



પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગતનો લાઈફ સાયન્સ વિષયનો (બી.એસસી. બાયોટેકનોલોજી વિથ ઓનર્સ) નો સેમેસ્ટર-૩ નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજૂરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન, ૨૦૨૪ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.



[Signature]
૨૨/૦૬/૨૦૨૪
ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૧૧૫૯/૨૦૨૪
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, સરકારી
પોલીટેકનિક કેમ્પસ, ભક્તકવિ નરસિંહ મહેતા
યુનિવર્સિટી રોડ, ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા. ૨૨/૦૮/૨૦૨૪

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાના:-

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

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થે:

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



**BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH**



**BOARD OF LIFE SCIENCE STUDIES
FACULTY OF SCIENCE
SYLLABUS FOR
B.Sc. (BIOTECHNOLOGY) (HONOURS)
PROGRAMME
(SEMESTER- III)
MAJOR/MINOR/MULTIDISCIPLINARY
EFFECTIVE FROM JUNE, 2024**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY**Major/Minor/Multidisciplinary****Syllabus of B.SC.(Honors) as per NEP-2020****Faculty of Science****Effective from June 2024****Subject: Biotechnology****SEMESTER-III****SUMMARY OF THE SYLLABUS**

Sr. No	Course Group	Course (Paper) Title	Paper No.	Credit	Teaching Hours	Internal Marks	External Marks	Practical internal Marks	Practical external Marks	Total Marks	Page
1	MAJOR-5	Analytical tools and techniques	MAJBTT301	4	60	50	50	-	-	100	2
2	MAJOR-6	Metabolism and plant tissue culture	MAJBTT302	4	60	50	50	-	-	100	4
3	MAJOR-7	Combine Practical	MAJBTP303	4	60	-	-	50	50	100	7
4	MDC -3	Environmental biotechnology and pollution	MDCBTT301	4	60	25	50	25	-	100	9
Total				16							

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SEMESTER-III

Course Level	UG (5.0)	Internal Marks	50
Programme	B.Sc. Biotechnology	External Marks	50
Semester	III	Practical Internal	-
Category of Course	MAJOR-5	Practical External	-
Course Credit	04	Prac. External Exam Duration	-
Teaching Hours	60	Total	100
Course Code	MAJBTT301	Exam Duration	2 hrs.
Course Title	Analytical tools and techniques		

Course Objectives: by completing the course, students have:

1. To Understand the principles and applications of various microscopy techniques.
2. Comprehend the basic principles and applications of absorption fluorimetry, colorimetry, and spectrophotometry across different spectral ranges (visible, UV, infrared)..
3. To perform microscopic observations and quantitative testing to analyse microbial products.
4. Understand the principles and applications of various electrophoretic techniques used in molecular biology.
5. Develop hands-on skills in starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, and Western blotting.

Course Learning Outcomes: After completion of the course, students will be able to:

1. Demonstrate safe and effective techniques for handling microorganisms in a laboratory setting.
2. Analyse the microscopic structure of microorganisms to enhance their understanding of their characteristics.
3. Perform electrophoretic experiments, including starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel, pulse field gel, immuno-electrophoresis, isoelectric focusing, and Western blotting.
4. Describe the principles of chromatography and its importance in separating and analyzing biomolecules.

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Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	1.1 Simple microscopy, 1.2 phase contrast microscopy, 1.3 fluorescence microscopy 1.4 Electron microscopy (TEM and SEM) 1.4 dark field microscopy 1.5 confocal microscopy	15
	2	2.1 Absorption fluorimetry, 2.2 colorimetry, 2.3 spectrophotometry (visible, UV, infrared), 2.4 centrifugation, 2.5 cell fractionation techniques, 2.6 isolation of sub-cellular organelles and particles.	15
	3	3.1 Introduction to the principle of chromatography. 3.2 Paper chromatography and thin layer chromatography, 3.3 column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC.	15
	4	4.1 introduction to Starch-gel, polyacrylamide gel (native and SDS-PAGE), 4.2 agarose-gel electrophoresis, 4.3 pulse field gel electrophoresis, 4.4 immuno- electrophoresis, 4.5 isoelectric focusing, 4.6 Western blotting.	15

Suggested Reading:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. 3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. 4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

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Course Level	UG (5.0)		Internal Marks	50
Programme	B.Sc. Biotechnology		External Marks	50
Semester	III		Practical Internal	-
Category of Course	MAJOR-6		Practical External	-
Course Credit	04		Prac. External Exam Duration	-.
Teaching Hours	60		Total	100
Course Code	MAJBTT302		Exam Duration	2 hrs.
Course Title	Metabolism and plant tissue culture			

Course Objectives: by completing the course, students have:

- Gain a comprehensive understanding of the fundamental biochemical processes like metabolic pathways such as glycolysis, the TCA cycle, and biosynthesis of primary and secondary metabolites.
- Learn the principles and techniques of plant tissue culture, including tissue culture media preparation, aseptic techniques, micropropagation, callus induction, somatic embryogenesis, and regeneration of whole plants.
- Understand the applications of plant tissue culture in agriculture, horticulture, forestry, pharmaceuticals, and biotechnology, including the production of disease-free plants, genetic modification, and conservation of endangered species.

Course Learning Outcomes: After completion of the course:

- Students will demonstrate a deep understanding of plant metabolism, including the biochemical pathways involved in energy production, biosynthesis of essential molecules, and regulatory mechanisms.
- Students will be able to apply knowledge of plant metabolism to analyze and interpret experimental data related to metabolic pathways and their regulation in plants.
- Students will design and conduct experiments in plant tissue culture, demonstrating proficiency in experimental design, data collection, analysis, and interpretation.

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Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	METABOLISM - 1 - Carbohydrate Metabolism: Glycolysis, fate of pyruvate - Carbohydrate Metabolism: TCA - Carbohydrate Metabolism: Gluconeogenesis and HMP - Lipid Metabolism: β-oxidation of fatty acids - ETC and Oxidative Phosphorylation	15
	2	METABOLISM - 2 - Protein Metabolism: Transamination, Decarboxylation and Deamination - Protein Metabolism: Urea Cycle - Biosynthesis of Nucleic Acid - Photosynthesis - Inborn Errors of Metabolism	15
	3	MOLECULAR TRANSPORTATION AND SIGNALING - Composition and architecture of membrane - Solute transport across membrane - Signal transduction cascade - Regulation of cell cycle by protein kinase - Role of signal transduction by hormones	15
	4	PLANT TISSUE CULTURE - Concept of Totipotency (Dedifferentiation, redifferentiation, regeneration of whole plant). - Nutritional requirements for plant tissue culture: nutrient media – macronutrients and micronutrients, - Media additives: Carbon source, vitamins, amino acids - Plant growth regulators (cytokinin's, auxins, gibberellins) - Advantages and Limitations of Plant cell and tissue culture	15

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Suggested Reading:

1. Lehninger. Principles of Biochemistry, Nelson & Cox, 4th Edition.
2. Voet&Voet Donald. 3rd Edition. Fundamentals of Biochemistry, J/W.
3. Mathews, Van Holde, Biochemistry, 3rd Edition Pearson Education.
4. Garret and Grisham, Biochemistry, Thomsan Edition, 3rd Edn.
5. U Satyanarayan, Biochemistry, 3rd Edn, Books and Allied Pvt. Ltd.
6. Salisbury and Rose, Plant Physiology, 4th Edn, Wadsworth Pub.
7. Arthur M. Lask, Introduction to Protein Science, Oxford publication.
8. Stryer – Biochemistry. W.H.Freeman& Co.
9. Curriculum: B.Sc. Biotechnology, Semester I &II.
10. Saurashtra University, Rajkot, Gujarat (INDIA)10 of 17
11. Price & Steven, Fundamentals of Enzymology,3rd Edition
12. Cohn and Stumph. Outline of Biochemistry. Wiley eastern.
13. Creighton, proteins: Structure & Molecular Properties, Freeman Pub.
14. Zube's Biochemistry.4th Edition Macmillan.
15. Switzer and Garritty. Experimental Biochemistry WH Freeman. 2nd Edition
16. Hames and Hooper. 2000. Instant notes in Biochemistry. BIOS Sci. Publ.
17. Smith G.Biotechnology. Cambridge Univ. Press.
18. Geoffrey Cooper. The cell with CD- Rom. SinauerAsso. Incorp.
19. Elliott & Elliot.3rd Edition Biochemistry and molecular biology.
20. Seidman and Moore. 2000. Basic laboratory methods for biotechnology. Longman
21. Boyer, Concepts in biochemistry. Thomson
22. A.V.S.S. Rama Rao, A Text book of Biochemistry, , UBS Publisher

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Course Level	UG (5.0)	Internal Marks	-
Programme	B.Sc. Microbiology	External Marks	-
Semester	III	Practical Internal	50
Category of Course	MAJOR-7	Practical External	50
Course Credit	04	Prac. External Exam Duration	4 hrs.
Teaching Hours	60	Total	100
Course Code	MAJBTP303	Exam Duration	4 hrs.
Course Title	Combine Practical		

Course Objectives: by completing the course, students have:

- To Understand the principles and applications of various microscopy techniques.
- Comprehend the basic principles and applications of absorption fluorimetry, colorimetry, and spectrophotometry across different spectral ranges (visible, UV, infrared)..
- To perform microscopic observations and quantitative testing to analyse microbial products.
- Understand the principles and applications of various electrophoretic techniques used in molecular biology.
- Develop hands-on skills in starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, and Western blotting.

Course Learning Outcomes: After completion of the course, students will be able to:

- Demonstrate safe and effective techniques for handling microorganisms in a laboratory setting.
- Analyse the microscopic structure of microorganisms to enhance their understanding of their characteristics.
- Perform electrophoretic experiments, including starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel, pulse field gel, immuno-electrophoresis, isoelectric focusing, and Western blotting.
- Describe the principles of chromatography and its importance in separating and analyzing biomolecules.

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Practical Course Content

Sr. No	Practical content	Teaching Hrs
1.	Native gel electrophoresis of proteins	60
2.	SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.	
3.	Separation of subcellular organelles	
4.	Preparation of protoplasts from leaves.	
5.	Separation of amino acids by paper chromatography.	
6.	To identify lipids in a given sample by TLC.	
7.	To verify the validity of Beer's law and determine the molar extinction coefficient of NADH	
8.	Media preparation and sterilization for plant tissue culture	
9.	Microscopic examination of plant tissue	
10.	Media preparation and sterilization for callus formation	
11.	To demonstrate the principles of different microscopy	
12.	Isolation of pesticides degrading microorganisms	
13.	Isolation and characterization of cellulose degrading microorganisms	
14.	Isolation and characterization of PHA and PHB producing microorganisms	
15.	Demonstrate of ultracentrifugation technique	

Suggested reading

1. S.R. Thimmaiah, Standard methods in Biochemical Analysis, Kalayani Pub.
2. Sawhney and Randhir Singh, Introductory Practical Biochemistry, Narosa Pub.
3. BeeduSashidar Rao & Vijay Deshpande, Experimental Biochemistry, I K Int. Pvt. Ltd.
4. Plummer. An introduction to practical Biochemistry, 3rd Edition
5. J.Jayraman. Lab Manual in Biochemistry.
6. Biotechnology, U. Satyanarayan, Books and Allied
7. Practical manuals of Biotechnology, S. Chand

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Course Level	UG (5.0)	Internal Marks	25
Programme	B.Sc. Biotechnology	External Marks	50
Semester	III	Practical Internal	-
Category of Course	MDC-3 (Multidisciplinary Course-3)	Practical External	-
Course Credit	03	Prac. External Exam Duration	-
Teaching Hours	60	Total	75
Course Code	MDCBTT301	Exam Duration	2 hrs.
Course Title	Environmental biotechnology and pollution		

Course Objectives: After completing this course students have able to:

- Gain a comprehensive understanding of various environmental challenges such as pollution (air, water, soil), waste management, climate change, and their impact on ecosystems and human health.
- Appreciate the interdisciplinary nature of environmental biotechnology, which integrates knowledge from biology, chemistry, microbiology, engineering, and environmental sciences.

Course Learning Outcomes: After completion of the course:

- **Demonstrate Understanding:** Students will demonstrate a comprehensive understanding of key environmental issues such as pollution types (air, water, soil), their sources, and their impacts on ecosystems and human health.
- **Apply Biotechnological Principles:** Students will be able to apply principles of biotechnology to address environmental challenges, including bioremediation, bioaugmentation, and biodegradation of pollutants.
- **Analyze Case Studies:** Students will analyze and evaluate case studies and examples of successful applications of environmental biotechnology for pollution control and environmental restoration.
- **Evaluate Sustainability:** Students will assess the sustainability of biotechnological solutions in terms of environmental impact, economic feasibility, and societal acceptance.

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Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	ECOSYSTEM AND ITS COMPONENT 1.1 Terrestrial Biomes: - Deserts, Grasslands, Tundra & Forests and Aquatic Biomes: Freshwater & Saline Ecosystem 1.2 Biogeochemical Cycles: Nitrogen, Carbon & Sulfur cycle 1.3 Interaction within, between & among populations 1.4 Population Ecology, Population characteristics, Models of population growth and Interactions	15
	2	ENVIRONMENTAL POLLUTIONS AND ITS REMEDIES 2.1 Overview: Biodegradation of Hydrocarbon & Xenobiotics 2.2 Biodegradation of DDT, Nitrobenzene 2.3 An overview of process of Bioremediation & Biomagnification 2.4 Conventional Air Pollutants & Acid rain & Acid mine drainage	15
	3	MICROBIAL APPLICATION IN ENVIRONMENT 3.1 Physical, Chemical & Biological properties of water and waste-water 3.2 Primary, Secondary and Tertiary treatment processes 3.3 Biofertilizers and Biocontrol 3.4 Bioleaching and Bioplastics	15
	4	HORMONES 4.1 Introduction to Hormones: Endocrine and Exocrine 4.2 Plant Hormones and its functions 4.3 Animal Hormones and its functions 4.4 Types of Animal Hormones	15

Suggested Reading:

1. Prescott, Healey and Klein., Microbiology-5th International Edition, Tata-McGraw Hill publications, Delhi
2. Richard H. Baltz. Julian E Davies and Arnold L. Demain Manual of Industrial Microbiology and Biotechnology. 3rd edition, ASM Press (2010).
3. Daniel Forciniti. Industrial Bioseparation: Principles and practice. 1st edition edition, Wiley-Blackwell (2008).
4. Reed. G. Prescott and Dunn's Industrial Microbiology. CBS Publishers. (1999).
5. Demain, A. L. Industrial Microbiology and Biotechnology. 2nd Edition. (2001).

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6. EL Mansi. E.M.T., Fermentation Microbiology and Biotechnology. 2nd Edition, CRC Taylor & Francis (2007).
7. Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. Industrial Microbiology: An Introduction. Blackwell Science Publishers (2002).
8. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London
9. Frobisher M., Hinsdill, Crabtree and Goodherat, Fundamentals of Microbiology, 9th Edition. W.B Saunders Co. USA
10. Dubey, R.C.and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi.
11. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai
12. Casida LE, Industrial Microbiology, J. Wiley, (1968).

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Course Level	UG (5.0)	Internal Marks	-
Programme	B.Sc. Biotechnology	External Marks	-
Semester	III	Practical Internal	25
Category of Course	MDC-3 (Multidisciplinary Course-3)	Practical External	-
Course Credit	01	Prac. External Exam Duration	1 hrs.
Teaching Hours	30	Total	25
Course Code	MDCBTP301	Exam Duration	-
Course Title	Microbial Biotechnology (Practical)		

Course Objectives:

1. To study the basic about the microbial biotechnology and its Industrial applications.
2. To explore the the micoorganisms for the biotechnology bioproducts.

Course Learning Outcomes: After completion of the course:

1. Developed an understanding how microbiology is relevant to technological developments for agriculture and environment.
2. students developed hand in the industries bioproducts and fermentations.
3. Developed an understanding how developments microbially-based bioproducts for agriculture, industry and environment application.

Sr. No.	Practicals	Teaching hours
1	Study yeast cell immobilization in calcium alginate gels	30
2	Study enzyme immobilization by sodium alginate method	
3	Winogradsky column preparation	
4	Estimate the Phosphate content of soil	
5	Determine the pH, temperature and texture of soil	
6	Water holding capacity of soil	
7	Soil moisture by oven drying method	

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Paper Style:

Time: 2 Hours

Total Marks: 50

Instructions:

1. Illustrate your answer with neat and labelled diagrams.
2. Figure to the right side indicates full marks of questions.

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	Particulars	Unit	Marks
Que. 1	(1)	Unit 1	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 2	(1)	Unit 2	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 3	(1)	Unit 3	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 4	(1)	Unit 4	05
	(2)		05
	Or		
	(1)		05
	(2)		05
Que. 5	(1)	Unit 1 & 2	05
	(2)		05
	Or		
	(1)	Unit 3 & 4	05
	(2)		05
Total			50

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INTERNAL EVALUATION SCHEME (MAJOR)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Test	50	25
2	Assignment		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME (MDC)			
INTERNAL ASSESSMENT			
No.	Particulars	Marks	Weightage
1	Internal Practical	50	25
2	Internal Test		10
3	Field visit report/ class presentation		10
4	Attendance		05
	Total		50

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT		
No.	Particulars	Weightage
1	Practical Performance	40
2	Viva	10
	Total	50

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Paper Style:

INTERNAL EVALUATION SCHEME		
INTERNAL ASSESSMENT PRACTICAL		
No.	Particulars	Weightage
1	Perform any Four practical from the given list of exercises as per the instruction of the examiner.	40
2	Viva	10
Total		50

ASSESSMENT BY UNIVERSITY		
Que. No.	Particulars	Marks
EXTERNAL EXAMINER		
1	Perform any Three or Four practical from the given list of exercises as per the instruction of the examiner	40
2	Viva-voce	10
Total		50
