Placed at the Meeting
of the Academic Council
held on 26-03-2018

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

MODIFIED SYLLABUS FOR B.Sc. MICROBIOLOGY

CBCS SEMESTER PATTERN
(w.e.f. THE ACADEMIC YEAR 2018-2019 ONWARDS)

1. Introduction of the programme

This three year Bachelor of Science course in Microbiology deals with the study of microorganisms comprising Bacteria, Fungi, Protozoans, Algae and Virus; and its association with the environment, plants, animals and humans. Candidates undertaking this curriculum will understand the basic and applied concepts of Microbiology. This includes the beneficial and harmful role of microorganism in the production of commercially important products and its role in various diseases respectively. Basic concepts of Immunology of the host and its interaction with infectious microorganisms are also included in the syllabus. The scope of this course is wide which enables the candidate to get placed in diagnostics, pharma, fermentation, dairy, food and medical arena.

2. Eligibility for admission:

A candidate who has passed Higher Secondary examination (10+2) conducted by the Board of Higher Secondary Education, Govt. of Tamil Nadu or any other examinations accepted as Equivalent thereto by the syndicates subject to such conditions

- Biology/Physics/Chemistry as subjects in the Higher Secondary education.
- Candidates should have secured at least 60% in the above subjects individually and as total aggregates
- A relaxation of 10% marks in the aggregate shall be given to SC/ST candidates

2.1 Duration of the programme:

The students will undergo the prescribed course of study for a period of not less than three academic years (six semesters)

The maximum duration for completion of the UG Program shall not exceed twelve semesters, beyond which the candidate has to get readmitted in the course with the new syllabus if any.

2.2 Medium of Instructions of the programme: English

3. Objectives of the Programme

- To inculcate the basic and advanced concepts of Microbiology including taxonomy, physiology, Immunology, biomolecule interactions, genomics, proteomics and rDNA technology.
- To impart the scope for the application of concepts learned in the subject.
- To introduce about the recent advances in the field of Microbiology and its importance in research.

4. Outcome of the programme:

At the end of this three year course, a candidate will have a thorough understanding on the basic concepts of Microbiology and its applications in the various fields of science and technology. Through the knowledge and hands-on experience imparted during the practical subjects, the candidate will get conveniently placed in the diagnostics, production and R&D units of various hospitals and industries respectively. This course will also lay a strong foundation to build the individual research caliber in the aspirants of Bachelor of Science in Microbiology.

5. Core subject papers:

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – 1						
General Microbiology	4	4	3	25	75	100
Microbial Physiology & Taxonomy	4	4	3	25	75	100
Major Practical -1 (Basic Microbiology, Microbial physiology and Biochemistry)	2	0	0	0	0	0
Semester – 1I						
Biochemistry	4	4	3	25	75	100
Major Practical -1 (Basic Microbiology, Microbial physiology and Biochemistry)	2	4	3	40	60	100
Semester-III						
Microbial Genetics & Molecular Biology	4	4	3	25	75	100
Major Practical-II Microbial genetics, Molecular Biology & Industrial Microbiology)	2	0	0			
Semester -IV						
Industrial Microbiology	4	4	3	25	75	100
Major Practical – II Microbial	2	4	3	40	60	100

genetics, Molecular Biology, & Industrial Microbiology						
Semester V						
Bioinformatics	5	4	3	25	75	100
Medical Microbiology	5	5	3	25	75	100
Soil & Agricultural Microbiology	4	4	3	25	75	100
Major Practical – III (Bioinformatics, Medical Microbiology & Soil and Agricultural Microbiology	4	0	0			
Major Practical – IV (Biotechnology & Immunology,)	4	0	0			
Semester VI						
Biotechnology	4	4	3	25	75	100
Immunology	4	4	3	25	75	100
Major Practical – III (Bioinformatics, Medical Microbiology & Soil and Agricultural Microbiology	4	4	3	40	60	100
Major Practical – IV (Biotechnology & Immunology,)	4	4	3	40	60	100

6a. Subject elective papers

rDNA Technology & Tissue culture Technology (Theory & Practical	4	3	3	25	75	100

6b. Skill based subjects

Mushroom Technology	2	2	3	25	75	100
BioControl	2	2	3	25	75	100
Medical Laboratory Technology	2	2	3	25	75	100

7. Non-Major Elective papers

Basic Microbiology	2	2	3	25	75	100
Food & Dairy Microbiology	2	2	3	25	75	100

8. Unitization: Content of every paper divided into FIVE units.

9. Pattern of semester examination

Examinations will be conducted at the end of each semester. Each semester has two pattern of examinations for theory paper, namely Internal (25) and External (75). Each semester has two pattern of examinations for practical paper, namely Internal (40) and External (60).

10. Scheme of Internal Evaluation:

The pattern of Internal valuation:

Tests	- 10 marks (Average of the best two tests)
Assignment	- 5 marks
Seminar/Group Discussion	- 5 marks
Peer-Team Teaching/Quiz	- 5 marks for all subjects
Total	**- 25 marks**

Core Practical Internal examination

The pattern for internal valuation for 40 marks may be

Two internal tests of 25 marks	: Average = 25 marks
Observation Book	: 10 Marks
One assignment	: 05 Marks

11.External Exam : As per the information furnished in No.9.

Examinations

The duration of theory examination shall be three hours to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for UG course should be conducted at the end of the academic year.

12. Question Paper Pattern

THEORY QUESTION PAPER PATTERN

Time: 3 hours Max. Marks: 75

Section- A (10 x 1 = 10 Marks) (Answer all the Question; 1 to 10)

1. Choose the correct answer type questions.
2. Two questions from each unit
3. Four choices with one correct answer in each question.
4. Answer all questions.

Section- B (5 x 7 =35 marks)

Answer all questions – Either Or type
Answers not exceeding two pages (One question from each unit)

Question Nos.

11a	or	11b
12a	or	12b
13a	or	13b
14a	or	14b
15a	or	15b

Section - C (3 x 10 = 30 Marks)

Answer Any Three out of Five
Answer not exceeding four pages (One question from each UNIT)

Question Nos. 16 - 20

CORE PRACTICAL QUESTION PAPER PATTERN

Time : 6 hours Maximum Marks (University Exam) - 60

Major Practical - 1	: 20 Marks
Minor Practical - 1	: 15 Marks
Spotters - 2	: 2 x 2.5 = 5 Marks
Record	: 5 Marks
Viva voce	: 15 Marks
Internal Marks	: 40 Marks
Total	: 100Marks

13. Scheme for evaluation

Section A – 10 X 1	= 10
Section B – 5 X 7	= 35
Section C – 3 X 10	= 30
Total	= 75 (External)

14.Passing minimum

To get a pass, a student should fulfill the following conditions:

a) Theory:
i) Minimum 40% or above as total aggregated marks, including both internal and external.
ii) No separate minimum pass marks for the internal, however the candidate must secure a minimum of 27 marks out of 75 in the external examination to be declared as pass.

b) Practical
i) 40% of the aggregated (Internal +External)
ii) No separate minimum pass marks for the internal, however the candidate must secure a minimum of 21 marks out of 60in the external examination to be declared as pass.

c) Project
i) 40% of the aggregated (Internal +External)
ii) No separate minimum pass marks for the internal, however the candidate must secure a minimum of 28 marks out of 80in the external examination to be declared as pass.

Candidates who have secured 60% and above in aggregates of the Part III will be given First class; Candidates who have secured 50% and above but less than 60% will be given Second class; Candidates who have secured 40% and above but below 50% will be given a Third class.

Ranking will be made for the candidates who have necessarily completed the course without any arrears in each semester and scored the maximum total among all candidates appeared for the examination in the Part III will be given the First Rank. Such candidates will be honored with a Gold Medal if there is a sponsorship or an endowment.

14.1. Classification

S.No	Range of CCPA	Class
1	40 & above but below 50	III
2	50 & above but below 60	II
3	60 & above	I

15.Model questions

Section A
Answer all questions (10x1=10)

1. _____ discovered Cellular immunity.
a. Robert Kotch b. Elie Metchnikoff c. Paul Ehrlich d. Karl Landsteiner

2. Administration of antigens is an example of _____ immunity.
a. Non-specific b. Active c. Passive d. Memory

3. _____ is an antibody which is abundantly present in breast milk.
a. IgG b. IgA c. IgE d. IgD

4. Two heavy chains of antibodies are joined together by _____ .
a. Hinge region b. Fab c. Fc d. Light chain

5. During allergic conditions which antibody concentration gets elevated?

a. IgG b. IgA c. IgE d. IgD

6. In Myasthenia Gravis, auto immunity is developed against_____.

a. Neurons b. Acetylcholine receptors c. Muscles d. Nephrons

7. Monoclonal antibodies are specific at the level of _____.

a. Antigen b. Epitope c. Fab d. Paratope

8. In Precipitation _____ antigen is involved.

a. Soluble b. Particulate c. Both a&b d. Partial

9. ABO blood grouping was given by _____.

a. Robert Kotch b. Elie Metchnikoff c. Paul Ehrlich d. Karl Landsteiner

10. HIV targets _____ cells.

a. CD4-Tcell b. CD8-T-cell c. B-Cells d. Neurons

Section B:

Answer all questions (5x7=35 marks)

11. a. Explain in detail about non-specific host defense mechanism with a few examples.

(or)

11. b. Elaborate on various cells of the immune system.

12. a. Explain classical complement pathway with its significance.

(or)

12. b. What are the different types of immunoglobulins? Write short notes on any three.

13. a. Differentiate hypersensitivity from autoimmunity with a few examples.

(or)

13. b. Write in detail about Type III hypersensitivity.

14. a. Explain double immunodiffusion using schematic representation and mention about its types and principle.

(or)

14. b. Discuss about the production of monoclonal antibodies.

15. a. Briefly explain about Erythroblastosis fetalis.

(or)

15.b. How immunodeficiency is caused by HIV? Explain**.**

Section C

Answer any three questions (3x10=30 marks)

16. What are the molecular tools available for rDNA technology? Discuss in detail about their significances.
17. Explain Sanger's method of sequencing with diagrammatic illustrations. Explain the difference between Sanger's method and Automated DNA sequencing.
18. Describe different blotting techniques that are used in the rDNA technology highlighting the principle behind each blotting techniques.
19. Discuss the different categories of risk groups and its biosafety guidelines.
20. Explain the microbes which live in extreme environments with suitable examples.

16. Teaching methodology

Each subject is designed with lectures / tutorials / seminar / Peer-Team teaching / PPT presentation / Assignments, etc., to meet the effective teaching and the learning requirements. 10% of the course content must be taught through peer team teaching methodology.

17. Text books

1) Prescott, Harley and Klein. 2006, Microbiology 6/e. The McGraw-Hill Companies.
2) Pelczar, M.J.. Chan. E.C.S. and Kreig. N.R. 1993. Microbiology, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3) Schlegel. H.G. 1993. General Microbiology. Cambridge University Press, Cambridge.
4) Stainer. R.Y., Ingraham, Wheelis, M.G. and Paintor. P.R.I986, The Microbial World, Prentice Hall, New Jersey.
5) Tauro. P., Kapoor, K.K.and Yadav. K.S.I989, An Introduction to Microbiology, Wiley Publications. New Delhi.

18. Reference books

1) Microbiology: A laboratory manual, P. Gunasekaran, New Age international publishers, 1996.
2) Laboratory manual in general microbiology, N. Kannan, Panima publishers, 2002.
3) Microbiology: A laboratory manual. J.G. Cappuccino and N. Sherman, Additon- Wesley, 2002.
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5) Moat AG. Foster JW and Spector MP. Microbial Physiology. 4/e Wiley-Liss,2002.
6) Caldwell DR. Wm. Microbial physiology and metabolism. C Brown publishers, USA 2002.
7) J.C. Cappuccino and N.Sherman, Microbiology: A laboratory manual, Addition – Wesley, 2002.

8) M.T.Maigan, J.M. Martinko and J.Parkar, 2000. Brock Biology of Microorganisms, (9th edition), Prentice- Jall.
9) C.J.Alexopoulos and C.W.Mims 1979, Introductory Mycology (3rd edition) Wiley, New York.
10) L.W.Nester, C.N. Roberts and M.L.Nester 1995, Microbiology – A Human Perspectives, Lowa, USA.
11) R.Y.Stainer, J.I.Ingraham, M.L. Wheelis and P.R.Painter 1999 General Microbiological, McMillian Educational Ltd. London.
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14) Biochemistry, Voet. D and Voet. JG. 1990. John Wiley & Sons. NY.
15) Text book of Biochemistry. 2/e. Devlin. T.M. 1986. Wiley Medical Publications, NY.
16) Biochemistry, 2/e, Stryer. L. 1998, W.H. Freeman and Company, NY.
17) Biochemistry, 2/e. Zubay. G. 1998. McMillan Publishers NY. Collier McMillan Company Publishers, London.
18) Enzymes. Ribozymes and DNAzyrnes, P. Palanivelu, 2007, Twenty first Century Publications, Palkalai Nagar, Madurai - 625 021.
19) Laboratory manual in biochemistry, 5/e, J. Jayaraman, New Age international publishers, 1996.
20) Principles of practical biochemistry, K. Wilson and J. Walker, Cambridge University press, 2000.
21) An Introduction to practical biochemistry, D.T. Plummer. TATA McGraw Hill, 1997.
22) Microbial Physiology, 4/e, Moat AG, Foster JW and Spector MP. Wiley-Liss. 2002.
23) Gene VII. Benjamin Lewin, 2000: Oxford University Press.
24) Molecular biology of the Gene,4/e. Watson, Hopkins, Roserts. Steits and Weiner, 1987, The Benjamin/Cumming Publishing Company, Inc.
25) Molecular Genetics of Bacteria, 2/e, Larry Snyder and Wendy Champness, 2003, ASM press. Washington DC.
26) Microbial genetics. David Friefelder, 1987, Narosa Publishing Mouse.
27) Essential ofimmunology, Roitt. I.M. 1998, ELBS, Blackwell scientific publication.
28) Immunology, 3/e. Kuby, J. 1997, W.H.Freeman and company. NY.
29) Crueger, W. and A. Crueger (2000), Biotechnology, A Text book of Industrial Microbiology. Panima Publishers, New Delhi.
30) Flinger, M.C., and Drew, S.W., (1999), Encyclopedia of Bioprocess technology - Fermentation, Biocatalysis and Bioseparation (Volumes I - V), John Wiley and Sons, New York.
31) Sambrook, J. Cold Spring Harbor laboratory (2002).
32) Advanced bacterial genetics, David, RW, Botstein, D & Roth, JR. Cold Spring

Harbor laboratory (1980).
33) Data basis in life sciences and Biotechnology: A directory - DBT, Govt. of India, March 1995.
34) Protein Structure Analysis - Springer Lab Manual. R.M.Kamp, T.Choli- Papadaopoulu B. WitmanLiebold.
35) Computer in microbiology- a practical approach. T.N, Bryant, JWT Wimpenny, IRL, Press, 1989.
36) Jawetz. E. Melnic. JL. &Adelberg. EA. Medical microbiology 22/e McGraw Hill Companies, 2004.
37) Rangasami G and Bagyaraj DJ. 1993. Agricultural Microbiology 2/e Prentice- Hall publications
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39) Ronald Atlas, Bartha Richard, 1987. Microbial ecology 2/e Benjamin/ Cummings publications.
40) Enzymes, Ribozymes and DNAzymes, P. Palanivelu, Twentyfirst Century Publications. Palkalai Nagar, Madurai - 625 021 (2006).
41) Enzymes-Biochemistry, Biotechnology, Clinical chemistry- T. Palmer -East-West press. New Delhi (2.004)

THEORY QUESTION PAPER PATTERN

Time: 3 hours Max. Marks: 75

Section- A (10 x 1 = 10 Marks) (Answer all the Question; 1 to 10)

Choose the correct answer type questions.
Two questions from each unit
Four choices with one correct answer in each question.
Answer all questions.

Section- B (5 x 7 =35 marks)

Answer all questions – Either Or type

Answers not exceeding two pages
(One question from each unit)

Question Nos.

11a	or	11b
12a	or	12b
13a	or	13b
14a	or	14b
15a	or	15b

Section - C (3 x 10 = 30 Marks)

Answer Any Three out of Five

Answer not exceeding four pages
(One question from each UNIT)

Question Nos. 16 - 20

The pattern of internal valuation may be:

- **a)** Two internal test of 15 marks each: Average = 15 marks
- **b)** Group Discussion / Seminar / Quiz = 05 Marks
- **c)** Two assignments: 5 marks each = 05 marks

CORE PRACTICAL - QUESTION PAPER PATTERN

Time : 6 hours Maximum Marks (University Exam) - 60

Major Practical - 1 : 20 Marks
Minor Practical - 1 :15 Marks
Spotters - 2 : 2 x 2.5 = 5 Marks
Record : 5 Marks
Viva voce : 15 Marks

Internal Marks : 40 Marks
Total : 100Marks

The pattern for internal valuation for 40 marks may be
Two internal tests of 25 marks : Average = 25 marks
Observation Book : 10 Marks
One assignment : 05 Marks

19. Retotalling and Revaluation Provision:

Candidates may apply of retotalling and revaluation within ten days from the date of the result published in the University website along with the required forms and fees.

20. Transitory provision

The candidates of previous scheme may be permitted to write exams in their own schemes upto the examinations of April 2020 as a transitory provision.

21. Subjects and Paper related websites

All the subject details along with syllabus may be downloaded from the University website **www.mkuniversity.org**

Overall Course content of B.Sc Microbiology (CBCS pattern)

SI.No	Subject	No. of Papers	No. of Hours	No. of Credits
1	Tamil / Hindi	4	24	12
2	English	4	24	12
3	Core subjects	14	66	58
4	Allied subjects	12	48	40
5	Skill Based Subjects	3	6	6
6	Elective Subjects	1	4	3
7	Non Major Electives	2	4	4
8	Environmental Studies	1	2	2
9	Value Education	1	2	2
10	Extension Activities	1	0	1
	Total	**43**	**180**	**140**

Work load per week, Credits per paper and scheme of examinations

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – 1						
Tamil (Paper I)	6	3	3	25	75	100
English (Paper I)	6	3	3	25	75	100
Core Subject						
General Microbiology	4	4	3	25	75	100
Microbial Physiology & Taxonomy	4	4	3	25	75	100
Allied Subject						
Anc.Chemistry I (Theory)	4	4	3	25	75	100
Anc.Chemistry I (Practical)	2	0				
Major Practical I (Basic Microbiology, Microbial physiology and Biochemistry)	2	0				
Value Education	2	2	3	25	75	100
Total	30	20				600

Tamil and English syllabi and workload are as per the other degree courses.
The Allied 1 (Chemistry) and Allied II (Biology) syllabi are as per other degree courses (E.g. B.Sc. Biochemistry)

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – II						
Tamil (Paper II)	6	3	3	25	75	100
English (Paper II)	6	3	3	25	75	100
Core Subject						
Biochemistry	4	4	3	25	75	100
Major Practical -1 (Basic Microbiology, Microbial physiology and Biochemistry)	2	4	3	40	60	100
Allied Subject						
Anc.Chemistry II (Theory)	4	4	3	25	75	100
Anc.Chemistry I (Practical)	2	2	3	40	60	100
Skill Based Subjects						
Mushroom Technology	2	2	3	25	75	100
BioControl	2	2	3	25	75	100
Environmental Studies	2	2	3	25	75	100
Total	30	26				900

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – III						
Tamil (Paper III)	6	3	3	25	75	100
English (Paper III)	6	3	3	25	75	100
Core Subjects						
Microbial Genetics & Molecular Biology	4	4	3	25	75	100
Major Practical –II (Microbial Genetics & Molecular Biology and Industrial Microbiology	2	0				
Allied Subject						
Anc.Chemistry III (Theory)	4	4	3	25	75	100
Anc.Chemistry II (Practical)	2	0				
Anc. Biology I (Theory)	4	4	3	25	75	100
Anc. Biology I (Practical)	2	0				
Total	30	18				500

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – IV						
Tamil (Paper IV)	6	3	3	25	75	100
English (Paper IV)	6	3	3	25	75	100
Core Subject						
Industrial Microbiology	4	4	3	25	75	100
Major Practical – II(Microbial genetics, Molecular Biology, and Industrial Microbiology)	2	4	3	40	60	100
Allied Subject						
Anc.Chemistry IV (Theory)	4	4	3	25	75	100
Anc.Chemistry II (Practical)	2	2	3	40	60	100
Anc. Biology II (Theory)	4	4	3	25	75	100
Anc. Biology I (Practical)	2	2	3	40	60	100
Extension Activities	0	1				
Total	30	27				800

Title of the Paper	Weekly Contact Hours	No. of Credits	Exam Hours	Marks		
				Int.	Ext.	Tol.
Semester – V						
Core Subjects						
Bioinformatics	5	4	3	25	75	100

Medical Microbiology	5	5	3	25	75	100
Soil & Agricultural Microbiology	4	4	3	25	75	100
Major Practical – III (Bioinformatics, Medical Microbiology and Soil & Agricultural Microbiology	4	0				
Major Practical- IV (Biotechnology and Immunology)	4	0				
Anc. Biology III (Theory)	4	4	3	25	75	100
Anc. Biology II (Practical)	2	0				
Non Major Elective Subject						
Basic Microbiology	2	2	3	25	75	100
Total	30	19				500

Title of the Paper	**Weekly Contact Hours**	**No. of Credits**	**Exam Hours**	**Marks**		
				Int.	**Ext.**	**Tol.**
Semester – VI						
Core Subjects						
Biotechnology	4	4	3	25	75	100
Immunology	4	4	3	25	75	100
Major Practical – III (Bioinformatics, Medical Microbiology and Soil & Agricultural Microbiology	4	4	3	40	60	100
Major Practical- IV (Biotechnology and Immunology)	4	4	3	40	60	100
Elective Subject						
rDNA Technology & Tissue culture Technology (Theory)	4	4	3	25	75	100
Anc. Biology IV (Theory)	4	4	3	25	75	100
Anc. Biology II (Practical)	2	2	3	40	60	100
Skill Based Subject						
Medical Laboratory Technology	2	2	3	25	75	100
Non Major Elective Subject						
Food and Dairy Microbiology	2	2	3	25	75	100
Total	30	30				900

CORE SUBJECTS: CS 01: GENERAL MICROBIOLOGY

Objectives

To facilitate the students to

- Enrich their knowledge in basic microbiology and its applications
- Know the basic features and functions of microbial taxonomy and its importance
- Get familiarized with the taxonomic positions and key identification features of microbes
- Understand the biology of most important microbes diseases, industries, environment, agriculture & medicinal importance.

Unit – I

Introduction - Definition, History,and Scope of Microbiology. Difference between the prokaryotic and eukaryotic microorganisms. Classification of microorganisms - general principles and nomenclature – Haeckel's three kingdom concept. Whittaker's five kingdom concept, Molecular Taxonomy.

Unit – II

Microscopy - Principles & Applications: Resolving power, numerical aperture. components, working principles and applications of simple, compound microscope, light & dark field microscope, electron microscope,phase contrast microscopes, Atomic Force Microscopy, Confocal microscopy and fluorescent microscopy.

Unit – III

Prokaryotes - structure and functions of cell and cellular components, slime, capsule, pili, flagella, cell wall, cytoplasmic membrane, mesosomes, ribosome, nucleoid and other cytoplasmic inclusions of - bacteria, archea, actinomycetes.

Unit – IV

Salient features of Algae, structure and reproduction of Chlamydomonas. Chlorella. Euglena. Diatoms, Dinoflagellates. Salient features of fungal morphology, structures and reproduction: *Dictvostelium, Rhizopus, Aspergillus, Penicillium, Agaricus, Saccharomyces, Neurospora& Candida.*

Unit – V

Microbiology and Human Health - Contributions by Leeuwenhoek, Jenner. Spallanzani, Louis Pasteur, John Needham and Robert Koch. Difference between electron microscope and Compound Microscope. Differences between prokaryotic and eukaryotic cells. Salient features of Bacteria: *Bacillus. Clostridium, E. coli. Salmonella.* Blue green algae, *Streptomyceles* and *Mycoplasma.*

Viruses: T4. Lambda, TMV, Adenovirus, Polio, HIV, Protozoa: Plasmodium.

Reference

1) Prescott, Harley and Klein. 2006, Microbiology 6/e. The McGraw-Hill Companies.
2) Pelczar, M.J.. Chan. E.C.S. and Kreig. N.R. 1993. Microbiology, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3) Schlegel. H.G. 1993. General Microbiology. Cambridge University Press, Cambridge.
4) Stainer. R.Y., Ingraham, Wheelis, M.G. and Paintor. P.R.I986, The Microbial World, Prentice Hall, New Jersey.
5) Tauro. P., Kapoor, K.K.and Yadav. K.S.I989, An Introduction to Microbiology, Wiley Publications. New Delhi.
6) Microbiology: A laboratory manual, P. Gunasekaran, New Age international publishers, 1996.
7) Laboratory manual in general microbiology, N. Kannan, Panima publishers, 2002.
8) Microbiology: A laboratory manual. J.G. Cappuccino and N. Sherman, Additon- Wesley, 2002.
9) Bergey's manual determinative bacteriology, J.G. Holt and N.R. Krieg. Lippincott Williams & Wilkin publishers, 2000.

CS 02 MICROBIAL PHYSIOLOGY & TAXONOMY

Objectives

To facilitate the students:

- To understand the basics of microbial physiology and metabolism.
- To gain knowledge about the importance of metabolism in microbial life.
- To know the basic & through knowledge about the microbial metabolism in the environment.

Unit - I

Generation of Energy - Concepts for Respiration and Fermentation.Fermentation (*vs*) respiration pathways, anaerobic respiration, acid fermentations. Generation of ATP substrate level phosphorylation, oxidative phosphorylation, proton motif force. Cell membrane of bacteria and fungi. Transport of sugars and metabolites - active, passive and facilitated transport systems, chemiosmosis, ion gradients. Secretion in bacteria - type of secretion systems.

Unit - II

Photosynthesis and inorganic metabolism –BacterialPhotosynthesis - Oxygenic and anoxygenic photosynthesis (BGA and Green bacteria). C2, C3 and C4 pathways of carbon assimilation. Assimilation of inorganic phosphorus, sulfur and nitrogen in bacteria - sulfate reduction pathway, ammonia assimilation pathway, nitrogenase and nitrogen fixation.

Unit – III

Bacterial cell division and differentiation –BacterialCell wall synthesis (Gram positive & Gram negative) and pattern of cell division in *E. coli*and Yeast.Life cycle of *Bacillus,* stages of endospore formation, germination and outgrowth. Morphology and life cycles of *Hyphobacterium* and *Caulobacter*. Gliding bacteria and gliding motility, life cycle of fruiting bacteria – Myxobacteria, Sporulation in fungi.

Unit - IV

Principles of chemotaxonomy and numerical taxonomy. Classification of bacteria as per Bergey's Manual of Systematic Bacteriology - Organisms placed in the five kingdoms - Their salient features with examples. Archea, Eubacteria, mycoplasma, Extremophiles.

Unit – V

Classification of Algae by Fritsch, classification of Fungi by Alexopoulos & Mims. Principles of Virus taxonomy, characteristics used in nomenclature & classification of bacterial, plant and animal viruses- their major families with suitable examples.

References

1. Moat AG. Foster JW and Spector MP. Microbial Physiology. 4/e Wiley-Liss,2002.
2. Prescott, Harley and Klein, Microbiology. 6/e The McGraw-Hill Companies, 2006.
3. Caldwell DR. Wm. Microbial physiology and metabolism. C Brown publishers, USA 2002.
4. J.C.Cappuccino and N.Sherman, Microbiology: A laboratory manual, Addition–Wesley, 2002.
5. L.M. Prescott, J.P. Harley and D.A. Klein, 2005, Microbiology (6^{th} edition) McGraw Hill
6. Publishers.
7. M.T.Maigan, J.M. Martinko and J.Parkar, 2000. Brock Biology of Microorganisms, (9^{th} edition), Prentice Hall.
8. C.J.Alexopoulos and C.W.Mims 1979, Introductory Mycology (3^{rd} edition) Wiley, New York.

9. L.W.Nester, C.N. Roberts and M.L.Nester 1995, Microbiology – A Human Perspectives, Lowa, USA.
10. R.Y.Stainer, J.I.Ingraham, M.L. Wheelis and P.R.Painter 1999 General Microbiological, McMillan Educational Ltd. London.

CS 03 : BIOCHEMISTRY

To facilitate the students:

- To know the basics of bio-molecules, structure, complexity and properties.
- To understand the biochemical process of life.
- To gain the thorough knowledge about the major biomolecules like carbohydrates, Proteins and lipids.
- To enrich the analytical and theoritical knowledge in the biomolecules and life

Unit I

Water and Life - pH and Buffers. Law of Thermodynamics-Oxidation and reduction reactions, redox potential, free energy and reaction. ATP energetics. Entropy, Enthalpy, Theory of thermodynamics.

Unit II

Carbohydrates - Biological significance-Classification, Structure, chemical and physical properties of monosaccharide, disaccharides and polysaccharides. Metabolism of carbohydrates-Embden-Meyerhof-Parnas, Entner-Doudoroff. Pentose Phosphate pathways – TCA cycle.

Unit III

Lipids-fatty acids- simple fats. Physical and Chemical properties- Nomenclature of fatty acids-Phospholipids- Spingolipids- Lipoproteins - Reaction of phospholipids and Eicosanoids, Oxidation of fatty acids (β-Oxidation) - Fatty acid synthesis.

Unit IV

Proteins- Structure- Classification, properties of ammo acids and proteins. Primary, secondary, tertiary and quaternary structures of proteins - Enzymes and their classifications - General properties of enzymes (pH, Temperature, substrate concentrations). Michaelis- Menton equation, enzyme inhibition. Isozymes.

Unit V

Nucleic acids - Components. Double helical structure- Nucleic acid denaturation-Classes of nucleic acids- Metabolism of nucleic acids.

References:

1) Principles of Biochemistry. Lehninger, AL. 1993 2nd edition, CSB Publishers.
2) Outlines of Biochemistry, 5/e - Conn. E.E., Stumpf, P.K. Bruening, G and Doi. R.H. John Wiley & Sons (1987)
3) Biochemistry, Voet. D and Voet. JG. 1990. John Wiley & Sons. NY.
4) Text book of Biochemistry. 2/e. Devlin. T.M. 1986. Wiley Medical Publications, NY.
5) Biochemistry, 2/e, Stryer. L. 1998, W.H. Freeman and Company, NY.
6) Biochemistry, 2/e. Zubay. G. 1998. McMillan Publishers NY. Collier McMillan Company Publishers, London.
7) Enzymes. Ribozymes and DNAzyrnes, P. Palanivelu, 2007, Twenty first Century Publications, Palkalai Nagar, Madurai - 625 021.

CP 01 : MAJOR PRACTICALS - I

Objectives

To facilitate the students:

1. To learn the basic principles of laboratory practice, handling the equipments etc.
2. To learn the experimental procedures of handling the pathogenic and non-pathogenic microbes.
3. To perform and understand the morphology and growth behaviors of bacteria, fungi, actinomycetes and algae.
4. To develop a skill to evaluate antimicrobial sensitivity, motility, physiological properties of microbes.
5. To carryout the bioassay and analytical principles to quantify the biomolecules.

BASIC MICROBIOLOGY

1. Parts, working principle and applications of the compound microscope
2. Sterilization methods: moist heat, dry heat, filtration, disinfectants
3. Preparation of bacterial and fungal culture media
4. Isolation of bacteria and fungi from environmental samples
5. Enumeration of bacteria and fungi from environmental samples
6. Observation of bacterial and fungal colony morphology
7. Observation of bacterial and fungal cell morphology under microscope

8. Measurement of bacterial size by micrometry method
9. Pure culture techniques: streak, spread and pour plate methods
10. Observation of bacterial motility by hanging drop method
11. Staining methods: Gram-staining, capsule-staining, endospore-staining

Microbial Taxonomy

Observation of permanent specimen slides:

Bacteria: *Bacillus; E. coli; Staphylococcus; Streptococcus* Algae: *Chlamydomonas, Chlorella, Euglena,* Diatoms Fungi: *Aspergillis: Penicillium; Rhizopus;* Yeast: *Agaricus* Visues: T4; Lambda; TMV. Pox: Vaccinia (photomicrographs)

Biochemical tests for bacterial identification

1. Carbohydrate fermentation: Acid-gas production
2. McConkey agar test for Lactose fermentation
3. IMViC tests
4. Catalase test
5. Oxidase test
6. Urease test
7. Starch, protein, and lipid hydrolysis
8. Coagulase test
9. Triple Sugar Iron test

Microbial Physiology

1. Measurement of growth-

a) Determination of direct count and viable count
b) Plotting growth curve on cm and semi-log graph sheets
c) Calculation of growth rate of *E. coli* and generation time

2. Effect of pH and Temperature on bacterial growth

Biochemistry:

1. Acid-Base titration to determine pK_avalues
2. pH meter- principle and measurements
3. Colorimetry- Beer & Lambert's law
4. Estimation of Carbohydrates

5. Estimation of Proteins (Lowry's method)
6. Estimation of Nucleic acids
7. Separation of amino acids by Paper chromatography
8. Thin layer chromatography

References

1. Microbiology: A laboratory manual, P. Gunasekaran, New Age international publishers, 1996.
2. Laboratory manual in general microbiology. N. Kantian, Panima publishers, 2002.
3. Microbiology: A laboratory manual, J.G. Cappuccino and N. Sherman, Additon- Wesley, 2002.
4. Analytical Biochemistry & Separation Techniques, III Edition - P. Palanivelu, 21st Century Publication, Palkalai Nagar, Madurai - 625 021 (2004).
5. Laboratory manual in biochemistry, 5/e, J. Jayaraman, New Age international publishers, 1996.
6. Principles of practical biochemistry, K. Wilson and J. Walker, Cambridge University press, 2000.
7. An Introduction to practical biochemistry, D.T. Plummer. TATA McGraw Hill, 1997.
8. Microbial Physiology, 4/e, Moat AG, Foster JW and Spector MP. Wiley-Liss. 2002.

CS 04 : MICROBIAL GENETICS & MOLECULAR BIOLOGY

Objectives

To facilitate the students:

- To understand the basic principles of genetic materials & its inheritance.
- To know the importance of molecular biology and genetics in life
- To enrich the knowledge in basic genetic features of bacteria, bacteriophages, fungi, and algae.
- To become familiar with the principles and applications of microbial genetransfer methods.

Unit I

Genetics - Microbial genetics vs. Mendelian genetics-DNA as genetic material-experimental evidence- concept of gene and mutations- fluctuation test and its significance- complementation. Mutagenes-chemical and physical mutagens – UV, NTG and hydroxylamine - mode of action-isolation of auxotroph and drug resistance mutants- DNA damage and repair.

Unit II

Structural aspects ofDNA - the double helical model- Various forms of DNA- Genome organization - Prokaryotes and Eukaryotes. DNA replication- Semi conservative - Nature of replication- DNA polymerases in prokaryotes & eukaryotes - the processes of DNA replication - Replication in eukaryotes- Mitochondrial DNA replication.

Unit III

Genetic exchange in bacteria – transformation, transduction (Generalized and Specialized), and conjugation- co-transduction and its use in genetic mapping-chromosome transfer by Hfr strains& arriving at *E. coli* genetic map.

Unit IV

Transcription - RNA polymerases in prokaryotes and eukaryotes - their function- process of transcription in prokaryotes- initiation and elongation and termination- factors involved. Regulation of gene expression in bacterial system- the operon model- detailed study of *lac* and *trp* operons.

Unit V

Genetic code, Codons and Anticodons. Wobble hypothesis. Protein synthesis- the stages of protein synthesis- the process of translation in prokaryotes factors involved in translation- the triplet nature of genetic code- an overview of comparisons with eukaryotic translation.

References

1.Gene VII. Benjamin Lewin, 2000: Oxford University Press.
2.Molecular biology of the Gene,4/e. Watson, Hopkins, Roserts. Steits and Weiner, 1987, The Benjamin/Cumming Publishing Company, Inc.
3.Molecular Genetics of Bacteria, 2/e, Larry Snyder and Wendy Champness, 2003, ASM press. Washington DC.
4.Microbial genetics. David Friefelder, 1987, Narosa Publishing Mouse.

CS 05 : INDUSTRIAL MICROBIOLOGY

Objectives

To facilitate the students to

- Know the basic features of fermentation biology and fermentors.
- Widen their knowledge in industrial uses of microbes.
- Know the In-depth information about the lab to industrial practices.
- Understand the biosafety features, containment facilities and other quality parameters.

Unit I

Industrial Microbiology: Introduction and Scope. Fermentation types: aerobic, anaerobic and solid state fermentation. Operation of fermentation by batch, fed batch and Continuous fermentations.

Unit II

Fermentor: Basic design, configurations, parts and function. Types of fermentors: Air lift and CSTR tower fermentor and packed bed bioreactor. Control and monitoring of variables, temperature, pH, agitation, pressure, online measurement, on/off control, PD control Computer applications in fermentation technology.

Unit III

Fermentation processes: Sterilization of fermentor and media. Inoculum preparation- Inoculum build-up, production processes. Scale-up process of fermentation. Downstream process of fermented products – cell harvesting, purification methods and drying.

Unit IV

Production processes: Aerobic fermentation of Penicillin, Glutamic acid, Lysine,and Vitamin B_{12}. Anaerobic fermentation of Ethanol, Acetone – Butanol, and solid state of Gibberellic acid. Detection and assay of fermentation products.

Unit V

Biosafety consideration: Types of containment, personal practices, primary and secondary contaminant barriers, Risk assessment and Regulation, Biosafety levels, guidelines and regulations. Quality assurance and quality control of fermented products.

Reference Books

1. Crueger, W. and A. Crueger (2000), Biotechnology, A Text book of Industrial Microbiology. Panima Publishers, New Delhi.
2. Flinger, M.C., and Drew, S.W., (1999), Encyclopedia of Bioprocess technology - Fermentation, Biocatalysis and Bioseparation (Volumes I - V), John Wiley andSons, New York.
3. Nandari, H., (2005), Industrial Biotechnology, Dominant Publications and Distributors, New Delhi.
4. Reed, G. (1987), Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors, New Delhi.
5. Rita Singh and Ghosh, S.K., (2004), Industrial Biotechnology, Global Vision Publishing House, New Delhi.
6. Stanbury, O.F., Whitakar, A., and Hall, S.J., (1997), Principles of Fermentation Technology, Aditya Books (P) Ltd.. New Delhi.
7. Whitacker, EX., 1987, From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany.

CP 02 : MAJOR PRACTICALS - II

Objectives

To facilitate the students to

- Learn the basic genetic experiments to understand the complexity of biological process.
- Perform an experiment to know the inheritance of bacterial genes.
- Demonstrate the techniques for the production, purification and assay of industrially valuable compounds.
- Develop the skill to evaluate the immune response, antigen-antibody reactions etc.

Microbial genetics & Molecular Biology

1. Separation of proteins by acrylamide gel electrophoresis
2. Isolation of spontaneous mutant: antibiotic resistant mutants
3. Isolation of auxotrophic mutant by chemical and UV mutagenesis, i. Replica plating technique.
4. Induction of *lac*operon

Industrial Microbiology

1. Isolation of amylase and protease producing bacteria and fungi

2. Crowded plate technique for antibiotics producing microbes
3. Alcohol (ethanol) production
4. Immobilization of yeast.

References

1. Analytical Biochemistry & Separation Techniques, III Edition - P. Palanivelu, 21st Century Publication, Palkalai Nagar, Madurai - 625 021 (2004).
2. Molecular Cloning, A laboratory manual, Maniatis, T., Fritsch, E.F. &
3. Sambrook, J. Cold Spring Harbor laboratory (2002).
4. Advanced bacterial genetics, David, RW, Botstein, D & Roth, JR. Cold Spring Harbor laboratory (1980).
5. Crueger, W. and A. Crueger (2000), Biotechnology, A Text book of Industrial Microbiology. Panima Publishers, New Delhi.
6. Flinger, M.C., and Drew, S.W., (1999), Encyclopedia of Bioprocess technology - Fermentation, Biocatalysis and Bioseparation (Volumes I - V), John Wiley and Sons, New York
7. Nandari, H., (2005), Industrial Biotechnology, Dominant Publications and Distributors, New Delhi.

CS 06 : BIOINFORMATICS

Objectives

To facilitate the students to

- Understand the principles of computer and networking
- Understand the principles of bioinformatics
- Widen their knowledge in genomics & Proteomics
- Become familiar with biological databases and data banks
- Enabling the knowledge in the processing of biological data

Unit I

Components of computers input/output devices. Storage devices. Graphic devices. Program and representation of information. Operations system. MS DOS & WINDOWS - Networks-Intranet and Internet - LAN.

Unit II

Use of commercial software: Lotus, D Base, Wordstar. Windows. Power Point. MS Excel, Print artist, Sigma Plot, Mathcad,

Unit III

Biological resource databases- Examples and application - Sequence analysis-Protein Nucleic acid: Genome analysis; sequence alignment, BLAST, MSA, etc.,.

Unit IV

Collection and downloading information from databases- Literature search -CCOD-Medline - Biological websites.

Unit V

Accessing information through Internet-Bionet news groups- WWW Software. (HTTP. HTML).

References

1. Software Director}' for molecular Biologists Christopher J Rawlings, Stockton Press, Mac Millan Publishers, 1986.
2. Data basis in life sciences and Biotechnology: A directory - DBT, Govt. of India, March 1995.
3. Protein Structure Analysis - Springer Lab Manual. R.M.Kamp, T.Choli- Papadaopoulu B. Witman Liebold.
4. Computer in microbiology- a practical approach. T.N, Bryant, JWT Wimpenny, IRL, Press, 1989.
5. Bio-Statistics Analyses by Zar. Second Edition, Prentice Hall International Englewood Cliffs, New Jersey.

CS 07 : MEDICAL MICROBIOLOGY

Objectives

To facilitate the students:

- To know the medically important microbes and pathogenesis.
- To understand the disease life.

- To gain the thorough knowledge about the pathogenesis, diagnosis, treatment methods of communicable diseases
- To enrich the research knowledge in medical Microbiology

Unit I

The History of Infectious Diseases: Host - pathogen interactions -epidemiology of infectious diseases. Systemic bacteriology: General characters, molecular pathogenesis and laboratory diagnosis of diseases using Southern and western blotting methods. Applications of PCR in Medical Microbiology - Role of virulent factors in bacterial adhesion and colonization - Host-defense mechanisms.

Unit II

Diagnosis and control of microbial diseases - Collection and identification of pathogens from specimen - Biochemical tests for bacteria - Diagnosis of viral infections using immunological tests and phage typing. Principle and significance of antimicrobial chemotherapy and susceptibility testing. Mechanism of action of β-lactam - drugs affecting protein and nucleic acid synthesis - Mode of action of antiviral and antifungal drugs- Development of drug resistance.

Unit III

Bacterial diseases: Transmission, diagnosis, clinical symptoms and treatment for bacterial diseases: diphtheria, plague, tuberculosis, leprosy, gonorrhea, syphilis, cholera typhoid, shigellosis, peptic ulcer, Staphylococcal and Streptococcal diseases.

Unit IV

Viral diseases: Etiology, prophylaxis, clinical symptoms and treatment for human viral diseases. Smallpox, yellow fever, rabies, viral hepatitis, poliomyelitis. AIDS and secondary infections.

Unit V

Fungal and protozoan diseases: Cutaneous mycoses, systemic mycoses, opportunistic mycoses. Life cycle, diagnosis and treatment of following protozoan diseases - amoebiasis, giardiasis, malaria, kala-azar, trypanosomiasis.

References

1. Jawetz. E. Melnic. JL. & Adelberg. EA. Medical microbiology 22/e McGraw Hill Companies, 2004.

2. Minis, C. Playfair, J Roitt, I, Wakelm, D. & Williams. R. Medical Microbiology, 3/e Mosby publications. 2004.
3. Prescotl, Harley and Klein, Microbiology, 6/e The McGraw-Hill Companies, 2008.
4. Ananthanarayanan R. & Jayaram Panicker, C.K. Textbook of Microbiology. Orient Longman. 2005.

CS 08 : SOIL AND AGRICULTURE MICROBIOLOGY

Objectives

To facilitate the students:

- To enrich their knowledge in basic soil microbiology and its applications
- To know the microbial importance in agriculture
- To familiar with beneficial and harmful microbes for soil and agriculture
- To understand the biology of most important nutrient recycling – microbial process.

Unit I

Soil microbes: Bacteria, Fungi and Actinomycetes (abundance & distribution). Microbial interaction: mutualism, amensalism and commensalisms.Beneficial Plant microbial interactions - Symbiotic and free living microbes, N_2 fixation - Genetics of N_2 fixation, phosphate solubilization.Mycorrhizal association: ecto and endomycorrhizae, and actinorrhizae. Rhizosphere effect.

Unit II

Plant microbe interactions (Harmful):Plant pathogens - pathogenesis, mechanism of pathogen establishment and symptoms. Plant diseases caused by Bacteria –*Xanihowonas, Mycoplasma,*Fungi -*Pvricularia, Fusarium* and Viruses –TMV, CMV.

Unit III

Disease control- Fungicides, Pesticides, Biological control mechanisms -Production of bioinsecticides, bacterial and viral. Microbial nematicides and microbial herbicides.

Unit IV

Biofertilizers production and applications: Rhizobium, Azotobacter, Azospirillum, cyanobacteria, Phosphobacter &VAM. Biotechnology in Agriculture: *Bt*. cotton and herbicide tolerant plants.Plant Growth Promoting Rhizobacteria(PGPR) – Bacteria & Actinobacteria.

Unit V

Role ofmicroorganisms in biogeochemical cycles -N, P,S and C cycles. Biodegradation of xenobiotics (chlorinated pesticides) - MEOR - bioleaching of metals. Microbes in waste treatment: solid waste (sanitary land fill and composting) and liquid waste - sewage treatment - BOD - pollution indicating microbes.

References

1. Rangasami G and Bagyaraj DJ. 1993. Agricultural Microbiology 2/e Prentice- Hall publications.
2. Ronald alias, Bartha, Richard, 1987. Microbial ecology 2/e Benjamin/ Cummings publications.
3. Prescott. Harley and Klein, 2006. Microbiology. The McGraw Hill companies.
4. Madigan. VI.T. Martinko, J.M. and Parker. J., 1997. Brock Biology of Microorganisms 8/e. Prentice-Hall Inc.

CP 03 : MAJOR PRACTICALS- III

Objectives

To facilitate the students to:

- Understand the principles of computer and networking
- Understand the principles of Bioinformatics
- Widen their knowledge in genomics & Proteomics
- Learn the basic experimental methods to screen targeted pathogens.
- Perform an experiment to know the antibiotic sensitivity pattern.
- Demonstrate the techniques for enumeration methods and analysis of soil microbial interactions.
- Develop the skill to evaluate the agricultural importance of Microbes.

Bioinformatics

1. Collection and downloading information from databases- NCBI, EMBL, SWISS PROT, DDBJ
2. DNA sequences alignment, BLAST, FASTA etc.,
3. Molecular Docking studies, protein structure prediction methods
4. GenBank submission
5. Phylogeny tree construction

Medical Microbiology

1. Antibiotic susceptibility test: disc diffusion method

2. Measurement of minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC)
3. Isolation and identification of pathogenic bacteria from clinical specimens: *Staphylococcus, Streptococcus, Salmonella, Shigella, Vibrio.*
4. Preparation of blood smear for malarial parasite
5. Collection and processing of medical samples

Soil and Agricultural Microbiology

1. Isolation and characterization of soil microbes
2. Serial dilution method for enumeration of soil bacteria
3. Identification of microbial pathogen in paddy and vegetable crops (field stud) I.
4. Isolation of symbiotic nitrogen fixing bacteria from root nodules – *Rhizobium*
5. Isolation of free-living nitrogen fixing bacteria from rhizosphere – *Azoiohacter*
6. Isolation of phosphate solubilizing bacteria – *Pseudomonas*
7. Examination of mycorrhizae – VAM
8. Potability testing of water (MPN test)

References

1. Rangasami G and Bagyaraj DJ. 1993. Agricultural Microbiology 2/e Prentice- Hall publications.
2. Ronald Atlas, Bartha Richard, 1987. Microbial ecology 2/e Benjamin/ Cummings publications.
3. Prescott, Harley and Klein, 2006, Microbiology, The McGraw Mill companies,
4. Madigan, M.T., Martinko, J.M. and Parker, J. 1997, Brock Biology of Microorganisms 8/e. Prentice-Hall Inc.
5. Jawetz, E, Melnic, J.L & Adelberg, E.A. Medical microbiology 22/e McGraw Hill Companies, 2001.
6. C Minis, J Playfair, I Roitt, D Wakelin, R Williams, Medical Microbiology. 3/e Mosby publications, 2004.
7. Prescott, Harley and Klein, Microbiology, 6/e The McGraw-Hill Companies. 20Q(x
8. Ananthanarayanan, R and CK Jayaram Panicker. Textbook of Microbiology, Orient Longman, 1997.
9. Data bases in life sciences and Biotechnology: A directory - DBT, Govt. of India, March 1995.
10. R.M.Kamp, T.Choli- Papadaopoulu B. Witman Liebold. Protein Structure Analysis - Springer Lab Manual.

CS 09 : BIOTECHNOLOGY

Objectives

To facilitate the students to

- Understand the principles of biotechnology
- Understand the biology of molecular vectors
- Become familiar with biological applications in agriculture, medicine and Industries
- Enable their knowledge in rDNA technology

Unit I

History and scope of Biotechnology; Biotechnology as an inter-disciplinary course - General Strategies of cloning - Vectors: Plasmids- constructed plasmids, pBR322, pUC18 - Lambda phage derived vectors, cosmids and their applications. Ml3 phage and its uses - BAC and YAC as vectors - Selection of suitable hosts - Cloning in *E.coli* and yeast

Unit II

Gene manipulation techniques: DNA isolation, Plasmid isolation- Restriction enzymes: Types and properties- DNA ligation. - Methods of gene transfer - Gene gun method, electroporation and microinjection methods - Southern and Northern blotting techniques- DNA sequencing.

Unit III

Animal & Plant Biotechnology: Mammalian cell cloning vectors-Transgenic animals: transgenic mice and sheep. - Gemini virus and Cauliflower mosaic virus as cloning vectors. Agrobacterium mediated gene transfer mechanism - Markers and Reporter genes and their applications - Transgenic plants - insecticide resistance, herbicide and drought tolerance.

Unit IV

Microbial production of recombinant proteins: Expression vectors-Constitutive and mducible promoters - Production of recombinant DNA proteins using microbial hosts - Production of Insulin- Growth hormone- Interferons - Tissue Plasminogen Activator, etc.

Unit V

Intellectual property rights - GATT and IPR, different forms of IPR, IPR inIndia, patent co-operation treaty, forms of patents, process of patenting, Indian and international agencies involved in patenting, patenting biological materials.

References

1. Basic Biotechnology 3/e, Ratledge, C and Kristiansen, B. Cambridge University Press (2008)
2. Brown. T.A., Genetics - A Molecular Approach. Chapman Hall. London. 2004.
3. Darnell, J. Lodish, H.. and Baltimore, D., Molecular Cell Biology, Scientific American Books Inc., Iowa. 2006
4. Glick.B.R. and Pasternak, J.J.,2006, Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.
5. Gower,D.M.,2001, DNA Cloning- A Practical Approach, IRI press, Oxford.
6. Mitra.S.,2001.Genetic Engineering, Macmillan, India Limited, New Delhi.
7. Paolella, P.. 2003. Introduction to Molecular Biology, McGraw Hill Publication, Boston.
8. A.L. Demain, R M. Atlas, W.S Hu, R C. Willson. C. L. Hershberger, G. Cohen, J. E. Davies, D. H. Sherman, J. H. David Wu, 1999 Manual of Industrial Microbiology and Biotechnology, 2nd Edition ASM press,
9. Michael J. Waites, 2001 Industrial Microbiology: An Introduction (Illustrated) Blackwell Science Inc.

CS 10: IMMUNOLOGY

Objectives

To facilitate the students to

- Understand the basics of Immunology
- Widen their knowledge in classical and molecular Immunology
- Become familiar with immunization practices and their importance
- Enabling their knowledge in the techniques of Immunology

Unit I

Elements of Immunity: Overview ofthe Immune system- Basic concepts in Immunology (History), principles of innate and acquired immunity - Cells and organs of the immune system - Classes of antigens and their characteristics. Haematopoiesis.

Unit II

Antibody structure: Classification,structure and characterization.Antigen Antibody reaction - properties, agglutination, precipitation, ELISA, RIA and Immunofluorescence. Complement pathways,immune tolerance.Monoclonal antibody and it’s applications

Unit III

Humoral and cell mediated immune response: Activation, differentiation of T-cells and B-cell maturation. Major Histocompatibility complex (MHC) - antigen processing and presentation.

Unit IV

Hypersensitivity reaction: Different types, disorders of immune response, auto immunity, Tand B cell and NK cell associated diseases; Phagocytosis.

Unit V

Transplantation immunology: Basics of graft rejection. Tissue typing, Clinical importance of transplantation, Tumor antigen, Immune response to tumor. Cancer immunotherapy.

References

1. Essential of Immunology, Roitt. I.M. 1998, ELBS, Blackwell scientific publication.
2. Immunology, 3/e. Kuby, J. 1997, W.H.Freeman and company. NY.
3. Immunobiology. The immune system in health and disease-3/e - Travers. J. 1997 - Garland publishers. NY.
4. Immunology; Understanding of immune system. Klaus, E., Elgert, 1996. Wiley Liss. NY.
5. Cellular and Molecular Immunology, 5/e, Abbas, A.K. Lichtman. A.H.2000. Sunders.

CP 04 : MAJOR FRACTICALS – IV

Objectives

To facilitate the students to

- Learn the basic experimental methods to screen the DNA & Plasmids.
- Perform an experiment to know the separation techniques.
- Demonstrate the techniques for construction of recombinant DNA.
- Develop the skill to evaluate the recombinants.
- Become familiar with immunization practices and their importance
- Enabling their knowledge in the techniques of Immunology

Biotechnology

1. Isolation of chromosomal DNA from microbial cells.
2. Separation of DNA by agarose gel electrophoresis
3. Determination of purity and quantification of DNA
4. Isolation and purification of a plasmid DNA
5. Restriction Digestion Analysis
6. Ligation
7. Transformation of *E. coli* using plasmid (pUC 18/19)
8. Blue-white Selection of transformants

Immunology

1. Lymphoid organs in experimental animals - mouse/rat/rabbit
2. Immunization and bleeding techniques
3. Separation of serum/plasma
4. Erythrocyte sedimentation rate
5. Blood cell count: RBC count, WBC count - total and differential
6. Blood typing: ABO, Rh factor
7. Agglutination tests: Widal test
8. Precipitation: Ouchterlony's double immunodiffusion

References

1. Molecular Cloning, A laboratory manual, Maniatis, T,, Fritsch, E.F. &Sambrook, J. Cold Spring Harbor laboratory (2002).
2. Immunology, 3/e. Kuby, J. 1997, W.H.Freeman and company. NY.
3. Immunobiology. The immune system in health and disease-3/e - Travers. J. 1997 - Garland publishers. NY.

ELECTIVE SUBJECTS

ES 01 : rDNA AND TISSUE CULTURE TECHNOLOGY

Objectives

- To understand the principles of rDNA technology.
- To understand the basic biology of tissue culture methods.
- To become familiar with rDNA applications in agriculture, medicine and Industries
- To enable their knowledge in rDNA technology

Unit I

Basics of rDNA technology- Land Marks in recombinant DNA. technology –Principle and methods of genetic transfer mechanisms Conjugation, Transformation, Transduction and Transfection.

Unit II

Techniques in molecular biology: Principle, methods, types and applications of proteins and DNA Sequencing, Blotting techniques - Southern, northern, western and Dot blot. Gene amplification technique: Polymerase Chain Reaction (PCR).

Unit III

Plant tissue culture: Surface sterilization of field-grown tissues, callus induction, role of hormones in dedifferentiation, regeneration of shoots and roots from callus cultures. Totipotency in plant cells- Micropropagation (large scale production of virus free seedlings for economically important plant species)

Animal tissue culture: Preparation of media, preparation of primary culture, maintenance of secondary culture, evaluation of culture dynamics. Cell synchronization - preservation and revival of cells.

Unit IV

Gene expression strategies, post-transcriptional (RNA splicing) and Post translation (protein folding) modification of expressed gene products.

Unit V

Applications of rDNA technology in Medicine- production of insulin, growth hormone, detection of genetic disorders - Protein engineering and Hybridoma technology (Production and applications of Monoclonal antibody). In Agriculture: Expression of bacterial toxin and herbicide tolerant plants, in Industry: microbial strain improvement and their significance.

References

1. S. B. Primrose. R. M, Twyman and R. W. Old. 1996. Principles of gene manipulations.6lh edition Blackwell scientific publication. London.
2. A. Slater, N, Scott and M Fowler. 2003. Plant Biotechnology. Oxford.
3. R. K. Gupta. 2001. Biotechnology and Genomics. India

4. Richard H, Baltz. Gorge D He gem an and Paul L Skatrud, 1993. Industrial Microorganisms- Basic and Applied Molecular Genetics. American Society for Microbiology. Washington.
5. J.Mammonds. P McGarvey and V Yusibov, Springer, 2000, Plant Biotechnology, Heidelberg.

SKILL BASED SUBJECTS

SBS O1 : MUSHROOM TECHNOLOGY

Objectives

To facilitate the students to

- Understand the skills for identification of edible mushrooms
- Widen their knowledge in mushroom classification and applications
- Become skillful self employer in mushroom cultivation technology

Unit I

History of edible mushrooms- Major genera of edible mushrooms - Structure and key for identification - Food values of mushroom - Medicinal values of mushrooms.

Unit II

Methods of cultivation of mushrooms - Substrate for mushroom production – Insect, pest and diseases of mushroom - Mushroom industry - Economics of mushroom production.

Unit III

Exotic mushrooms - Truffles (*Tuber melanosporum)* - Poisonous mushrooms -identification

References

1. Mushroom Technology by Nitabhal. Publications (--)
2. Cultivation of edible mushrooms - ICAR Publications (--).
3. Mushroom Production and Processing Technology/V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Vedams Ebooks Pvt Ltd., New Delhi (2000)

SBS 02 : BIOCONTROL

Objectives

To facilitate the students to

- Understand the basic skills of Biocontrol of insects & pests
- Lean the techniques for culture and processing of biopesticides
- Become skillful self employer in Biocontrol agent production & marketing.

Unit I

Outline of pest management programme - Insect pest management and Rodent pest management - Need of Biocontrol agents. Economics of Biocontrol

Unit II

Biopesticides - microbes used in biopesticides, *Bacillus thuringemis, B. sphaericus,* Metarizyum and *Trichoderma*- Insect control, Nuclear Poiyhedro Virus and CPV- potentials and limitations.

Unit III

Biology and ecology of organisms for Biocontrol- Predators and Parasifoids-*Trichogramma*

References

1. Roy G. Van Driesche and Thomas S Bellows Jr. Biological Control -Giude to its application s, Springer (1996).
2. Helmut Fritz Van Embden and M.W Service, Pest and vector control, Cambridge University Press (2004)

SBS 03 : MEDICAL LABORATORY TECHNOLOGY

Objectives

To facilitate the students to

- Understand the skills for collection and processing of clinical samples
- Widen their knowledge in identification of pathogenic Microbes & pathology of clinical specimens
- Become skillful self employer in Medical Lab technology

Unit I

Role of Microbiology Labs - Safety regulations. Types of specimens. Collection and handling of specimens. Anticoagulants. Components ofblood and their functions-erythrocytes, leukocytes, lymphocytes, monocytes, and thrombocytes. Preparation of blood collecting containers with anticoagulant. Blood collection by venipuncture, Blood collection by capillary puncture,. Preparation of serum and plasma. Routine haematological tests- determination of haemoglobin concentration, RBC and WBC counts. Study of stained blood smear- differential WBC count. Reticulocyte count- ESR- Eosinophils count- Platelet count; Packed Cell Volume. Maintenance of laboratory records.

Unit II

Laboratory identification ofinfectious agents. Staining techniques-Simple. Gram staining, acid-fast, Capsular (negative staining) and spore staining. Antimicrobial susceptibility tests. Diagnosis of mycotic and parasitic infections.

Unit III

Clinical Pathology- Urine analysis and Stool examination- Clinical Biochemistry-Routine biochemical tests-Blood sugar, urea, creatinine and cholesterol. Routine procedures in blood bank-ABO blood grouping and Rh typing-AHG test-compatibility testing or cross-matching.

References

1. Kanai L. Mukherjee, 1988, Medical Laboratory Technology Volumes-I to III. Tata McGraw-Hill Publishing Company Limited. New Delhi.
2. Basic laboratory procedures in clinical bacteriology 2nd Edition, World health organization.

NON-MAJOR ELECTIVE SUBJECTS

NME 01 : BASIC MICROBIOLOGY

Unit - I

History and scope of microbiology, spontaneous generation – biogenesis theory – contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Fleming.

Unit II

Sterilization and disinfection – principles – methods of sterilization – physical methods – dry heat – moist heat – radiation – filtration (membrane and HEPA) – chemical sterilization – chemical agents – mode of action. Preservation and maintenance of culture and staining techniques

Unit III

General characteristic features of bacteria, virus, algae, fungi, protozoa and parasites. Microbiology and human health - any two examples.

References

1. Talaro K.P. and Chess B. (2012) Foundations in Microbiology, 8th Edn. The McGraw Hill Companies.
2. Tortora, G.J., Funke, B.R. and Chase C.L. (2013) Microbiology: An Introduction, 11th Edn. Pearson-Benjamin Cummings.
3. Brown A. and Smith H. (2015) Benson's Microbiological Applications: Laboratory Manual in General Microbiology, 13th Edn. McGraw-Hill Companies.
4. Prescott, Harley and Klein. 2006, Microbiology 6/e. The McGraw-Hill Companies.
5. Pelczar, M.J.. Chan. E.C.S. and Kreig. N.R. 1993. Microbiology, Tata McGraw-Hill Publishing Co. Ltd., New Delhi

NME 02 : FOOD AND DAIRY MICROBIOLOGY

Unit I

Importance of Food and Dairy Microbiology- Food as substrate for microbial growth-intrinsic and extrinsic factors affecting growth and survival of microorganism in foods - Microorganisms present in the vegetables, fruits, cereals, milk, egg, etc.

Unit II

Features of food spoilage like fruits, vegetables, milk and milk products - Milk sterilization techniques. Phosphatase test- Spoilage of bread and cereals, egg. meat, fish and poultry.

Unit III

Food preservation by removal of microorganisms, low temperature, high temperature irradiation and chemical methods. Food borne infection, food borne intoxications Detection of food-borne pathogens.

References

1. M.R.Adams and M.O.Moss. 2005. Food Microbiology. New age international Pvt Ltd publications.
2. W. C. Frazier and D. C. Westhoff. 2003. Food Microbiology, 4Ih edition. McGravvHill, NewYork.
3. B. C. Hobbs and D. Roberts. 1993. Food Poisoning and Food Hygiene. Edwards Arnold. London.
4. A. E. Yousef and C.Caristrom. 2003. Food Microbioiogy-A Laboratory manual, Wiley Interscience.
5. J. *M,* Jay. 2000. Modem Food Microbiology. Aspen Publishers.
6. Robinson, R.K.I990. Dairy Microbiology. Elsevier Applied Science. London.