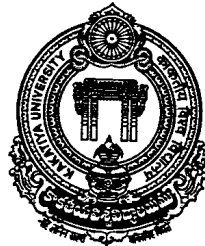


M.Sc. MICROBIOLOGY
SYLLABUS (SEMESTER –WISE)
w. e. f. the academic Year 2008-2009



DEPARTMENT OF MICROBIOLOGY
KAKATIYA UNIVERSITY
WARANGAL

Department Microbiology Kakatiya University

The Department of Microbiology, Kakatiya University is an infant Department of six years old. It has a humble beginning and made a steady progress to attain the full fledged status. Its origin can be traced back to 1983 – 1985 when it was started as one of the specializations in M.Sc Botany . In order to develop it into a full-fledged course, M.Sc. Microbiology, a two year course, was started during the year 1993-1994 *in lieu* with specialization. The staff engaging the classes of specialization was deputed to look after the course. In due course, a Ph.D. program was started and a separate Board of Studies was also constituted. Meanwhile, many affiliated colleges of University started offering both UG and PG courses in Microbiology. The dream of creation of independent department was realized during the year 2003-2004. Now, the department is exactly six years old. So far 14 batches with an overall strength of 333 students have come out of the portals of the Department.

Mission of the Department

- *It shall develop competent, committed and compassionate leaders with advanced level of knowledge skills and attitude required manage changes in field.*
- *It shall endeavor to continuously acquire, upgrade, disseminate knowledge, creating and developing skills of highly adaptable employees capable of working in both laboratory and managerial roles*
- *It shall encourage students to go beyond the classroom and learn on the basis research and applications.*
- *Uncompromising commitment to teaching and to develop practical laboratory skills.*

Achievements of the Department

The teachers have upgraded their subject knowledge time to time through research and undergoing specialized training at reputed universities and research institutes. The teachers have published a large number of papers in National and International journals and authored a number of books for undergraduate, postgraduate and research students. A number of research agencies like UGC, CSIR, DBT, AICTE, and ICMR have sponsored the research projects proposed by teachers. Recognizing the research potential of the department, UGC, New Delhi has identified this department for financial assistance under special Assistance Program (SAP-DRS).The research work is mostly of multidisciplinary nature. In less than ten years duration about twenty scholars were awarded Ph.D. degrees under the guidance of teaching faculty and all of them are well placed.

The students graduated from this department are getting job opportunities in teaching, industry, agriculture and health related fields. Many of the students are pursuing research in reputed National and International institutes and few of them have settled abroad. It is a matter of pride for the Department that all the students up to the last batch have been absorbed in one or other fields.

The department, through its research, is interacting with industry, research establishments in order to train the students. In brief, the department excels itself in teaching and research among all the departments of University. Under the aegis of this department, thirteen more affiliated colleges are offering M.Sc. Microbiology course with a total intake of 333 seats.

Succession of Heads

Prof. S. Ram Reddy (Course Coordinator)	2001-2004
Prof. M.A. Singara Charya	2004-2006
Dr. S. Girisham	2006-2008
Prof. S. Ram Reddy	2008

Succession of Chairpersons, Board of Studies (BOS)

Prof. A. Subramanyam	1997-1999
Prof. S. M. Reddy	1999-2000
Prof. V. Thirupathaiah	2000-2003
Prof S Ram Reddy	2003-2003
Prof. M.A.Singara charya	2003-2004
Prof. S. Ram Reddy	2004-2006
Prof. M.A.Singara Charya	2006-2008
Dr. S. Girisham	2008-

Future plans of the Department

- *To develop the state- of- art laboratories to train the students in latest technologies*
- *To improve the teaching by computer aided, NET based methodologies*
- *To establish interaction and collaboration with industry to enhance job opportunities*
- *To develop computer lab with biostatistics and bioinformatics software. Providing the accessibility to online journals*
- *To establish language laboratory for improving the communication and writing skills*
- *To modernize the curriculum to suit the need of industry and competitive examinations*
- *Personality development of the students keeping in view global demands*

Board of Studies in Microbiology –PG Courses

- 1) Dr. S. Girisham - Chairman
- 2) Prof. S. Ram Reddy - Head, Member
- 3) Prof M.A.Singra Charya - Member
- 4) Prof A.V.N.Appa Rao - Member
- 5) Prof G.Raguramulu - Member
- 6) Prof A.Sadanandam - Member
- 7) Prof. L.V. Rao - External Member
Osmania University, Hyderabad
- 8) Prof P.B.B.N. Charyulu - External Member
S.K. University, Ananthapur
- 9) Dr.R.S.Prakasham - External Member
IICT,Hyderabad
- 10) Prof Udayabhaskara Rao - External Member
Shanntha Biotech,Hyderabad

KAKATIYA UNIVERSITY
M.Sc. Microbiology
Syllabus contents and Scheme of Examination
For the candidates admitted from the academic Year 2008-2009

Semester	Paper Code No	Title of Paper	Instruct Hours	Duration of Examination	Internal Marks	External Marks	Min Marks *	Total
Semester I	MBT 101	Principles of Microbiology	4	3	20	80	32	100
	MBT 102	Bacteriology & Virology	4	3	20	80	32	100
	MBT 103	Biological Chemistry	4	3	20	80	32	100
	MBT 104	Cell biology & Enzymology	4	3	20	80	32	100
	MBP 101	Principles of Microbiology & Bacteriology & Virology	9	4	-	100	40	100
	MBP 102	Biological Chemistry & Cell biology & Enzymology	9	4	-	100	40	100
	Seminar		2	-	-	-	-	-
Semester II	MBT 201	Microbial Physiology	4	3	20	80	32	100
	MBT 202	Molecular Biology	4	3	20	80	32	100
	MBT 203	Advanced Immunology	4	3	20	80	32	100
	MBT 204	Biophysical Techniques & Instrumentation	4	3	20	80	32	100
	MBP 201	Microbial Physiology & Molecular Biology	9	4	-	100	40	100
	MBP 202	Advanced Immunology & Biophysical Techniques & Instrumentation	9	4	-	100	40	100
		Seminar		2	-	-	-	-

MBT = Microbiology Theory; MBP = Microbiology practical

*** Minimum marks required for pass out of University theory examination (80 Marks)**

KAKATIYA UNIVERSITY
M.Sc. Microbiology
Syllabus contents and Scheme of Examination
For the candidates admitted from the academic Year 2008-2009

Semester	Paper Code No	Title of Paper	Instruct Hours	Duration of Examination	Internal Marks	External Marks	Min. Marks *	Total
Semester III	MBT 301	Microbial Genetics & Genetic Engineering	4	3	20	80	32	100
	MBT 302	Bioinformatics & Computational Methods	4	3	20	80	32	100
	MBT 303	Bioprocess Technology	4	3	20	80	32	100
	MBT 304	Agricultural Microbiology	4	3	20	80	32	100
	MBP 301	Microbial Genetics & Genetic Engineering & Bioinformatics & Computational Methods	9	4	10	90	40	100
	MBP 302	Bioprocess Technology & Agricultural Microbiology	9	4	10	90	40	100
	Seminar		2	-	-	-		-
Semester IV	MBT 401	Environmental Microbiology	4	3	20	80	32	100
	MBT 402	Medical Microbiology	4	3	20	80	32	100
	MBT 403	Microbial Technology	4	3	20	80	32	100
	MBT 404	Theoretical practices, Laws & Regulations of Microbial Products	4	3	20	80	32	100
	MBP 401	Environmental Microbiology & Medical Microbiology	9	4	-	100	40	100
	MBP 402	Microbial Technology & Theoretical practices, Laws & Regulations of Microbial Products	9	4	-	100	40	100
		Seminar		2	-	-	-	

MBT = Microbiology Theory; MBP = Microbiology practical

* Minimum marks required for pass out of University theory examination (80 Marks)

FACULTY OF SCIENCE
M.Sc. MICROBIOLOGY
Model Question Papers (Theory)
Semester :I, II, III, IV Paper: I/II/III/IV
Time: 3 Hrs Max. Marks: 80

Answer ALL questions. All questions carry equal marks

1. **Writ short notes on :** (ONE question is to be set from each unit)
Each question carries 4 marks **4 x 4 = 16**

- a) **Question from Unit I**
- b) **Question from Unit II**
- c) **Question from Unit III**
- d) **Question from Unit IV**

(TWO questions are to be set from each unit)
Each question carries 16 marks **4 x 16 = 64**

2. **From Unit I**

a)

Or

b)

3. **From Unit II**

a)

Or

b)

4. **From Unit III**

a)

Or

b)

- 5 **from Unit IV**

a)

Or

b)

FACULTY OF SCIENCE
M.Sc. MICROBIOLOGY
Practical Examination
Scheme of Question Paper (Practical)
Semester – I / II / III / IV Paper - I, II, III, IV.

Time: 4 Hrs

Max. Marks: 100

- | | | |
|--------------------------------------------|----------|----------|
| 1. Major Experiment | | 20 Marks |
| a) Principle & procedure | 5 | |
| b) Conducting experiment | 10 | |
| c) Interpretation of results & conclusions | 5 | |
| 2. Major Experiment | | 20 Marks |
| 3. Minor Experiment | | 10 Marks |
| a) Principle & procedure | 3 | |
| b) Conducting the experiment | 5 | |
| c) Interpretation of results & conclusions | 2 | |
| 4. Minor Experiment | | 10 Marks |
| 5. Spotting (4 Nos) | (4x5=20) | 20 Marks |
| a) Identification | 2 | |
| b) Critical notes | 3 | |
| 6. Record | | 10 Marks |
| 7. Seminar / Internal | | 10 Marks |

(To be submitted by the in charge of the department duly signed by Principal)

Semester – I
Paper –I
MBT-101: PRINCIPLES OF MICROBIOLOGY

Unit - I

- a. **History and scope of microbiology: Discovery of micro organisms, germ theory of diseases; Major contributions and events in the field of microbiology. Relevance of microbiology.**
- b. **Microbial taxonomy: Definition and systematics, nomenclature rules, taxonomic ranks and major characteristics used in identification: morphological, physiological, biochemical, ecological, genetic and molecular. Numerical taxonomy.**
- c. **Recent Trends in exploitation of microbial diversity. Community level physiological profile, fatty acid methyl esterase analysis, G+C ratio, nucleic acid reassociation and hybridization and DNA micro arrays.**

Unit - II

- a. **Details of the ultra structure of prokaryotic cell. Differences between prokaryotic and eukaryotic cells**
- b. **Types of culture media, isolation, purification and preservation techniques**
- c. **Microbial growth kinetics, growth measurements, factors effecting the growth.**

Unit - III

- a. **General characters, thallus organization, cell structure, reproduction and classification of fungi.**
- b. **Physiology of fungi: Growth, nutrition, reproduction, heterothallism, heterokaryosis, parasexuality, sex hormones, spore dormancy and germination.**
- c. **General characters, reproduction, life cycles and economic importance of**
Mastigomycotina- *Albugo, Perenospora*
Zygomycotina- *Mucor, Pilobolus*
Structure, reproduction, molecular and biotechnological aspects of yeasts.

Unit – IV

- a. **General characters, reproduction, life cycles and economic importance of**
 - **Ascomycotina – *Penicillium, Neurospora***
 - **Basidiomycotina- *Puccinia, Agaricus***
 - **Deuteromycotina- General characters, classification.**
- b. **General characters, thallus organization, pigments, reproduction, classification and economic importance of green algae; diatoms, euglenoids.**
- c. **Morphology, reproduction and life cycles of *Trypanosoma, Leishmania, Plasmodium, Giardia, Entamoeba and Balantidium.***

Recommended Books

1. Sneath, P.H.A .and R.R. Sokal 1973 Numerical taxonomy .The Principles and Practice of Numerical Classification, San Francisco. W.H. Freeman
2. Sneath, P.H.A 1989 Analysis and Interpretation of sequence data for bacterial Systematic. The view of a Numerical taxonomist .*Syst.Appl.Microbiol.* 12:15-31
3. Woese,C.R.,Kandler,O. and M.L.Wheelis 1990 Towards a natural System of organisms: Proposal for the Domains Archea, Bacteria and Eucarya. *Proc. Nati, Acad, Sci.* ,87: 4576- 4570
4. Woese.C,R 1987 Bacterial evaluation, *Microbiological Reviews.* 51: 221-271
5. Madigan,M.T.,J.M.Mrtinko and J.Parker 2000 Brock Biology of Microbiology IX Ed .Prentice Hall International, Inc.
6. Balows, A.A.G. Thuper, M. Dworker, W. Harder, K.Schleifer 1991 The Prokaryotes , Springer, VerlogGunsales and Stainer, The Bacteria I-V vol. Academic press
7. Prescott, L.M., J.P Harley and D.AKlein, 2007 Microbiology VII Ed.Mc Grow Hill,
8. Davis R.Y. E.A. Adeberg and J.L. Ingram,1991 General Microbiology
9. Stainer General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
10. Schaechter.R. and Ledenberg.J 2004 The desk encyclopedia of microbiology. Elsevier Academic Press California.
11. Cook .T 2002 Microbial Biodiversity saving bacteria to save ourselves, Harvard Sci. Review 26-28.
12. Vandanme,D. B.Pot, M.Gillis, P. Devos, K. Kersters and J. Swings.1996 Polyphasic taxonomy, a consensus approach to Bacterial Systematic, *Microbiological Reviews.* 407-438.
13. Bacterial (Prokaryotic) phylogeny web page. 2006, http:
14. [www.bacterialphylogeny.com / Index .html.](http://www.bacterialphylogeny.com/Index.html)
15. Brun,Y.V. and Schinketes 2000 Prokaryotic developments ASM press
16. Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
17. Talaro, K.P. and A. Talaro 1999 – Foundations in Microbiology. Mc Graw Hil. Pub.
18. Davies *et al.*,1990 Microbiology 4thEdition Philadelphia, JB Lippincott
- 19 Mehrotra RS and KR Aneja. An Introduction to Mycology, New Age Publishers
- 20 Alexopoulos CJ et al, Introductory Mycology 4th Edition
- 21 The Fungi: An Advanced treatise I-IV volumes (Ed) Ainsworth & Sussman; Academic Press.
22. Structure and Reproduction of algae FE Fritsch vol I & II
- 23 Fresh water algae of united States G. M. Smith
- 24 Introduction to the algae- Bold H.D and M.J. Wynne, Printice Hall.
- 25 Introductory Phycology – Trainor, F.R John Wiley, New York
- 26 Protozoology – Grell, Karl G .1973 Springer – Verlag, Heidelberg
- 27 The Biology of Protozoa – Sleigh, MA American Elsevier, New York

Semester – I
Paper –II
MBT 102: BACTERIOLOGY AND VIROLOGY

Unit I

- a. Systematic position of microorganisms in the living world. Classification of microorganisms: Haeckel's three kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese
- b. Historical account of bacterial classification. Detailed account of bacterial classification according to the 1st edition of Bergey's Manual of Systematic Bacteriology (up to sections).
- c. C). Detailed account of bacterial classification according to the 2nd edition of Bergey's Manual of Systematic Bacteriology (up to orders).

Unit II

- a. Characteristics, classification and economic importance of the following sections (Bergey's Manual of Systematic bacteriology 1st edition). Spirochetes, Gram - negative aerobic rods and cocci: Facultative anaerobic Gram - negative rods, Rickettsia and Chlamydia.
- b. Mycoplasma, Endospore-forming Gram - positive rods and cocci; Mycobacteria, Anoxygenic photosynthetic bacteria and Oxygenic photosynthetic bacteria.
- c. Aerobic chemolithotrophic bacteria, Archaea and Actinomycetes

Unit III

- a. Brief account of discovery of viruses, chemical composition of viruses; morphology, architecture, principles of symmetry with reference to T4, TMV, Adeno, Polio, Influenza, Rhabdo, Reo and HIV viruses. Nucleic acid diversity in viruses; sub viral particles- satellite viruses, viroids, DI particles and prions.
- b. Taxonomy of viruses: classification and nomenclature of viruses as per ICTV.
- c. Isolation, purification, cultivation, assay and characterization of plant, animal and bacterial viruses.

Unit IV

- a. Life cycles of bacterial viruses; one step growth curve, lytic and lysogenic cycles with reference to T4, ϕ and ϕ X 174. Importance of phages.
- b. Classification and nomenclature of plant viruses, replication of TMV and CaMV. Classification and replication of animal viruses (Adeno, Influenza, Herpes, Hepatitis and Retro viruses).
- c. Transmission and management of plant and animal viral diseases (interferons, antiviral drugs and vaccines etc.)

Recommended Books

- 1 Sneath, P.H.A .and R.R. Sokal 1973 Numerical taxonomy .The Principles and Practice of Numerical Classification, San Francisco. W.H. Freeman
- 2 Sneath, P.H.A 1989 Analysis and Interpretation of sequence data for bacterial Systematic. The view of a Numerical taxonomist .*Syst.Appl.Microbiol.* 12:15-31
- 3 Tom Parker, M. Lerline , H.Collier,1990,Principles of Bacteriology, Virology and Immunity, VIII Ed.
- 4 Woese,C,R 1981 Archeabacteria , *Sci. Am.* 244:98-122
- 5 Woese,C.R.,Kandler,O. and M.L.Wheelis 1990 Towards a natural System of organisms: Proposal for the Domains Archea, Bacteria and Eucarya. *Proc. Natl, Acad, Sci.* ,87: 4576- 4570
- 6 Woese, C. R 1987 Bacterial evolution, *Microbiological Reviews.* 51: 221-271
- 7 Madigan, M. T.,J.M.Mrtinko and J.Parker 2000 Brock Biology of Microbiology IX Ed .Prentice Hall Inter, Inc.
- 7 Holt, J.G, and N.R.Krieg, 1984-1989 Bergey's Manual of Systematic Bacteriology 1st Ed (Vol 1-4) Williams and Wilkins Co Baltimore,Springer.
- 8 Holt , J.G, and N.R. Krieg, P.H .A .Sneath, J.T.Staley and J.T. Williams ,1994 Bergey's Manual Determinative Bacteriology IX Ed. Williams and Wilkins Co Baltimore, Springer
- 9 Garrity George, M. Edieor-In Cheaf 2005 Bergey's Manual of Systematic Bacteriology II Ed. (Vol- I-V) .J.Brenner,K.R.Krieg, J.T.Stanly. Editors. Springer-Verlog
- 10 Garrity, M. George. Winters, B.S.Denise 2001 Taxonomic outline of the prokaryotic genera Bergeys Manual of Systematic Bacteriology. II Ed.
- 11 Balows, A.A.G. Thuper, M. Dworker, W. Harder, K.Schleifer 1991 The Prokaryotes , Springer, VerlogGunsales and Stainer, The Bacteria I-V vol. Academic press
- 12 Prescott, L.M., J.P Harley and D.AKlein, 2007 Microbiology VII Ed. Mc Grow Hill,
- 14 Davis R.Y. E.A. Adeberg and J.L. Ingram,1991 General Microbiology
- 15 Stainer General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
- 16 Schaechter.R. and Ledenberg.J 2004 The desk encyclopedia of microbiology. Elsevier Acad. Press California.
- 17 Amann.R. I. Ludwing. W and Schleifer. K .M. 1995 Phylogenetic identification and in detection of individual microbial cell with cultivation. *Microbiological Reviews* 59, 143-169.
- 18 Cook .T. 2002 Microbial Biodiversity saving bacteria to save ourselves, Harvard Sci. Review 26-28.
- 19 Vandanme,D. B.Pot, M.Gillis, P. Devos, K. Kersters and J. Swings.1996 Polyphasic taxonomy, a consensus approach to Bacterial Systematic, *Microbiological Reviews.* 407-438.
- 20 Bacterial (Prokaryotic) phylogeny web page. 2006, [http: www.bacterial phylogeny.com / Index .html](http://www.bacterial_phylogeny.com / Index .html).
- 21 Brun,Y.V. and Schinketes 2000 Prokaryotic developments ASM press
- 22 Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
- 23 Talaro, K.P. and A. Talaro 1999 Foundations in Microbiology. Mc Graw Hil. Pub.
- 24 Davies *et al.*,1990 Microbiology 4thEdition Philadelphia, JB Lippincott
- 25 Alan J. Cann, 1997 Principles of Molecular Virology.(2nd edition).Academic Press, California.
- 26 Conrat HF, Kimball PC and Levy J.A. 1988 Virology. II edition. Prentice Hall, Englewood Cliff, New Jersey
- 28 Dimmock,N.J, Primrose,S. B.1994 Introduction to Modern Virology IV edition. Blackwell Scientific Pub, Oxford
29. Flint, S.J., Enquist, L.W., Krung, R. Racaniello, VR. and Skalka, A.M. (2004). Principles of Virology,ASM Press
- 31 Molecular Biology, Pathogenesis and Control, ASM Press, Washinton D.C.-
- 32 Roger Hull ,2002 Mathews' Plant Virology. (4thEdition). Academic press-A
33. Tom Parker, Leslie, M. and Collie, H.1990 Topley & Wilson's Principles of Bacteriology, Virology & Immunity (VIII Edition).
34. Ram Reddy S and Reddy S M. 2007 Essentials of Virology Scientific Publishers (India) Jodhpur
35. Knipe, DM *et al(eds)* 2001 Fields Virology Vol I , Lippincott Williams and Wilkins
36. Granoff,A and Webster R.G. 1999 Encyclopaedia of Virology Vol I, II and III San Diego Acad. Press
37. Krik.L.K. et al., 2004 Methods of studying soil microbial Diversity 58: 169-188

Semester – I
Paper –III
MBT 103: BIOLOGICAL CHEMISTRY

Unit I

- a. **Carbohydrates: Characters and classification; Monosaccharide -classification, structure and physico-chemical properties, glycosides, derivatives of monosaccharide - amino sugars, sugar acids and phosphorylated sugars.**
- b. **Disaccharides- sucrose, lactose and maltose. Structure, occurrence and biological significance of polysaccharides (starch, cellulose, chitin, glycogen and peptidoglycan).**

Unit II

- a. **Amino acids – Standard amino acids, nonstandard amino acids, D-amino acids, beta- and gamma-amino acids. Classification of amino acids. Analysis of mixtures of amino acids. Derivatives of amino acids.**
- b. **Proteins classification, organization and specificity of proteins, supramolecular assemblies of proteins, purification methods, glycoprotein and proteoglycans..**

Unit III

- a. **Lipids - classification of lipids; fatty acids – physico - chemical properties, separation, distribution in nature, characterization and saponification and iodine number.**
- b. **Nomenclature, outline structure, properties and functions of glycerides, neutral lipids (waxes, fats and oils) phospholipids, spingophospholipids and glycolipids. Steroids- plant sterols, ergosterol, stigmasterol and cholesterol. Important features of bacterial lipids.**

Unit IV

- a. **Vitamins: Classification- water and fat soluble vitamins, structure and their biochemical properties.**
- b. **Nucleic acids: Structure of purine and pyrimidine bases, nucleosides and nucleotides and their nomenclature. Types of RNA and DNA their structure.**

Recommended Books

1. Voet Donald and Voet J.G .3rd Edition , Biochemistry John Wiley and sons INC
2. Zubay .G. Biochemistry- Wm.C.brown Publishers
3. White .D. 2000 The Physiology and Biochemistry of prokaryotes-Oxford Univ.press
4. Lehninger A.L.Cox and Nelson -2006,4th Edition, Principles of Biochemistry –CBS Publishers and Distribution Pvt.Ltd
5. Gottschalk .G.1985 Bacterial metabolism –Springer Verlag
6. Stryer .L.5th Edition –Biochemistry . W.H.Freeman and Co
7. Doelle H.W.1975 Introduction to bacterial metabolism –Academic press
8. Wilson. K. and Walker.J.2000 Principle and Techniques –Practical Biochemistry-Cambridge University press
9. Murray, Harpers Biochemistry Mc Graw Hill
10. White , Handler and Smith-Biochemistry
11. West and Todd –Biochemistry Mac Millan Publishers
12. Corn and Stumpf, 5th Edition-Outlines of Biochemistry-Wiley Eastern Publications.
13. Upadhyaya and Nath- Biophysical chemistry (Himalaya Publications)
14. Morrison –Physical Biochemistry (Oxford)
15. Satyanarayana and Chakrapani 3rd Edition-Biochemistry Books and Allied Publishers
16. Trevor Palmer 2004 Enzymes, Affiliated East-West Press Pvt .Ltd
17. Dixon and Webb –Enzymes
18. Mathews,C.K.,K.E.van Holde and K.G.Ahern 1997 Biochemistry, 3rd , Pearson Edu.Pvt. Ltd.
19. Rawn, J.D.2004 Biochemistry Panima Pub. Corporation.
20. Voet Donald,J.W.Voet and Ch.W.Pratt, 2006 Fundamentals of Biochemistry 2nd ED.Jhon Willey & Sons Inc.
21. David,E. Metzler,2006 Biochemistry 2nd Ed Academic Press
22. Willium, H. Elliott and Daphne ,C.Elliot, 2004 Biochemisry and Molecular Biology 2nd ED Oxford University Press

Semester-I
Paper- IV
MBT 104: CELL BIOLOGY AND ENZYMOLOGY

Unit I

- a. Principles of bioenergetics – Laws of thermodynamics, enthalpy, entropy, concept of free energy: chemical equilibriums; structure and energetics of ATP molecule and other high energy compounds, types of phosphorylation.
- b. Oxidation reduction reactions, measurement of redox potentials. Biological energy transducers- electron carriers and their arrangement in mitochondria, chloroplasts and bacteria, Chemiosmotic hypothesis and proton motive force and energy transformations.
- c. Electron transport, oxidative phosphorylation, structure of ATP synthase; mechanism of ATP synthesis. Inhibitors and uncouplers

Unit-II

- a. Membrane structure and dynamics; diversity structure and physiology of membrane pumps, carriers and channels
- b. Basic elements of signaling system; extracellular signal molecules, receptors-ion linked, G- protein linked and enzyme linked receptors; calcium and NO as intracellular messengers. Convergence, divergence and crosstalk among different signaling pathways.
- c. Cell cycle – over view, phases of the cell cycle, cell growth and extra cellular signals, Regulations of cell cycle progression (cyclins and cyclin dependent kinases), cell differentiation and cell cycle check points.

Unit-III

- a. Introduction to enzymology - properties and classification of enzymes, IUB nomenclature; constitutive, inducible and marker enzymes.
- b. Mechanism of enzyme action, specificity of enzyme action, Fishers lock and key hypothesis, Koshland induced fit hypothesis, Haldane and Pauling concept.
- c. Enzyme activators, co-enzyme and co-factors in enzymatic catalysis, concept of enzyme and substrate specificity, chemistry of active centre, chemical modifications, theories of mechanism of enzyme action.

Unit-IV

- a. Enzyme kinetics of uncatalyzed / catalyzed chemical reactions - kinetics of single substrate enzyme catalyzed reactions, Michaelis Menton equation, determination of Vmax, Km, Kcat and their significance, Briggs and Haldane concept, Lineweaver-Burk plots, Eadie-Hofstee and Hanes plots.

- b. Enzyme inhibition - competitive, uncompetitive, non-competitive, mixed, partial, substrate, allosteric and irreversible. Isozymes and their metabolic significance, allosteric enzymes and co-operativity, ribozymes, abzymes.
- c. Stability of enzyme - enzyme stabilization by selection and genetic engineering, methods of immobilization, large scale enzyme extraction, enzyme purification, recovery and yield of enzymes. Criteria for testing purity of enzyme preparations and characterization of enzymes.

Recommended Books

1. Getzen berg, R.H.and E.E.Bittar, Cell Structure and Signalling, Elsevier Science.
2. Henderson et al., 1999 Cellular Microbiology.
3. Cossart et al., 2000 Cellular Microbiology
4. Phillip Sheeler and Donald E.Blanch Cell & Molecular Biology 3rd ED John Willey Pub.
5. Ernet, J.M. Helmreich, The Biochemistry of Cell Signalling, Oxford Press.
6. Cooper, The Cell.
7. De Roberts and De Roberts, 1998 Cell and Molecular Biology. Wavely Pvt. Ltd.
8. Voet and Voet J.G .3rd Edition , Biochemistry John Wiley and sons INC
9. Zubay .G. Biochemistry- Wm.C.brown Publishers.
10. White .D. 2000 The Physiology and Biochemistry of prokaryotes-Oxford Univ. Press.
11. Lehninger A.L.Cox and Nelson -2006, 4th Edition, Principles of Biochemistry –CBS Pub.
12. Gottschalk .G.1985 Bacterial metabolism –Springer Verlag
13. Stryer .L. 5th Edition –Biochemistry. W. H. Freeman and Co
14. Doelle H.W.1975 Introduction to bacterial metabolism –Academic press
15. Wilson. K. and Walker.J. 2000 Principle and Techniques –Practical Biochemistry-Cambridge University Press.
16. Murray, Harpers Biochemistry Mc Graw Hill.
17. White, Handler and Smith-Biochemistry.
18. West and Todd –Biochemistry Mac Millan Publishers.
19. Wiley Eastern Publications.
20. Morrison –Physical Biochemistry (Oxford).
21. Satyanarayana and Chakrapani 3rd Edition-Biochemistry Books and Allied Publishers.
22. Trevor Palmer – Enzymes, 2004 Affiliated East-West Press Pvt .Ltd.
23. Dixon and Webb –Enzymes.
24. Pollard T D and Earnshaw W. C .2008 Cell Physiology 2nd ed Saunders, Elsevier.
25. Dawes, E. A. 1986 Microbial Energetics, New York: Chapman.
26. Albert *et al.*, Molecular Biology of cell. 4th Edition Garland Publishing Inc.
27. Karp Gerald 2008 Cell and Molecular Biology John Wiley &sons, Inc.Lewin, B. 2004 Genes VIII. Oxford University Press, Oxford.
28. Principles of Biochemistry, 3rd Edition by Lehninger, Nelson & Cox.
29. White, D.1995 The Physiology and Biochemistry of Prokaryotes, Oxford University Press,
30. Boyer,P. D. 1997 .The ATP synthase- A splendid moleculare machine. Ann. Rev.
31. Nicholas, D. G. and Ferguson S.J. 1992 Bioenergetics, Academic Press.

Semester- I
Practical Paper- I
MBP 101: PRINCIPLES OF MICROBIOLOGY & BACTERIOLOGY &
VIROLOGY

1. Preparation of different types of media
2. Isolation and enumeration of bacterial and fungal population in air.
3. Enumeration of bacterial population in water.
4. Isolation and enumeration of bacterial and fungal population in soil
5. Demonstration of bacterial motility by Hanging drop technique
6. Staining techniques.
 - i) Gram staining
 - ii) Cell wall staining
 - iii) Endospore staining
 - iv) Flagella staining
 - v) Capsule staining
 - vi) Staining of PHB granules
 - vii) Staining of phosphate granules
7. IMVIC tests (Inole, methylred, Voges prausker and citrate test)
8. Oxidast test
9. Carbohydrate fermentation & Gas production
10. Catalase test
11. Gelatinase test
12. Caseinase test
13. Amylase test
14. H₂S production test
15. Nitrate reduction test
16. Litmus milk reactions
17. Urease test
18. Determination of bacterial growth by turbidometric method
19. Effect of temperature on bacterial growth.
20. Effect of osmotic pressure on bacterial growth.
21. Effect of p^H on bacterial growth
22. Cultivation of anaerobes
 - i) Shake culture technique
 - ii) Pyrogallic acid method
 - iii) Anaerobic gas pack jar
23. Growth kinetics (problems)
24. Estimation of chlorophyll in healthy and viral diseased plants
25. Study of symptomology of plant, animal and human diseases caused by viruses.
26. Estimation of proteins in healthy and viral diseased plants
27. Estimation of DNA in healthy and viral diseased plants
28. Estimation of RNA in healthy and viral diseased plants
29. Transmission of viruses by grafting
30. Transmission of viruses by aphids
31. Sap transmission of plant viruses
32. Isolation of phages from sewage
33. Propagation of animal viruses in embryonated eggs
 - a) Amniotic cavity
 - b) Chorioallantoic cavity
 - c) Yolk sac
34. Preparation of bacteriophage stocks
35. One step growth curve experiments.
36. Problems on i) Phage enumeration ii) Acid end point iii) Hemagglutination assay
37. Micrometry-measure the fungal spore dimensions by using ocular and stage micrometers and calculation of the mean and standard deviation
38. Demonstration of mycorrhizal association
39. Identification of fungal cultures, algal cultures, and Protozoa
40. Electron photo micrographic study of virus.

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester - I

Question Bank

Paper - I

MBP 101: PRINCIPLES OF MICROBIOLOGY & BACTERIOLOGY & VIROLOGY

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment

20 Marks

1. Micrometry-measurement of the fungal spore dimensions by using ocular and stage micrometers and calculation of the mean and standard deviation
2. Demonstration of mycorrhiza association
3. Demonstration of bacterial motility by hanging drop technique
4. Gram staining
5. Cell wall staining
6. Endospore staining
7. Flagella staining
8. Capsule staining
9. Staining of PHB granules
10. Staining of phosphate granules
11. Measurement of bacterial growth by turbidometric method

2. Major Experiment

20 Marks

1. Estimation of chlorophyll in healthy and viral diseased plants
2. Study of symptomology of plant, animal and human diseases caused by viruses.
3. Estimation of proteins in healthy and viral diseased plants
4. Estimation of DNA in healthy and viral diseased plants
5. Estimation of RNA in healthy and viral diseased plants
6. Transmission of plant viruses by grafting
7. Transmission of plant viruses by aphids
8. Sap transmission of plant viruses
9. Isolation of coliphages from sewage

3. Minor Experiment

10 Marks

- | | |
|-------------------------|-----------------------------------------------|
| 1. Indole test | 6. Carbohydrate fermentation & Gas production |
| 2. Methyl red test | |
| 3. Voges Proskauer test | 7. Catalase test |
| 4. Citrate test | 8. Gelatinase test |
| 5. Oxidase test | 9. Caseinase test |

10. Amylase test

11. H₂S production test

12. Nitrate reduction test

13. Litmus milk reactions

14. Urease test

15. Growth kinetics (problems)

16. Effect of osmotic pressure on bacterial growth.

17. Effect of p^H on bacterial growth

4. Minor Experiment

10 Marks

1. Cultivation of anaerobes by shake culture technique
2. Cultivation of anaerobes pyrogallic acid method
3. Cultivation of anaerobes by anaerobic gaspak jar system
4. Propagation of animal viruses in amniotic cavity of embryonated eggs
5. Propagation of animal viruses in chorioallantoic cavity of embryonated eggs
6. Propagation of animal viruses in yolk sac of embryonated egg
7. Preparation of bacteriophage stocks
8. One step growth curve experiments.
9. Problems on phage enumeration
10. Problems on acid end point
11. Problems on hemagglutination assay of viruses

5. Spotters Identification (4 Nos)

20 Marks

(Viruses = 1; Fungi = 1; Algae = 1; Protozoa = 1)

1. Viruses : a) Electron micrographic study: TMV, T₄ phage, λ-phage Mu phage, ϕ 174 Phage adsorption to *E. coli*, Adenovirus, Influenza virus
b) Symptomology; Small pox, FM disease, Tulip break, Leaf curl of papaya, Chilli mosaic, Phage plaques, pocks, animal virus plaques in monolayer cell culture, Golden yellow mosaic of beans.
2. Fungi : *Rhizopus, Mucor, Penicillium, Aspergillus, Alternaria, Curvularia, Nigrospora, Phoma, Fusarium, Rhizoctonia, Chaetomium, Pestalotiopsis.*
3. Algae : *Nostoc, Scytonema, Oscillatoria, Anabaena, Spirulina, Volvox, Scenedesmus,*
4. Protozoa : *Trypanosoma, Giardia, Balantidium, Leishmania, Entamoeba histolytica, Plasmodium, Peramoecium* (permanent slides)
5. Photographs of eminent microbiologists & their contributions

6. Record

10 Marks

7 Seminar / Internal

10 Marks

Semester- I
Practical Paper- II
MBP 102: BIOLOGICAL CHEMISTRY & CELL BIOLOGY AND
ENZYMOLOGY

1. Preparation of buffers, titration curve of glycine
2. Quantitative estimation of glucose by Anthrone method
3. Quantitative estimation of reducing sugars by 3,5, DNS method
4. Quantitative estimation of fructose
5. Quantitative estimation of proteins by Lowry's method
6. Quantitative estimation of Indole Acetic Acid
7. Quantitative estimation of Ascorbic acid
8. Quantitative estimation of DNA
9. Quantitative estimation of RNA
10. Quantitative estimation of Amino acid
11. Qualitative test of carbohydrates: Glucose, Xylose, Starch, Lactose, Maltose, Sucrose
12. Qualitative test of amino acids: Tryptophan, Tyrosine, Methionine, Arginine, Proline,
13. Qualitative test of proteins: Gelatin, Globulin, Albumin, Peptone, Casein
14. Determination of iodine number of fat
15. Qualitative test of lipids: Cholesterol
16. Demonstration of mitosis cell division stages
17. Demonstration of meiotic cell division stages
18. Evolution of kinetic constant of the purified enzyme.
19. Effect of different parameters on enzyme activity such as PH, temperature, time, enzyme concentration
20. Effect of inhibitors on enzyme activity
21. Immobilization of enzyme
22. Enzyme purification
23. Peroxidase isozyme separation by gel electrophoresis
24. Estimation of arginase activity
25. Estimation of catalase activity

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester – I

Question Bank

Paper - II

MBP 102: BIOLOGICAL CHEMISTRY & CELL BIOLOGY AND ENZYMOLOGY

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment 20 Marks
 1. Preparation of buffers, titration curve of glycine
 2. Quantitative estimation of glucose by Anthrone method
 3. Quantitative estimation of reducing sugars by 3,5 DNS method
 4. Quantitative estimation of fructose
 5. Quantitative estimation of proteins by Lowry's method
 6. Quantitative estimation of Indole Acetic Acid
 7. Quantitative estimation of Ascorbic acid
 8. Quantitative estimation of DNA
 9. Quantitative estimation of RNA
 10. Quantitative estimation of Amino acids
 11. Determination of iodine number of fat

2. Major Experiment 20 Marks
 1. Demonstration of mitotic cell division stages
 2. Demonstration of meiotic cell division stages
 3. Enzyme purification –Ammonium sulphate precipitation
 4. Estimation of arginase activity
 5. Estimation of catalase activity
 6. Evaluation of kinetic constant of the purified enzyme.
 7. Immobilization of enzyme

3. Minor Experiment 10 Marks
 1. Qualitative test of carbohydrates: Glucose, Xylose, Starch, Lactose, Maltose, Sucrose
 2. Qualitative test of amino acids: Tryptophan, Tyrosine, Methionine, Arginine,
 3. Qualitative test of proteins: Gelatin, Globulin, Albumin, Peptone, Casein
 4. Qualitative test of lipids: Cholesterol

4. Minor Experiment 10 Marks
 1. Mitosis cell division stages
 2. Meiotic cell division stages

3. Influence of PH on enzyme activity
4. Influence of temperature on enzyme activity
5. Influence of time on enzyme activity
6. Influence of enzyme concentration on enzyme activity
7. Influence of enzyme inhibitors on enzyme activity.

5. Spotters Identification (4 Nos)

20 Marks

- | | |
|--------------------------------------|--------------------------------------------------------------|
| 1. Structures of monosaccharides | 17. Telophase |
| 2. Structures of oligosaccharides | 18. Leptotene |
| 3. Structures of polysaccharides | 19. Zygotene |
| 4. Structures of amino acids | 20. Pachytene |
| 5. Structures of proteins | 21. Diplotene |
| 6. Structures of lipids | 22. Diakinesis |
| 7. Structure of a typical chromosome | 23. Immobilised cells |
| 8. Heterochromatin in metaphase | 24. Lock and key model |
| 9. Giant chromosomes | 25. Allosteric inhibitors |
| 10. Polytene chromosome | 26. Competitive enzyme activity |
| 11. Lamp brush chromosome | 27. Un-Competitive enzyme activity |
| 12. Cell cycle | 28. Non-Competitive enzyme activity |
| 13. Interphase | 29. Isozyme Patterns |
| 14. Prophase | 30. L-B Plots |
| 15. Metaphase | 31. Photographs and contributions of cell biology scientists |
| 16. Anaphase | |

6. Record

10 Marks

7 Seminar / Internal

10 Marks

Semester – II
Paper - I

MBT 201: MICROBIAL PHYSIOLOGY AND METABOLISM

Unit I

- a. **Nutritional diversity in micro organisms, nutritional types - autotrophy, heterotrophy, chemotrophy, phototrophy, lithotrophy and organotrophy. Nutrition –essentiality of major and minor elements, growth factors.**
- b. **Uptake of nutrients: passive diffusion, facilitated diffusion, active transport, group translocation, iron transport –siderophores.**
- c. **Chemotrophism: (sulphur, ammonia, nitrite, iron, hydrogen, carbon monoxide oxidizers) and their importance, reverse electron transport, CO₂ assimilation, reductive acetyl COA pathway. Chemoheterotrophism: Acetogens, methanogens, methanogenesis and its importance. Physiology and economic importance of methylophiles.**

Unit II

- a. **Phototrophism: Oxygenic and anoxygenic phototrophs and their diversity, photosynthetic pigments and their light absorption, basic photochemistry of PSI, PSII and light driven electron transport. Modes of CO₂ fixation (Calvin cycle, reverse TCA cycle, HP pathway), halobacterial photosynthesis. Anaplerotic reactions.**
- b. **Carbohydrate metabolism – various pathways underlying the utilization of different sugars (EMP, ED, HMP, phosphoketolase pathway) in microorganisms.**
- c. **Gluconeogenesis and its significance. Outlines of inter relationship between carbohydrate, protein and lipid metabolisms**

Unit III

- a. **Aerobic respiration: TCA cycle- intracellular location and reactions, amphibolic reactions. Glyoxalate cycle. Mechanisms of substrate – level phosphorylation. Respiratory electron transport in mitochondria and bacteria. Mechanism of oxidative phosphorylation.**
- b. **Anaerobic respirations: sulphate, nitrate, carbonate respirations and their ecological significance. Fermentations: Types of fermentations, alcoholic, lactate, propionate, mixed acid, butyrate and butanol fermentations and their industrial importance.**
- c. **Concepts of primary and secondary metabolisms. Biosynthesis of secondary metabolites with special reference to penicillin and polyketides, biotransformations. Bioluminescence, quorum sensing, signal transduction pathways.**

Unit IV

- a. **Lipid metabolism – Biosynthesis of glycerols, phospholipids and glycolipids. Oxidation of saturated and unsaturated fatty acids. Microbial metabolism of aromatic and aliphatic hydrocarbons (camphor, 2,4-D and toluene) with emphasis on the role of monooxygenases and dioxygenases in the ring cleavage (ortho, meta and gentisate cleavage) and reductive catabolism**
- b. **Protein metabolism – Assimilation of inorganic nitrogen and sulphur. Biosynthetic pathways of amino acids and their regulation with emphasis on tryptophan and histidine. Porphyrin biosynthesis; catabolism of amino acids (transamination, decarboxylation, deamination). Degradation of proteins-proteases, exo- endo peptidases.**
- c. **Nucleotide metabolism – Biosynthesis of purine and pyrimidine nucleotides-salvage and *de novo* pathways. Biosynthesis of deoxy ribonucleotides and regulation. Catabolism of nucleotides**

Recommended Books

1. Caldwell, D.R. 1995 Microbial Physiology and Metabolism, Wm. C. Brown Publishers, USA
2. Lansing M. Prescott, John P. Harley and Donald A. Klein. 2007 Microbiology (5th edition). McGraw-Hill Company, New York.
3. Larry McKane and Judy Kandel. 1996 Microbiology-Essentials and applications. (2nd edition). McGraw Hill, Inc., New York.
4. Moat, A.G. and Foster, J.W. 1988 Microbial Physiology (Second Edition). John Wiley & Sons,
5. Pelczar Jr, M.J. Chan, E.C.S., Kreig, N.R. 1993 Microbiology, Mc. Graw Hill. Inc, New York.
6. Salle, A.J. 1996 Fundamental principles of Bacteriology (7th edition). Tata McGraw-Hill publishing company limited, New Delhi.
7. White, D. 1995 The Physiology and Biochemistry of Prokaryotes, Oxford University Press,
8. S. Ram Reddy and S.M. Reddy, 2006 Microbial Physiology, Scientific Pub, Jodhpur
9. Donald Voet and Judith G. Voet, 1995. Biochemistry – Second Edition. John Wiley and Sons,
10. Lubert Stryer. 1995. Biochemistry. (4th edition). W.H. Freeman and company, New York
11. Zubay, G. 1998 Biochemistry WCB. Mc Graw – Hill, Iowa.
12. Principles of Biochemistry, 3rd Edition by Lehninger, Nelson & Cox
13. Harper's Review of Biochemistry by Martin, Mayer & Rodwell
14. Smith, Hill, Lehman, Lefkowitz, Handler & White. Principles of Biochemistry: General aspects
15. Outlines of Biochemistry (5th edition) Conn, Stumpf, Bruening & Doi.
16. Gottschalk G. 1986 Bacterial Metabolism 2nd ed. New York : Springer – Verlag.
17. Dawes, I.W., Sutherland, I.W. 1992 Microbial Physiology 2nd ed London: Blackwell scientific Publishers

SEMESTER – II
Paper –II
MBT 202: Molecular Biology

Unit I

- a. Chromosome organization in prokaryotes and eukaryotes.
- b. DNA replication: General principles, enzymology, various models of replication (semi conservative, rolling circle, unidirectional and bidirectional). DNA synthesis by reverse transcription, inhibitors of DNA replication
- c. DNA damage and repair: Types of damages (deamination, oxidative damage, alkylation, pyrimidine dimers), repair pathways - methyl directed mismatch repair, short patch repair, excision repair, recombination repair, SOS system.

Unit II

- a. Transcription: Structural features of rRNA, tRNA and mRNA and their functions. Transcription - general principles, basic apparatus, RNA polymerases, promoters, enhancers and other regulatory sequences, mechanism of transcription and inhibitors of transcription.
- b. Post – transcriptional modifications: Transcriptional attenuation, cutting and trimming of rRNA, mRNA modifications (capping, polyadenylation and splicing), cutting and modification of tRNA, catalytic RNA, group I and group II intron splicing and RNase P

Unit III

- a. Translation: Basic features of genetic code, Wobble concept, prokaryotic and eukaryotic ribosomes, RNA pol. I, II and III. Details of translation- initiation, elongation and termination, factors that control the above steps, inhibitors of protein synthesis.
- b. Post translational modifications: Protein folding, structural analysis, signal hypothesis protein targeting and secretion, *in vitro* transcription and translation systems.

Unit IV

- a. Regulation of gene expression – Operon concept, regulatory elements of operon - inducers, apo-repressors and co – repressors. Positive and negative regulations. Catabolite repression. Detailed account of structure, function and regulation of *lac* operon, *trp* operon and *ara* operon.
- b. Global regulatory responses: heat shock response, stringent response, SOS response and regulation by small molecules such as ppGPP, pppGPP and cAMP,
- c. Eukaryotic translational control – translational control of gene expression, inhibitory RNA(RNAi), Antisense RNA. Hormone and Environmental factors affecting gene expression. Coordinate regulation of unlinked genes – The Britten – Davidson model.

Recommended Books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Burrell, M.M. 1993. Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. 1995 Biotechnology – Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
4. Gerhardt, P. Murray, R.G., Wood, W.A., and Kreig, N.R. 1994 Methods for
- 5 General and Molecular Bacteriology, ASM Press, Washington D.C.
6. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology – Principles and Applications of Recombinant DNA, ASM Press, Washington D.C.
7. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
8. Murray Moo1992 Plant Biotechnology. Young, Pergamon Press.
9. Ratledge, C. and Kristiansen, B. 2001 Basic Biotechnology, II Edition, Cambridge University Press.
12. Winnacker, E.L. 1987 From genes to Clones: Introduction to Gene technology. V C H Publications, Federal Republic of Germany.
13. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
14. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
15. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
16. George M. Malacinski, David Freifelder. 1998 Essentials of Molecular Biology. Jones and Bartlett Publishers.
17. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
18. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.
19. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
20. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of the Gene, 4th edition, Benjamin/Cummings publishing company.
21. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
22. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
23. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
24. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers, London.
25. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
26. Twynan, R.M. 2003 Advanced Molecular Biology. Viva books Pvt. Ltd. New Delhi.
27. Ram Reddy S, Venkateswarlu K and Krishna Reddy V 2007 A Text Book of Molecular Biotechnology Himalaya Publishers Hyderabad
28. Old, R.W. and Primrose, S.B. 1994 Principles of Gene Manipulation, Blackwell Science Publication.

SEMESTER – II
Paper - III
MBT 203: ADVANCED IMMUNOLOGY

Unit-I

- a. **General principles of immunology: History of immunology: structure, composition and function of cells and organs involved in immune system.** Immune response (humoral and cell mediated) innate immunity, acquired immunity; immune haematology, blood groups, blood transfusion and Rh-incompatibility
- b. **Antigens – antibodies: Antigens-structure and properties; types-iso and allo; haptens adjuvants, antigen specificity. Membrane receptors for antigens; immunoglobulins; structure-heterogeneity- types and subtypes-properties (physico, chemical and biological); theories of antibody production.**

Unit-II

- a. **Antigen and antibody interactions: *In vitro* methods-agglutination, precipitation, complement fixation, immunofluorescence, ELISA, radio immunoassay; *in vivo* methods; phagocytosis, opsonization, neutralization.**
- b. **Complement system; complement components. complement activation - pathways, regulation of complement system, biological consequences of complement activation, complement deficiencies**

Unit –III

- a. **Immunogenetics: Structure, distribution and functions of histocompatibility antigens. Major histocompatibility gene complex (MHC) and the HLI-A system; gene regulation and immune response (IR) genes; HL-A and tissue transplantation- tissue typing- methods for organ and tissue transplantations in humans; graft versus host reaction and rejection.**
- b. **Tumor immunology: Tumor immunology - tumor antigens, Host immune response to tumors, antibody dependent cell cytotoxicity (ADCC), tumor escape mechanisms Immuno diagnosis and therapy**

Unit-IV

- a. **Immunopathology: Classification of immunopathological disorders. General account of immune deficiency disorders. Primary and secondary, phagocytic cell disorder. Gammopathies. Complement deficiencies. Hypersensitivity reactions: type I, II, III and IV the respective diseases, immunological methods of their diagnosis. Autoimmunity- mechanism and diseases .General account of interferon's, Lymphokines and cytokines.**
- b. **Immuno biotechnology: Active and passive immunization, Isolation of spleen cells, Myeloma cell lines used as fusion partner, fusion method, detection and application of monoclonal antibodies, recombinant antibodies, immunotoxins types of vaccines, whole - organism vaccines, recombinant vector vaccines, DNA vaccines, synthetic peptide vaccines, subunit vaccines, immunization procedures, adverse reactions to vaccines.**

Recommended Books

1. Bellanti. J.A.1985 Immunology III Ed.
2. Coleman, R.M. Lambard , M. F.and Siccard , 1992 Fundamental of Immunology II Ed.
3. Kuby, J. 2004 Immunology VI Ed. W.H. Freeman and Company New York.
4. Poul, W.E. 1990 Fundamental of Immunology II Ed. Ravar Press, New York.
5. Riot. M.Ivan 1998 Essential Immunology VII Ed. ELBS and Black well Scientific Pub. .
6. Tizarrd. I.R. 2004 Immunology an Introduction II Ed. Thomson Asia Pvt. Ltd
7. Ross. G.D. Immunology of the complement System
8. Riott, J.M. Brostoff, J.J and Male D.K. 1996 Immunology IV Ed. CV Mos by Pub. St. Loius.
9. Johnstone, A. and R. Thrope Immuno Chemistry.
10. Weir, Hand Book of experimental Immunology Voll,II
11. Unani and Benacerraf, Text Book of Immunology.
12. Stiter, Terr and Parlow Basic and Clinical Immunology
13. Tom Parker,M.Lesline,H.Collier,1990 Principles of Bacteriology, Virology and Immunity.VII Ed.
14. Chapel, H. and Halbey, 1986 Essentials of clinical Immunology ELBS London.
15. Donald M. Weir, John Steward , 1993 Immunology VII Ed. ELBS, London.
16. Hue Davis, 1997 Introductory Immunology Champman and Hall Publisher.
17. Peter,J Delves, Ivan M. Roit Ed 1998 Encyclopedia of Immunology II Ed.Acad, Press.
18. Ridklad, M. Aydl, 1995 Immunology II Ed. Baltimore, Hangkang, NMS Pub.
19. Janeway, C. 2004 Immunology VI ED, Garland Science. New Yark.

Semester – II
Paper –IV
MBT 204: BIOPHYSICAL TECHNIQUES & INSTRUMENTATION

Unit – I

- a. **Buffers:** Henderson and Hesselbach equation, Pka and Pkb. Preparation of buffers, measurement of pH, types of electrodes. **Viscosity:** specific, intrinsic and reduced viscosities, viscometers, determination of molecular size and shape through viscosity.
- b. **Osmosis:** Osmosis in relation to molecular size and molecular weight, osmometer; Partial, specific volume and diffusion co-efficient. Dialysis, membrane filtration and application.
Microscopy–Phase contrast, fluorescence microscopy, Electron microscopy- Transmission and scanning electron microscopes (TEM & SEM)

Unit-II

- a. **Centrifugation techniques:** Basic principles of centrifugation, standard sedimentation co-efficient and measurement of sedimentation co-efficient; analytical and preparative centrifugation, differential, rate zonal and equilibrium density gradient centrifugation. Applications in determination of molecular weight.
- b. **Chromatography:** General principles. Types- partition, adsorption; paper, thin layer, column chromatography, HPLC, GLC, gel filtration, ion exchange chromatography and affinity chromatography.

Unit-III

- a. **Electrophoresis:** General principles, Types - moving boundary electrophoresis, , paper electrophoresis, cellulose acetate, starch gel electrophoresis, polyacrylamide electrophoresis and agarose gel electrophoresis, pulse-field gel electrophoresis, horizontal and vertical electrophoresis, two dimensional electrophoresis, immuno electrophoresis, iso electric focussing electrophoresis, capillary electrophoresis. Blotting techniques -Southern, northern and western blottings.
- b. **Radioisotopic techniques:** Principle and applications of tracer techniques in biology. Radioactive isotopes, radioactive decay; Detection and measurement of radioactivity, Geiger-Muller counter, scintillation counter, autoradiography, tracer techniques, Commonly used isotopes in biology, labelling procedures and safety aspects.

Unit-IV

- a. **Spectroscopic techniques-** Principle, simple theory of absorption of light by molecules, electromagnetic spectrum
- b. **Instrumentation:** measuring the absorption and application of UV- visible spectrophotometer, Fluorescence spectroscopic, NMR, ESR and Mossbauer spectroscopic method

Recommended Books

1. Hames, B.D. and Rickwood, D. 1990 Gel Electrophoresis A practical Approach, Oxford University Press, New York.
2. Westermeier, R. 1993 Electrophoresis in practice VCH, Federal Republic of Germany.
3. Cotterill, R.M J. 2002 Biophysics An Introduction, John Wiley and Sons England.
4. Harrett, R.H. and Grisham C...M, 2004 Biochemistry III Ed. Cole publishing co. California.
5. Nolting, B. 2006 Methods in Modern Biophysics II Ed. Springer, Germany.
6. Patabhi, V. and Goutham .N.2002 Biophysica Kluwer Academic Pub. New York
7. Wilson Keith and Walker John 2005 Principles and Techniques and Biochemistry and Molecular Biology VI Ed. Cambridge University press, New York.
8. Narayana .P. 2000 Essentials of Biophysics New Age International Pub. New Delhi.
9. Stephenson, F.H. 2003 Calculation in molecular biology and biotechnology Academic Press, Elsevier Science .London.
10. Keeler, J.2002 Understanding NMR spectroscopy. John Wiley and Sons England.
11. Cavangh John et al 1995 Proton NMR, Spectroscopy principles and practice, Academic Press.
12. Holme. D.J. and H. Peck. Analytical Biochemistry.
13. A.Upadhyay, K.Upadhyay and N. Nath 2006 Biophysical Chemistry, Principles and Techniques Himalaya Pub. House.
14. Slater, R.J. 1991 Radioisotopes in Biology. A practical Approach, IRL Press, Oxford.
15. Holler, F.J.,D.A.Skoog and S.R.Crouch, 2007 Principles of Instrumental Analysis IV ED.Thomson, Brooks/Cole Pub. US

Semester- II
Practical Paper- I
MBP 201: MICROBIAL PHYSIOLOGY & MOLECULAR BIOLOGY

1. Bacteria growth curve
2. Growth of the bacteria at different P^H
3. Effect of different temperatures
4. Effect of osmotic pressure
5. Isolation of photosynthetic bacteria from sewage water
6. Estimation & characterization of bacterial chlorophylls
7. Enrichment cultivation of photosynthetic bacteria – Winogradsky column
8. Cultivation of anaerobic bacteria
 - i) Shake culture technique
 - ii) Pyrogallic acid
 - iii) Candle method
 - iv) Liquid paraffin method
 - v) Gaspak jar method
9. Determination of Thermal death time.
10. Biochemical tests for identification of bacteria.
 - i) Phenylalanine test
 - ii) Malonate test
 - iii) Nitrate reduction test
 - iv) Digestion of casein
 - v) Urease test
 - vi) Digestion of meat
 - vii) H₂S production
 - viii) Starch hydrolysis
 - ix) Decarboxylase test
11. Carbohydrate catabolism by microorganisms through oxidation and fermentation of glucose.
12. Fermentation of carbohydrates.
13. Bacterial endospore staining.
14. Enrichment cultures of sulphate reducing bacteria
15. Estimation of ethanol in fermentation broth.
16. Estimation of lactic acid in fermentation broth.
17. Estimation of DNA by DPA method
18. Estimation of RNA by orcinol method
19. Determination of purity of DNA
20. Restriction analysis and agarose electrophoresis
21. Isolation of DNA from sheep LIVER / yeast/ *E.coli*
22. Isolation of plasmid DNA
23. Problems on DNA characteristics
24. Problems related to transcription, genetic code, translation, gene regulation.

FACULTY OF SCIENCE
M.Sc. MICROBIOLOGY
Practical Examination

Semester – II

Question Bank

Paper - I

MBP 201: MICROBIAL PHYSIOLOGY & MOLECULAR BIOLOGY

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment

20 Marks

1. Bacteria growth curve
2. Growth of the bacteria at different P^H
3. Effect of different temperatures
4. Effect of osmotic pressure
5. Isolation of photosynthetic bacteria from pond water
6. Estimation and characterization of bacterial chlorophylls
7. Estimation of ethanol in fermentation broth.
8. Estimation of lactic acid in fermentation broth.

2. Major Experiment

20 Marks

1. Estimation of DNA by DPA method
2. Estimation of RNA by orcinol method
3. Determination of purity of DNA
4. Restriction analysis and agarose electrophoresis
5. Isolation of DNA from sheep LIVER / yeast/ *E.coli*
6. Isolation of plasmid DNA

3. Minor Experiment

10 Marks

1. Biochemical tests for identification of bacteria.
 - i) Phenylalanine test ii) Malonate test iii) Nitrate reduction test
 - iv) Digestion of casein v) Urease test vi) Digestion of meat
 - vii) H₂S production viii) Starch hydrolysis ix) Decarboxylase test
2. Carbohydrate catabolism by micro-organisms through oxidation and fermentation of glucose.
3. Fermentation of carbohydrates.
4. Isolation of sulphate reducers.
5. Isolation of *Thiobacillus ferroxidans*
6. Setting of Winogradsky column
7. Isolation and enumeration of nitrifiers

4. Minor Experiment

10 Marks

1. Problems on DNA characteristics

2. Problems related to DNA characteristics, transcription, genetic code, translation, gene regulation

5. Spotters Identification (4 Nos)

20 Marks

1. Cultivation of anaerobic bacteria - Shake culture technique
2. Cultivation of anaerobic bacteria - Pyrogallic acid
3. Cultivation of anaerobic bacteria - Candle jar method
4. Cultivation of anaerobic bacteria - Liquid paraffin method
5. Cultivation of anaerobic bacteria - Gaspak jar method
6. Photosynthetic bacteria
7. Phenylalanine test
8. Malonate test
9. Nitrate reduction test
10. Digestion of casein
11. Urease test
12. Digestion of meat
13. H₂S production
14. Starch hydrolysis
15. Decarboxylase test
16. Fermentation of carbohydrates.
17. Winogradsky column
18. Bacteria growth curve
19. Bacterial endospore
20. Plasmid DNA
21. Denitrification and evolution of N₂
22. ATPase
23. Structure of lac operon
24. Semiconservative model of DNA replication
25. Rolling circle replication
26. Nucleosomes
27. Prokaryotic chromosomes
28. Action of topoisomerases
29. t RNA
30. RNA splicing & spliceosome
31. DNA damages
32. Photographs and contributions of molecular biologists

6. Record

10 Marks

7 Seminar / Internal

10 Marks

Semester -II
Practical Paper- II
MBP 202: ADVANCED IMMUNOLOGY AND BIOPHYSICAL TECHNIQUES
& INSTRUMENTATION

1. Typing of human blood groups.
2. Differential staining of wbc by Leishman stain
3. Enumeration of RBC and WBC
4. Estimation of haemoglobin count in blood
5. Widal tests
 - i) Slide agglutination
 - ii) Tube agglutination methods
6. VDRL test (Venereal disease research laboratory)
7. Hepatitis-B Surface antigen test.
8. HCG test (Agglutination inhibition test)
9. ELISA test.
10. Tridot test
11. Detection of rheumatoid factor
12. Spot test for infections of Mononucleosis
13. RAPITEX CRP Test
 - i) Qualitative CRP
 - ii) Quantitative CRP
14. Febrile Antigen tube test
15. ASO Test- Anti streptolysin 'O' test
16. Immuno diffusion test
 - i) Single radial immuno diffusion
 - ii) Double immuno diffusion
17. Isolation of lymphocytes
18. Rocket immuno electrophoresis
19. Tube flocculation test
20. Determination of $P^{k \text{ value}}$ of amino acid
21. Determination of y_{max} of a given solution
22. Separation of Carbohydrates by Paper Chromatography
23. Separation of Amino acids by Paper Chromatography
24. Separation of Lipids by Thin Layer Chromatography
25. Demonstration Column Chromatography
26. Demonstration HPLC and GC
27. Verification of Lambert-Beers Law by UV-VIS Spectrophotometer, scanning
28. Separation of Proteins by Electrophoresis
29. Ultraviolet spectroscopy of Proteins
30. Membrane separation -Dialysis

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester - II
MBP 202: ADVANCED IMMUNOLOGY & BIOPHYSICAL TECHNIQUES &
INSTRUMENTATION

Question Bank

Paper - II

Time: 4 Hrs

Max. Marks:

100

1. Major Experiment

20 Marks

1. Differential staining of WBC by Leishman stain
2. Enumeration of RBC and WBC
3. Estimation of haemoglobin content in blood
4. HCG test (Agglutination inhibition test)
5. Detection of rheumatoid factor
6. RAPITEX CRP Test
 - i) Qualitative CRP
 - ii) Quantitative CRP
7. Febrile Antigen tube test
8. ASO Test- Anti streptolysin 'O' test
9. Isolation of lymphocytes
10. Rocket immuno electrophoresis

2. Major Experiment - (To be conducted on instruments)

20 Marks

1. Determination of P^k value of amino acid
2. Determination of y_{max} of a given solution
3. Separation of carbohydrates by paper chromatography
4. Separation of amino acids by paper chromatography
5. Separation of lipids by thin layer chromatography
6. Separation of proteins by electrophoresis
7. Ultraviolet spectroscopy of proteins

3. Minor Experiment

10 Marks

1. Typing of human blood groups.
2. Widal tests - Slide agglutination
3. Widal tests - Tube agglutination methods

4. VDRL test (Venereal disease research laboratory)
5. Hepatitis-B surface antigen test.
6. ELISA test (Direct and sandwich)
7. Tridot test
8. Spot test for infections of Mononucleosis
9. Immuno diffusion test - Single radial immuno diffusion
10. Immuno diffusion test - Double immuno diffusion
11. Tube flocculation test

4 Minor Experiment

10 Marks

Comment on principle and applications of two instruments

1. Paper chromatography
2. Thin layer chromatography
3. Column chromatography
4. HPLC
5. GLC
6. Gel filtration
7. Ion exchange chromatography
8. Affinity chromatography.
9. pH meter
10. Spectrophotometer
11. Colorimeter
12. Centrifuge
13. Electrophoretic unit
14. Southern blotting
15. Western blotting
16. Northern blotting

5. Spotters Identification (4 Nos)

20

Marks

- | | |
|------------------------------------|-------------------------------------|
| 1. Immuno electrophoresis | 23. Buffers |
| 2. Lymph node | 24. Circular Paper Chromatography |
| 3. Spleen | 25. Ascending Paper Chromatography |
| 4. Thymus gland | 26. Descending Paper Chromatography |
| 5. Structure of IgG, IgM, IgA, IgE | 27. Thin Layer Chromatography |
| 6. Monoclonal antibodies | 28. GLC |
| 7. Immunotoxins | 29. Gel filtration |

- | | |
|--------------------------------------------------------------------|----------------------------------------|
| 8. ELISA plate | 30. Column Chromatography |
| 9. Immuno precipitation | 31. HPLC |
| 10. Flow cytometry | 32. Ion exchange chromatography |
| 11. Immunofluorescence | 33. Affinity chromatography. |
| 12. RIA | 34. Electrophoretic Unit |
| 13. Hypersensitive reactions Type-I,II,III,IV | 35. Agarose vertical gels with bands |
| 14. Severe combined Immunodeficiency | 36. Agarose horizontal gels with bands |
| 15. Grave's disease | 37. pH meter |
| 16. Autoimmune diseases - SLE | 38. Spectrophotometer |
| 17. Myasthonia gravis disease | 39. Colorimeter |
| 18. Graft acceptance rejection in transplantation | |
| 19. Tissue typing methods | 40. Centrifuge |
| 20. Tumor | 41. Southern blotting |
| 21. Recombinant antibodies | 42. Western blotting |
| 22. Animal inoculation | |
| 43. Photographs and contributions of Nobel laureates in immunology | |

**6. Record 10
Marks**

7 Seminar / Internal 10 Marks

Semester-III
Paper-I
MBT 301: Microbial Genetics & Genetic Engineering

UNIT-I

- a. Genetic recombination in bacteria: Transformation, transduction, sexduction, conjugation; recombination in phages and genotype mixing ; Molecular basis of recombinations- Models of homologous recombinations , The Holliday model, double strand break repair model, site specific recombination.
- b. Gene mapping in prokaryotes: deletion mapping, complementation, intragenic complementation, heteroduplex mapping, DNA foot printing, chromosome walking and jumping.
- c. A general account of plasmids: Characteristics, functions, genes of plasmids, F-plasmids, R-plasmids, Colicinogenic plasmids, Ti-plasmid, broad host range plasmids.
- d. Transposable elements: IS elements, bacterial transposons, mechanism and types of transposition. Genetic phenomena mediated by transposons, transposons as genetic tools.

UNIT-II

- a. Mutations: Types of mutagens (physical, chemical), mutagenesis, types of mutations- molecular basis of mutations, frameshift mutations, transitions, transversion; site-directed mutagenesis and its significance.
- b. Mutation screening in microorganisms: Evaluation of mutagens using microbial systems, Ames test, detection of mutations- RFLP, HOT, SSCP and DGGE methods.
- c. Outlines of cancer biology- types of cancers-benign and malignant, carcinogens - physical, chemical and biological , carcinogenesis, metastasis and invasion, tumorigenesis,
- d. Cancer critical genes- protooncogenes-oncogenes, tumor-suppressor genes (antioncogenes) p53 gene, telomeres and cancers ; apoptosis-path ways and molecular mechanism of apoptosis

UNIT-III

- a. Essentials of recombinant DNA technology: DNA manipulating enzymes, restriction endonucleases- specificity, sticky ends and blunt ends; cloning vectors- recombinant plasmids, phages, cosmids, phagemids their advantages and disadvantages; ligation, optimizing ligation conditions- linkers, adapters, homopolymer tailing.
- b. Selection of transformants: insertional inactivation- blue and white selection. Identification of cloned genes- colony hybridization, southern blotting.
- c. Applications of rRNA technology in medicine and industry: Production of heterologous proteins products, role of expression vectors, production of insulin, human growth hormone and hepatitis vaccine.
- d. Gene therapy: Inherited disorders, detection of gene defects, strategies for gene therapy-*in vivo* and *ex vivo* therapies, gene delivery strategies- viral vectors, liposomes their advantages and disadvantages; future prospects of gene therapy.

UNIT-IV

- a. Polymerase chain reaction (PCR) technology: Theoretical aspects of PCR- PCR cycle, thermostable DNA polymerases, primers and their importance, optimizing the conditions for PCR, factors limiting PCR efficiency
- b. Different versions of PCR: AP-PCR, Multiplex PCR, Broad range PCR, RT-PCR, inverse PCR, Nested PCR, Real time PCR and their applications; PCR site directed mutagenesis; Applications of PCR technology- Forensic, clinical diagnosis, detection of pathogens in food, water; PCR in molecular evolution.
- c. DNA libraries: construction and screening of genomic libraries; cDNA library- isolation of mRNA and cDNA synthesis.
- d. Genetically engineered organisms (GEO): transgenic animals and plants as protein batteries; Genetic engineering for resistant crop plants against pests and diseases.

Recommended Books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Burrell, M.M. 1993. Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. 1995 Biotechnology – Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
4. Gerhardt, P. Murray, R.G., Wood, W.A., and Kreig, N.R. 1994 Methods for General and Molecular Bacteriology, ASM Press, Washington D.C.
5. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology – Principles and Applications of Recombinant DNA, ASM Press, Washington D.C.
7. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
8. Murray Moo 1992 Plant Biotechnology. Young, Pergamon Press.
9. Ratledge, C. and Kristiansen, B. 2001 Basic Biotechnology, II Edition, Cambridge University Press.
12. Winnacker, E.L. 1987 From genes to Clones: Introduction to Gene technology. V C H Publications, Federal Republic of Germany.
13. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
14. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
15. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
16. George M. Malacinski, David Freifelder. 1998 Essentials of Molecular Biology. Jones and Bartlett Publishers.
17. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
18. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.
19. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
20. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of the Gene, 4th edition, Benjamin/Cummings publishing company.
21. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
22. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
23. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
24. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers, London.
25. Turner, P.C., Mclennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
26. Twynan, R.M. 2003 Advanced Molecular Biology. Viva books Pvt. Ltd. New Delhi.
27. Ram Reddy S, Venkateswarlu K and Krishna Reddy V 2007 A Text Book of Molecular Biotechnology Himalaya Publishers Hyderabad
28. Old, R.W. and Primrose, S.B. 1994 Principles of Gene Manipulation, Blackwell Science Publication.

Semester-III
Paper- II
MBT 302: Bioinformatics & Computational Methods

UNIT-I

- a. **Bioinformatics: definition, concept, scope, relevance of bioinformatics, development of bioinformatics, applications of bioinformatics. Genomics, proteomics, operating systems (Linux) and programming languages (Perl, CORBA) in bioinformatics.**
- b. **Databases: Gene banks, objectives, types of databases- flat files, relational databases, objective oriented databases, hypertext databases, web interfaces ; Resource databases- Generalized (DNA, protein) and specialized databases.**
- c. **Search tools: Data mining, BLAST and FASTA.**
- d. **Sequence analysis of biological data: terminology, methods for alignment- pairwise & multiple sequence alignments, algorithm for alignment of sequencing fragments**

UNIT-II

- a. **Phylogenetic analysis: Concept of phylogenetic trees, phylogenetic trees and multiple alignment methods - distance matrix, character based evaluation of methods, evaluation of phylogenies, steps in constructing alignments and phylogenies, working with phylogeny trees- with suitable software-EMBOSS**
- b. **Gene prediction: Approaches and methods, tools- GRAIL, GenLang, BCM GeneFinder, Procrutes, GeneParser. Prediction of protein structure- Methods for structure prediction for known and unknown folds, prediction of protein function.**
- c. **Genomics: Gene mapping, sequence assembly and gene expression, DNA microarrays, microarray design and data analysis.**
- d. **Proteomics: Definition, proteome analysis; tools for proteome analysis, protein-protein interactions; metabolic and genetic networks, concept of E- cell.**

UNIT-III

- a. **Biostatistics: definition, scope, applications in biology, terminology; sampling techniques- random and non-random methods.**
- b. **Measures of central tendencies - Mean, mode, median, standard errors and standard deviations.**
- c. **Probability - concepts, terminology, kinds of probabilities, theorems of probability, normal, binomial and poisson distribution. Skewness and kurtosis.**

- d. **Chi Square test- characteristics, degrees of freedom, test of goodness of fit, null hypothesis.**

UNIT-IV

- a. **Analysis of variance (ANOVA): Methods of ANOVA, one way and two way classifications, F-test, steps involved in ANOVA, importance of ANOVA.**
- b. **Correlation: Definition, methods of studying the correlation, scatter diagram, Karl Pearson's efficient of correlation and rank correlation methods, types of correlations.**
- c. **Regression: Definition, types of regression analysis, regression equation, methods of studying regression, graphic and algebraic methods, importance of regression.**
- d. **Importance of statistical software in data analysis.**

Recommended Books

1. **Andreas D.Baxevanis, B.F. Francis Ouellete.2004Bioinformatics A practical guide to the analysis of genes and proteins,**
2. **Attwood, T.K. and D.J Parry-Smith.Introduction to Bioinformatics**
3. **Bishop, M. J.and C.J.Rawlings Nucleic acid and protein sequence analysis-A practical approach**
4. **Blicks, C.K 1967 Statistics in biology vol 1 Mc Graw Hill, New York**
5. **Brown, T.A Genomes John Wiley & Sons Asia Pte. Ltd. 1999**
6. **Campbell RC 1974 Statistics for Biologists Cambridge university press**
7. **Chritine Orengo, David Jones, Janet Thornton.Bioinformatics: genes, proteins and computers**
8. **Cynthia and Perk Jambeck Bioinformatics computer skills, Wiley**
9. **Dan E. krane, Michael raymer. 2003 Fundamental Concepts of bioinformatics,**
10. **David Mount. 2003 Bioinformatics sequence and genome analysis**
11. **Hewitt.W 1977 Microbiological assay Academic press, New York**
12. **Higgins, W. Taylor. Bioinformatics: Sequences, structure and databanks- A practical approach,**
13. **Jean-Michel claverie, Cedric Notredme Bioinformatics A Beginner's Guide, Wliiey Publication**
14. **Jonathan Pevsner. 2004 Bioinformatics and Functional Genomics**
15. **Stephen Misener and Stephen A. Krawetz.Bioinformatics methods and protocols**
16. **Wardlaw,AC 1985 Practical statistics for experimental Biologists.**

Semester-III
Paper- III
MBT 303: Bioprocess Technology

Unit – I

- a. An overview of fermentation technology, range of fermentation processes, primary and secondary metabolites, components of fermentation process.
- b. Industrial micro organisms: isolation, preservation, screening and strain improvement and maintenance.
- c. Formulation of industrial media: Medium requirements for fermentation processes, carbon, nitrogen, mineral sources, buffers, antifoam agents, medium optimization.
- d. Stoichiometry of cell growth and product formation, Sterilization of media and fermenters, scale – up process and starter culture technology

Unit – II

- a. Basic design of a microbial fermentor, types of fermentation vessels. aseptic operation, containment,
- b. Body construction (stirrer glands, bearing, valves, steam traps) baffles, spargers and impellers.
- c. Types of fermentations: batch, continuous, fed-batch, solid state, sub-merged.
- d. Aerobic and anaerobic, dual and multiple fermentations, their advantages and disadvantages.

Unit – III

- a. Importance of downstream processing in industrial fermentation processes. Problems and requirements of bio product recovery and purification.
- b. Physico- chemical basis of bio separation processes.
- c. Fermentation economics - Market potential, some effects of maintenance legislation on production of antibiotics and recombinant proteins, plant and equipment.
- d. Continuous culture, recovery costs, water usage and recycling and effluent treatment.

Unit – IV

A brief out lines of processes for the production of the following commercially important products

a. Primary metabolites

- i. **Organic acids** : Citric acid, lactic acid,
- ii. **Amino acids** : Glutamic acid, L – lysine,
- iii. **Solvents** : Acetone, ethyl alcohol

b. Secondary metabolites

- i. **Antibiotics** : Streptomycin, penicillin
- ii. **Vitamins** : B₁₂, Riboflavin,
- iii. **Biofuels** : Hydrogen, methane

Recommended Books

1. Ali Cinar, Satish J. Parulekar, Cenk Undey, Birol Gulnur 2003 Batch Fermentation: Modeling, Monitoring, and Control Marcel Dekker Inc
2. Anke, T 1997 Fungal Biotechnology, Chapman & Hall, London.
3. Arnold, L. Demain and Julian E. Davies, Atlas. R.M. 1999 Manual of Industrial Microbiology and Biotechnology 2nd Edition.
1. Berry, D.R. (Ed) 1998 Physiology of Industrial fungi BSP, Oxford University.
2. Crueger & Crueger Biotechnology: A Text Book of Industrial microbiology 2nd edition
3. Dellweg .Biotechnology Vol III.
4. Demain, A.L Biology of Industrial Microorganisms
5. Diliello Methods in Food and Dairy Microbiology
6. Glazer & Nikaido .Microbial Biotechnology
7. Harold B. Reisman 1988 Economic Analysis of Fermentation Processes CRC Pr I Llc
8. Henry, C. Vogel and L. Celeste Todaro 2005 Fermented and Biochemical Engineering Hand Book 2ed Standard Publishers Distribution New Delhi
9. Harvey, W., Blanch, S. Clark. 2007 Biochemical Engineering Marcel Dekker
10. Hershnergen, C.L., Queener, S.W. and Hegeman, Q Genetic and Biotechnology of Industrial Microbiology
11. Ladisch, M.R. 2001 Bioseparation Engineering: Principles, Practice and Economics, Wiley Interscience.
12. Miller & Litsky Industrial Microbiology by
13. Coeplor, S.H. and D. Perhman Encyclopedia of Industrial microbiology Vol. I & II
14. Patel, A.H. Industrial microbiology
15. Peppler & Pearlman .Microbial Technology Vol I & Vol II .
16. Prescott & Dunn, Industrial microbiology,
17. Prescott & Dunn's Fundamentals of Applied Microbiology (2nd edition)
18. Rao. D.J. 2005 Intrudicion to Biochemical Engineering McGraw-Hill
19. Reed, G. Industrial Microbiology, CBS Publishers
20. Rose. Microbial enzymes and bioconversions
21. Shuler, M.L., AND F. Kargi Bioprocess engineering, Prentice Hall of India
22. Stanbury, P.F. Whitaker. A and S.S 1995 Principle of Fermentation Technology 2nd Edition
23. Tampion & Tampion Immobilized cells: Principles and Application
24. Thoma Industrial Microbiology
25. Walker, G.M. 1998 Yeast physiology and Biotechnology Wiley

Semester-III
Paper- IV
MBT 304: Agricultural Microbiology

Unit I

- a. Significance of global nitrogen cycle. Microbiology and ecological significance of ammonification, nitrification and denitrification.
- b. Biology of nitrogen fixation: Diversity of nitrogen fixers, mechanism of symbiotic and asymbiotic nitrogen fixation: signaling, interaction, initiation and nodule formation, genetic regulation of nitrogen fixation.
- c. Rhizosphere – Nature, extent, influence of root exudates on microflora, plant growth promoting rhizobacteria and siderophore production. Ecology of phyllosphere microflora.
- d. Nature and ecological significance of ectotrophic and endotrophic mycorrhizal associations- Role of microorganisms in transformation of phosphorus, sulphur and iron.

Unit II

- a. Principles of plant pathology: entry and establishment of pathogens in plants, host and parasite interaction, role of toxins and enzymes in pathogenesis.
- b. Disease resistance in plants – protection and defense, mechanisms of resistance (performed and induced defense, local signals, programmed cell death, induced structural barriers, phytoalexins)
- c. Biochemical basis of disease resistance – Systemic Acquired Resistance (SAR) and Local Acquired Resistance (LAR) – Pathogenesis Related Proteins (PR proteins)- chitinases and glucanases.
- d. Transgenic Resistance: Gene-to-gene resistance (horizontal and vertical), functions of plant resistance genes, features and classification of cloned resistance genes. Transformation for disease resistance: Resistance to viruses, fungi, bacteria and insects, the Bt genes and the resistance to insects.

Unit III

- a. Plant diseases – Epidemiology and plant disease forecasting- Principles, symptoms and control measures of the following diseases:
- b. Plant diseases caused by fungi – late blight of potato, downy mildew of grapes, Loose smut of wheat, smut of bajra, covered smut of barley, blast disease of rice, red rot of sugarcane.
- c. Plant diseases caused by bacteria – bacterial blight of paddy, angular leaf spot of cotton, common scab of potato.
- d. Plant diseases caused by viruses – tobacco mosaic, leaf curl of tomato, yellow vein mosaic of bhindi.

Unit IV

- a. Plant disease control – Cultural methods, Agronomic practices (crop rotation, field and crop sanitation), Chemical control (fungicides, fumigants, inorganic copper/ sulphur compounds, dithiocarbamates) - Organic agriculture and disease control.
- b. Biological control – Principle, concepts and environmental safety– bio-pesticides (bacterial, fungal and viral).
- c. Plant disease assessment methods – visual method in the field, scales for estimating disease intensity, yield losses, multiple point model and remote sensing techniques.

- d. **Post-harvest diseases – microbial spoilage of fruits, vegetables, stored seeds/grains, mode of infection and factors influencing post-harvest diseases, strategies for post-harvest disease control (fungicides, irradiation, fumigation and VHT - Vapour Heat Treatment).**

Recommended Books

1. **Agrio, G.N. Plant pathology**
2. **Alexander, M Soil Microbiology**
3. **Benjamin Cunnings, Merio pank. California 1987 Microbial ecology, fundamentals an application**
4. **Bilgrami,K.S. and H.C. Dube Modern Plant pathology**
5. **Biofertilizedrs by N.S. Subba Rao**
6. **Lynch J.M.Soil Biotechnology**
7. **Lynch Poole Microbial ecology : A conceptual approach**
8. **Mehrotra,R.S. Plant Pathology**
9. **Microbial ecology: Principles, methods & applications & Biological nitrogen fixation.**
10. **R.S. Singh An introduction to principles of plant pathology**
11. **Rangaswami, G. and A. Mahadevan Diseases of crop plants**
12. **Rangaswamy,G and. Bhagyaraj D.J .Agricultural Microbiology by**
13. **Richard, B.N. An introduction to soil ecosystem**
14. **Singh,R.S. Plant diseases R**
15. **Stolop H. Microbial ecology : Organisms, habitats, Activities**
16. **Subba Rao N. S Advances in Agriculture Microbiology by**
17. **Subba Rao, N.S. Soil microorganisms and plant growth**
18. **Tarr,S.A.J. Principles of plant pathology**
19. **Vander Plank Plant disease resistance**
20. **Vidyasekaran Molecular plant pathology.**

Semester-III
Practical Paper- I
MBP 301: Microbial Genetics & Genetic Engineering &
Bioinformatics & Computational Methods

1. Isolation of auxotrophic mutants by Replica plate technique
2. Mutagenesis and UV survival curve
3. Isolation of petite mutants
4. Restriction analysis of DNA and agarose gel electrophoresis
5. Diauxic growth experiment
6. Preparation of competent cells
7. Transformation- selection of recombinants-Blue and white selection(X-gal method)
8. Amplification of DNA by PCR
9. Problems related to
(a) Mutation (b) Recombination(Conjugation, transformation, transduction),
(c) Gene mapping (d) Restriction mapping (e) Primer design and PCR
amplifications (f) DNA libraries.
10. Aligning sequences using Clustal-X
11. Sequence data retrieval in FASTA format from NCBI database.
12. Similarity search in BLAST for protein or nucleotide sequence.
13. Prediction of secondary structure of protein
14. Viewing the Protein Data Box (PDB) files using Rasmol software.
15. Conversion of raw sequences into different sequence format by using Read Seq Tool.
16. Classification of data, computation of mean, mode, median and standard deviation
17. Co-efficient of variation, skewness and Kurtosis
18. Correlation and regression coefficients
19. Fitting of straight line, parabola, power curve, exponential curve.
20. Chi-square test
21. Normal distribution- co ordinates method
22. ANOVA- one way classified data- two way classified data
23. Completely Randomised Design (CRD)
24. Randomised Block Design(RBD)
25. Latin Sequence design (LSD)
26. Application of t-test and F-test

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester - III

Question Bank

Paper - I

MBP 301: Microbial Genetics & Genetic Engineering &

Bioinformatics & Computational Methods

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment

20 Marks

1. Isolation of auxotrophic mutants by replica plate technique.
2. Mutagenesis and plotting of U.V survival curve
3. Isolation of petite mutants of Yeast
4. Restriction digestion of DNA and analysis of fragments by electrophoresis
5. Preparation of competent cells
6. Transformation – selection of recombinants – Blue and white selection (X-gal method)
7. Amplification of DNA fragments by PCR and visualisation of amplicons
8. Southern blotting technique.

2. Major Experiment

20 Marks

1. Aligning sequences using Clustal-X
2. Sequence data retrieval in FASTA format from NCBI database
3. Similarity search in BLAST for protein or nucleotide sequence
4. Prediction of secondary structure of protein
5. ANOVA-one way and two- way classified data.
6. Problems related to regression and correlation.

3. Minor Experiment

10 Marks

Problems related to

- i) Mutation studies
- ii) Recombination (Conjugation, transformation and transduction)
- iii) Gene mapping
- iv) Restriction digestion
- v) Primer design and PCR amplifications
- vi) DNA libraries

4. Minor Experiment

10 Marks

1. Computation of mean, mode, median, standard deviation and standard errors.
2. Problems related to theorems of probability
3. Problems related to Chi-square test.

5. Spotters Identification (4 Nos)

20 Marks

1. Restriction digestion-sticky ends and blunt ends.
2. RNA polymerase activity
3. pBR 322
4. pUC 18

5. **Ti plasmid**
6. **Replica plating**
7. **DNA ladders**
8. **PCR unit**
9. **Electrophoresis unit**
10. **Gene gun**
11. **Identification of recombinants (Blue and white colonies)**
12. **Ames test**
13. **Transgenic plants (Tobacco luciferase)**
14. **Transgenic animals (Dolly)**
15. **Protocols for cDNA and genomic libraries**
16. **Carcinogenic chemicals**
17. **Colon cancer**
18. **Retinoblastoma cancer**
19. **Recombination-Holliday model**
20. **Transposons (T_5 , T_{10})**
21. **DNA damage-molecular models**
22. **Gene therapy-*in vivo*, *ex vivo* models**

6. Record **10 Marks**

7. Seminar / Internal **10 Marks**

Semester-III
Practical Paper- I

MBP 302: Bioprocess Technology & Agricultural Microbiology

1. The use of Logarithms in Microbial growth study, in fermentation process.
2. Determination of the mid point of the Logarithmic phase of microbial growth in fermentation process.
3. Harvesting the microbial cells and determination of the yield of Fermentation products.
4. Manometric study in Fermentation process.
5. Isolation and identification of secondary metabolites in the fermentation process.
6. Design and construction of microbial fermentor.
7. Screening of microorganisms through war cup method in strain improvement.
8. Production and estimation of streptomycin.
9. Production and estimation of Lactic acid.
10. Production and estimation of Ethyl alcohol.
11. Production and estimation of Penicillin.
12. Production and estimation of Indole Acetic Acid (IAA).
13. Estimation of Cynacobalamine(Vitamin B₁₂).
14. Solubilization of rock phosphate by microorganisms
15. Estimation of organic matter in agricultural soils to assess the soil fertility
16. Estimation of cell wall degrading enzymes : cellulases (exo-and endo glucanases), polymethyl esterase, poly galacturonase, pectic lyase in host-pathogen interactions
17. Estimation of accumulated soil enzymes : catalase/peroxidase, phosphatase, urease,
18. Isolation and identification of cyanobacteria used as biofertilizers- *Nostoc*, *Anabaena*, *Scytonema*
19. Isolation of *Rhizobium* from root nodules
20. Classification and symptomology of plant diseases covered in theory (unit III)
21. Determination of Disease Tolerance Index (DTI) in crop plants
22. Biochemical changes in healthy and diseased crop plants : carbohydrates, proteins, amino acids, chlorophyll
23. Quantification of phytoalexins in healthy and diseased crop plants
24. Analysis of PR proteins in healthy and diseased plants through electrophoresis

25. Enumeration of Rhizosphere microflora and comparison with normal soil microflora
26. Enumeration of ammonifiers, nitrifiers and denitrifiers in soil samples
27. Assay of fungicides by humid chamber technique and calculation of LD₅₀ value
28. Section cutting of infected plant parts :

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester - III

Question Bank

Paper - II

MBP 302: Bioprocess Technology & Agricultural Microbiology

Time: 4 Hrs

Max. Marks:

100

1. Major Experiment

20 Marks

1. Estimation of Streptomycin.
2. Estimation of Lactic acid.
3. Estimation of Ethyl alcohol.
4. Estimation of Penicillin.
5. Estimation of Indole Acetic Acid (IAA).
6. Solubilization of rock phosphate by micro organisms
7. Estimation of Cyanocobalamin (Vitamin B₁₂).

2. Major Experiment

20 Marks

1. Estimation of cell wall degrading enzymes (*in vivo* & *in vitro*) involved in pathogenesis
 - a) cellulases (exo-and endo gluconases),
 - b) polymethyl esterase,
 - c) poly galacturonase,
 - d) pectic lyase
2. Determination of Disease Tolerance Index (DTI) in crop plants
3. Biochemical changes in healthy and diseased crop plants : carbohydrates, proteins, amino acids, chlorophyll
4. Quantification of phytoalexins in healthy and diseased crop plants
5. Analysis of PR proteins in healthy and diseased plants through electrophoresis
6. Enumeration of rhizosphere microflora and comparison with normal soil microflora
7. Assay of fungicides by humid chamber technique and calculation of LD₅₀ value
8. Section cutting of infected plant materials.

3 Minor Experiment

10 Marks

1. The use of logarithms in microbial growth study, in fermentation process.
2. Determination of the mid point of the Logarithmic phase of microbial growth in fermentation process.
3. Harvesting the microbial cells and determination of the yield of fermentation products.
4. Monometric study in fermentation process.

5. Isolation and identification of secondary metabolites in the fermentation process.
6. Design and construction of microbial fermentor.
7. Screening of microorganisms through war cup method for strain improvement.

4 Minor Experiment

10 Marks

1. Solubilization of rock phosphate by microorganisms
2. Estimation of organic matter in agricultural soils to assess the soil fertility
3. Estimation of accumulated soil enzymes : catalase / peroxidase, phosphatase, urease,
4. Isolation and identification of cyanobacteria used as biofertilizers- *Nostoc*, *Anabaena*, *Scytonema*
5. Isolation of *Rhizobium* from root nodules
6. Classification and symptomology of plant diseases covered in theory (unit III)
7. Enumeration of ammonifiers, nitrifiers and denitrifiers in soil samples by MPN method.
8. Identification of *Rhizobium*, *Azotobacter* and *Azospirillum* cultures.
9. Identification of phyllosphere and rhizosphere microorganisms.

5. Spotters Identification (4 Nos)

20 Marks

- | | |
|---------------------------------|----------------------------------|
| 1. Design of fermenter | 22. Wilt of pigeon pea |
| 2. Seed Flask | 23. Wilt of cotton |
| 3. Seed fermenter | 24. Root rot of cotton |
| 4. Production fermenter | 25. Stem rot of rice |
| 5. Air sparger | 26. Brown spot diseases of rice |
| 6. Foam breaker | 27. Blast diseases of rice |
| 7. Stirrer gland | 28. Bacterial blight of paddy |
| 8. Baffles | 29. Citrus canker |
| 9. Impellers | 30. Angular leaf spot of cotton |
| 10. Bread | 31. Stalk rot of maize |
| 11. Monometric fermenter | 32. Sesamum phylloidy |
| 12. Strain improvement | 33. Tobacco mosaic virus |
| 13. Immobilized beads | 34. Yellow vein mosaic of bhendi |
| 14. Downy mildew of peas | 35. <i>Nostoc</i> , |
| 15. Downy mildew of bajra | 36. <i>Anabaena</i> , |
| 16. White rust of crucifers | 37. <i>Scytonema</i> |
| 17. Powdery mildew of cucurbits | 38. <i>Rhizobium</i> |
| 18. Rust of beans | 39. Ammonifiers, |
| 19. Rust of pea | 40. Nitrifiers |
| 20. Rust of ground nut | 41. Denitrifiers |
| 21. Whip smut of sugarcane | |

6. Record

10 Marks

7 Seminar / Internal

10 Marks

Semester-IV
Paper- I
MBT 401: ENVIRONMENTAL MICROBIOLOGY

Unit I

- a. Principles and concepts of Environmental Microbiology and its role in conservation and management of Natural Resources .Soil principles and properties – soil formation, texture, composition, characteristics, number and biomass of microbes in soil, terrestrial carbon cycles, soil fertility.
- b. Decomposition of organic matter – litter chemistry, carbon assimilation and immobilization, dynamics of organic matter (microbial succession), accumulated soil enzymes and their role in soil development.
- c. Bioremediation of polluted soils/sites – Degradation of xenobiotics with special reference to pesticides. Genetically Engineered Microorganisms (GEMs) in bioremediation.
- d. Microbial leaching and biomining(copper and uranium) - Dump, heap and agitated leaching, chemistry and microbiology of bioleaching, Biomining (*ex situ* and *in situ* (hole-to-hole leaching)), plasmids and genes in biomining.

Unit II

- a. Biomonitoring of the aquatic environment – Biological indicators, Biosensors, Genosensors – Pollution indices (Odum, Nygaard, Palmer, Margalef, Kothe)-Self-purification of aquatic systems – Oligotrophic,mesotrophic and eutrophic status.
- b. Waste water treatment through aerobic micro-organisms – Biological filters, aeration tanks, Biological ponds, Irrigation fields (biofilms).
- c. Waste water treatment through anaerobic microorganisms – Septic tanks, imhof's tank, upflow anaerobic sludge blanket (UASB), anaerobic filters, anaerobic attachment film expanded bed (AAFEB), anaerobic rotating biological contractor and sequential batch reactors.
- d. Pollution control Biotechnology – Commercial blends of microorganisms and enzymes, immobilized cells and enzymes, biotechnological approaches for recovery of useful products from sewage and industrial wastes.

Unit III

- a. Historical introduction – Nomenclature of atmospheric layers, microbes as source and sink of atmospheric pollutants, pollutant transformation by microbes.
- b. Air sampling techniques – The impactors : slit sampler, cascade impactor, hirst trap, anderson sampler, rotorod, vertical cylinder trap, burkard trap.The impingers: porton impinger and pre-impinger.
- c. Air quality in Indian cities – mapping of the hot spots, air quality monitoring and measurement, impact of air-borne microorganisms on living beings – Allergy: immediate type of hyper sensitivity, atopic allergy, delayed type of hypersensitivity.
- d. Emission control technology – typical cyclones, industrial fabric filters,electrostatic precipitators, liquid scrubbers, gravity settling chambers, special multifan units.

Air sanitation – Control of air borne pathogens – irradiation, chemical disinfection, dust control.
Biotechnological methods for the abatement of environmental bio-pollution.

Unit IV

- a. **Environment and Bioenergy – Energy production and consumption, energy planning and conservation strategies – Maintenance and managerial practices.**
- b. **Lignocellulosic material as bioenergy source – Biodelignification- Role of lignolytic and xylanolytic enzymes, separation of cellulose, development of cellulase minus mutants- Biobleaching and bio-pulping. .**
- c. **Bioethanol in social and scientific perspective –Alternate/renewable energy source - Bioethanol vs. food crisis; Bioethanol vs. climate change, advantages and disadvantages.**
- d. **Biogas (Methane) – Biogas plant design, construction, process microbiology, production and applications. Methane vs. Green house effect. Hydrogen – production process of hydrogen from biomass, thermal gasification, pyrolysis, microbial conversions – Biotechnological production of hydrogen to reverse global warming.**

Recommended Books

- | | |
|--------------------------------|---------------------------------------------|
| 1. Alexander M. | Soil Microbiology |
| 2. Anil Prakash (Ed.) | Fungi in Biotechnology |
| 3. Atlas & Batra | Microbial Ecology |
| 4. Benjamin Cunnings | Microbial Ecology |
| 5. Burns R.G & J.H.Slater | Experimental Microbial Ecology - |
| 6. Gabriel Bitton | Wastewater Microbiology |
| 7. Gilbert S. Omen | Environmental Biotechnology |
| 8. Gray T.R.G.&S.T.Williams | Soil Microorganisms |
| 9. Gregory P.H. | The Microbiology of Atmosphere |
| 10. Lautit M.W&C.M.Eds.Keuin | Microbial Ecology Proc. |
| 11. Lynch J.M | The Rhizosphere |
| 12. Lynch J.M and N.J. Poole | Microbial Ecology: A conceptual approach |
| 13. Michael S.Switzerbaury(Ed) | Anaerobic Treatment of Sewage |
| 14. Mishra R.R | Soil Microbiology |
| 15. Odum E.P. | Fundamentals of Ecology |
| 16. Omenn G.S.& M. Alexander | Genetic control of Environmental Pollutants |
| 17. Ralph Mitchell | Environmental Microbiology |
| 18. Ratledge C. | Biochemistry of Microbial degradation |
| 19. Spani J.C. | Biodeterioration of non-aromatic compounds |
| 20. Subba Rao N.S. | Soil Microbiology |
| 21. Thomas D. Brook | Thermophiles |
| 22. Tilak S.T | Environmental Biopollution |
| 23. Williams G.C | Biofilms |

Semester- IV
Paper- II
MBT 402: Medical Microbiology

Unit – I

- a. Historical developments, Classification and characteristics of medically important microorganisms Diagnosis of infectious diseases, types of specimens, specimen collection, transport, processing of material for laboratory investigations.
- b. Specific and non specific laboratory tests, morphological identification, culture isolation, detection of antigen by immunological assays; serological tests, antibody stains, immunoblotting.
- c. Molecular diagnosis:- DNA – DNA or DNA- RNA hybridization, 16s RNA, target amplification systems (PCR, RT PCR, TMA, NASBA).
- d. Probe amplification systems – Ligase chain reaction(LCR) signal amplification techniques.

Unit -II

- a. Study of etiology, cultural characteristics, antigen structure, biochemical properties, diagnostic laboratory tests of pathogenic bacteria.
- b. Epidemiology and prophylaxis of α and β hemolytic Streptococci, *Corynebacterium diphtheria*, *Mycobacterium tuberculosis* and *Neisseria meningitidis*
- c. Sexually transmitted diseases: *Treponema*, *Neisseria gonorrhoea*; LGV agent (Chlamydia); *H. ducreyi*, *Calymmotobacterium granulomatis*
- d. Water borne infections : *E. coli*, *Salmonella*, *Vibrio*
Wound infections : *Clostridium tetani*, *Staphylococci*,
Pseudomonas.

Unit – III

- a. Study of etiology, pathogenesis, epidemiology and prevention of Malaria, Amocbiasis, Leshmaniasis, Echinococcus grannulosus, Ascariasis, Ancylostomiasis Filariasis.
- b. Study of etiology , pathogenesis, epidemiology and prevention dermatomycoses.
- c. Superficial mycoses (Pityriasis) , Cutaneous mycoses (*Microsporum*, *Trichophyton* and *Epidermophyton*), Subcutaneous mycoses (*Sporothrix*, *Mycetoma*),
- d. Endemic mycoses (Coccidiomycosis, Histoplasmosis), Opportunistic mycoses (Candidiasis, Cryptococcosis, Aspergillosis,) and their control.

Unit – IV

- a. Study of etiology , cultivation, antigen structure, pathogenesis, diagnostic laboratory tests, epidemiology, prevention and treatment of Air borne and zoonotic viral infections; Influenza virus, rhinovirus, rubella, adenovirus, mumps, measles, varicella zoster virus rabies, Japanese encephalitis.
- b. Water, contact and sexually transmitted viral diseases; HAV, HBV, HCV, Enterovirus, Rotavirus, HSV, HIV
- c. Antimicrobial agents; screening and assay of antimicrobial compounds.
- d. Mode of action of antimicrobials ;cell wall, nucleic acid, purine, pyrimidine, protein, respiration, Enzyme inhibitors, cell membrane disruptors, antimetabolites, analogues, drug resistance and side effects.

(i) Recommended Books

1. Arnold, 1998 Medical Microbiology, Volume 4
2. Bernard, Davia, Dulbecco Microbiology (4th edition)
3. Blackwell, 1993. Modern Parasitology : A Text Book of Parasitology (2nd Ed.) Cox FEG,
4. Brooks, G.F., J.S. Butel and S.A. Morse, Mc Graw – Hill Medical Microbiology
5. Christie AB, Edinburgh, Churchill – Livingstone Infectious diseases : Epidemilogy and clinical practice (4th ed.)
6. Chung KJ, Bennett JE, Lea & Febiger, 1992 Medical Mycology
7. Kwon – Topley & Wilson's Microbiology and Microbial infections (9th Ed.) Ajello L, Hay
8. Churchill Livingstone, Davies et al 2nd edition. Microbiology
9. Churchill Livingstone, 1996 Practical Medical Microbiology (14th ed.)
10. Cruickshank Medical Microbiology Vol. I and II
11. DH *et al* (ed.) American Society for Microbiology, 1993 Diagnostic Molecular Microbiology,
12. Evans EGV *et al* (ed.) Medical Mycology, Oxford : Oxford University Press.
13. Jawetz, Melnick & Adebery Reviews of Medical Microbiology
14. Jayaram Paniker Text book of Medical parasitology (4th edition)
15. Jhon Bernard Clinical diagnosis and management – Laboratory methods
16. Joklik, Wille, Amos & Wilfert Zinser Microbiology
17. Longman, 2000 Test Book of Microbiology
18. Macowiak PA N. Engl J. Med. 1982 The normal microbial flora 307: 83
19. Mandell, Douglas and Bennett's 2000 Principles and Practice of infectious diseases 5th edition
20. Mosby Bailey and Scott's Diagnostic microbiology
21. Murray PR *et al* (Ed.) American Society for Microbiology 1999 Manual of clinical Microbiology
22. Panjarathinam R Orient Longman. Text book of Medical Parasitology. Principles and Applications,
23. Reppon JW, Philadelphia: WB Saunders, 1988 Medical Mycology,
24. Richmann, DD *et al* Churchill Livingstone, 1997 Clinical virology,
25. Skinner, FA and Carr, JG (ed.) 1974 The Normal Microbial Flora of Man, Academic Press,
26. Yu VL, Merrigan TC Jr. Barriere William & Wilkins, 1999 Antimicrobial therapy and vaccines
27. Franklin, T.J. and G.A. Snow 2008 Biochemistry and Molecular Biology of Antimicrobial Drug Action. Springer International Edition England

Semester-IV
Paper- II
MBT 403: Microbial Technology

Unit – I

- a. Microbes important in food microbiology: yeasts, filamentous fungi and bacteria contamination of foods.
- b. Factors influencing food spoilage (intrinsic and extrinsic)
- c. Food poisoning and food borne infections (bacterial, viral, fungal and protozoa), bacterial and fungal toxins.
- d. Detection of microbial contamination of foods : Direct microscopic count (DMC), standard plate count, MPN method, reductase tests, membrane filters and molecular methods

Unit – II

- a. Contamination and spoilage of cereals , cereal products, fruits, vegetables , meats , meat products, fish , sea foods, eggs, poultry and canned foods.
- b. General principles of food preservation- Physical and Chemical methods.
- c. Dairy microbiology: Normal flora of milk and milk products, Spoilage of milk and milk products. Fermented milk products: acidophilus milk, bifidus milk ,yoghurt manufacture of cheese, evolution of quality milk
- d. Microbial food fermentation: Fermentation in food processing, role of microorganisms in food fermentation. Microbial products of food; SCP, mushrooms, oriental foods Fermented beverages (fruit and cereal based) and fermented meat and meat products.

Unit – III

- a. Yeasts fermentation and a yeast products: Production of active dry bakers yeast, instant yeast, quality of bakers yeast, production of brewer's yeast, wine yeast food and fodders yeast.
- b. Industrial production of enzymes: cellulases, amylases, proteases, phytases, pectinases, lipases, glucose isomerases
- c. Immobilization of enzymes and cells and their applications.
- d. Scope, utility and methodology of biotransformation, biotransformation of antibiotics, steroids and non – steroids.

Unit – IV

Industrial production of

- i) Biopesticides – Bacterial, viral and fungal
- ii) Biofertilizers – Nitrogen fixers, PSM, mycorrhizae
- iii) Biopolymers – Extracellular polymers, xanthans, dextrans, poly β hydroxyl alkanates
- iv) Biosurfactants - Classification , production and application
- v) Vaccines – Bacterial and viral vaccines.

Recommended Books

1. Adams, M.R. and Moss. M.O. 2007 Food Microbiology Royal society of Chemistry Pub Cambridge.
2. Bamforth C W 2005 Food, Fermentation and Micro-organisms Blackwell
3. Banwart, G.S. 1989 Basic Food Microbiology
4. Chaplin, M.F. & Bucke.C 1990 Enzyme Technology Cambridge.
5. Cliver, D.O 1990 Food borne diseases Academic Press San Diego
6. Diliello Methods in Food and Dairy Microbiology
7. Doyle P. Michael Food Microbiology 2nd Edition SAM Press
8. Ealters, R.W. (Ed) 1992 Vaccines: New Approaches to immunological problems, B.H. London.
9. El-mansi, E. M. T. A.L. Demain , C.F.A. Bryce, C.F.A. Bryce , A. R. Allman , Mansi El-Mansi , Charles F. A. Bryce 2006 Fermentation Microbiology And Biotechnology
10. Fellows P. J 2009 Food Processing Technology Principles and Practice, Third Edition Published by: CRC Press
11. Fogarty, W.M. & Kelly C.T. 1990 Microbial enzymes and Biotechnology Elsevier, London.
12. Frazier, W.C. and Werthaff, D.C. 1998 Food Microbiology 4th edition. Tata Mc Grow Hill New Delhi
13. Harrigan W. 1976 Laboratory Methods in Food and Dairy Microbiology Academic Py
14. Hobbs, B.C. and Rioberts,D 1993 Food Poisoning and Food Hygiene Edward Anold, London.
15. [http:// WWW.sallys-place.com/beverages/beer/beer_is_made.htm](http://WWW.sallys-place.com/beverages/beer/beer_is_made.htm)
16. <http://WWW.Indianfoodindustry.net/>
17. Hui Y H 2006 Food Biochemistry and Food Processing Blackwell
18. Hui, Y.H. Wai-Kit Nip , Joseph G. Sebranek 2007 Handbook of Fermented Meat and Poultry Iciar Astiasaran Blackwell Pub Professional
19. Hui, Y.H. and Khachatowrian, G.C. (Ed) 1995 Food Biotechnology.
20. Indu Sheker Thakur 2006 Industrial Biotechnology Problems and Remedies I K Inter.
21. Jay. J.M. 1991 Modern food microbiology. 4th ed Van Nostrand Reinhold Co. New York.
22. Joshi, V.K. Ashok Pondey 1999 Biotechnology and Food fermentation Vol. I & II.
23. Katherine Smart 2003 Brewing Yeast Fermentation Performance John Wiley & Sons Inc
24. New Delhi
25. Persley, G.J. 1996 Biotechnology and Integrated Pest Management.
26. Prescott and Dunn's, Industrial Microbiology 4th edition.
27. Robison, R.K. 1990 Dairy Microbiology.
28. Scrages, A 1999 Environmental Biotechnology Longman Scientific and Technical, Harlow.
29. Smart, K. Katherine Smart 2003 Brewing Yeast Blackwell Pub Professional
30. Stannard, C.J. F.A. Skinner (Editor), S.B. Petitt 1990 Rapid Microbiological Methods for Foods Beverages and Pharmaceuticals Blackwell Science Inc
31. Thomas J. Montville, Karl Matthews, 2005 Food Microbiology: An Introduction: Amer Society for Microbiology

Semester-IV

Paper- IV

MBT 404: Theoretical practices, Laws & Regulation of Microbial Products

UNIT-I

- a. The concept of intellectual property- The history and evolution of patents, the effect of intellectual property protection on economic and technological development- industrial property rights and development.
- b. Patents: copy right and neighboring rights, patents for invention, utility models, industrial designs, trade marks, trade names and geographical relations, unfair competitions
- c. Forms of intellectual property protection, conditions for patentability: patentable subject matter, industrial applicability, novelty, inventive step, disclosure of the invention. Drafting and filing a patent application, infringement, copyright and development, exploitation of patented invention.
- d. International treaties and conventions with special reference to biodiversity; Indian patent laws.

UNIT- II

- a. Genetically engineered microorganisms and their products: release of genetically engineered microorganisms and their products and their impact on the environment (food, water, air) and human health, hazard identification and risk management, field tests for genetically modified microorganisms.
- b. Concept of biosafety, biosafety levels, biocontainment, good microbiological practices, biosafety guidelines.
- c. Biohazard: Levels of biohazard, biological weapons, biosecurity, components of biosecurity program, bioethical issues.
- d. Requirements and procedures for recombinant DNA: Registration, review and approval of rDNA research; general approval procedure for rDNA products and genetically modified microorganisms.

UNIT-III

- a. Language skills for writing scientific articles: Basic rules of grammar, word choice, sentence structure, paragraph structure, writing methods.
- b. Format of scientific writing: margins, title page, headings and subheadings, IUPAC symbols, terminology, SI units, some standard symbols and abbreviations used in biology. Titles, authors, abstract and keywords, introduction, material and methods, results, design of tables, figures, legends, discussion, acknowledgements and references.
- c. Publishing manuscript: preparing manuscript, submission of hardcopy and online submission to the journals, proof reading and corrections
- d. Writing project proposals: significance, targets, current status, methodology, time-schedule and PERT chart, financial requirements, justification, collaborations; preparation of curriculum vitae (CV)

UNIT-IV

- a. Communication skills: Language, grammar, pronunciation, choice of words, body language, purpose of oral presentation.
- b. Oral presentations: preparation, making the presentation, delivery (speed, pitch, timing) visual aids- charts- OHP, 35mm slides, computer projection (PowerPoint), video and film, real objects, black board, Dos and Dents of oral presentation.
- c. Poster presentations: Planning and design of text, printing, displaying and presentation.
- d. PowerPoint presentations: templates, slide layouts, designs, inserting figures and photos, creation of charts and diagrams, colour schemes, slide transitions and animations, transfer of slides, creation of notes, sound recordings, electronic presentations

Recommended Books

1. Alexander I. Poltorak and Paul J. Lerner Essentials of Intellectual Property
2. Holland, Catherine J. Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets (Author), Canuso, Vito A., Reed, Diane M.
3. [Stephen Elias](#) An Patent, Copyright & Trademark: An Intellectual Property Desk Reference (Author), [Richard Stim](#)
4. [Chawla A](#) Copyright and Related Rights
5. Christopher May, Susan K. Sell Intellectual Property Rights
6. Shiv Sahai Singh Law of Intellectual Property Rights
7. Virginia Baldwin Patent and Trademark Information: Uses and Perspectives
8. Indian Patent Law: Legal and Business Implications
9. Ajit Parulekar, Sarita D'Souza Bioethics and Biosafety in Biotechnology V Sree Krishna
10. WHO Laboratory manual 3rd edition 2004. Laboratory Biosafety and Biosecurity Guidance
11. CDC/NIH biosafety in microbiological and biomedical laboratories 5th edition, 2007
12. Gilbert P R Biotechnology Ethics Risks and Code of Conduct
13. [Ashok Kumar](#) Agricultural Biotechnology
14. [Mark Kortepeter](#) Biohazard 9-1-1
15. [Young, Tomme](#) Genetically Modified Organisms: A Guide to Biosafety Tzotzos, George
16. Sue Carson, Dominique Robertson [Manipulation and Expression of Recombinant DNA, 2nd Edition](#)
17. Michae Alley 1st edition, 2003 The craft of scientific presentations critical steps to succeed and critical errors to avoid-
18. Hegde M N A course book on Scientific and professional writing for Speech- language pathology 3 edition. An outline of scientific writing (for researchers with English as a foreign language) Jen Tsi Yang, World scientific pub.

Semester-IV
Practical Paper- I
MBP 401: Environmental Microbiology & Medical Microbiology

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test.
4. Estimation of Gross primary productivity (GPP), Net primary Productivity (NPP), and Respiratory Consumption (RC) to determine the autotrophic/heterotrophic status of aquatic bodies
5. Estimation of phosphates, sulphates and nitrates (eutrophication factors) in polluted and unpolluted water bodies
6. Disinfection of potable water by chlorine (bleaching power method) – determination of chlorine demand and residual chlorine
7. Biomonitoring of water quality by algal indices: Nygaard's index, Palmer's index, Kothe's index, Margalef's index.
8. Bioremediation of heavy metals : chromium/cadmium/lead
9. Phytoremediation of toxic metals by cyanobacterial species
10. Assay of lignolytic enzymes (lignin peroxidase and laccase) by white rot fungi
11. Decolourization of dye effluents by immobilized bacteria and fungi
12. Bidesulphurization of coal by *Thiobacillus ferrooxidans*
13. Air sampling by Petri plate method/gravity slide method/tilak air sampler
14. Estimation of xylanase enzyme : Role in biopulping
15. Preparation of different types of culture media, staining techniques – Gram's staining, F.B. staining, Albert staining, Capsular staining etc.
16. Identification of various pathogenic bacteria by biochemical, enzymatic and serological methods.
17. Bacteriological examination of urine, blood, pus, sputum, stools etc. from patients for diagnosis.
18. Cultivation of viruses.
19. Egg inoculation methods.
20. Tissue culture techniques.
21. Animal inoculation technique.
22. Microscopic studies of virus infected materials.
23. Potency test for vaccines.
24. Toxicity test for vaccines.
25. Handling of lab animals.
26. Examination of pathogenic fungi.
27. Examination of stools for helminthes & Amoeba.
28. Examination of blood smears to identify malarial parasite.
29. Isolation, observation and identification of normal microbial flora of human body.

FACULTY OF SCIENCE

M.Sc. MICROBIOLOGY

Practical Examination

Semester - IV

Question Bank

Paper - I

MBP 401: Environmental Microbiology & Medical Microbiology

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment 20 Marks

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test.
4. Estimation of Gross primary productivity (GPP), Net primary Productivity (NPP), and Respiratory Consumption (RC) to determine the autotrophic/heterotrophic status of aquatic bodies
5. Bioremediation of heavy metals : chromium/cadmium/lead
6. Phytoremediation of toxic metals by cyanobacterial species
7. Assay of lignolytic enzymes (lignin peroxidase and laccase) by white rot fungi
8. Air sampling by Petri plate method/gravity slide method/tilak air sampler

2. Major Experiment 20 Marks

1. Preparation of different types of culture media, staining techniques – Gram's staining, F.B.staining, Acid fast staining Albert staining, Capsular staining etc.
2. Bacteriological examination of urine, blood, pus, sputum, stools etc. from patients for diagnosis.
3. Examination of pathogenic fungi.
4. Examination of stools for Helminths & Amoeba.
5. Examination of blood smears to identify malarial parasite.
6. Isolation, observation and identification of normal microbial flora of human body.

3. Minor Experiment 10 Marks

1. Estimation of phosphates, sulphates and nitrates (eutrophication factors) in polluted and unpolluted water bodies
2. Disinfection of potable water by chlorine (bleaching power method) – determination of chlorine demand and residual chlorine
3. Biomonitoring of water quality by algal indices: Nygaard's index, Palmer's index, Kothe's index, Margalef's index.
4. Decolourization of dye effluents by immobilized bacteria and fungi
5. Biodesulphurization of coal by *Thiobacillus ferrooxidans*
6. Estimation of xylanase enzyme : Role in biopulping

4 Minor Experiment

10 Marks

1. Animal inoculation technique.
2. Microscopic studies of virus infected materials.
3. Potency test for vaccines.
4. Toxicity test for vaccines.
5. Handling of lab animals.
6. Cultivation of viruses.
7. Egg inoculation methods.
8. Tissue culture technique.
9. Identification of pathogenic bacteria by microscopy and biochemical tests.

5. Spotters Identification (4 Nos)

20 Marks

- | | |
|---------------------------------------|----------------------------------------------|
| 1. Multiple tube fermenter | 20. Candida albicans infection of the tongue |
| 2. Winogradsky column | 21. Athletes foot |
| 3. Aeroflora agar plate | 22. Black piedra |
| 4. Dye effluent treatment | 23. Ring worm |
| 5. Decomposed litter Humus | 24. <i>Microsporum</i> |
| 6. Bioleaching rayon pulp | 25. Chromomycosis |
| 7. Desulphurised coal
(Clean coal) | 26. Madurella mycetomatis |
| 8. Drug sensitivity | 27. Blastomycosis |
| 9. TSIA slants | 28. <i>Histoplasma capsulatum</i> |
| 10. Small pox | 29. <i>Cryptococcus neoformans</i> |
| 11. Mumps | 30. <i>Plasmodium</i> |
| 12. HSV infection | 31. Elephantiasis |
| 13. Staphylococcal skin Infection | 32. Leishmaniasis |
| 14. Syphilis infection | 33. α -Haemolytic streptococci plate |
| 15. Gas gangrene | 34. β - Haemolytic streptococci plate |
| 16. <i>Corynebacterium</i> infection | 35. Proteolytic activity |
| 17. EMB plate | 36. Lipolytic activity |
| 18. Measles | |
| 19. Herpes vesicles | |

6. Record

10 Marks

7 Seminar / Internal

10 Marks

Semester-IV
Practical Paper- II
MBP 402: Microbial Technology & Theoretical practices, Laws & Regulations of Microbial Products

1. Enumeration of micro organisms from food, feed, vegetable and fruits.
2. Screening of mycotoxins from infected food material
3. Detection of microbial contamination in milk through direct microscopic count (DMC)
4. Detection of microbial contamination through MPN method.
5. Isolation and identification of yeast and formulation of Bakers yeast.
6. Wine production.
7. Methylene blue reductase test for milk quality.
8. Microbial reactions in litmus milk.
9. Assay of cellobiohydrolase.
10. Assay of endogluconase.
11. Production and assay of β - amylase.
12. Production and assay of α - amylase
13. Production and assay of protease.
14. Production and assay of lipase.
15. Production and assay of asparaginase.
16. Production and assay of Phosphatase.
17. Bio - transformation of organic compounds through MOS.
18. Formulation of Bio - pesticides (*Pseudomonas* and *Trichoderma* powder preparation).
19. Bioassay of antagonism micro organisms.
20. Seed coating of *Rhizobium* bacteria for N₂ fixation.
21. Screening of P- solubilizing micro organisms through plate method.
22. Extraction of bio – polymers.
23. Preparation of immobilized cells and fermentation
24. Isolation and identification of AM spores by wet sieving method.
25. Quantification of mycorrhiza root infection
26. Cultivation of mushrooms.
27. Awareness and knowledge of Indian patent laws
28. Drafting and filing a patent application
29. Hazard identification and risk management of GEMS and risk management.
30. Knowledge of bio safety guidelines
31. Scientific writings-general guidelines, IUPAC symbols.
32. Submission of manuscript for scientific journal- hard copy and on-line submission
33. Procedure for writing project proposals.
34. Scientific presentations (oral) –types of presentations, DOs and DONTs.

35. Preparation of power point presentation.
36. Demonstration of oral presentation using PowerPoint.

FACULTY OF SCIENCE
M.Sc. MICROBIOLOGY
Practical Examination

Semester - III **Question Bank** **Paper - II**
MBP 402: Microbial Technology & Theoretical practices, Laws & Regulations of Microbial Products

Time: 4 Hrs

Max. Marks: 100

1. Major Experiment **20 Marks**

1. Enumeration of micro organisms from food, feed, vegetable and fruits.
2. Screening of mycotoxins from infected food material
3. Wine production
4. Assay of cellobiohydrolase.
5. Assay of endogluconase.
6. Assay of β - amylase.
7. Assay of α – amylase
8. Assay of protease.
9. Assay of lipase.
10. Assay of asparaginase.
11. Assay of phosphatase.
12. Bio - transformation of organic compounds through microorganisms.
13. Formulation of Bio - pesticides (*Pseudomonas and Trichoderma* powder preparation)
14. Screening of P- solubilizing micro organisms through plate method.

2. Major Experiment **20 Marks**

1. Fill up an application form for the submission to patent office on a new given invention.
2. Write some important symbols, SI units and abbreviations commonly used in biology during scientific writing.
3. How you prepare a manuscript for the submission to the Research Journal.
4. Taking an example prepare a project proposal to the funding agency like DBT, DST, CSIR, UGC, ICMR with objectives, graph, significance, methodology, National/International status, time schedule, budget etc.
5. Prepare Curriculum vitae, explaining your strengths and weakness.
6. Prepare a poster on a given research topic/subject supported by figures and tables highlighting its significance.
7. Submit the given research manuscript after through proof reading and corrections.
8. Prepare a power point presentation on a given research topic/ content and submit a soft and hard copy.
9. Submit the given research manuscript after critical grammar corrections.

3. Minor Experiment **10 Marks**

1. Detection of microbial contamination in milk through direct microscopic count (DMC)
2. Detection of microbial contamination through MPN method.
3. Isolation and identification of yeast and formulation of Bakers yeast.

4. Methylene blue reductase test for milk quality.
5. Microbial reactions in litmus milk.
6. Bioassay of antagonism microorganisms.
7. Seed coating by *Rhizobium* bacteria for N₂ fixation.
8. Extraction of bio – polymers.
9. Preparation of immobilized cells.
10. Isolation and identification of VAM spores by wet sieving method.
11. Quantification of mycorrhizal root infection
12. Cultivation of mushrooms

4. Minor Experiment

10 Marks

Oral presentation using OHP –Powerpoint

Viva questions on

- i) Patent laws
- ii) Biosafety guidelines
- iii) Dos and DONTs of oral and written presentations
- iv) Genetically engineered microorganisms
- v) Guidelines for scientific writings and project proposals
- vi) IUPAC symbols
- vii) Powerpoint commands

5. Spotters Identification (4 Nos)

20 Marks

- | | |
|------------------------------------|-------------------------------|
| 1. Infected food | 21. <i>Scutellospora</i> |
| 2. Infected vegetables | 22. <i>Entrophospora</i> |
| 3. Infected fruits | 23. <i>Aspergillus</i> |
| 4. Aflatoxin | 24. <i>Penicillium</i> |
| 5. Mushroom spawn | 25. <i>Fusarium</i> |
| 6. Cropping (Casing) | 26. <i>Cunninghamella</i> |
| 7. Litmus milk | 27. Yeast |
| 8. MBRT | 28. <i>Alternaria</i> |
| 9. Biopesticides | 29. <i>Trichoderma</i> powder |
| 10. VAM spores by funnel technique | 30. Antagonism microorganisms |
| 11. Bakers yeast. | 31. Immobilized cell |
| 12. Foods Fermented beverages | 32. IUPAC symbols |
| 13. Cheese | 33. DOS |
| 14. Idly | 34. OHP |
| 15. Curd | 35. Hard copy |
| 16. Alcohol | 36. Soft copy |
| 17. <i>Glomus</i> | 37. Biosafety |
| 18. <i>Gigaspora</i> | 38. Symbols |
| 19. <i>Sclerocystis</i> | 39. Abbreviations |
| 20. <i>Acaulospora</i> | |

6. Record

10 Marks

7. Seminar / Internal

10 Marks

S.NO	College Code	Name of the College	No of Students
1	00	University College, KU, Warangal	32
2	117	Vaagdevi PG College, Warangal	30
3	99	New Science PG College, Warangal	30
4	100	S.V.S.PG College, Warangal	30
5	125	Kakatiya Mahila College, Warangal	24
6	06	Kakatiya Govt College, Warangal	18
7	05	Govt Pingle College for Womens Warangal	24
8	98	Kavitha Memorial College, KMM	30
9	28	Govt Womens College, KMM	18
10	142	Viveka Vardhini PG College, KGM	24
11	35	S.R.R.Govt College, Karimnagar	18
12	146	KIMS College, Karimnager	24
13	49	Govt College for Womens, Adilabad	18

Colleges Offering M.Sc. Microbiology

DEPARTMENT OF MICROBIOLOGY
KAKATIYA UNIVERSITY
WARANGAL

Day	Class	Theory			Lunch 1.00- 2.00	Practical (2.00 – 5.00)
		10.00 – 11.00	11.00 – 12.00	12.00 – 1.00		
Monday	Semester-I / II					
	Semester-III / IV					
Tuesday	Semester-I / II					
	Semester-III / IV					
Wednesday	Semester-I / II					
	Semester-III / IV					
Thursday	Semester-I / II					
	Semester-III / IV					
Friday	Semester-I / II					
	Semester-III / IV					
Saturday	Semester-I / II					
	Semester-III / IV					

