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VEER NARMAD SOUTH GUJARAT UNIVERSITY
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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી

યુનિવર્સિટી કેમ્પસ, ઉદ્ધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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-: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની માઈક્રોબાયોલોજી વિષય ચલાવતી સંલગ્ન સ્નાતક તથા અનુસ્નાતક કોલેજોના આચાર્યશ્રીઓને તથા ડિપાર્ટમેન્ટના વડાશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૧-૨૨ અમલમાં આવનાર બી.એસસી.સેમે. -૩ અને ૪ તથા એમ.એસસી. સેમેસ્ટર-૩ અને ૪ (માઈક્રોબાયોલોજી) વિષયનાં અભ્યાસક્રમ અંગે ચર્ચા કરતા માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંક: ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૧૭/૦૬/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંક: ૬ અન્વયે મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ એકેડેમિક કાઉન્સિલએ તેની તા.૨૫-૨૬/૦૬/૨૦૨૧ ની સભાના ઠરાવ ક્રમાંક: ૨૫ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્દુપરાંત તેનો અમલ કરવો.

માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ભલામણ ક્રમાંક:૨

- :: 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 મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

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

- :: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા.૧૫/૦૩/૨૦૨૧ ની સભાનાં ઠરાવ ક્રમાંક:૨ 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 ક્રમાંક: ૨૫

- :: આથી ઠરાવવામાં આવે છે કે, માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિએ તેની તા.૧૫/૩/૨૦૨૧ની 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.

બિડાણ: ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૮૦૦૪/૨૧

તા.૨૮-૦૬-૨૦૨૧

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.

.....તરફ જાણ તેમજ અમલ સારૂ.

સંસ્કૃતિ સંચાલન નં. ૨૫/૦૩/૨૦૨૧

૨૫/૦૩/૨૦૨૧



Veer Narmad South Gujarat University,
Surat

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

(Effective from June, 2021)

W. K. Sharma

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

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

Paper No.	Paper Title	Theory	Practical	External	Internal	Total	Credit
		(Hrs/Week)					
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 phylogeny
- To study classical and molecular characteristics for microbial taxonomy
- To understand Bergey's manual of systematic bacteriology
- To study archaea and its classification
- To acquire knowledge of taxonomy of proteobacteria

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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 <i>Archaea</i>	
2.3	Phylum <i>Crenarchaeota</i>	
2.4	Phylum <i>Euryarchaeota</i> 2.4.1 Methanogens and Methanotrophs 2.4.2 Haloarchaea	

	UNIT 3	Taxonomy of Proteobacteria
		Teaching Duration: Lectures 08
3.1	Class <i>Alphaproteobacteria</i> : Order <i>Rhizobiales</i>	
3.2	Class <i>Beta Proteobacteria</i> : Order <i>Hydrogenophiales</i>	
3.3	Class <i>Gamma Proteobacteria</i> : Order <i>Enterobacteriales</i>	
3.4	Class <i>Delta Proteobacteria</i> : Order <i>Bdellovibrionales</i>	
3.5	Class <i>Epsilonproteobacteria</i>	

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

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 archaea, 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, Spirochaetes 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's Microbiology*. 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 Takaro K. P., (2006), *Microbiology: A Systems Approach*, 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.

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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 *Klebsiella mobilis* (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.

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- 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), 2ndEdi. 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.

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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
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	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.

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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.

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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.

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