PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM – 636 011

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR M.SC. APLIED MICROBIOLOGY

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2012 – 2013 ONWARDS

1. CONDITIONS FOR ADMISSION

A. ELIGIBILITY CONDITIONS FOR ADMISSION

Candidate who has passed the B.Sc. degree in any Life Sciences [Microbiology / Applied microbiology/ Industrial Microbiology/ Botany/ Plant Sciences and Plant Biotechnology/ Zoology/ Animal Science/ Applied Animal Science and Animal Biotechnology/ Biochemistry/ Bioinformatics/ Biology/ Life Sciences/ Home Science/ Food Science & Nutrition/ BSMS/BAMS/BUMS/Chemistry with Botany / Zoology as Allied Subjects of this University or an Examination of any other University accepted by the Syndicate as equivalent thereto shall be eligible for admission to M.Sc. Degree Course in Microbiology.

Candidate shall be admitted to the examination only if he/she has taken the qualifying degree in Science/ Medical subjects as mentioned after having completed the prescribed courses consisting of twelve years of study and has passed the qualifying examination.

B. METHOD OF SELECTION

Candidates have to appear for an **entrance examination** in the respective subjects to be conducted by the respective departments and thereafter an interview. The date, venue, and time of the entrance examination and interview will be notified to the applicants separately as soon as it is fixed.

2. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed course of study in a college affiliated to the University for a period of not less than two academic years, passed the examination of all the four semesters prescribed earning 90 credits (plus 2 credits for Human Rights) and fulfilled such conditions as have been prescribed therefore.

3. DURATION OF THE COURSE

The duration of the course is for two academic years consisting of four semesters.

4 EXAMINATIONS

There shall be four semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

5. COURSE OF STUDY AND SCHEME OF EXAMINATIONS

NAME OF THE COURSES

Semester I : Core –I General Microbiology

	Core – II	Immunology and Immunotechnology
	Core – III	Pharmaceutical chemistry
	Core – IV	Practical - 1; General Microbiology & Immunology
	Elective I	
Semester II	Core – V	Medical Bacteriology and Mycology
	Core – VI	Virology and Parasitology
	Core – VII	Microbial Genetics and Molecular Biology
	EDC I	
	Core – VIII	Practical - 2; Medical Bacteriology, Virology, Mycology & Parasitology
	Core – IX	Practical - 3; Microbial Genetics & Molecular Biology
	Internship	
Semester III	Core – X	Industrial Microbiology and Fermentation technology
	Core – XI	Microbial Biotechnology and Nanotechnology
	Core – XII	Soil, Agriculture, Food and Environmental Microbiology
	Elective II	
	Core – XIII	Practical - 4; Industrial Microbiology & Biotechnology
	Core – XIV	Practical - 5; Applied Microbiology
Semester IV	Core – XV	Research methodology, Biostatistics and Bioinformatics
	Elective III	
	Core – XVI	Project Work

Elective courses - Major

1. Microbial Nanotechnology
2. Biofertilizer and Biomanure Technology
3. Disease diagnosis Technology
4. Marine Microbiology
5. IPR, Biosafety & Bioethics
6. Bioremediation Technology

EDC- Supportive courses for other Departments:

1. Microbial Technology

2. Entrepreneurship in Microbiology
3. Human Infectious Diseases & Diagnostics
4. Microbial Nanotechnology

SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

Theory: Maximum marks – 75 Marks:

Part A – 25 Marks (5 Questions) and

Part B – 50 Marks (5 Questions).

Internal marks – 25

Total marks – 100.

Time - 3 hrs.

The following procedure will be followed for Internal Marks:

Theory Papers:	**Internal Marks**
Best Two tests out of 3	10 marks
Attendance	5 marks
Seminar	5 marks
Assignment	5 marks
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	25 marks

Practical:	**Internal Marks**	40
Attendance		5 marks
Practical Test Best 2 out of 3		30 marks
Record		5 marks

Project:

Internal Marks presentations	40 marks
Viva	10 marks
Project Report	50 marks

Break-up Details for Attendance

Below 60%	- No marks
60% to 75%	- 3 marks
76% to 90%	- 4 marks
91% to 100%	- 5 marks

IMPORTANT POINTS

1. The each practical examination should be conducted for 6hrs/day, 2 consecutive days. **The fee for the practicals is double the amount of the normal 6 hours practicals** (ie. If the practical fee is Rs. 210 for 6 hrs practicals, for these Applied Microbioogy students, the fee will be Rs. 420/- practical). Similarly, **the practical examiners also should be paid with double the remuneration** (ie. Rs. 100/- practical)
2. Elective papers can be selected by the concerned College Departments based on the student's interest.
3. For the internship programme, the students **should undergo training in any of the reputed microbiology / Biotechnology concerns for minimum of two weeks time during the II semester holidays**. The reports of the internship should be submitted to the concerned department head and will be evaluated during the III semester practical examinations.

M.Sc. DEGREE COURSE IN APPLIED MICROBIOLOGY

Course of Study

Semester	Paper code	Course	Hrs/week	Credits	Marks		
					CIA	EA	TOTAL
Sem-I	12AMB 01	Core I	6	5	25	75	100
	12AMB 02	Core II	6	5	25	75	100
	12AMB03	Core III	6	5	25	75	100

	12AMBE01	Elective-I	6	4	25	75	100
	12AMBP01	Core Practical-1	6	4	40	60	100
Sem-II	12AMB04	Core IV	5	5	25	75	100
	12AMB05	Core V	5	5	25	75	100
	12AMB06	Core VI	5	5	25	75	100
	12AMBEDC01	EDC Paper (Supportive) -1	4	4	25	75	100
	12AMBP02	Core Practical-2	6	4	40	60	100
	12AMBP03	Core Practical 3	5	4	40	60	100
Sem-III	12AMB07	Core VII	5	5	25	75	100
	12AMB08	Core VIII	5	5	25	75	100
	12AMB09	Core IX	5	5	25	75	100
	12AMBE01	Elective - II	4	4	25	75	100
	12AMBI01	Internship	Two weeks		40	60	100
	12AMBP04	Core Practical-4	6	4	40	60	100
	12AMBP05	Core Practical-5	5	4	40	60	100
Sem-IV	12AMB10	Core X	5	5	25	75	100
		Elective –III	4	4	25	75	100
	12AMB11	Core- XI PROJECT	21	4	40	60	100
Total				**90**			**2100**

No. of courses : 16
Elective - Major : 3
Supportive course –EDC : 1
Internship : 1

6. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS:

(i) Candidates shall register their names for the First semester examination after the admission in the PG courses.

(ii) Candidates shall be permitted to proceed from the First Semester upto the Final Semester irrespective of their failure in any of the Semester Examination subject to

the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

7. PASSING MINIMUM:

a) There shall be no Passing Minimum for Internal.
b) For External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.
c) In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.
d) Grading shall be based on overall marks obtained (internal + external).

8. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the First Class. All other successful candidates shall be declared to have passed in Second Class. Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class with Distinction, provided they pass all the examinations (theory papers, practicals, project and viva-voce) prescribed for the course in the First appearance.

9. GRADING SYSTEM:

The term grading system indicates a Seven (7) Point Scale of evaluation of the performances of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade.

SEVEN POINT SCALE (As per UGC notification 1998)

GRADE	GRADE POINT	PERCENTAGE EQUIVALENT
`O' = Outstanding	5.50 – 6.00	75 – 100
`A' = Very Good	4.50 – 5.49	65 – 74
`B' = Good	3.50 – 4.49	55 – 64
`C' = Average	3.00 – 3.49	50 – 54
`D' = Below Average	1.50 – 2.99	35 – 49

`E' = Poor	0.50 – 1.49	25 – 34
`F' = Fail	0.00 – 0.49	0 - 24

10. RANKING:

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under "Requirements for Proceeding to subsequent Semester" are only eligible for Classification.

11. PATTERN OF QUESTION PAPER:

PART –A (200 words): Answer 5 out of 7 Questions 5 x 5 = 25 marks
PART –B (500 words): Answer All 5 Questions either or type 5 x 10 = 50 marks

12. APPEARANCE FOR IMPROVEMENT:

Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper / papers only once in order to improve his/her marks, by paying the fee prescribed from time to time. Such candidates are allowed to improve within a maximum period of 10 semesters counting from his/her first semester of his/her admission. If candidate improve his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be
counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration. Candidate will be allowed to improve marks in the Practicals, Project, Viva-voce, Field work.

13. TRANSITORY PROVISION:

Candidates who have undergone the course of study prior to the academic year 2008-2009 will be permitted to appear for the examinations under those Regulations for a period of three years i.e., up to and inclusive of April/May 2012 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

M.Sc. DEGREE COURSE IN APPLIED MICROBIOLOGY

SYLLABUS

SEMESTER I

12AMB01 – GENERAL MICROBIOLOGY

UNIT I

Introduction – Development of microbiology and the early discoveries - Isolation of different types of bacteria – fungi – actinomycetes – cyanobacteria – protozoa. Preservation methods of microbes for storage and microscopy studies, culture collections, Sterilization and disinfection – physical and chemical methods for controlling microorganisms.

UNIT II

Bacteria: Morphological types: cell wall – cell walls of Gram negative, Gram positive, halophiles, L-forms and archae bacteria. Cell wall synthesis, capsule types composition and function. Cell membranes in eubacteria, archaebacteria and cyanobacteria – membrane functions, periplasmic space. Structure and function of flagella, cilia and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Fungi: cell wall – chemical composition and functions, membranes and their functions

UNIT III

Microbial taxonomy – definition and systematics, nomenclature rules and identification, hierarchical organization and the position of microbes in the living world classification systems – artificial and phylogenetic – dendogram. Whittaker's five kingdom approach. Major characteristics used in taxonomy – morphological, physiological, metabolic, genetic and molecular. Classification of salient features of bacteria according to Bergey's Manual of Determinative Bacteriology.

UNIT IV

Microbial respiration and fermentative pathway – respiratory metabolism – Embden Mayer Hoff pathway – ED pathway – Glyoxalate pathway – Krebs cycle – oxidative and substrate level phosphorylation – TCA cycle – gluconeogenesis – Fermentation of carbohydrates – homo and hetero lactic fermentation.

UNIT V

Numerical and chemotaxonomy of microorganisms. Modern classification of fungi, mycoplasma, cyanobacteria, protozoa and prochlorates. Microbes in extreme environments and space.

Reference:

Prescott LM, Harley JP and Klein DA (2003) Microbiology (5th Edition) McGraw Hill New York

Pelczar Jr, M.J.Chan, E.C.S and Krei N.R (1993) Microbiology McGraw Hill New York

Alexopoulus CJ and C. W. Mims (1993) Introductory Mycology (3rd edition) Wiley Eastern Ltd. New Delhi

Elizabeth Moore Landecker (1996) Fundamentals of the Fungi (4th edition) Prentice Hall International Inc, London

Holt, JS., Kreig NR., Sneath P.H.A and Williams S.T Bergeys Manual of Determinative Bacteriology (9th edition) Williams and Wilkins, Baltimore

Madian MT, Martinko JM and Parker J Brock TD (1997). Biology of Microorganisms (8th edition) Prentice Hall International Inc. London

Web Site Address

http://www.sheffcol.ac.uk/links/Science/Biology/Microbiology
http://www.cat.cc.md.us/courses/bio141/Labmanal/index.html
http://www.microbiologyonline.org.uk/links.html
http://www.bact.wisc.edi/Microtextbook/index.php
http://www.bris.ac.uk/vetpath/cpl/tut.html
http://www.bmb.leeds.ac.uk/mbiology/ug/ugteach/elect/elect.htm
http://www.kensbiorefs.com/Microbio.html
http://www.microbeworld.org/

12AMB02 - IMMUNOLOGY AND IMMUNOTECHNOLOGY

UNIT-1 History and scope of immunology; Lymphoid tissues and organs. Types of immunity: Innate and acquired, active and passive. Cell mediated immunity and Humoral immunity. Kinetics of antibody production – primary and secondary antibody response.

UNIT-2 Haematopoiesis. Ontogeny, origin, development and differentiation of immune cells. Clonal selection theory. B-lymphocytes and their activation. Thymus derived lymphocytes, Antigen presenting cells, mechanism of T-cell activation. T-helper and T-cytotoxic cells, Natural killer cells, Dendritic cells, Langerhan cells, Macrophages, Microphages. Phagocytosis process. Structure and functions of Class I and II molecules. Major Histocompatibility Complex.

UNIT-3 Immunoglobulins - structure, distribution and function. Generation of antibody diversity. Organisation and expression of immunoglobulin genes. Antigenicity: factors governing antigenicity. Antigen types, haptens, epitopes, adjuvants, carriers, bacterial, viral and tumour antigens, autoantigens, blood group antigens, T dependent, T independent antigens. Antigen antibody reactions. Factors governing antigen-antibody interactions: affinity, avidity, valency, cross reactivity.

UNIT-4 The complement systems: mode of activation, classical and alternate pathway Transplantation immunity - Organ transplantation and HLA tissue typing. Introduction to autoimmune disorders and immunology of infectious diseases.

UNIT- 5 Hypersensitivity reactions. Immunological tolerance. Immunosuppression. Immunotherapy. Hybridoma and monoclonals. Recombinant antibodies. DNA vaccines and Edible vaccines.

Text Books

1. Roitt.I.M. (1998). Essential Immunology. Blackwell Scientific Publications, Oxford.
2. Abbas, A.K., Litchman, A.H., Pober. J.S. (1994) Cellular and Molecular Immunology. Second Edition. W.B.Saunders, USA.
3. C.V. Rao, (2002) An Introduction to Immunology. Narosa Publisihng House, India
4. K. R. Joshi, N.O. Osama (2000) Immunology, Agrobios Ltd, India.

References

1. Kuby Immunology (2002) by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Company, New York.
2. C.A. Janeway, P. Travers, M. Walport and M.J. Shlomchik(2001), Immunobiology: The Immune System in Health and Disease. Garland Publishing, USA.
3. Ivan M. Roitt and Peter J. Delves (2001) Essential Immunology, Blackwell Science Ltd. Oxford.
4. Stefan E. Kaufmann, Alan Sher and Rafi Ahmed (2002) Immunology of Infectious diseases , ASM Press, USA
5. Peter Wood, (2001).Understanding Immunology University of Manchester, Pearson Education Lts, Essex.

Websites

http://www-immuno.path.cam.ac.uk/-immuno/part1.html
http://www.Iclark.edu/-reiness/immuno/lectures.html
http://www.hhmi.org/biointeractive/immunology/lectures.html
http://www.immuneweb.xxmc.edu.cn/immunology/immunology.html

12AMB03 PHARMACEUTICAL CHEMISTRY

Unit I Basic Chemistry concepts- Standard periodic table of the chemical elements - Atomic structure: Atom - Ion - Electron - Proton - Neutron -Atomic orbital - Molecular orbital - Chemical element - Valence - Atomic nucleus - Isotope. Bonding : Chemical bond - Ionic bond - Covalent bond - Metallic bond - Hydrogen bond - Intermolecular force - Dipole - Electron pair - Unpaired electron.

Unit II Chemical structure and uses – Antibiotics - Penicillin, Chloramphenicol, Tetracyclin. General properties and drug action of Sulphonamides – Sulphadiazine, Sulphapyridine, Sulpathiazole, Sulphafurazole. Narcotic analgesics – morphine, heroine and codeine. Synthetic analgesics – pethidine and methadone. Antipyretic analgesics – methyl salicylate, aspirin, paracetamol and phenacetin. Anaesthetics, Tranquilizers, Antineoplastics, Alkaloids, Hypnotics and Sedatives.

Unit III Pharmacokinetics and Pharmacodynamics - Routes of drug administration- volume of distribution- biotransformation- phase I and phase II reactions- bioavailability- excretion of drugs and their metabolites as defined by Hendersson hassle batch equation.

Unit IV Mechanism of action of drugs - Drug physical and chemical actions – drug interactions- therapeutic applications of beneficial interactions. Adverse drug reactions. Principles of toxicity, evaluation and determination of LD 50,ED 50 and TD 50. Water activity. Drug safety.

Unit V Techniques in pharmaceutics – Screening, extraction procedures, purification and evaluation of biomedical potential and the side effects of the drugs. Evaluation of drugs in biological fluids - bioassays, microbiological assays, radio immunoassays. Indian medicinal plants and trees. Medical importance of magnesium, aluminium, phosphorus, silver, gold and iron.

Text Books

1. Gajapathy, D. and Sasikala Amarasurya, 1995. Pharmaceutical chemistry. R.T.Publications, Vellore. 194pp.
2. Lakshmi. S. Pharmaceutical chemistry, 1st edition. 1995. Sultan Chand and Sons Publications, New Delhi. 212ppext Books
3. Satoskar R.S. and S.D. Bandarkar, 1989, Vol I and II. 11th edition
4. Marine Biotechnology Vol I. Pharmaceutical and Bioactive Natural Products (1993) Edited by D.H. Attaway and O.R. Zaborsky, Plenum Press, USA

Reference Books

1. Highlights of Marine Natural Products Chemistry (1972-1999). D. J. Faulkner, Natural Products Report, 2000, 17, 1-6
2. Marine Pharmacology. D. J. Faulkner, Antonie van Leeuwenhoek, 2000, 77, 135-145
3. Biosynthesis of Marine Natural Products: Microorganisms and Macroalgae. B. S. Moore, Natural Products Report, 1999, 16, 653- 674
4. Marqquis JK (authour). Contemporary issues in pesticide toxicology and pharmacology. London S Karger, 1986.
5. Ghosh MN (Ed.). Fundamentals of experimental pharmacology (2nd edn.). Scientifica book agency, Calcutta, 1984.
6. Rang HP, Dale MM, Ritter JM (Eds.). Pharmacology (4th edn.). Churchill Livingstone, New York, 1999.
7. Cooper JR, Bloom FE, Roth RH (Eds.). The biochemical basis of neuropharmacology (8th edn.). Oxford University Press, Chennai, 2003.
8. Purohit, S.S., 2003. Phamaceutical microbiology. 596.pp

Websites

http://www.chemlin.net/chemistry/pharmaceutical_chemistry.htm

http://www.internetchemie.info/chemistry/pharmaceutical-chemistry.htm

http://web.chem.ucla.edu/~harding/orglinks.html

http://en.wikipedia.org/wiki/H3_Pharmaceutical_Chemistry

http://ibchem.com/IB/ibfiles/options/opt_B/opb.htm

PRACTICAL – 1

PRACTICAL EXAM : 6 HRS / DAY; 2 CONSECUTIVE DAYS

12AMBP01- GENERAL MICROBIOLOGY & IMMUNOLOGY

General Microbiology

UNIT -I

Direct microscopic observations of bacterial shape – simple, gram staining, acid-fast, metachromatic granular staining, spore staining, capsule staining, flagella staining, LPCB staining, yeast budding, germ tube.

Measurement of size of microbes – micrometry method, motility determination – hanging drop method.

UNIT -II

Enumeration of bacterial / yeast cells viable count (pour plate and spread plate), total count (haemocytometer count), fungal slide culture technique.

Measurement of growth – growth curve, Determination of growth rate and generation time. Effect of pH, and temperature on growth of bacteria.

UNIT -III

Biochemical tests: carbohydrate fermentation, IMVIC tests, starch hydrolysis, cellulose, gelatin, casein, catalase test, oxidase test, urease test, nitrate reduction, TSI.

Immunology

UNIT -IV

1. ABO Blood grouping – Rh typing and cross matching
2. Agglutination tests
    a. WIDAL,
    b. RA,
    c. ASO,
    d. CRP,
    e. Beta-HCG,

UNIT -V

3. Precipitation
    a. Ouchterlony's Double Immuno-diffusion test,
    b. Counter Immunoelectrophoresis,
    c. Rocket Immunoelectrophoresis.
    d. Radial Immuno Electrophoresis
4. Rapid plasma reagin test- and VDRL
5. ELISA

Text Books

1. Sundaraj T, Mrs. Aswathy Sundararaj. (2002) Microbiology Laboratory Manual, First edition, Chennai.
2. Dubey, R.C. and Maheshwari, O.K. (2005) Practical Microbiology. S, Chand and Co.Ltd., First edition. New Delhi.
3. Baron E J and Finegold S M. (1995). Diagnostic Microbiology. Blackwell Scientific Systems.
4. An Introduction to Immunology (2002) by C.V. Rao, Narosa Publisihng House, India
5. Immunology (2000) by K. R. Joshi, N.O. Osama, Agrobios Ltd, India.
6. Manual of Clinical Laboratory Immunology (2002) Edited by N. R. Rose, R. G. Hamilton and B. Detrick, ASM Press.

Reference Books

1. Cappuccino, J and Sherman, N. (2002) Microbiology. A Laboratory Manual . 6th Edition. Pearson Education Publication, New Delhi.
2. Celis, V.E . (1994) Cell Biology Vol I to III .
3. Hand book of Experimental Immunology Vol.I & II (1986) by Weir, D.M. Blackwell Scientific Company.
4. Immunochemistry (Vol. IV) Publication, Chicago
5. Immunology (2000) Janis Kuby fourth edition, W H Freeman Company, USA
6. Essential Immunology (1997) Ivan Roitt (Blackwell Science Publishers, UK,
7. A Hand Book of Practical Immunology (1983) GP Talwar ,Vikas Publishing House, India.

Web sites

http://www.sheffcol.ac.uk/links/Science/Biology/Microbiology
http://www.cat.cc.md.us/courses/bio141/Labmanal/index.html
http://www.microbiologyonline.org.uk/links.html
http://www.bact.wisc.edi/Microtextbook/index.php
http://www.bris.ac.uk/vetpath/cpl/tut.html
http://www.bmb.leeds.ac.uk/mbiology/ug/ugteach/elect/elect.htm
http://www.kensbiorefs.com/Microbio.html
http://www.microbeworld.org/
http://microbiology.mtsinai.on.ca/manual/default.asp
http://microbes.wordpress.com/category/practical/
www.sgm.ac.uk/pubs/micro_today/book_reviews/rev17.cfm
www.staff.ncl.ac.uk/n.j.morris/**lecture**s/class2007.html
www.york.ac.uk/depts/biol/ugrad/current/2007Intake/Moduleinformation/secondyrPDFfiles/403.pdf

SEMESTER - II

12AMB04 – MEDICAL BACTERIOLOGY AND MYCOLOGY

UNIT I Bacteriology: Indigenous normal microbial flora of human body. General attributes and virulence factors of Bacteria causing infections. Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis.

UNIT II

Morphology, classification, cultural characteristics, Pathogenicity, pathology, Laboratory diagnosis and prevention – Control and treatment of diseases caused by the following organisms: *Staphylococci, Streptococci, Pneumococci, Neisseriae (Gonococci & Meningococci), Corynebacterium, Mycobacterium, Clostridium* and *Bacillus*.

UNIT III Studies on *Salmonella, Shigella, Vibrios, Brucella,* Gram negative anaerobes Spirochetes, Rickettsiae, Chlamydiae, Mycoplasmas and Ureoplasmas. Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions – Hospital waste disposal – Ethical committee – functions.

UNIT IV

Morphology and classification of medically important fungi - Isolation and Identification of fungi from clinical specimens - Antifungal agents - sensitivity test - mycotoxins.

UNIT V

Superficial mycosis - Tinea, Piedra. Cutaneous mycosis - Dermatophytosis. Subcutaneous mycosis - *Sporotrichosis, Mycetoma, Rhinosporidiosis.* Systemic mycosis Blastomycosis and Histoplasmosis. Opportunistic mycosis - Candidiasis, Cryptococcosis and Aspergillosis.

Reference Books

1. Morag, C. and Timbury, M.C. (1994) *Medical Virology,* 10th Edn. Churchill Livingston, London.
2. Dimmock, N.J. and Pimrose, S.B. (1994) *Introduction to Modern Virology*, 4th Edn. Blackwell Scientific Publications, Oxford.
3. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) *Virology*, 3rd Edn, Prentice Hall, New Jersey.
4. Flint, S.J., Enquist,L.W., Krung,R. Racaniello,VR. And Skalka,A.M. (2000). Principles of Virology,Molecular Biology,pathogenesis and control,ASM Press, Washinton D.C.
5. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial genetics. Jones and Bartlett publishers.
6. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.
7. Tom Parker,M., Leslie H. Collier. (1990). Topley &Wilson's Principles of Bacteriology,Virology and Immunity (VIII Edition).
8. Greenwood, D., Slack, R.B. and Peutherer, J.F.(2002) *Medical Microbiology*, 16th Edn. Churchill Livingstone, London.
9. Finegold, S.M. (2000) *Diagnostic Microbiology,* 10th Edn. C.V. Mosby Company, St. Louis.
10. Ananthanarayanan, R. and Jayaram Panicker C.K. (2004) *Text book of Microbiology*. Orient Longman, Hyderabad.
11. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) *Methods for General and Molecular Bacteriology.* ASM Press, Washington, DC.
12. .

Web sites

1. http:// www.virology.net/garryfavwebaids.html
2. http:// www. virology.net/garryfavwebaids.html≠genaids
3. http:// www.bcm.edu/pedi/infect/dvl/links.htm
4. http://users.ox.ac.uk/-genemed/virology.htm
5. http:// www.bact.wisc.edu/bact330
6. http:// www-micro.msb.le.ac.uk/224/
7. http:// www.cellsalive.com/ecoli.htm
8. http:// www.bact.wise.edu/microtextbook/
9. http:// www. Pitt.edu/-super1/lecture/lec4771/
10. http:// www.textbook of bacteriology.net/

12AMB05– VIROLOGY AND PARASITOLOGY

Unit I

Brief outline on discovery of Viruses, nomenclature and classification of Viruses; Distinctive properties of Viruses; Morphology & ultra structure. General methods of diagnosis and serology, viriods, prions, satellite RNAs and virusoids. Newly emerging viral diseases.

UNIT II Bacteriophage - Bacteriophage typing- application in bacterial genetics. Plant viruses-TMV- general characters- morphology-replication-RNA as its initiators of infection. Cauliflower mosaic virus; Transmission of plant viruses; common viral diseases of crop plants- paddy, cotton, tomato, and sugarcane. Viruses of cyanobacteria, algae, fungi and insects.

UNIT III Classification and nomenclature of Animal and Human Viruses. Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of DNA Viruses- Pox viruses, Herpes viruses, Adeno viruses, Hepatitis viruses ; RNA Viruses- Picorna, Orthomyxo, Paramyxo, Toga and other arthropod borne viruses, Rhabdo, Rota, HIV- oncogenic viruses. Viral Vaccines and Antiviral agents.

Unit IV

Introduction and classification of parasites - Laboratory techniques in parasitology - Examination of faeces - Direct and concentration methods - Intestinal amoebae - *Entamoeba histolytica*, *E. coli*. Free living amoebae - *Naegleria fowleri*, *Acanthamoeba* spp. Intestinal and genital flagellates - *Giardia*, *Trichomonas*. Blood and tissue flagellates - *Leishmania donovani*, *Trypanosome cruzi* and *T. brucei* comples. Haemosporina - Malarial parasites. Coccidian - *Toxoplasma*, *Cryptosporium*.

Unit V

Infection of helminthes - *Taenia solium*, *T. Saginata*, *Echinococcus granulosus*, *Fasciola hepatica*, *Paragonimus westermani* and *Schistosomes*, *Ascaris lumbricoids*, *Ancylostoma duodenale*, *Trichuris*, *Enterobius* and *Wuchereria bancrofti*. Blood smear examination - cultivation of protozoan parasites, serology and PCR techniques.

Reference

1. Topley and Wilson (1995) *Principles of Bacteriology Virology and Immunity*. 9th Edn. Vol I, Edward Arnold, London
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3. Jegadish Chander, 1996. A Text Book of Medical Mycology. Interprint, New Delhi.
4. Chakraborty, P., 2003. A Text Book of Microbiology. 2nd edition, Published by New Central Agency (P) Ltd., Kolkatta.
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11. Ichpujani, R.L. and Rajesh Bhatia, 2003. Medical Parasitology. 3rd edition, JAYPEE brothers, Medical publishers (P) Ltd, New Delhi.

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http://microbiology.mtsinai.on.ca/manual/default.asp
http://cal.vet.upenn.edu/parasite/links.html
http.www.suite101.com/links.cfm/microbiology
http://www.biosci.ohio-state.edu/-zoology/parasite/home.html

12AMB06 – MICROBIAL GENETICS AND MOLECULAR BIOLOGY

UNIT - I

Mendelian genetics, Linkage, Crossing over, Classical experiments - Hershey and Chase, Avery McLeod and McCarty. Bacterial conjugation, Transduction and transformation.

UNIT - II

Gene as a unit of mutation and recombination, Mutation - Molecular nature, Mutagenesis - Chemical and physical. Mechanism of repair, Photo reactivation, Excision, Repair, Recombination repair, SOS.

UNIT - III

Confirmation of DNA and RNA, Replication in prokaryotes, Organization of eukaryotic chromosome - Transcription - Features of promoters and enhancers, RNA splicing, Translation - Genetic code. Gene expression and regulation - Operon models.

UNIT - IV

Extra chromosomal Heredity: Biology of plasmids, their discovery, types and the structure of F, Col factors and Ti – plasmid - Natural and artificial plasmid and their applications, Transposons - Types and importance. Vectors-plasmid based vectors – pBR322, pUC series – Phage vectors – m13 mp series, λ – vectors, cosmids.

UNIT - V

Yeast vectors and mammalian vectors. Basics of r-DNA technology – restriction and modifyning enzymes, Restriction mapping. Ligases – Linkers and adaptors. Construction of cDNA and genomic Libraries, Blotting techniques - PCR, RACE, RAPD, Identification of microorganisms by 16s rRNA, Safety guidelines of recombinant DNA research.

References

1. Berger, S.l., Kimmer, A.R., 1987. Methods In Enzymology, Vol 152, Academic Press,
2. Ansubel, F.M., Brent, R., Kingston, R.E., Moore, D.D, 1988. Current Protocols In. Molecular Biology, Greene Publishing Associates, NY,
3. Old, R.W., Primrose S.B., 1993. Principles of Gene Manipulation, An Introduction to Genetic Engineering, Blackwell Science Publications.
4. Peter Paolella, 1998. Introduction to Molecular Biology, Mc Graw-Hill
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7. Benjamin Lewin, 2000. Gene VII, Oxford University Press.

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PRACTICAL - 2

PRACTICAL EXAM : 6 HRS / DAY; 2 CONSECUTIVE DAYS

12AMBP02- MEDICAL BACTERIOLOGY, VIROLOGY, MYCOLOGY & PARASITOLOGY

UNIT I

Collection and transport of clinical specimens –Pre requisites -Proforma - Methodologies. Direct examinations –wet films/staining for Faeces (*V.cholerae, Shigella, Salmonella*) Pus, Sputum, throat/ear/nasal/wound swabs, CSF and other body fluids. Simple, differential and special staining methods.

UNIT II

Cultivation methods -Transport media -Isolation methods –Basal, Differential Enriched, selective media & special media for the pathogenic bacteria. Biochemical identification tests for the respective bacteria up to species level. Antibiotic sensitivity tests - Kirby Bauer method – Stokes method, Dilution -Agar dilution & Broth dilution -MIC -Quality Control for antibiotics and standard strains.

UNIT III

KOH preparation of skin / nail scrapings for fungi and for scabies mites, Hair infected under UV light. LPCB mount. Cultivation of fungi and their identification - *Mucor -Rhizopus, Aspergillus, Penicillium, Candida, Trichophyton, Microsporum, Epidermophtyon* -SDA/corn meal agar. Slide culture method -Germ tube method - Sugar assimilation/fermentation tests for yeast.

UNIT IV

Examination of parasites in clinical specimens -ova/cysts in Faeces -Direct and concentration: methods -Formal Ether and Zinc sulphate methods -Saturated salt solution method. Blood smear examination for malarial parasites. Thin smear by Leishman's stain.

UNIT V

Isolation and characterization of bacteriophage from natural sources – phage titration-T4. Study of virus infected plants-– chick embryo isolation- fibroblast culture

– preparation (demonstration). Spotters of viral inclusions and CPE- stained smears. Viral serology- HAI-ELISA kits, Western Blotting.

Reference Books

1. Dubey, R.C. and Maheshwari, D.K. (2002) *Practical Microbiology,* 1st Edn. S. Chand & Co. Ltd., New Delhi.
2. Cappuccino, J. and Sherman, N. (2002) *Microbiology: A Laboratory Manual*, 6th Edn. Pearson Education Publication, New Delhi.
3. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. (1996) *Mackie and McCartney Practical Medical Microbiology,* 14th Edn. Churchill Livingstone, London.
4. Cowan and Steel (1995) *Manual for Identification of Medical Bacteria*, 4th Edn. Cambridge University Press, London.
5. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H. (2003) *Manual of Clinical Microbiology* , 8th Edn. Vol 1&2, ASM Press, Washington, D.C.
6. Balows, A., Hausler. W.J., Ohashi.M. and Turano.A. (Eds) (1988) *Laboratory Diagnosis of Infectious Diseases: Principles and Practice,* Vol 1 Springer-Verlag, New York.
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9. Finegold, S.M. (2000) *Diagnostic Microbiology,* 10th Edn. C.V. Mosby Company, St. Louis.

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http:// www.textbook of microbiology.net/

http:// www.microbeworld.org/

http:// www.protocol-online.com

http:// www.microbiologyonline.org.uk/

http:// www.microbes.info/

http:// dmoz.org/science/biology/microbiology

http:// www.biosci.ohio-state.edu/%7Eparasite/home.html

http:// cal.vet.upenn.edu/parasitic/links.htm

PRACTICAL – 3

PRACTICAL EXAM : 6 HRS / DAY; 2 CONSECUTIVE DAYS

12AMBP03- MICROBIAL GENETICS AND MOLECULAR BIOLOGY

UNIT I

Isolation of DNA and RNA from microbial system -quantification-

Chemical methods: dinitrophenol, orcinol, physical methods - UV - Adsorption.

Isolation of plasmid DNA from bacteria (mini preparation).

Isolation of plasmid DNA from Cyanobacteria (mini preparation)

Size Characterization of DNA by agarose gel electrophoresis.

UNIT II

Isolation of antibiotic resistant microbes.

Induction of mutation by Ultra-Violet radiation and chemical mutagens

UNIT III

Protoplast / Spheroplast isolation.

Purification of plasmids - large scale.

UNIT IV

Preparation of competent *E.coli* cells.

Transformation of plasmid DNA to the *E.coli* cells.

PCR amplification -16s rRNA and RAPD.

UNIT V

Southern blotting

Northern blotting

SEMESTER - III

12AMB07 – INDUSTRIAL MICROBIOLOGY AND FERMENTATION TECHNOLOGY

Unit I

Industrially important microorganisms - Isolation, preservation and improvement of strains - handling - development of inoculum for various fermentation processed upstream processing - media for industrial fermentation - formulation - sterilization.

Unit II

An Introduction on fermentation process - The range of fermentation process, chronological development - component parts of fermentation process - fermentation economics.

Unit III

Fermentation types - submerged and solid state fermentation - down stream processing - Recovery of intracellular and extra cellular products - Biomass separation by centrifugation, filtration, flocculation and other recent developments, Cell disintegration - physical, chemical and enzymatic methods. Extraction - solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction. Purification by different methods, Concentration by precipitation, ultra filtration, reverse osmosis. Drying and crystallization.

Unit IV

Fermentor design - Body construction, individual parts, heat production - gas liquid exchange - mass transfer - heat transfer - oxygen transfer - stirring and mixing - Newtonian, non Newtonian fluids - effect of viscosity - scale up - control of temperature, pH, form pressure - Sterilization of Bioreactors and nutrients, computer application and fermenter technology.

Unit V

Microbial production of organic acids - Amino acids, antibiotics - enzymes - vitamins - alcoholic beverages - wine and beer, Fermented foods - bread, cheese, soy nance,

microbial transformations - steroids and sterols, non steroid compounds - antibiotics and pesticides.

References

1. Stanbury, P.F., Whittaker, A. and Hall, S.J., 1995. Principles of fermentation technology, 2nd edition, Pergamon press.
2. Crueger and Crueger, A., Biotechnology : A text book of Industrial Microbiology, 2nd edition, Sinavos association, Ino Sundeland.
3. Cassida, J.E., 1968. Industrial Microbiology, Willy Eastern.
4. Presscott and Dunn, S., Industrial Microbiology.
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7. Chand, Fermentation Biotechnology: Industrial Perspectives.
8. Belter, P.A., Cussler, E.L. and Hu, W.S., Bioseparation: Down stream processing for Biotechnology, John Wiley and Sons, N.Y.
9. Chisti, Y., Fermentation, Biocatalysis and bioseparation, Encyclopedia of Bioprocess Technology, Vol. 5, John Wiley and Sons, N, Y.

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http://www.fsis.usda.gov/
http://www.cdc.gov/
http://web.indstate.edu/thcme/mwking/
http://lifesciences.asu.edu/text/classesbk.html

12AMB08 - Microbial Biotechnology and Nanotechnology

UNIT - I

Introduction to microbial biotechnology: History and scope of microbial biotechnology. Microbial metabolites: Production and its use of enzymes, Organic solvents, Single cell proteins, Baker's yeast, Beverages, Beer, Wine,. Production of microbes as biofertilizers and biopesticides: Biomass: Production from carbohydrates, higher alkanes and methanol.

UNIT - II

Biodegradation of natural substances: Cellulose, Xylan, Hemicelluloses, Starch, Fructose, Mannan, Pectin and Lignin. Role of microbes in waste management: Production and application of biocompost, biogas. Microbial fuel cells (Biodiesel and H_2 production). Microbial gene therapy, production of insulin, growth hormones, TPA, GMOs, Transgenic crops. Bioplastics and biopolymer.

UNIT - III

Bioremediation: definition, microbial approaches to bioremediation. Bioremediation of contaminated soils. Diversity and magnitude of soil contaminants. Bioremediation of contaminated aquifers. Oil spills degradation. Bioremediation of air pollutants. Bioleaching, biomagnifications, bioaccumulation of metallic and non metallic components.

UNIT - IV

Biotechnology to nanotechnology - Needs. Historical perspectives. Introduction to nanotechnology, Opportunities and challenges of nanotechnology. Structural and functional principles of nanotechnology, Applications of nanotechnology. Characteristics and applications of quantum dots and fullernes. Magnetic nano particles, Nano biosensors, Synthesis of Gold, Silver, Titania and Nano arrays.

UNIT - V

Nanotechnology : Nanoparticle synthesis by plants, bacteria and yeast. Nanotechnology in human disease control. *In vitro* diagnosis. Medical applications of nanoparticles and nanosystems. Nano drug delivery - Micelles for drug delivery. Conventional drug delivery and targeted drug delivery. Advantages. Delivery profile, Role of nanotechnology in Cancer treatment.

References

1. Alexander N. Glazer, Hiroshai and Nikaido, 2007. Microbial Biotechnology,
2. Maheshwari. D. K., R.C.Dubey, R.Saravanamuthu, 2010, Industrial Exploitation of Microorganisms, I. K. International Publishing house Pvt Ltd, New Delhi.
3. Dubey R.C, 2006, Textbook of Biotechnology , S.Chand and Company Ltd, New Delhi, Revised Edition
4. Satyanarayana .U, 2005, Biotechnology, 1st edition published by books and allied (p) Ltd. Kolkata.
5. El-Mans, E.M.T and Bryce C.F.A., 2006. Fermentation Microbiology and Biotechnology
6. Walker, M. and Gingold E.B. 1993. Molecular Biology and Biotechnology,
7. Subba Rao, N.S. 2004, Soil Microbiology, Oxford and IBH Publishing Co pvt. New Delhi.

8. Casida, Industrial Microbiology, L.E. New age International Publishers.
9. David S. Goodsell, JOHN WILEY and SONS,INC., Lessons from Nature Publication Bionanotechnology: Editors Lynn Goldman and Christine Coussens Implications of nanotechnology for environmental health research, The national academic Press.
10. K. Eric Drexler the Coming Era of Nanotechnology.

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1. http://www.indiastudychannel.com/resources/41331-Osmania-University-M-Sc-Microbiology-MB-Microbial-Biotechnology.aspx
2. http://www.foresight.org/EOC/index.html
3. Nanophotonics: Accessibility and Applicability This free PDF can be downloaded from:http://www.nap.edu/catalog/11907.html

12AMB09 – Soil, Agriculture, Food and Environmental Microbiology

UNIT - I

Food Microbiology: Sources of contamination of microorganisms in foods, Factors influencing microbial growth in foods, Extrinsic and intrinsic. Principles and methods of food preservation: High temperature, Low temperature, Drying, Irradiation and Chemical preservatives. Food borne diseases: Bacteria, Fungi, Viruses, Algae and Protozoa. Spoilage of fruits, vegetables, meat, poultry, fish and seafood.

UNIT - II

Dairy Microbiology: Micro flora of milk, sources of contamination, preservation and spoilage of milk and milk products, Milk borne diseases, Preservation of milk. Fermented foods: Sauerkraut, Pickles, Buttermilk, Yogurt and Cheese. Probiotics and Prebiotics. Food sanitation, food control agencies and their regulations.

UNIT - III

Soil Microbiology: Characteristics and classification of soil. Interactions between microorganisms: Mutualism, commensalism, ammensalism synergism, parasitism, predation, competition. Interaction of microbes with plants and animals:

Rhizosphere, phyllosphere, mycorrhizae. Biogeochemical cycles: Carbon, Nitrogen, Phosphorus and Sulfur. Plant Pathogens.

UNIT - IV

Microbiology of air and water: Composition of air, Number and types of organisms in air, Distribution and sources of air borne organisms, Droplet and droplet nuclei, Assessment of air quality, Airborne diseases, Air sanitation, Microbes and climatic change, Microbial carbon sequestration. Microbiology of water: Microbial assessment of water,

UNIT - V

Environmental Microbiology: Waste treatment - Types of wastes. Characterization of solid and liquid wastes. Treatment of solid wastes - composting, vermiform composting, silage, pyrolysis and saccharifications. Treatment of liquid wastes - Primary, secondary (anaerobic and aerobic) - trickling, activated sludge, oxidation pond, and oxidation ditch-tertiary - disinfection. Biodegradation of xenobiotic compounds: Hydrocarbon, pesticides, paper, leather, wood, textile and paints.

References

1. Alexander M 1971. Microbial Ecology. John Wiley and Sons Inc., New York.
2. Alexander M. 1977. Introduction to Soil Microbiology. John Wiley and Sons New York.
3. Frazier WC and Westhoff DC 1988. Food Microbiology. Tata Mc Graw Hill Pub Comp. New Delhi.
4. Robinson RK. 1990. Dairy Microbiology. Elsevier Applied Sciences, London.
5. Ecology and Biotreatment by Ec Eldowney, S. Hardman D.J. and Waite S. 1993. - Longman Scientific Technical.
6. Bioremediation by Baker K.H. and Herson. D. S, 1994, Mc Graw Hill Inc.,
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8. Adams MR and Moss MO 1995. Food Microbiology. Royal Society of Chemistry Pub., Cambridge.
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11. Joshi.Biotechnology: Food Fermentation Microbiology, Vol: 2.
12. Prajapati, Fundamentals of Dairy Microbiology.
13. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
14. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood. Elsevier Applied Science Publication.
15. Environmental Microbiology edited by Ralph Mitchell. A John Wiley and Sons. Inc.

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2. www.microbes.info/resources/Food_Microbiology
3. www.bionewsonline.com/1/what_is_food_microbiology.htm
4. www.microbiologyprocedure.com/microbiology...dairy/microbiology-in-dairy.htm
5. www.titanbiotechltd.com/dairy-microbiology.asp -
6. www.ncbi.nlm.nih.gov ›
7. www.en.wikipedia.org/wiki/Environmental_microbiology
8. www.microbes.info/resources/Environmental_Microbiology

PRACTICAL –4

PRACTICAL EXAM : 6 HRS / DAY; 2 CONSECUTIVE DAYS

12AMBP04 – Industrial Microbiology and Biotechnology

UNIT – I

1. Inoculum preparation for fermentation
2. Screening of antibiotic producing microorganisms from soil
3. Production of extracellular metabolites from actinomycetes

UNIT – II

1. Production of industrially important enzymes by Submerged fermentation (Any one enzyme)
2. Production of industrially important enzymes by Solid state fermentation (Any one enzyme)

3. Assay of extracellular enzymes produced by bacteria : a) Amylase, b) Protease and c) Lipase
4. Purification of enzymes by Filtration method / Chemical method by ammonium sulphate

UNIT - III

1. Wine production
2. Microbial Production of citric acid by using *Aspergillus niger*

UNIT – IV

1. Separation of biomass – Wet and Dry mass
2. Immobilization of cells and enzymes
3. Isolation of dye degrading microorganism
4. Antibiotic sensitivity test : a) Kirby Bauer's method and b) MIC determination by filter paper assay and broth dilution assay

UNIT - V

1. Separation of proteins : a) Paper chromatography, b) Column chromatography
2. Separation of proteins by SDS-PAGE
3. Lipid separation using TLC
4. Microbial synthesis of Nanoparticles.

References

1. Dharmalingam K., 1986. Experiments with M13,Macmilan India Ltd. Chennai.
2. Hames BD and Rickwood D., 1990. GEL Electrophoresis-a practical approach, Oxford University press, New york.
3. Lorian V., 1991. Antibiotics in Laboratory Medicine, Williams and Wilkins.
4. Willett JE., 1991. Gas Chromatography, John Wiley and Sons.
5. Westermeier R., 1993. Electrophoresis in practice-VCH-Federal Republic of Germany.

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PRACTICAL -5

12AMBP05 – Agriculture, Food and Environmental Microbiology

UNIT - I

Isolation and enumeration of soil microorganisms (bacteria, fungi and actinomycetes). Isolation of phosphate solubilizers from soil. Isolation of nitrogen fixers (a) *Rhizobium* from root nodule and (b) *Azotobacter* from rhizosphere. Screening of antagonistic bacteria in soil by agar block overlay method. Isolation of Cyanobacteria and photosynthetic bacteria from soil / water.

UNIT - II

Isolation of plant pathogens - Study of the following diseases: Tobacco mosaic, Bacterial blight of paddy, Red root of sugarcane, Citrus cancer, Leaf spot of mulberry, Red rot of sugarcane, Root knot of mulberry, Tikka disease.

UNIT - III

Detection of number of bacteria in milk by breed count. Determination of quality of milk sample by methylene blue reductase test and resazurin method. Detection of number of bacteria in milk by standard plate count. Isolation of yeast and molds from spoiled fruits and vegetables.

UNIT - IV

Extracellular enzyme activities - phosphatase. Quantification of microorganisms in air – settle plate and air sampler techniques.

UNIT - V

Physical, chemical and microbial assessment of water and potability test for water. Colour, pH, DO, COD, BOD,. Microbiological - MPN index presumptive and confirmatory tests.

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1. Alexander M 1971. Microbial Ecology. John Wiley and Sons Inc., New York.
2. Alexander M. 1977. Introduction to Soil Microbiology. John Wiley and Sons New York
3. Frazier WC and Westhoff DC 1988. Food Microbiology. Tata Mc Graw Hill Pub Comp. New Delhi
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3. www.bionewsonline.com/1/what_is_food_microbiology.htm
4. www.en.wikipedia.org/wiki/Environmental_microbiology
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IV SEMESTER

12AMB10 - Research Methodology, Biostatistics and Bioinformatics

UNIT - I

Research Methodology - Meaning and importance. Statement, Constraints, Review of literature - Review and synopsis presentation. Types of research, Research tools, Qualities of a good researcher.

UNIT - II

Research process, Research designs - Experimental and non-experimental. Preparation of research report. Guidelines for preparing an article. Computers in biological research.

UNIT - III

Biostatistics - Introduction - Basic concepts, Measurement and measurement scales, Sampling and data collection, Data presentation, Descriptive Statistics- Basic concepts of probability. Probability distributions- Normal distribution, Binomial distribution, Poisson distribution. Z-scores, Student's t- test, Chi square test, Correlation- regression, ANOVA.

UNIT - IV

Bioinstrumentation - Principles and applications of pH meter ,Centrifuge .Electrophorosis, Chromatography -Thin layer, Column, Gas and high pressure liquid chromatography, spectrophotometry, NMR, Atomic absorption spectrophotometer, Microbial Identification System, Autoanalyser - ELISA Reader.

UNIT - V

Bioinformatics - Introduction and skills for a bioinformatician. Biological databases- Database searching, Sequence analysis, Pair alignment, Visualizing protein structures, Predicting structure and function of protein using sequences, Tools for genomics and proteomics.

References

1. Balagurusamy. E, 1992, Programming in ANSIC, Tata Mcgraw Hill.
2. Bernard Rosner, 1999, Fundamentals of Biostatistics ,Duxbury Press

3. Attwood T.K. and D.J. Parry-Smith, 2001. Introduction to Bioinformatics, Pearson Education Asia
4. Jeffrey A. Witmer Myra L. Samuels, 2002. Prentice Hall Statistics for the Life Sciences (3rd Edition)
5. Gurumani .N., 2006. Research methodology for biological sciences. 1st edition, MJP Publishers. A unit of Tamilnadu Book House, Chennai.
6. Wayne W. Daniel, 2006. Biostatistics- A foundation for analysis in the Health Sciences. 7TH edition. Wiley India publication.
7. Rastogi. S. C, N. Mendiratta and P. Rastogi, 2008. Bioinformatics- Methods and Applications Genomics, Proteomics and Drug Discovery 3rd edition
8. Harvey Motulsky, 1995, Intuitive Biostatistics, Oxford University Press.
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10. Higginns . D and W. Taylor (Eds.) 2000. Bioinformatics. Sequence, Structure and databanks- A Practical Approach by Oxford University Press.
11. Baxevanis A.D and B.F. Francis Ouellette (Eds.) Wiley-Interscience, 2001. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins
12. Stanton A. Glantz, 2001. Primer of Biostatistics McGraw-Hill
13. David W. Mount, Cold Bioinformatics, 2001. Sequence and Genome Analysis, Spring Harbor Laboratory Press.
14. Claverie J-M and C. Notredame, 2003. Bioinformatics for Dummies, Wiley Publishing, Inc.
15. Beth Dawson Robert G. Trapp Beth Dawson Robert Trapp, 2004. Basic and Clinical Biostatistics (LANGE Basic Science), McGraw-Hill.

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3. www.math.yorku.ca/scs/statResource.html# General
4. www.jegsworks.com/Lessons/index.html
5. www.bettycjung.net/statsites.html
6. www.biostat.harvard.edu/links/
7. www.ped.mod.utah.edu/genpedscrr/Epibio.html

ELECTIVE COURSES FOR ALL THE THREE SEMESTERS

ELECTIVE PAPER I – MICROBIAL NANOTECHNOLOGY

Unit I Definition – Evolution of Nano science – Need of Nano technology – Hurdles for Nanotechnology development – Factors affecting the manufacturing process of nano materials – Role of physicists, chemists, medical doctors, engineers, biologists and computer scientists in nano technology.

Unit II Spectroscopy and Microscopy – the two most important tools used in nano technology research – Infra red spectroscopy, Raman spectroscopy, Ultra violet-visible spectroscopy. Atomic force microscope – Scanning electron microscope – Transmission electron microscope – Scanning tunnelling microscope- Magnetic resonance force microscopy.

Unit III Nanospectra biosciences. Nanocrystals – Quantum dot as Biological fluorescent tag – Bucky balls for medical imaging – Ganolidium for for Magnetic resonance imaging – Dendrimers in molecular imaging. Nanoprobles for nucleic and hybridization detection. Nucleophillic carbenes. Working on the DNA chain gangs. DNA and protein based nanocircuity.

Unit IV Nanotechnology for drug development and medical applications. Nanotechnology for drug solubilization and drug delivery. Diagnosis using nanomaterials. Nanotherapy for cancer treatment – Interior artery expansions – Replacing joints with better stuff. - Radioactive tuberene cages in Nuclear medicine.

Unit V Cleaner environment with Nanotech. Cleaning the air with Nanotechnology – Nanotechnology for water treatment. Microbial nanoparticles. Nanocarbon ball as deodorizer in ferment process. Biomotors for engineered devices. Possible harm from Nanomaterials. Nanoscience in India – Nanoscience education abroad – Looking at ethics and society.

Reference Books

1. Richard Brooker and Earl Boysen (2006). Nanotechnology. Wiley Publishing Inc., India. Pp 361.
2. Paul Dieppe and Paul Calvert. (1983). Crystals and Joint disease, Chapman and Hall Ltd, London.
3. Duckruix, A. and R. Giege, (1992). Crystallization of Nucleic acids and Proteins. A practical approach, Oxford Umiversity Press, England.

Web Sites

1. www.nanotechnologyfordummies.com
2. www.nanobotblogspot.com
3. www.azonano.com
4. www.nano.gov
5. www.forbesnanotech.com
6. www.foresight.org
7. www.nanotech-now.com

Magazines

1. Technology Review
2. Small Times

Journals

1. Science
2. Nature
3. Nano Letters

ELECTIVE PAPER II –

09MBC04- BIOFERTILIZER AND BIOMANURE TECHNOLOGY

Unit I

Introduction - History, importance and present status of different types of fertilizers and their application to crop plants. Biological fixation of nitrogen; Natural cycles associated with microorganisms - carbon, nitrogen, phosphorous and sulphur.

Unit II

Cyanobacterial Biofertilizers - Nostoc, Anabaena, Gloeocaps and Scytonema as biofertilizers; Symbiotic association with Azolla; Multiplication of blue green algae and its effect on agricultural (rice) yields. Bacterial Biofertilizers - Free living forms : Azatobacter, Azospirillum; Symbiotic forms : Rhizobium - Legume Association; Psuedomanas, Nonlegume association.

Unit III

Fungal Biofertilizers - Ectomycorrhizal association with pines; Vescicular arbuscular mycorrizal association (VAM) - *Glomus* sp; Actimomycetes as Biofertilizers - Actinomycetes associations - Frankia sp.

Unit IV

Biomanures - A general account of manures – moulds; Composts Farm Yard Manure - Oil seed cakes - Castor and neem; Green leaf manures - Gyricidia, Sesbania and Crotalaria; Agro-industrial wastes - Poultry manure and saw-dust; Vermi Compost; Microbial compost - pure culture techniques, consortium - types of compost pits. Biodegradation of organic components.

Unit V

Application of Biofertilizers and manures - A combination of biofertilizer and manure applications with reference to soil, seed and leaf sprays. Laboratory and field application; Cost analysis of biofertilizer and biomanure production.

References

1. Burns, R.C. and Hardy, R.W.F., 1975. "Nitrogen fixation in bacteria and higher plants. Springer - Verlag, Bertin.
2. Gallen and Chaplin, 1987. Introduction to N2 fixation. Elswer Publications.
3. Harley, J.L. and Smith, S.E. 1983. Mycorrhizal Symbiosis. Academic Press, London.
4. Kumar, H.D., 1990. Introductory Phycology. Affiliated East-West Press Ltd., Madras.
5. Marks, G.C. and Koslowski, TT. (Eds.) 1973. Ectomycorrhizae, Academic Press, London.
6. Rao, N.S., Venkataraman, G.S. and Kanyan, 1983. Biological N2 fixation, ICAR Publications, New Delhi.
7. Sandera, F.E., Mosse. B. and Tinke, P.B., 1975. Endomycorrhizae Academic Press, London.
8. Rao, N.S., 1980. Biofertilizers in Agriculture. Oxford & IBH Publishing Co., Pvt., Ltd., Bombay.
9. Thompson, Louis, M. and Fredrick, T., 1979. Soils and Soil Fertility. Tata Mc Graw-Hill Publishing Co., New Delhi.
10. Tilak, K.V.B.R., 1990. Bacterial Biofertilizers. IARI Publications, New Delhi.
11. Tirdale, Nelson, S.L., Werver, L. and Becton, J.D., 1985. Soil fertility and fertilizers. Macmillan Publishing Co., New York.
12. Venkataraman, G.S., 1972. Algal Biofertilizers and Rice Cultivation. Today and Tomorrow's Printers and Publishers, New Delhi.
13. Totawat, K.L., Somani, L.L., Sharma, R.A. and Maloo, S.R., 2004. Biofertilizer Technology. Agrotech Publishing Academy. Udaipur, Rajasthan.
14. Kannaiyan, S., Kumar, K. and Govindarajan, K., Biofertilizer Technology.
15. Subba Rao, N.S., 1995. Soil Microorganisms and plant growth. Oxford and IBH, New york.
16. Subba Rao, N.S., 1995. Biofertilizer in agriculture and forestry. Oxford and IBH, New york.

Websites

www.fnca.mext.go.jp/english/bf/e_ws_2003.html
stary.biom.cz/sborniky/sb97PrVana/sb97PrVana_archip.html
www.tnau.ac.in/micro/ug.htm
www.indianindustry.com/fertilizers/126.html
www.inforse.dk/asia/M_III_biogas.htm
www.scienceandsociety-dst.org/highlights.htm

ELECTIVE PAPER III – DISEASE DIAGNOSIS TECHNOLOGY

Unit I Scope and relevance of Microbiology-Definition and concepts, Type of micro organism, Distribution of Microorganism in nature; Development of Microbiology as a Scientific discipline; General characteristics of microorganisms- General principles, Taxonomy, classification and structural organization of Bacteria, fungi, viruses, algae, actinomycetes, Mycoplasma, and ricketssiae; Microscopy- Principles and application of Phase contrast, Dark field, Fluorescent, and Electron microscope; Micrometry- Basic principles and applications.

Unit-II Fixatives and Fixation of smears, Stains- Definition, Acidic, Basic stains, simple and differential staining, use and significance of stains in microbiology; cultivation of micro organism- Definition, concept, use and types of different culture media for cultivation of microorganism, Pure culture techniques; cultivation of anaerobes; control of microorganism- sterilization by physical and chemical methods , Antiseptics .

Unit-III Binomial nomenclature; Outline classification of living organisms- Haekel, Whittaker, and woese system, normal micro flora in human body and their beneficial effects; Lymphoid organs and types of immunity; General principles of diagnostic microbiology- collection, transport, and processing of clinical specimens, General methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.

Unit-IV Host pathogen interaction- virulence factors, General account of the following diseases- Causal organisms, pathogenesis, diagnosis, prevention and therapy of Typhoid, cholera, dysentery, whooping cough, tuberculosis, , urinary tract infection, syphilis, ring-worm, dermatophytes, Malaria, small pox, measles, hepatitis, and AIDS. General account of Nosocomial Infections and prevention.

Unit V Antimicrobial therapy in the diagnosis of diseases; *In vitro* diagnostic methods- agglutination, precipitation, immunofloresence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Synthetic

peptide vaccines. Immunization, its rationale, schedules and its importance in public health; Automation in Disease diagnosis; Ethical committee – structure and functions

Reference Books

1. Morag, C. and Timbury, M.C. (1994) *Medical Virology,* 10th Edn. Churchill Livingston, London.
2. Dimmock, N.J. and Pimrose, S.B. (1994) *Introduction to Modern Virology*, 4th Edn. Blackwell Scientific Publications, Oxford.
3. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) *Virology*, 3rd Edn, Prentice Hall, New Jersey.
4. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial Genetics. Jones and Bartlett publishers.
5. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.
6. Greenwood, D., Slack, R.B. and Peutherer, J.F.(2002) *Medical Microbiology*, 16th Edn. Churchill Livingstone, London.
7. Finegold, S.M. (2000) *Diagnostic Microbiology*, 10th Edn. C.V. Mosby Company, St. Louis.
8. Ananthanarayanan, R. and Jayaram Panicker C.K. (2004) *Text book of Microbiology*. Orient Longman, Hyderabad.
9. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) *Methods for General and Molecular Bacteriology*. ASM Press, Washington, DC.
10. Topley and Wilson (1995) *Principles of Bacteriology Virology and Immunity*. 9th Edn. Vol I, Edward Arnold, London.

Web sites

1. http:// www.microbiologyonline.org.uk/sgmprac.htm
2. http:// www.cvm.uiuc.edu/vdl/AppenA_man.html
3. http:// www.microbes.info/resources/education_and learning
4. http://infohost.nmt.edu/-nmtlib/subj/boil.html
5. http:// www.hoflink.com/%7Ehouse/microbio.html
6. http:// www. Splammo.net/bact102/home102.html
7. http:// www.pathmicro.med.sc.edu/book/bact-sta.htm
8. http:// www.textbookofbacteriology.net/
9. http://libweb.sonoma.edu/search/articles.html
10. http:// www.ucmp.berkeley.edu/bacteria/bacterialh.html

ELECTIVE PAPER IV – MARINE MICROBIOLOGY

Unit I

Structure: Bacteria, fungi, algae, protozoa and viruses;Classification of microbes(Genetic level)-conventional and modern methods.Biology of micro-organisms used in genetic engineering(Escherichia coil, Rhizobium sp., Agrobacterium tumefaciens,Saccharomyces cerevisiae, phage lambda, Nostoc, Spirulina,Aspergillus, Pencillium and Streptomyces).

Unit II

Methods of studying the marine micro-organisms-Methods of collection, enumeration (total and viable counts), Isolation, culture & identification based on morphological, physiological and biochemical characteristics; Preservation of marine microbes; Culture collection Centers (ATCC, IMTECH, etc.).Microbial nutrition - influence of environment factors on microbial growth, activity and distribution

Unit III

Microbial nitrogen fixation; Carbon, nitrogen and phosphorus cycle; Decomposition of organic matter; Bioleaching and biodeteroriation of natural and synthetic materials.

Unit IV

Microbes of Biotechnological importance; Primary and secondary metabolites (enzymes, antibiotics, organic acid, toxins etc.)

Unit V

Seafood microbiology - normal genera associated with fish, food spoilage, fish & human pathogens; Indicator of Pollution – faecal coliforms; Prevention & control.

Reference Books

1. Pelczar MJ Jr., Chan ECS and Kreig NR. Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
3. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006.
4. Rheinhemer, G., 1980. Aquatic Microbiology, Johnwiley & Sons, pp. 235.
5. Elay, A.R.1992. Microbial food poisoning. Chapman and Hall London, 191 pp.
6. Ford, T.E., 1993. Aquatic microbiology. An ecological approach.Blackwell scientific publication, London, 518 pp.
7. Krichman, D.L., 2000. Microbial ecology of the oceans. Wiley –liss, NewYork, 542

Web sites

1. http:// www.mba.ac.uk/
2. http:// www.mbl.edu/
3. http:// www.univie.ac.at/marine-biology/
4. http://oceanlink.island.net/
5. http:// life.biosunysb.edu/marinebio/mbweb.html
6. http:// wwwumi.com/pqdauto.

Journals

1. Limnology and oceanography
2. Quarterly review of Microbiology
3. Journal of Marine Research
4. Marine Technology Society Journal
5. Marine Technology and SNAME news.

ELECTIVE PAPER V – Intellectual Property Rights (IPR) and Bio-Safety

Unit I :

Introduction to Intellectual Property

IPR - Definition - Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; IPs of relevance to Microbiology / Biotechnology and few Case Studies
WTO - Definition - Functions - Forms of IPR Protection.

Unit II :

Agreements and Treaties

History of GATT & TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments

Unit III :

Basics of Patents and Concept of Prior Art

Introduction to Patents; Types of patent applications: Ordinary,PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, esp@cenet(EPO), PATENTScope (WIPO), IPO, etc.).
National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Precautions while patenting –disclosure/non-disclosure; Financial assistance for patenting -introduction to existing schemes Patent licensing and agreement Patent infringement- meaning, scope, litigation, case studies

Unit IV :

Biosafety

Introduction; Historical Backround; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Biosafety guidelines - Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Biosafety in relation to transgenic research and applications

Unit V :

Bioethics

Bioethics - Definition - Animal ethics - Norms in India - Licensing of animal house - Ethical clearance norms for conducting studies on human subjects.

Texts/References:

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007
3. Gurumani, N. Research Methodology,;For Biological Sciences . MJP Publishers, Chennai 2006

Important Links:

http://www.w3.org/IPR/
http://www.wipo.int/portal/index.html.en
http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
www.patentoffice.nic.in
www.iprlawindia.org/
http://www.cbd.int/biosafety/background.shtml
http://www.cdc.gov/OD/ohs/symp5/jyrtext.htm
http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section3.html

EXTRA DISCIPLINARY COURSES (EDC) FOR OTHER DEPARTMENT STUDENTS

SUPPORTIVE I - MICROBIAL TECHNOLOGY

UNIT I

Industrially important microorganisms and their development, screening methods for industrial microbes-detection and assay of fermented products-classification of fermentation types-genetic control of fermentation-strain selection and improvement-mutation and recombinant DNA techniques for strain development

UNIT II

Definition, concepts – history, biotechnological potentials of microalgae – food – feed – fuel and pharmaceutically valuable compounds. Cultivation methods of algae with reference to *Dunaliella*. Production of microbial biofertilizers – cyanobacteria, *Rhizobium, Azotobacter, Azospirillum, Phosphobacteria* and VAM.

UNIT III

Single cell protein – Chlorella, Spirullina, Yeasts, Mushrooms, SCP from wastes. Economic implications of SCP, microbial production of enzymes – cellulase, lipase, Taq polymerase and restriction endonuclease. Production of wine, vinegar and alcohol.

UNIT IV

Immobilization of enzymes – Starch processing industry – proteases – therapeutic enzymes - Diagnostic enzymes - Enhancement of enzyme activity – uses of engineered protein – advantages of protein engineering.

UNIT V

Microbes involved in biodegradation of organic wastes and xenobiotic compounds – heavy metals, pesticides, insecticides, Bioinsecticides – BT toxin. Microbial leaching

– Extraction of metals from ores. Biofuels, Microbial hydrogen production, Biodegradation of oils and petroleum products.

References:

Balasubramaniam D, Bryce CFA, Dharmalingam K, Green J, Jayaraman K. (1996). Concepts in Biotechnology, University Press, India.

Borowitzka MA, Borowitzka LJ (1989) Microalgal technology, Cambridge University Press

Glick BR, Pastenak JJ (1998) Molecular Biotechnology – Principles and applications of recombinant DNA, ASM press, Washington DC

Glick BR, Pastenak JJ (1994) Molecular Biotechnology, ASM press, Washington DC

Glazer AN., Nikaido H (1994) Microbial Biotechnology – Fundamentals of Applied Microbiology, WH freeman and company, New York

Walsh G, Headon Dr. (1994) Protein Biotechnology, John Wiley and Sons, New York

Supportive Course II: ENTREPRENEURSHIP IN MICROBIOLOGY

UNIT I

Evolution of the concept of entrepreneur – Entrepreneurship: Definitions-concept of Entrepreneurship, development – need – role of resource, talent and spirit – process of Entrepreneurship to socio-economic gains

UNIT II

Institutions and schemes of government of India- Schemes and programmes, Department of science and technology schemes, Nationalized banks – other financial institutions etc – SIDBI – NSIC – NABARD – IDBI – IFCI – ICICI etc.

UNIT III

Skills for entrepreneurs – communication skills, problem solving skills; Business plan development; Market need – market research, SWOT analysis, identify your competition. Financial plan – obtain financing for your business, insure your business, Marketing – mix-product, distribution, price, promotion, set marketing goals

UNIT IV

Composting – domestic waste, agricultural and industrial waste, vermi – composting. SCP production – mushroom cultivation.

UNIT V

Biofertilizers and Biopesticides. Production of teaching kits (plasmid DNA isolation, serum electrophoresis) and diagnostic kits (WIDAL test kits, ABO blood grouping kits)

Reference:

Greene, Entrepreneurship ideas in action, (2000) Thomson learning

SUPPORTIVE PAPER III- HUMAN INFECTIOUS DISEASES AND DIAGNOSTICS

Unit I Scope and relevance of Microbiology-Definition and concepts, Type of micro organism, Distribution of Microorganism in nature; Development of Microbiology as a Scientific discipline; General characteristics of microorganisms- General principles, Taxonomy, classification and structural organization of Bacteria, fungi, viruses, algae, actinomycetes, Mycoplasma, and ricketssiae; Microscopy- Principles and applications.

Unit-II Fixatives and Fixation of smears, Stains- Definition, Acidic, Basic stains, simple and differential staining, use and significance of stains in microbiology; cultivation of micro organism- Pure culture techniques; cultivation of anaerobes; control of microorganism- sterilization by physical and chemical methods , Antiseptics .

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methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.

Unit-IV Host pathogen interaction- virulence factors, General account of the following diseases- Causal organisms, pathogenesis, diagnosis, prevention and therapy of Typhoid, cholera, dysentery, whooping cough, tuberculosis, , Malaria, small pox, and AIDS. General account of Nosocomial Infections and prevention.

Unit V Antimicrobial therapy in the diagnosis of diseases; *In vitro* diagnostic methods- agglutination, precipitation, immunofloresence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.

Reference Books

11. Morag, C. and Timbury, M.C. (1994) *Medical Virology*, 10th Edn. Churchill Livingston, London.
12. Dimmock, N.J. and Pimrose, S.B. (1994) *Introduction to Modern Virology*, 4th Edn. Blackwell Scientific Publications, Oxford.
13. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) *Virology*, 3rd Edn, Prentice Hall, New Jersey.
14. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial Genetics. Jones and Bartlett publishers.
15. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.
16. Greenwood, D., Slack, R.B. and Peutherer, J.F.(2002) *Medical Microbiology*, 16th Edn. Churchill Livingstone, London.
17. Finegold, S.M. (2000) *Diagnostic Microbiology*, 10th Edn. C.V. Mosby Company, St. Louis.
18. Ananthanarayanan, R. and Jayaram Panicker C.K. (2004) *Text book of Microbiology*. Orient Longman, Hyderabad.
19. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) *Methods for General and Molecular Bacteriology*. ASM Press, Washington, DC.
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Web sites

11. http:// www.microbiologyonline.org.uk/sgmprac.htm
12. http:// www.cvm.uiuc.edu/vdl/AppenA_man.html
13. http:// www.microbes.info/resources/education_and learning
14. http://infohost.nmt.edu/-nmtlib/subj/boil.html
15. http:// www.hoflink.com/%7Ehouse/microbio.html
16. http:// www. Splammo.net/bact102/home102.html
17. http:// www.pathmicro.med.sc.edu/book/bact-sta.htm
18. http:// www.textbookofbacteriology.net/

19. http://libweb.sonoma.edu/search/articles.html
20. http:// www.ucmp.berkeley.edu/bacteria/bacterialh.html

SUPPORTIVE IV – MICROBIAL NANOTECHNOLOGY

Unit I Definition – Evolution of Nano science – Need of Nano technology – Hurdles for Nanotechnology development – Factors affecting the manufacturing process of nano materials – Role of physicists, chemists, medical doctors, engineers, biologists and computer scientists in nano technology.

Unit II Spectroscopy and Microscopy – the two most important tools used in nano technology research – Infra red spectroscopy, Raman spectroscopy, Ultra violet-visible spectroscopy. Atomic force microscope – Scanning electron microscope – Transmission electron microscope – Scanning tunnelling microscope- Magnetic resonance force microscopy.

Unit III Nanospectra biosciences. Nanocrystals – Quantum dot as Biological fluorescent tag – Bucky balls for medical imaging – Ganolidium for for Magnetic resonance imaging – Dendrimers in molecular imaging. Nanoprobles for nucleic and hybridization detection. Nucleophillic carbenes. Working on the DNA chain gangs. DNA and protein based nanocircuity.

Unit IV Nanotechnology for drug development and medical applications. Nanotechnology for drug solubilization and drug delivery. Diagnosis using nanomaterials. Nanotherapy for cancer treatment – Interior artery expansions – Replacing joints with better stuff. - Radioactive tuberene cages in Nuclear medicine.

Unit V Cleaner environment with Nanotech. Cleaning the air with Nanotechnology – Nanotechnology for water treatment. Microbial nanoparticles. Nanocarbon ball as deodorizer in ferment process. Biomotors for engineered devices. Possible harm from Nanomaterials. Nanoscience in India – Nanoscience education abroad – Looking at ethics and society.

Reference Books

4. Richard Brooker and Earl Boysen (2006). Nanotechnology. Wiley Publishing Inc., India. Pp 361.
5. Paul Dieppe and Paul Calvert. (1983). Crystals and Joint disease, Chapman and Hall Ltd, London.
6. Duckruix, A. and R. Giege, (1992). Crystallization of Nucleic acids and Proteins. A practical approach, Oxford Umiversity Press, England.

Web Sites

8. www.nanotechnologyfordummies.com
9. www.nanobotblogspot.com
10. www.azonano.com
11. www.nano.gov
12. www.forbesnanotech.com
13. www.foresight.org
14. www.nanotech-now.com

Magazines

3. Technology Review
4. Small Times

Journals

4. Science
5. Nature
6. Nano Letters

SUPPORTIVE V Entrepreneurship in Microbiology

UNIT - I

Evolution of the concept of entrepreneur - Entrepreneurship: Definitions - concept of Entrepreneurship, development - need - role of resource, talent and spirit - process of Entrepreneurship to socio-economic gains.

UNIT - II

Institutions and schemes of Government of India - Ministry of Science and Technology, Nationalized banks - other financial institutions - SIDBI, NSIC, NABARD, IDBI, IFCI and ICICI.

UNIT – III

Skills for entrepreneurs - communication skills, problem solving skills, Business plan development. Market need - market research, SWOT analysis, identifying competitors. Financial plan - financial support for business, business insurance, Marketing - mix-product, distribution, price, promotion and market goal setting.

UNIT - IV

Project- idea generation - Sources of idea generation-Trade Fairs and Exhibitions-Project identification-classification - project formulation - project appraisal. Composting of domestic, agricultural and industrial wastes, vermi - composting, SCP production - mushroom cultivation.

UNIT - V

Biofertilizers and Biopesticides. Microbial synthesis of nanoparticles and nano based product. Production of teaching kits (plasmid DNA isolation, serum electrophoresis) and diagnostic kits (Widal test kits, ABO blood grouping kits).

References

1. Venkataraman, G.S., 1972. Algal Biofertilizers and Rice Cultivation. Today and Tomorrow's Printers and Publishers, New Delhi.
2. Marks, G.C. and T.T. Koslowski (Eds.),1973. Ectomycorrhizae, Academic Press. London.

3. Sandera, F.E., B. Mosse. and P.B. Tinke, 1975. Endomycorrhizae. Academic Press, London.
4. Thompson, L. M. and T. Fredrick, 1979. Soils and Soil Fertility. Tata Mc Graw-Hill Publishing Co., New Delhi.
5. Rao, N.S., 1980. Biofertilizers in Agriculture. Oxford and IBH Publishing Co. Pvt. Ltd., Bombay.
6. Rao, N.S., G.S. Venkataraman and Kannaiyan, 1983. Biological N2 fixation. ICAR Publications, New Delhi.
7. Harley, J.L. and S.E. Smith, 1983. Mycorrhizal Symbiosis. Academic Press, London.
8. Tirdale, S.L. Nelson, L. Werver and J.D. Becton, 1985. Soil fertility and fertilizers. Macmillan Publishing Co., New York.
9. Kumar, H.D., 1990. Introductory Phycology. Affiliated East-West Press Ltd., Madras.
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11. Subba Rao, N.S., 1995. Soil Microorganisms and plant growth. Oxford and IBH, New york.
12. Subba Rao, N.S., 1995. Biofertilizer in agriculture and forestry. Oxford and IBH, New york.
13. Totawat, K.L., L.L. Somani, R.A. Sharma and S.R. Maloo, 2004. Biofertilizer Technology. Agrotech Publishing Academy, Udaipur, Rajasthan.

Web references

1.www.ucc.ie/en/ProspectiveStudents/Admissions/programmes/DocumentFile, 41238,en.pdf
2. www.orgs.tigweb.org/33065
3. www.womensjoblist.com/resumes/18143-Microbiologist.html
4. www.entretechforum.org/mm_May19_2009.htm
5. www.linkedin.com/pub/dir/george/hlass.

Theory

I/II/III/IV Semester M. Sc. Examination, ..MONTH …YEAR
M.Sc. Applied Microbiology

Paper title

Duration: 3 Hrs **Max Marks:75**

Instruction: ***Answer all the three Parts.***

PART – A

Answer all the questions: **5 X 5 = 25**

1.
2.
3.
4.
5.

PART – B

Answer any FIVE questions of the following: **5 X 10 = 50**

6.
7.
8.
9.
10.

Practical

M.Sc. Applied Microbiology
Scheme of Examination

I/II/III/ Semester M. Sc. Examination, ..MONTH …YEAR

Applied Microbiology Practical Exmanination

Duration : 6 Hrs/ day, 2 days **Max. Marks : 60**

Q.1. Major Practical 20 Marks

Q.2. Minor Practical 15 marks

Q.3 Spotters

Identify and Critical comment on. (Specimens / Spotters) 5 X 3 = 15 Marks

A.

B.

C.

D.

E.

Viva-Voce 05 Marks
Record note 05 Marks

IV Semester M.Sc. Examination Project work (Dissertation)

Dissertation Thesis – 50 Marks
Viva-Voce - 10 Marks