. 5th edition, ASM Press Washington DC, USA. (ISBN; 978-1-555-81936-1)
- Rastogi S. and Pathak N. (2016). Genetic engineering. 7th impression, Oxford University Press. (ISBN; 978-0195696578)
- Primrose S.B. and Twyman R.M. (2007), Principles of gene manipulation and Genomics. 7th edition. Blackwell Publishing, USA. (ISBN; 978-1-405-13544-3)

Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
MB 1003: ENVIRONMENTAL MICROBIOLOGY AND BIOFUELS

1. Course Code & Title

Course code: Core course III / Course elective 1
Course title: Environmental microbiology and biofuels
Course type: Core
Course credits: 04

2. Course overview and Course Objectives

The objective of the course is to enrich the students with the current problems and research being focused to address environmental problems. The understanding of principles of environmental microbiology and its application for sustainable development. The course focuses on aspects of waste water engineering and reuse of water, versatility of microbial ecology, bioremediation and biodegradation as well as intricacies of microbial fuels.

Course Objectives

- To understand the principles of microbial ecology and its strategic approaches and to learn microbial ecological phenomena.
- To gain knowledge of constituents of waste water and the treatment and use of wastewater.
- To learn about biodegradation and bioremediation by microorganisms and microbial transformations of pesticides and heavy metals.
- To understand the use of cellulose for ethanol technology and algal fuels.

3. Course Content

UNIT 1	MICROBIAL ECOLOGY
1.1	Principles of microbial ecology
1.2	Strategic approach to study microbial ecology
1.3	Microbial mats
1.4	Biofilms
1.5	Algal blooms
1.6	Endophytic microbes
1.7	Quorum sensing

UNIT 2	WASTEWATER TREATMENT AND REUSE
2.1	Constituents in wastewater treatment, sampling, analysis methods
2.2	Aggregate organic constituents
2.3	Types of biological processes for wastewater treatment
2.4	Biological nitrification, denitrification and phosphorus removal

2.5	Guidelines for planning and designing treatment plants and CETPs

UNIT 3	BIODEGRADATION AND BIOREMEDIATION
3.1	Biodegradation and Bioremediation
3.2	Bioremediation technologies
3.3	Biodesulfurization
3.4	Biotreatment of pharmaceuticals and nuclear wastes
3.5	Biotreatment of textile effluent, food and dairy industry
3.6	Biodegradation of dyes
3.7	Biodegradation of polymers
3.8	Microbial transformation of pesticides
3.9	Microbial transformation of heavy metals

UNIT 4	BIOFUELS AND BIOENERGY
4.1	Cellulosic ethanol technology 4.1.1 Enzymatic processes 4.1.2 Cellulosic hydrolysis and fermentation 4.1.3 Ethanol extraction 4.1.4 Process economics
4.2	Algal fuels 4.2.1 Microalgae: growth and harvesting 4.2.2 Algae oil extraction 4.2.3 Transesterification for biodiesel 4.2.4 Prospects and economics

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

Unit 1: Students shall learn the principles of microbial ecology and gain knowledge of microbial mats, biofilms, algal blooms, endophytes and quorum sensing by microorganisms.

Unit 2: Students shall gain insight on the constituents of waste water and the treatment of waste water and working of CETPs.

Unit 3: Students shall learn microbial degradation of dyes, polymers, biotreatment of pharmaceuticals, nuclear wastes, textile effluents, food and dairy as well as microbial transformations.

Unit 4**:** Students shall learn cellulosic ethanol technology, algal fuels and its economics.

Recommended Learning Resources

- T. M. Schmidt and M. Schaechter, (2012). Topics in ecological and environmental microbiology. edited by Academic press. (ISBN; 978-0-12-383878-0)
- Metcaff & Eddy Inc, (2002). Wastewater engineering: Treatment and Reuse, 4th edition, McGraw Hill higher education. (ISBN; 9780070495395)
- Doble, M. & Anil kumar. (2005). Biotreatment of industrial effluents. Butterworth Heinemannan imprint of Elsevier. (ISBN; 9780080456218)
- Mohapatra P.K. (2010). Environmental Biotechnology, I.K. International. (ISBN 9788188237548)
- Sungyu Lee and Shah Y.T., (2013). Biofuels and Bioenergy Processes and Technologies, CRC Press. (ISBN 978-1-4200-8955-4)

Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
Elective paper 1
MB 1004: BIOPHYSICAL TECHNIQUES AND INSTRUMENTATION

1. Course Code & Title

Course code: Elective paper 1
Course title: Biophysical techniques and instrumentation
Course type: Elective (AECC)
Course credits: 04

2. Course overview and Course Objectives

This course is to learn the principles of detection and measurement systems and principles of the major molecular techniques to study the prokaryotes. The study also emphasizes the study of the various separation techniques and the spectroscopic techniques for the detection of bio-analytes.

Course Objectives

- To learn molecular techniques based on non-amplified and amplified nucleic acids and genetic fingerprinting methods.
- To study principle and different types of chromatographic techniques and electrophoresis.
- To understand UV/vis, IR and Mass spectroscopic techniques.
- To study NMR and X-ray spectrometers and its applications.

3. Course Content

UNIT 1	MOLECULAR TECHNIQUES
1.1	Non-amplified nucleic acid probes
1.2	Amplified nucleic acid technique 1.2.1 Signal Amplification technique 1.2.2 Target amplification technique 1.2.3 Probe Amplification technique
1.3	Genetic fingerprinting methods 1.3.1 RFLP to analyze lower eukaryotic pathogens and prokaryotes. 1.3.2 RFEL 1.3.3 RAPD 1.3.4 Other PCR-Based method for DNA fingerprinting.

UNIT 2	SEPARATION TECHNIQUES
2.1	Chromatographic techniques 2.1.1 Principles of chromatography 2.1.2 Chromatographic performance parameters 2.1.3 Partition chromatography 2.1.4 Adsorption chromatography 2.1.5 Thin layer chromatography 2.1.6 Gel permeation chromatography 2.1.7 Ion exchange chromatography 2.1.8 Affinity chromatography 2.1.9 High-Performance Liquid chromatography 2.1.10 Gas chromatography
2.2	Electrophoresis 2.2.1 Principle 2.2.2 Modes of electrophoresis 2.2.3 Support media 2.2.4 Different types of electrophoresis 2.2.5 Electrophoresis of DNA 2.2.6 Immuno-electrophoresis

UNIT 3	SPECTROSCOPIC TECHNIQUES
3.1	3.1.1 General properties of electromagnetic radiation 3.1.2 The electromagnetic spectrum 3.1.3 Interactions of radiation and matter 3.1.4 Transmittance, Absorbance & Beer's law 3.1.5 Measurement of Transmittance and Absorbance
3.2	UV/Vis Spectrometry 3.2.1 Instrument component 3.2.2 Types of instruments 3.2.3 Some typical instruments: Photometers & Spectrophotometers 3.2.4 Qualitative Applications of UV/Vis Spectroscopy
3.3	IR Spectrometry 3.3.1 Theory of IR absorption spectrometry 3.3.2 IR instrumentation 3.3.3 IR sources and transducers 3.3.4 Sample handling for IR spectrometry 3.3.5 Application of IR spectrometry
3.4	Mass spectrometer 3.4.1 Molecular mass spectra 3.4.2 Ion Sources 3.4.3 Mass Spectrometers: Instrument components 3.4.4 Mass Analyzers 3.4.5 Tandem Mass Spectrometry 3.4.6 Application of Mass spectrometry

UNIT 4	BIOPHYSICAL TECHNIQUES
4.1	Nuclear Magnetic Resonance spectrometers
	4.1.1 Theory of NMR: Quantum & Classical Description
	4.1.2 Types of NMR Spectrometers
	4.1.3 Theory of chemical shift
	4.1.4 NMR Spectrometers: Instrumentation
	4.1.5 Application of NMR
4.2	X-Ray Spectrometers
	4.2.1 X-Ray Spectrum
	4.2.2 Instrumentation for X-Ray Spectrometry
	4.2.3 X-Ray Diffractometers
	4.2.4 X-Ray Absorption meter
	4.2.5 X-Ray Fluorescent spectrometer
	4.2.6 Electron probe microanalyzer

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

Unit 1: Students shall gain an understanding of amplified nucleic acid techniques and applications of genetic fingerprinting methods.

Unit 2: Students shall learn the principle of chromatography and electrophoresis, types and application of separation techniques.

Unit 3: Students shall develop insight of principle of spectroscopic techniques and applications of IR and Mass spectrometer.

Unit 4: Students shall learn theory and applications of NMR and X-ray spectrometers.

Recommended Learning Resources:

- Murray, P. R., Baron, E. J., Pfaller, M. A., Tenover, F. C., & Yolken, R. H. (2005). Manual of clinical microbiology. 9th edition, Vol.2, American Society of Microbiology Press, Washington DC, (ISBN; 1-55581-255-4)
- Wilson, K. and Walker, J., (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th edition, Cambrige University Press (Low price edition), New York. (ISBN; 9780521731676)
- Ghosal, S., & AVASTHI, A. S. (2018). Fundamentals of bioanalytical techniques and instrumentation. PHI Learning Pvt. Ltd. (ISBN; 978-8120338555)
- Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Instrumental analysis. Cengage learning. (ISBN; 978-8131505427)
- Khandpur, R. S., (2008). Handbook of analytical instruments. 2nd edition, Tata McGraw-Hill Publishing Company Limited (New Delhi). (ISBN; 978-0070604605)

Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
Elective Paper 2
MB 1004: CELL CHEMISTRY AND MOLECULAR INTERACTIONS

1. Course Code & Title

Course code: Elective paper 2
Course title: Cell chemistry and molecular interactions
Course type: Elective (AECC)
Course credits: 04

2. Course overview and Course Objectives

This course is to learn the principles governing the structure and function of cell defined at cellular, chemical, physical, genetic and evolutionary level. It includes the understanding of interaction in these biomolecules so as to understand its structure and function. It gives an understanding of law of thermodynamics and energy generation as well as cell signaling pathways for the functioning of cell.

Course Objectives

- To learn the biochemistry of cell structure and function.
- To study principle of molecular interactions and its role in determining cell structure and function.
- To understand the laws of thermodynamics and principles underlying energy generation.
- To study cell signaling pathways.

3. Course Content

UNIT 1	CELL CHEMISTRY
1.1	Cellular foundations
1.2	Chemical foundations
1.3	Physical foundations
1.4	Genetic foundations
1.5	Evolutionary foundations

UNIT 2	MOLECULAR INTERACTIONS
2.1	Weak interactions in aqueous systems
2.2	Ionization of water, weak acids and weak bases
2.3	Separation, purification and characterization of proteins by electrophoresis
2.4	Determination of protein structure: primary, secondary and tertiary
2.5	Determination of protein structure: DNA based methods

2.6	Extraction, separation and determination of lipid structure

UNIT 3	BIOENERGETICS
3.1	Bioenergetics and thermodynamics 3.3.1 Laws of thermodynamics 3,3,2 Free –energy changes
3.2	Phosphoryl group transfers and ATP
3.3	Biological oxidation-reduction reactions 3.3.1 Half reactions and dehydrogenation 3.3.2 Reduction potentials 3.3.3 Universal and soluble electron carriers

UNIT 4	BIOSIGNALING
4.1	G protein coupled receptors and second messengers
4.2	Receptor Tyrosine kinases
4.3	Gated Ion channels
4.4	Nuclear Hormone receptors
4,5	Signaling in microorganisms
4.6	Regulation of cell cycle
4.7	Programmed cell death

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

Unit 1: Students shall gain an understanding of cell chemistry at varied levels.
Unit 2: Students shall develop insight regarding molecular interactions underlying the determination of cell structure and function.
Unit 3: Students shall gain knowledge of laws of thermodynamics and the principle governing energy generation in cell
Unit 4: Students shall learn the varied ways of a cell in signaling in cellular structure and functioning.

Recommended Learning Resources:

- Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). *Lehninger principles of biochemistry*. Macmillan.
- Voet, D., Voet, J. G., & Pratt, C. W. (2016). *Fundamentals of biochemistry: life at the molecular level*. John Wiley & Sons.
- Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). *Biochemistry*. Lippincott Williams & Wilkins.
- Garrett, R. H., & Grisham, C. M. (2012). *Biochemistry*. Cengage Learning.
- White, A. (1954). *Principles of biochemistry*. McGraw-Hill Book.

Veer Narmad South Gujarat University, Surat

M. Sc. Microbiology Semester-I

MBP-1005: PRACTICALS

1. Determination of burst size of coliphage lysate by One-step growth curve.
2. Extraction and detection (Electrophoretic & spectrophotometric) of bacterial genomic DNA.
3. Ligation of DNA fragments.
4. Amplification of gene by PCR.
5. Study of RFLP
6. Study of bacterial transformation
7. Extraction of total RNA from yeast.
8. Extraction of plasmid DNA from bacteria
9. Thin layer chromatography of sugars and amino acids.
10. Analysis of physico-chemical analysis of domestic water and wastewater.
    - Acidity
    - Alkalinity
    - Hardness –EDTA titrimetric method
    - Solids: TDS and TSS
    - Chlorine demand
    - Chloride
11. Analysis of aggregate organic constituents
    - Biochemical oxygen demand
    - Chemical oxygen demand
12. Enzyme substrate coliform test for drinking water.
13. Isolation and cultivation of cyanobacteria.
14. Study of bacterial growth curve.
15. Study of fungal growth by slide culture technique.
16. Decontamination of disposable and reusable lab materials.
17. Disinfection and validation test of laminar air flow cabinet.
18. Monitoring and validation of sterilization in autoclave.

- Note: A report has to be prepared for the industrial field visit/ educational tour undertaken during the semester.

Veer Narmad South Gujarat University, Surat

M. Sc. Semester I

MB 1006: Skill based Elective paper

BIOSECURITY AND BIOSAFETY IN PUBLIC HEALTH LABORATORIES

1. Course Code & Title

Course code: General Elective 1
Course title: Biosecurity and Biosafety in Public Health Laboratories
Course type: Skill based Elective paper
Course credits: 02

2. Course overview and Course Objectives

The course shall include the importance of biosafety in laboratories, biosafety level, risk assessment, preparations of samples for shipment and biosecurity program. It includes the good microbiological techniques and safe laboratory procedures. The course gives an understanding of health care waste management, including segregation, collection, transport, treatment and waste disposal, is fundamental to wider efforts to provide safe and quality health care. Student's will have an insight on biosecurity, biosafety and biomedical waste management.

Course Objectives

- To study the routes of exposure for a pathogen to a human being.
- To demonstrate and assess the proper use of PPE, best practices, biological containment, and be prepared to safely conduct research.
- To study and identify the role of the Biosafety Professional in Biomedical Research Laboratories.

3. Course Content

UNIT 1	Introduction to Biosafety and Biosecurity in Laboratories.
1.1	General Principles of Biosafety.
1.2	Different elements of containment.
1.3	Various Biosafety Levels.
1.4	Risk assessment in Biosafety.
1.5	Practices followed at various biosafety levels.
1.6	Biosecurity and Biosafety.
1.7	Laboratory biosecurity programme.
1.8	General preparation of shipments for transport.

UNIT 2	Safety equipment and safe laboratory procedures
2.1	Biosafety cabinets and its types.
2.2	Use of Biosafety cabinets in work practices and procedures.
2.3	Cleaning and Disinfection of Work Surfaces.
2.4	Decontamination of equipment.
2.5	Certification of Biosafety cabinet.
2.6	Good Microbiological Techniques-Safe laboratory procedures

UNIT 3	Biosafety precautions and Biomedical Waste Management
3.1	Specimen collection and handling.
3.2	Handling of lyophilized biological material.
3.3	General biosafety instructions for lab workers.
3.4	National Rules/Regulatory mechanisms for BMW management in India.
3.5	Biological Hazards, Asphyxiation Hazards, Explosion Hazards.

UNIT 4	Sterilization, disinfection and transport of infectious substances
4.1	Methods of sterilization.
4.2	Decontamination and Disinfectants.
4.3	Washing of laboratory glassware.
4.4	Quality Control
4.5	Classification of infectious substances.

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

- Students shall learn the principles related to biosafety in research and clinical laboratories, various biosafety levels, risk assessment and laboratory biosecurity program.
- Students shall gain knowledge of various types of biosafety cabinets used in laboratory and its use at various biosafety levels. Students shall learn the use of different disinfection procedures at work places that will help the researcher/student for effective result.
- Students shall understand the handling of infected specimens and waste generated in the laboratory. Students shall gain awareness of hazards and rules/regulatory mechanisms for Biomedical waste management.
- Students shall learn about basic aspects of various sterilization and disinfection methods used in laboratory and classification of infectious substances.

Recommended Learning Resources

- Government of India Ministry of Health. Biosafety Manual for Public Health Laboratories. (https://ncdc.gov.in/WriteReadData/l892s/File608.pdf)
- Training Manual on Biomedical-waste management for doctors, nurses, nodal officers and waste managers. Training component of the project "Environmentally sound management of medical wastes of India" Endeavour of GEF, UNIDO, MoEFCC and State Government of Gujarat, Karnataka, Maharashtra, Odisha and Punjab, 2018. https://www.biomedicalwastemanagementinindia.in/Resurces/5_Waste_handlers_manual_FLIP_CHART.pdf
- https://www.researchgate.net/publication/235990567_Biomedical_Waste_Management_Manual_for_Healthcare_Personnel_in_Grenada
- Laboratory biosafety manual Third edition. World Health Organization Geneva 2004. https://www.who.int/publications-detail-redirect/9241546506