પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો લાઈફ સાયન્સ (માઈક્રોબાયોલોજી) વિષયનો (એમ.એસસી. માઈક્રોબાયોલોજી) પ્રોગ્રામનો સેમેસ્ટર-૩ અને સેમેસ્ટર-૪ નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૪ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં લાઈફ સાયન્સ વિષયનાં પી.જી.નો અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં પી.જી.સેન્ટર ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

04/07/2024

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/એકેડેમિક/૮૯૧/૨૦૨૪
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૦૪/૦૭/૨૦૨૪

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં પી.જી.(લાઈફ સાયન્સ)નાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તેમજ સંલગ્ન ભવનનોનાં અધ્યક્ષશ્રીઓ તરફ....

નકલ સાદર રવાના:-

- માન.કુલપતિશ્રી/કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થે:

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH

BOARD OF LIFE SCIENCE STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR

M.Sc. (MICROBIOLOGY) PROGRAMME

(SEMESTER- III & IV)

EFFECTIVE FROM JUNE, 2024

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of M.Sc. MICROBIOLOGY
Faculty of SCIENCE
Effective from June 2024
SEMESTER-III & IV

1. The Course

    - The course is full time course comprising of four semesters. There will be four theory papers (three core papers and one interdisciplinary / multidisciplinary paper) and one combined practicals in first two semesters. The last two semesters offer choice of courses to the students where three core courses and one elective (to be chosen from two available) courses will be taught. Any elective course will be taught only when prerequisite number of the student enrols for that course. Students shall be required to submit at the time of practical examination at the end of each semester.
        - The laboratory Journal and diary of field work (Tour report) duly signed by the teachers concerned from time to time.
        - A set of assignments, submissions, preparations or materials illustrating the subject - matter as per syllabus for each semester.

2. Eligibility

    - The candidate with B.Sc. degree in Microbiology with minimum 45% is eligible for admission to M.Sc. Microbiology course.
    - A total of 20 seats are available in the Botany.
    - Students will be admitted as per the reservation policy in effect from time to time, as directed by the University.

3. Educational tour

    - The study/ educational tour is compulsory and part of Curriculum to study different ecosystems, botanical, zoological and microbiological places of interest anywhere in the country. Since the tour or tours are part of the curriculum, these can be conducted during any or all of the four semesters. However, in special cases, alternative of the educational tour will be decided and assigned to the student concerned, by the Staff Council of the Department.

4. Seminars / Assignments / Submission
    - Regular seminars will be organised on I and II Semesters and it is compulsory. Presentation on relevant topics, mostly from syllabus (oral and / or poster), is mandatory for the enrolled student. For each seminar, a student will be given marks, which will be added in the III Semester marksheet.
5. Attendance
    - Admitted students have to attend all the Lectures, Practicals and Seminars. A minimum prescribed attendance as per University rules is required to sanction a term grant. Students whose term is not granted will not be allowed to appear in the examination, and will have to join the same semester in the following year.
6. Semester wise distribution of marks
    - SEMESTER-I:

        4 Papers (100 Marks each*) : 400
        1 Combined Practical : 200
        Total : 600
    - SEMESTER-II:

        4 Papers (100 Marks each*) : 400
        1 Combined Practical : 200
        Total : 600

        *** 70 external + 30 internal**
    - SEMESTER-III:

        4 Papers (100 Marks each*) : 400
        1 Combined Practical : 200
        Total : 600
    - SEMESTER-IV:

        Dissertation / Project : 500 (400 + 100 viva)
        Seminar course (Intermediate presentation) : 50

        Submission (Research proposal and review article): 50 (25+25)

        Total : 600

7. The M.Sc. courses run by this Department are full time studies and as such, a student admitted to the Department is not allowed to join any other courses or study, or take up any paid service.
8. The candidate should bring all original mark sheets, certificates etc. At the time of the interview.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of M.Sc. MICROBIOLOGY
Faculty of SCIENCE
Effective from June 2024
SEMESTER-III & IV

Semester - III

Course code	Paper title	Hours / week	Credits	Marks		
				Int.	Ext.	Total
MICR 313	Genetic Engineering and Protein Engineering (Core)	04	04	30	70	100
MICR 314	Bioprocess Engineering and Fermentation Microbiology (Core)	04	04	30	70	100
MICR 315	Pharmaceutical and Medical Microbiology (Core)	04	04	30	70	100
$ MICR 316 A	Omics, Integrative Microbiology and Recent Advances in Microbiology (Elective)	04	04	30	70	100
MICR 316 B	Ecology and Environmental Microbiology (Elective)					
MICR PRAC 317	Combined Practicals	12	12	-	200	200
* MICR 419	Dissertation / Project	09	00	-		
	Total	**37**	**24**	**-**		**600**

$ Out of two elective papers 316 A and 316 B ***any one*** **is to be selected**

***** ***Dissertation / Project*** commences in III Semester but evaluated and Grade Points are to be added in 4th Semester.

Semester - IV

Course code	Paper title	Hours / week	Credits	Marks		
				Int.	Ext.	Total
MICR 418	*Dissertation / Project	20	20	-	500	500
MICR 419	#Seminar course	04	04	50	-	50
MICR 420	@Submission			50	-	50
Total		**24**	**24**	**-**		**600**

***** ***Dissertation / Project*** commences in 3rd Semester but evaluated and Grade Points are to be added in 4th Semester.

*# **Seminar Courses** are to be carried out as intermediate evaluation of dissertation progress in the 4th Semester.*

*@ **Submission** of research proposal and review article are to be submitted and evaluated in the 4th Semester.*

Semester - III

Micro-313 Genetic Engineering and Protein Engineering (Core)

Unit - 1

1. Concepts and application: Introduction to gene cloning; Application of Recombinant microorganisms.
2. Enzyme used in genetic engineering: Restriction endonuclease; DNA Polymerase: Reverse transcriptase; RNA polymerase; Alkaline Phosphatase; Polynucleotide Kinase; DNA ligase; Deoxyribonuclease; Ribonuclease; Phosphodiesterase; β Agarase; Uracil – DNA Glycoylase; Proteinase K; Lysosome; Topoisomerase
3. Cutting of DNA: Host Controlled Restriction Modification system; Nomenclature of Restriction Endonuclease; Types of Restriction Endonuclease; Recognition sites; Cleavage by Restriction endonuclease; variants of Restriction Endonuclease; Application of Restriction Endonuclease
4. Joining of DNA Fragments: Introduction; Ligation of DNA fragment using DNA ligase; ligation using homopolymer Tailing; Increasing versatility and Efficiency of ligation by modification of the Ends of Restriction Fragments; Ligation of PCR products

Unit - 2

1. Plasmid as a vector: pSC101; pSF124; Col E1; pBR 322 series; pUCSeries; pGEM series; pET,pBAD,
2. Bacteriophage as a vector:lambda phage; M13; Cosmid;Phagemids; Phasmids;Fosmid;
3. Advanced vector: Shuttle vector; Expression vector; Advanced gene trapping vector; Specializedvector for making SS DNA; facilitate Purification of cloned product; promotes solubilizationofexpressed product; promotes export of cloned product; PAC, YAC, BAC, HAC;
4. Other vectors : Chimeric vector; Gram negative bacteria other than *E. coli* as cloning vector; Gram positive bacteria as cloning vector; Plant and Animal Vectors; Fungi system other than yeast.

Unit-3

1. Introduction of DNA in to Host: Introduction; Introduction of DNA in to bacterial cells; Introduction of DNA in to yeast cells; Genetic transformation of Plants; Introduction DNA in to insects.
2. Construction of Genomic and c DNA Libraries: Introduction; Genomic Library; cDNA Library; PCR as an alternative to library Construction; Functional cloning; Positional cloning; Differential cloning
3. Techniques for Selection, Screening and characterization of trans formants: Introduction; Selectable Marker gene; Reporter genes; Screening of clone(s) of interest.
4. Nucleic Acid Blotting and Hybridization; Protein structure/ Function Fusion- based techniques

Unit-4

1. Site directed mutagenesis; Concept tools, technique of and application
2. Concept of protein engineering; Evolutionary Methods for Protein Engineering; Phage Display Systems for Protein Engineering; Cell Surface Display Systems for Protein Engineering; Cell-Free Display Systems for Protein Engineering;
3. Protein engineering in basic and applied biotechnology; Enhanced recovery and folding of recombinant proteins using Fusion protein strategies; Protein engineering for affinity purification; Stabilization of industrial enzymes by protein engineering; Engineering of Therapeutic Proteins
4. DNA Microarray technology: Concepts, tools and techniques, data generation and analysis, application; Microarrays for Bacterial Typing; Overview of protein Microarray technology

Suggested Practical

1. Isolation of genomic DNA from Bacteria
2. Isolation of genomic DNA from Plant
3. Isolation of genomic DNA from Blood
4. Isolation of genomic from fungi
5. Agarose gel electrophoresis and recovery of DNA from gel
6. Isolation of plasmid
7. Separation of protein by Native and SDS-PAGE
8. Isolation and extraction of RNA from bacteria
9. RFLP
10. RAPD
11. PCR amplification
12. Cloning in bacteria
13. Transformation of plants
14. Protein denaturation and in vitro Protein folding
15. BT cotton testing

Reference Books

1. Nicholl, An Introduction to Genetic Engineering
2. Reece, Analysis of Genes and Genomes
3. Primrose, Principle of gene Manipulation
4. Brown, Gene cloning and DNA Analysis
5. Howe , Gene Cloning and Manipulation
6. Wong , The ABC of gene cloning
7. Watson, Recombinant DNA genes and genomics
8. Budisa, Engineering the Genetic Code
9. Sheldon J. Park, Protein Engineering and Design
10. Allan Svendsen Enzyme Functionality Design, Engineering, and Screening
11. Lilia Alberghina Protein engineering in industrial Biotechnology by Lilia Alberghina
12. Joanna S. Albala, Protein Arrays, Biochips, and Proteomics The Next Phase of Genomic
13. Isaac, Discovery by Microarrays for an Integrative Genomics

MICRO-314: Bioprocess engineering and Fermentation Microbiology (Core)

Unit-1

1. The Basic Nutrient Requirements of Industrial Media; Criteria for the Choice of Raw Materials Used in Industrial Media; Some Raw Materials Used in Compounding Industrial media;
2. Growth Factors; Water; Some Potential Sources of Components of Industrial media, Carbohydrate sources, Protein sources; The use of plant waste materials in Industrial
3. Microbiology media: Saccharification of Polysaccharides, Starch, Cellulose, hemi-celluloses and lignin in plant materials
4. Growth Kinetics : Introduction; Kinetics of batch culture; Disadvantages of batch culture ; Advantages of continuous culture ; Growth kinetics for continuous culture;

Unit-2

1. Introduction; The basis of loss by contaminants; Physical and Chemical Methods of Achieving Sterility : Hot plates; High temperature sterilization; Dry heat sterilization; Sterilisation with filtration; Microwave sterilization; Chemical sterilization;
2. Batch sterilization; Continuous sterilization; The sterilization of the fermentor and its accessories; Media sterilization; Viruses (Phages) in Industrial Microbiology
3. Bioprocess Scale-up: Introduction; Scale-up procedure from laboratory scale to plant scale; Dynamic model and oxygen transfer rate in activated sludge; Aerobic wastewater treatment
4. Bioreactor : Introduction; Background; Bioreactor for batch type fermentation : The Aerated Stirred Tank, Anerobic Batch, Airlift bioreactors, Bubble column, Surface or Solid State; Bioreactor Configurations for Fedbatch Cultivation and Continuous fermentations

Unit-3

1. Amino Acids: Introduction, Microbial strain employed in aminoacid production, process control in amino acid fermentation, Production of Glutamic Acid by Wild Type Bacteria.
2. Production of Amino Acids Using Metabolically Engineered Organisms; Vitamin: Vitamin B12, Riboflavin, Carotenodis.
3. Production of Fermented Foods: Introduction; Fermented Food from Wheat: Bread; Fermented Foods Made from Milk; Fermented Foods from Corn; Fermented Vegetables;
4. Fermentations for the Production of the Stimulant Beverages: Coffee, and Cocoa; Production of Beer, Wines and Spirits.

Unit-4

1. Microbial Polysaccharides and Polyesters : Polysaccharides, Xanthan Gum, Polyesters.
2. Production of Organic Acids: Citric, acetic lactic, Gluconic and Itaconic acid.
3. Single Cell Protein (SCP): Substrates for Single Cell Protein Production; Microorganisms Used in SCP Production; Use of Autotrophic Microorganisms in SCP Production; Safety of Single Cell Protein; Nutritional Value of Single Cell Protein;
4. Production of Ergot Alkaloids: Nature of Ergot Alkaloids, Uses of Ergot Alkaloids and their Derivates

Suggested Practical

1. Amino acid Production
2. Wine Production
3. Production of extra-cellular polysaccharide
4. Production of Vitamin B12/Vitamin B2
5. production of Alcohol
6. Lab scale production and estimation of citric acid.
7. Isolation and Screening of citric acid producers
8. Isolation and Screening of Antibiotic producing microorganism
9. Production of Antibiotics streptomycin
10. Sterility testing of pharmaceutical product
11. Isolation, screening and optimization of Amylase producer
12. Isolation, screening and optimization of Protease
13. Purification of Amylase and protease
14. Immobilization of enzyme

Suggested Books:

1. Okafor, Modern Industrial Microbiology and biotechnology.
2. Najafpour, Biochemical Engineering and Biotechnology.
3. Shigeo, Biochemical engineering.
4. Whittaker, Principles of fermentation technology.
5. Alexander, Microbial Biotechnology.
6. Sikyta, Techniques in Applied Microbiology.
7. Vogel, Fermentation and Biochemical Engineering Handbook.
8. Mcneil, Practical Fermentation Technology.
9. Doran, Bioprocess engineering Principle.
10. Nathan, Modern Biotechnology.
11. Mansi, Fermentation microbiology and Biotechnology, Taylor and Francis
12. Waites, Industrial Microbiology: An Introduction, Blackwell publication
13. Michal, Bioprocess Engineering Basic Concept, Prentica Hall of India

14. Crueger, A text book of Industrial microbiology.
15. Volkmar, Microbial Fundamentals of Biotechnology
16. Peppler, Microbial technology: fermentation technology
17. Mansi, Fermentation microbiology and Biotechnology, Taylor and Francis
18. Najafpour, Biochemical Engineering And Biotechnology
19. Waites, Industrial Microbiology: An Introduction, Blackwell publication
20. Whittaker, Principles of fermentation technology.
21. Walker, Microbial Processes and Products
22. Michal, Bioprocess Engineering Basic Concept
23. Biotol series, Operational Models for Bioreactor,
24. Biotol series, Product recovery in Bioprocess technology,

Micro-315 Pharmaceutical and Medical Microbiology (Core)

UNIT-1

1. Introduction of the Drug Discovery and Development Process; Drug Discovery: Targets and Receptors;
2. Drug Discovery: Small Molecule Drugs; Drug Discovery: Large Molecule Drugs:
3. Computer aided drug discovery and QSAR
4. Drug Development and Preclinical Studies; Clinical Trial : Overview, Role of microbiologist in CRO

UNIT-2

1. Host-Parasite relationship: Nonspecific host defenses, virulence factors, normal flora and gnotobiologyEpidemiology : Infectious diseases, disease cycle, epidemiological methods, diagnostic principles, control, prevention, antimicrobial therapy.
2. Bacterial diseases: Pathogenesis, diagnosis, prevention and treatment of diseases caused by Staphylococcus, Streptococcus, Neisseria;
3. Viral diseases: SARS, bird flu , swine flu , Ebola,Zica etc.
4. Pathogenesis, diagnosis, prevention and treatment diseases caused by Shigella, Salmonella, Mycobacteria, Treponema;

UNIT-3

1. Immune response to infectious diseases: Bacteria, viruses, Intracellular parasites and Helminthes
2. AIDS & other immunodeficiencies: Primary & secondary immunodeficiencies.
3. Transplantation immunity: Immunological basis of graft rejection, clinical manifestations of graft rejection, immunosuppressive therapies, immune tolerance to allograft, clinical transplants.
4. Cancer and immune system: Malignant transformation of cells, oncogenes and cancer induction, tumour antigens, cancer immunotherapy.

UNIT -4

1. Vaccines: Designing vaccines for active immunization, purified macromolecules as vaccines, recombinant vaccines, DNA vaccines and multivalent vaccines.
2. Immunodiagnostics : Immunofiltration and Immunochromatography based rapid diagnostic methods
3. Introduction to Molecular Diagnostic Technology; Immunological Diagnostic Procedure; Monoclonal Antibodies; DNA diagnosis systems; Molecular Diagnosis of genetic disease
4. Overview and Current status of Anti HIV, Anti Malaria, Anti Tuberculosis and Anti Cancer treatment; Multidrug resistance : Introduction, development, detection and treatment

Suggested Practical:

1. Identification of Gm- and Gm+ (medically important) bacteria according to Bergey's manual.
2. Antibiotic sensitivity test
3. Immunology and Serology :

4. Single radial diffusion
5. Ouchterlony and immunoelectrophoresis
6. Widal
7. Hematology; RBC Count; Total WBC Count; Differential WBC Count; E.S.R. determination; Hb estimation
8. Blood Grouping: Slide technique and Tube technique;
9. Reverse and forward grouping/ Cross matching
10. Isolation and identification of Pathogens
11. VDRL test
12. Enzyme Linked Immuno Sorbent assay (ELISA)
13. Bleeding time and clotting time

Suggested Books:

1. Immunology; Roitt et al, Mosby Publications
2. Cellular and Molecular Immunology; Abbas and Litchman, Saunders Publication.
3. Kuby Immunology; Tizard RI, Saunders College Publishing.
4. Roitt's Essential Immunology; Roitt I, Blackwell Publishing.
5. Essential haematology A.V.Hoffbrand Black well
6. De Gruchy's Clinical Haematology in medical practice Frank Firkin, C ChesterMan Black well
7. Principles of haematology Peter Haen WCB
8. Haematology EmamanuelBesaHarwal
9. Abbas, A.K., Litchman, A.H., Pober. J.S, Cellular and Molecular Immunology. Second Edition. W.B.Saunders, USA, 1994.
10. Bellanti. J.A, Immunology III Ed, 1985.
11. C.V. Rao, An Introduction to Immunology. NarosaPublisihng House, India, 2002.
12. Chapel, H. and Halbey, Essentials of clinical Immunology ELBS London, 1986.
13. Coleman, R.M. Lambard , M. F. and Siccard , Fundamental of Immunology II Ed, 1992
14. Donald M. Weir, John Steward, Immunology VII Ed. ELBS, London, 1993.
15. Hue Davis, Introductory Immunology Champman and Hall Publisher, 1997.
16. Janeway, C, Immunology VI ED, Garland Science. New York, 2004.
17. K. R. Joshi, N.O. Osama, Immunology, Agrobios Ltd, India, 2000.
18. Kuby, J, Immunology VI Ed. W.H. Freeman and Company New York, 2004.
19. Poul, W.E, Fundamental of Immunology II Ed. Ravar Press, New York, 1990.
20. Riot. M.Ivan, Essential Immunology, VII Ed. ELBS and Black well Scientific Pub., 1998.
21. Tizarrd. I.R, Immunology an Introduction II Ed. Thomson Asia Pvt. Ltd,2004.
22. Tom Parker, M.Lesline, H.Collier, Principles of Bacteriology, Virology and Immunity.VII Ed, 1990.
23. Unani and Benacerraf, Text Book of Immunology.
24. Weir, Hand Book of experimental Immunology, Vol I,II.
25. http://www-immuno.path.cam.ac.uk/-immuno/part1.html
26. http://www.Iclark.edu/-reiness/immuno/lectures.html
27. http://www.hhmi.org/biointeractive/immunology/lectures.html
28. http://www.immuneweb.xxmc.edu.cn/immunology/immunology.html

Micro 316 Omics, Integrative Microbiology and Recent Advances in Microbiology (Elective)

Unit-1

1. Introduction to Holistic Biology of Microorganisms: Genomics, Transcriptomics and Proteomics; Understanding genes, genomes, "otheromes"; Introduction and basic concept of systems biology
2. Concepts tools and technique for Genomics
3. Applied aspects of Microbial genomics
4. Concepts tools, technique and applied aspects of Metagenomics

Unit-2

1. Concept, tools and techniques for transcriptomics
2. Applied aspect of transcriptomics
3. Concept, tools and techniques of proteomics
4. Applied aspect of proteomics

Unit-3

1. Concept, tools and techniques of metabolomics and interactomics
2. Applied aspect of metabolomics and interactomics
3. Concept, tools, techniques and application of system biology
4. Concept, tools, techniques and application of synthetic biology

Unit-4

Selected topics on recent developments in Microbiology from recent popular research paper/ review articles

Suggested practical

1. Metagenome isolation from Soil
2. Metagenome isolation from Water
3. Isolation of m RNA
4. PCR
5. Study of genome database
6. Study of Microbial genome annotation tools
7. Study of Metagenomics database
8. Study of Metagenome analysis tools
9. Study of proteomics database and tools

Reference Books

1. Woodford, Genomics, Proteomics and clinical bacteriology
2. Andreas, Computing for Comparative Microbial Genomics
3. Humphery-Smith, Microbial Proteomics
4. Rehm, Protein Biochemistry and Proteomics
5. Daniel, Introduction to Proteomics
6. Heinrich, Industrial Pharmaceutical Biotechnology
7. Richmond, Bio safety in Microbiological and Biomedical Laboratories
8. Rick, Drugs: From Discovery to Approval
9. Gad, Handbook of Pharmaceutical Biotechnology
10. Walsh, Biopharmaceuticals Biochemistry and Biotechnology
11. Hugo, Pharmaceutical Microbiology, Blackwell scientific Publications
12. Glick, Molecular Biotechnology

MICRO-317: Ecology and Environmental Microbiology (Elective)

UNIT-1

1. Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C, N, and P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).
2. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
3. Applied Ecology: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.
4. Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves)..

UNIT-2

1. Environmental Pollution; Types, Detection and Measurement of Pollutants; Environmental monitoring techniques
2. Water Pollution: sources, measurement and management;
3. Waste Water Treatment systems: primary, secondary and tertiary treatments; Biological Treatment Processes, Biochemistry and Microbiology of Aerobic and Anaerobic Treatment, Bioreactors for waste water treatment, Disinfection and Disposal
4. Global environmental problems: Ozone depletion, UV-B and greenhouse gases

UNIT-3

1. Environmental Pollution control: concepts of bioaugmentation, biostimulation, biodegradation, biosorption,
2. Bioremediation of xenobiotics, petroleum hydrocarbons, pesticides and heavy metals,elucidation of biodegradative pathways.
3. Treatment of industrial effluents: Dairy, Distillery, Sugar, and pharmaceutical Industries.
4. Management of municipal, biomedical and agricultural solid waste

UNIT-4

1. Environment friendly technologies: Biosurfactants, biofertilizers, biopesticides, microbially enhanced oil recovery, resource management, integrated waste management;
2. Production of biomass, biogas and biofuel from waste.
3. Pollution monitoring: chemical, biological and molecular methods;
4. Environmental impact assessment, Biodiversity and its conservation, GMOs and Biosafety.

Suggested Practical

1. Biodegradation of oil
2. Biodegradation of industrial effluent
3. Biodegradation of textile dye
4. Estimation of BOD
5. Estimation of COD
6. Estimation of phosphorus
7. Estimation of sulphate
8. Estimation of chloride
9. Study the Lip producers
10. Perform the Winogradsky Column

Suggested Books:

1. Eugene Odum,Fundamentals of Ecology, , Cengage
2. Kormondy Edward, Concepts of Ecology, Pearson Education
3. Smith,Elements of Ecology, Pearson Education
4. Santra, Fundamentals of Ecology and Environmental Biology,
5. Rana,Essentials of Ecology and Environmental Science, PHI
6. Ecology: The Experimental Analysis of Distribution and Abundance, Person
7. The Ecology Book (Big Ideas Simply Explained),DK, DK publication
8. M. Dash, Fundamentals of Ecology, McGraw Hill Education
9. Manuel C Molles, Ecology: Concepts and Applications, McGraw-Hill Higher Education
10. Alan,First Ecology, Oxford
11. PD Sharma,Ecology and Environment, Rastogi Publications

Semester – IV

MICR 418: Dissertation/Project

- Selection of the dissertation topic should be new and not repeated amongst the class students.
- Any reported case study will not be considered as a dissertation report.
- Dissertation carried out from other than the affiliated university/college will be liable to produce the attendance and work carried out certificate from the respected university/institute/industries. The original certificate should be attached to the dissertation report.

MICR 419: Seminar Course

- Seminar course includes the topic selection for dissertation.
- Seminar course covers the presentation of selected topic and intermediate evaluation of dissertation.

MICR 420: Submission (Research Proposal & Review Article)

- Preparation of research proposal prescribe format of state and nation funding agency such as GUJCOST, DST-SERB, DBT, ICMR etc. download from portal.
- Research paper and review article writing from the national and international publisher such as Current Sciences, Elsevier, Springer, Taylor and Francis, Wiley etc. download the instruction from selected journal.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of M.Sc. MICROBIOLOGY
Faculty of SCIENCE
Effective from June 2024
SEMESTER-III & IV

Question paper Skeleton

1. Do as direct (any seven out of eight questions each of one mark) **14**

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……

2. Answer the following (Two short Questions) **14**

A. Write a short note…….
B. Explain ……
C. Describe……

3. Answer the following (Two short Questions) **14**

A. Write a short note…….
B. Explain ……
C. Describe ……

4. Answer the following (Two short Questions) **14**

A. Write a short note…….
B. Explain ……
C. Describe……

5. Answer the following (Two short Questions) **14**

A. Write a short note……
B. Explain ……
C. Describe……

Note: Question 1 from the all four units and Questions 2,3,4, and 5 from each respective unit.