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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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-: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન સ્નાતક કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, પેટાસમિતિએ તૈયાર કરેલ એમ.એસસી.માઈક્રોબાયોલોજી (સેમેસ્ટર–૧,૨,૩,૪,) નાં પુનઃગઠિત અભ્યાસક્રમ અંગે માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિએ તેની તા. ૦૪/૦૫/૨૦૧૭ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે કરેલી નીચેની ભલામણ વિજ્ઞાન વિદ્યાશાખાએ તેની તા.૧૨/૦૭/૨૦૧૭ ની સભાના ઠરાવ ક્રમાંક : ૧૧ અન્વયે સ્વીકારી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ માનનીય કુલપતિશ્રીએ એકેડેમિક કાઉન્સિલવતી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

માઈક્રોબાયોલોજી વિષયની અભ્યાસસમિતિની તા. ૦૪/૦૫/૨૦૧૭ ની સભાની ભલામણ ક્રમાંક : ૨

:: આથી ઠરાવવામાં આવે છે કે, પેટાસમિતિએ તૈયાર કરેલ શૈક્ષણિક વર્ષ ૨૦૧૭–૧૮ થી અમલમાં આવનાર એમ.એસસી. માઈક્રોબાયોલોજી (સેમેસ્ટર–૧,૨,૩,૪,)ના પેપરો પર ચર્ચા વિચારણા કરી તેને સર્વસંમતિથી પાસ કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

વિજ્ઞાન વિદ્યાશાખાની તા.૧૨/૦૭/૨૦૧૭ ની સભાની ભલામણ ક્રમાંક : ૧૧

:: **આથી ઠરાવવામાં આવે છે કે, એમ.એસસી. માઈક્રોબાયોલોજી (સેમેસ્ટર–૧,૨,૩,૪,)ના પેપરો ક્રમશઃ એટલે કે સેમે.૧ અને ૨ જુન ૨૦૧૭ થી અને સેમે.૩ અને ૪ જુન ૨૦૧૮ થી અમલમાં આવે તે રીતે મંજુર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.**

બિડાણ: ઉપર મુજબ

Shree Ramkrishna Institute of
Computer Education & Applied Sciences
Inward No. 234
Date 20/7/17

ક્રમાંક : એકે./પરિપત્ર/૧૩૪૧૦/૧૭
તા. ૧૭–૦૭–૨૦૧૭

ઈ.ચા.કુલસચિવ 17/7/17

2019-2-15 14:18

પ્રતિ,

૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ સ્નાતક કોલેજોના આચાર્યશ્રીઓ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

...તરફ જાણ તેમજ ઘટતી કાર્યવાહી સારૂ.

Veer Narmad South Gujarat University, Surat

M.Sc. (Microbiology) Syllabus

(Effective from June, 2017 to April 2020)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. MICROBIOLOGY

Teaching & Evaluation Scheme

Semester – I

Paper No.	Paper Title	Theory (Hrs/Wk)	Practical (Hrs/Wk)	External	Internal	Total	Credit
MB-101	Taxonomy,Virology & Cytology	4	-	70	30	100	**4**
MB-102	Molecular Biology & rDNA Technology	4	-	70	30	100	**4**
MB-103	Bioanalytical techniques and Instrumentation	4	-	70	30	100	**4**
MB-104	Advances In Environmental Microbiology	4	-	70	30	100	**4**
Practicals		-	16	140	60	200	**8**
Total		**16**	16	420	180	600	**24**

Semester – II

Paper No.	Paper Title	Theory (Hrs/Wk)	Practical (Hrs/Wk)	External	Internal	Total	Credit
MB-201	Microbial Physiology	4	-	70	30	100	**4**
MB-202	Bioinformatics & Other "OMICS"	4	-	70	30	100	**4**
MB-203	Enzyme Kinetics & Technology	4	-	70	30	100	**4**
MB-204	Research methodology, Biostatistics and IPR	4	-	70	30	100	**4**
Practicals		-	16	140	60	200	**8**
Total		**16**	16	420	180	600	**24**

Semester – III

Paper No.	Paper Title	Theory (Hrs/Wk)	Practical (Hrs/Wk)	External	Internal	Total	Credit
MB-301	Fermentation Technology & Bioprocess Engineering	4	-	70	30	100	**4**
MB-302	Industrial Microbiology	4	-	70	30	100	**4**
MB-303	Molecular Pathogenesis and Immunology	4	-	70	30	100	**4**
MB-304	Advances in Pharmaceutical Microbiology	4	-	70	30	100	**4**
Practicals		-	16	140	60	200	**8**
Total		**16**	16	420	180	600	**24**

Semester – IV

Paper No.	Paper Title	Theory (Hrs/Wk)	Practical (Hrs/Wk)	External	Internal	Total	Credit
MB-401	Seminar Presentation	6	-	70	30	100	**4**
MB-402	Report on Industrial / Conference / Symposium visit	4	-	-	50	50	**4**
MB-403	Review Article	6	-	-	100	100	**4**
MB-404	**PROJECT/DISSERTATION**	-	16	250	100	350	**12**
Total		**16**	16	320	280	600	**24**
Total credit of the course							**96**

M.Sc. Semester - I

MB 101: TAXONOMY, VIROLOGY AND CYTOLOGY

OBJECTIVE: The main aspects of this paper includes Taxonomy and Classification of Bacteria & Virus, Fundamentals of Virology along with concepts of new emergent virus, it also includes molecular aspects of phage and different organelle studies.

Unit-1	**Taxonomy and classification of bacteria and virus**		
	Ref: Bergey's manual, 2 edition,vol 1	**Teaching Duration:**	**Lectures: 9**
1.1	Taxonomy and classification of bacteria		
1.2	Procaryotic domains		
1.3	Classification of Procaryotic organisms and the concept of bacterial species		
1.4	Identification of procaryotes		
1.5	Polyphasic Taxonomy		
1.6	Bacterial nomenclature		
1.7	Culture Collections		
1.8	Virus taxonomy		**(Ref. Fields)**
1.9	The Baltimore scheme of virus classification		**(Ref. Wagner)**
1.10	Banking diverse data in ICTVdB		**(Ref. Murray)**

Unit-2	**Fundamentals of virology**		
	Ref: Shors	**Teaching Duration:**	**Lectures: 7**
2.1	Virus properties, structure and morphology		
2.2	Viruses that challenge the definition of a virus		
2.3	One step growth curve		
2.4	Key steps of virus replication cycles		
2.5	New Viruses and Viruses that are reemerging		
2.6	Prions and viroids		

Unit-3	**Bacteriophages**		
	Ref: Fields	**Teaching Duration:**	**Lectures: 8**
3.1	Virulent Phages		
	3.1.1 Phage T4		
	3.1.2 Ø x174		
	3.1.3 MS2		
3.2	Temperate phages		
	3.2.1 Phage λ.		
	3.2.2 Phage Mu-1 as a Model Transposon.		
	3.2.3 Phage P 1 as a Model plasmid		
3.3	Evolution and natural biology of Phages		
3.4	Bacteriophage creates pathogenic bacteria in nature		**(Shors)**

Unit-4	Cytology		
	Ref: Campbell and Reece	**Teaching Duration:**	**Lectures: 8**
4.1	Eucaryotic cell structure		
4.2	The Nucleus		
4.3	Ribosomes		
4.4	Endoplasmic reticulum		
4.5	Golgi apparatus		
4.6	Lysosomes		
4.7	Vacuoles		
4.8	Mitochondria		
4.9	Chloroplast		
4.10	Peroxisomes		
4.11	Cytoskeleton		
4.12	Cell wall		
4.13	Extracellular matrix and intercellular junctions		

REFERENCES:

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2. Murray, Barron, Jorgenson, Pfaller, Yolken. *Manual of clinical microbiology*, 8th Edition, Vol. 2, ASM Press: ISBN: 1-55581-255-4.
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4. Alan. J. Cann, (2005). *Principles of molecular virology*, 4th Edition. Elservier academic press, ISBN: 0-12-088787-8.
5. David. M. Knipe, Peter M. Howley, (2007). *Fields virology*, 5th Edition Vol. 1, LWW, ISBN-13: 978-0-7817-6060-7.
6. Geoffrey M. Cooper, Robert E. Hausman, (2007). *The cell*, 4th edition, ASM press, ISBN-13:978-0-87893-220-7.
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8. Shors, T., (2013). *Understanding viruses*, 2nd edition, Jones and Bartlett, ISBN: 978-1-4496-4892-3.
9. Campbell, J. et al., (2015). *Biology: A Global Approach*, 10th edition, Pearson Education Pvt. Ltd.

MB 102: MOLECULAR BIOLOGY & rDNA technology

OBJECTIVE: The paper intends to deal basic reactions of molecular biology at its most advanced level.

Unit-1	**GENOME ORGANIZATION, REPLICATION**		
	Ref: Watson	**Teaching Duration:**	**Lectures: 8**
1.1	The Structures of DNA		
1.2	Nucleosome		
1.3	DNA topology		
1.4	The structure of RNA		
1.5	The replicon		(**Ref.Lewin)**
1.6	DNA replication		

Unit-2	**GENE EXPRESSION**		
	Ref: Watson and Baker	**Teaching Duration:**	**Lectures: 8**
2.1	Transcription 2.1.1 RNA Polymerase 2.1.2 Features of Prokaryotic promoters 2.1.3 Assembly synthesis and processing of prokaryotic transcripts 2.1.4 Regulation of transcription in prokaryotes		
2.2	Translation 2.2.1 Structure and role of tRNA 2.2.2 Ribosome structure 2.2.3 Genetic code 2.2.4 Translation in prokaryotes		
2.3	DNA topology		
2.4	The structure of RNA		
2.5	The replicon		(**Ref.Lewin)**
2.6	DNA replication		

Unit-3	**TOOLS OF RECOMBINANT DNA TECHNOLOGY**		
	Ref: Watson and Baker	**Teaching Duration:**	**Lectures: 8**
3.1	Enzymes and vectors 3.1.1 Restriction enzymes 3.1.2 DNA ligase 3.1.3 Vectors: plasmids, bacteriophage, M13 based vectors, phagemids, cosmids, YAC, BAC, HAC/ MAC		
3.2	Polymerase Chain Reaction		**(Murray)**
3.3	Genomic and chromosome libraries		**(Russel)**

Unit-4	APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY		
	Ref: Primrose	**Teaching Duration:**	**Lectures: 8**
4.1	DNA Fingerprinting & DNA Forensics		**(Watson)**
4.2	Gene Therapy		
	4.2.1 Human Gene Therapy		**(Glick)**
	4.2.2 DNA Vaccines		
	4.2.3 Gene Augmentation		
	4.2.4 Gene therapy for Cancer Cells		
4.3	Recombinant products: hormones and vaccines		**(Rastogi)**
4.4	Regulation of gene action by RNAi		**(Watson)**
4.5	Transgenesis in plants		
	4.5.1 Gene transfer to plants		
	4.5.2 Plants as bioreactor		
4.6	Transgenesis animals		**(Glick)**
	4.6.1 Retroviral vector method		
	4.6.2 Cre-*lox P* recombination system		

REFERENCES:

1. Lewin, B., (2004). *Genes VIII*. Pearson.
2. Watson, J. D. *et al* (2008). *Molecular Biology of the Gene.* 5th Edition, Pearson
3. Murray, Barron, Jorgenson, Pfaller, Yolken. *Manual of clinical microbiology*, 8th Edition, Vol. 2, ASM Press, ISBN: 1-55581-255-4.
4. Primrose, S. and Twyman, R. (2006). *Principles of gene manipulation & genomics*, 7th edition. Black well publishing, Malden.
5. Glick, B. R., Pasternak, J. J. and Patten C. L., (2010), *Molecular Biotechnology: Principles and Applications Recombinant DNA*, 4th edition, ASM Press.
6. Rastogi, S. and Pathak, N. (2009), *Genetic Engineering*, Oxford Uni. Press.

MB 103: BIOANALYTICAL TECHNIQUES AND INSTRUMENTATION

OBJECTIVE: The objective of the course is to introduce the students to the concepts of physical principles of detection and measurement systems. Emphasis will also be given to understand the principles of major experimental techniques applied to understand these physical problems. The course will cover theoretical aspects and applications of modern analytical techniques in Modern Biology.

Unit-1	**Molecular techniques**		
	Ref: Murray	**Teaching Duration:**	**Lectures: 7**
1.1	Non amplified nucleic acid probes		
1.2	Amplified nucleic acid technique		
1.3	Target Amplification technique		
1.4	Probe Amplification technique		
1.5	Post amplification detection and Analysis		
1.6	Current Application		
1.7	RFLP, RAPD, VNTR, STR and SNP analysis		

Unit-2	**Chromatographic techniques**		
	Ref: Wilson	**Teaching Duration:**	**Lectures: 8**
2.1	Principle and classification of chromatography 2.1.1 Partition chromatography 2.1.2 Adsorption chromatography 2.1.3 Thin layer chromatography 2.1.4 Gel permeation chromatography 2.1.5 Ion exchange chromatography 2.1.6 Affinity chromatography 2.1.7 High-Performance Liquid chromatography 2.1.8 Gas chromatography 2.1.8.1 GC-MS 2.1.8.2 LC-MS		

Unit-3	**Spectroscopic and X-ray diffraction techniques**		
	Ref: Khandpur	**Teaching Duration:**	**Lectures: 9**
3.1	Principles, Instrumentation and applications in biological sciences 3.1.1 UV-VIS spectroscopy 3.1.2 Infrared spectroscopy 3.1.3 Nuclear Magnetic Resonance spectroscopy. 3.1.4 Mass spectrometer 3.1.4.1 Basic mass spectrometer 3.1.4.2 Principle of operation 3.1.4.3 Types of mass spectrometers		

3.2	3.1.4.4 Components of a mass spectrometer 3.1.4.5 Application of mass spectrometry X-ray Diffraction 3.2.1 Principle & applications of Debey scharrer camera

Unit-4	**Electrophoretic techniques**		
	Ref: Walker	**Teaching Duration:**	**Lectures: 8**
4.1	General principles		
4.2	Support media		
4.3	Electrophoresis of proteins		
4.4	Electrophoresis of nucleic acids		
4.5	Capillary electrophoresis		
4.6	Microchip electrophoresis		

Reference:

1. Wilson, K. and Walker, J., (2010). *Principles and Techniques of Biochemistry and Molecular Biology*, 7th edition, Cambrige University Press (Low price edition), New York.
2. Khandpur, R. S., (2008). *Handbook of analytical instruments*. 2nd edition, Tata McGraw-Hill Publishing Company Limited (New Delhi).
3. Webster J. G., (2009). *Bioinstrumentation*, Student edition, Wiley India (P) Ltd. New Delhi.
4. Upadhyay, A., Upadhyay, K and Nath, N., (2003). *Biophysical Chemistry (Principles and Techniques)*, 8th edition, Himalaya Publishing House.
5. Khopkar, S. M., (2008). *Basic concepts of Analytical Chemistry*, 3rd edition, New age international publishers (New Delhi.
6. Sharma, B. K., (2005). *Instrumental methods of chemical analysis*, 24th edition, GOEL publishing house, Meerut.
7. Murray, Barron, Jorgenson, Pfaller, Yolken. *Manual of clinical microbiology*, 8th Edition, Vol. 2, ASM Press, ISBN: 1-55581-255-4.

MB 104: ADVANCES IN ENVIRONMENTAL MICROBIOLOGY

OBJECTIVE: The paper focuses on several aspects of waste water engineering and also on the application of microbes to solve several environmental problems. The paper also makes the students familiar with current research in making the environment safe and healthy. It also exploits the principles of environmental microbiology and applies this understanding for economic purpose.

Unit-1	**Characteristics of waste water**		
	Ref: Metcalf & Eddy	**Teaching Duration:**	**Lectures: 8**
1.1	Waste water constituents.		
1.2	Sampling and analytical procedures		
1.3	Physical characteristics		
1.4	Inorganic non-metallic constituents.		
1.5	Metallic constituents.		
1.6	Aggregate organic constituents.		
1.7	Microbial growth kinetics		

Unit-2	**Bioremediation**		
	Ref: Doble &Anilkumar	**Teaching Duration:**	**Lectures: 8**
2.1	Bioremediation technologies		
2.2	Biotreatment of waste 2.2.1 Textile effluent 2.2.2 Food and Dairy industry 2.2.3 Sugar and Distillery waste 2.2.4 Pharmaceuticals 2.2.5 Hospital waste 2.2.6 Waste from nuclear plants		
2.3	Biodesulfurization		

Unit-3	**Biodegradation**		
	Ref: M. Alexander	**Teaching Duration:**	**Lectures: 8**
3.1	Fundamentals of Biodegradation 3.1.1 Growth linked biodegradation 3.1.2 Acclimation 3.1.3 Detoxication 3.1.4 Activation 3.1.5 Bioavailability 3.1.6 Cometabolism 3.1.7 Inoculation		
3.2	Biodegradation of pesticides **(Doble&Anilkumar)**		

3.3	Biodegradation of polymers	**(Doble&Anilkumar)**
3.4	Biodegradation of dyes	**(Doble&Anilkumar)**

Unit-4	**Microbial ecology and Environmental Biotechnology**		
	Ref:	**Teaching Duration:**	**Lectures: 8**
4.1	Microbial ecology – New Directions, new importance **(BMSB Ed. 2 Vol 1)**		
4.2	Nucleic acid probes and their application in environmental microbiology **(BMSB Ed. 2 Vol 1)**		
4.3	Metagenomic libraries from uncultured microorganisms		**(Osborn)**
4.4	Microbial transformation of heavy metals		**(Mohapatra)**
4.5	Microbial transformations of Pesticides		**(Mohapatra)**
4.6	Bioprospecting		**(Sumit Ray)**
4.7	Investigative Biodeterioration		**(Allsopp)**
4.8	The control of Biodeterioration		**(Allsopp)**

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1. Hawksworth, D. L., (1995). *Biodiversity: Measurement and Estimation*, 1st edition, Chapman & Hall - The royal society.
2. Garrity, G. M. and Boone, D. R., (2001). *Bergey's Manual of Systematic Bacteriology Volume 1: The Archaea and the Deeply Branching and Phototrophic Bacteria*; 2nd edition, Springer.
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5. Alexander, M., (1999). *Biodegradation and Bioremediation*, 2nd edition, Academic Press.
6. Osborn, A.& Smith, C., (2005). *Molecular Microbial Ecology (Advanced methods)*, 1st edition. BIOS Scientific Publisher, Taylor & Francis group.
7. Hurst, C., (2007). *Manual of Environmental Microbiology*, 3edition, ASM Press.
8. Allsopp, D. *et al.*, (2004). *Introduction to Biodeterioration*, 2nd edition, Cambridge University Press.
9. Mohapatra P. K., (2010). *Environment Biotechnology*, I K International.
10. Ray S & Ray A K (2010) Biodiversity & Biotechnology, New Central Book Agency, London (ISBN: 81-7381-505-4)

LIST OF PRACTICALS
SEMESTER 1

1. One-step growth curve.
2. Digesting DNA with Restriction Endonuclease.
3. Ligation of DNA fragments.
4. Amplification of gene by PCR.
5. To study RFLP.
6. Extraction of total RNA from Yeast
7. DNA isolation from filamentous fungi.
8. Demonstration HPLC and GC
9. Thin layer chromatography of sugars, amino acids.
10. Extraction of plasmid DNA from bacterial cell
11. Proteins quantification by SDS-PAGE.
12. Analysis of domestic water and waste water

    12.1Physical

    - Acidity
    - Alkalinity
    - Hardness –EDTA titrimetric method
    - Chlorine demand
    - Solids : TDS and TSS

    12.2 Inorganic non-metallic constituents

    - Chloride

    12.3Aggregate organic constituents

    - Biological oxygen demand
    - Chemical oxygen demand

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