SRI SANKARA ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

ENATHUR, KANCHIPURAM – 631 561
CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF MICROBIOLOGY
B.Sc. DEGREE COURSE IN MICROBIOLOGY
REGULATIONS
(With effect from the academic year 2015-2016)

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science courses shall be required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination. Provided that candidates for admission into the specific main subject of study shall be Possess such other qualifying conditions as may be prescribed by the University as given in the **APPENDIX-A.**

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 three academic years, passed the examinations all the Six-Semesters prescribed earning 140 Credits (in Parts-I, II, III, IV & V).

3. DURATION:

a) Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semester respectively.

b) The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

4. COURSE OF STUDY:

The main Subject of Study for Bachelor Degree Courses shall consist of the following and shall be in accordance with **APPENDIX-B**

5. EXTENTION ACTIVITIES:

A candidate shall be awarded a maximum of 1 Credits for Compulsory Extension Service.

All the Students shall have to enrol for NSS /NCC/ NSO (Sports & Games) Rotract/ Youth Red cross or any other service organizations in the college and shall have to put in Complusory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 31st March in a year. If a student LACKS

40 HOURS ATTENDANCE in the First year, he/she shall have to compensate the same during the subsequent years.

Students those who complete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT.

Literacy and population Education Field Work shall be compulsory components in the above extension service activities.

6. SCHEME OF EXAMINATION:

Scheme of Examination shall be given in **APPENDIX - C**

The following procedure to be followed for Internal Marks:

Theory Papers: Internal Marks 25

INTERNAL MARKS

Tests (2 out of 3)	= 10
Attendance	= 5
Seminars	= 5
Assignments	= 5

	25marks

Break-up Details for Attendance

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

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

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:

i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.

ii. Candidates shall be permitted to proceed from the First Semester up to 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 subject of earlier semesters along the current (subsequent) Semester Subjects.

iii. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed there for by the college from time to time.
Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any extraordinary circumstances 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 Candidates 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 College from time to time.

8. PASSING MINIMUM:

A candidate shall be declared to have passed:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 40% (Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.

c) In the aggregate (External + Internal) the passing minimum shall be of 40%.

d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 140 CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree.

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

PART- I TAMIL / OTHER LANGUAGES

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (1) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

PART – II ENGLISH

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

PART – III consisting of CORE SUBJECTS, ALLIED SUBJECTS, PROJECT / ELECTIVE with three courses:

Successful candidates passing the examinations for Core Courses together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core courses together shall be declared to have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the Third Class.

PART – IV (consisting of sub items 1 (a), (b) & (c), 2, 3 and 4) as furnished in the Regulations 4 Part-IV supra.

PART – V EXTENTION ACTIVITIES**:**
Successful Candidate earning of 1 credit SHALL NOT BE taken into consideration for Classification/Ranking/ Distinction.

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. 7 (iii) supra are only eligible for classification.

11. TRANSITORY PROVISION:

Candidates who have undergone the course of study prior to the academic year 2014 – 2015 will be permitted to appear for the examinations under those Regulations for a period of TWO years i.e. up to and inclusive of April/May 2018 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

Question Paper Pattern

SECTION – A (30 words)				
10 OUT OF 12	-	10 X 2 marks	=	20 marks
SECTION – B (200 words)				
5 out of 7	-	5 x 5 marks	=	25 marks
SECTION – C (500 words)				
3 out of 5	-	3x 10 marks	=	30 marks

		TOTAL	=	**75 marks**

QUESTION PAPER FOR PRACTICALS

The external examiner will prepare a question paper on the spot with the help of the Question Bank supplied by the Controller's office.

APPENDIX – A

ADDITIONAL ELIGIBILITY CONDITIONS FOR ADMISSION TO THE FOLLOWING COURSE

(1) CANDIDATES FOR ADMISSION TO THE FOLLOWING COURSES SHALL HAVE PASSED THE QUALIFYING EXAMINATION WITH THE SUBJECTS NOTED AGAINST EACH:

(i) MICROBIOLOGY : ANY SCIENCE GROUP

APPENDIX - B

PART – I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS

ALLIED SUBJECTS

PROJECT/ELECTIVES WITH THREE COURSES

PART – IV

1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6^{th} Standard).

(b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.

(c) Others who do not come under a + b can choose non-major elective comprising of two courses.

2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)

3. ENVIRONMENTAL STUDIES

4 VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

APPENDIX – C

Model Scheme

Course Component **Name of the course**	**Inst. Hour**	**Credits**	**Exam Hours**	**Max. Marks**		
				Ext. mark	**Int. mark**	**Total**
PART-I Language				**75**	**25**	**100**
PART-II English				**75**	**25**	**100**
PART-III Core subject :				**75**	**25**	**100**
Core Subject				**75**	**25**	**100**
Allied Subject				**75**	**25**	**100**
PART – IV 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6th Standard). (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses. (c) Others who do not come under a + b can choose non-major elective comprising of two courses.						
2*Skill based subjects(Elective) – (Soft Skill)						

SYLLABUS
(With effect from the academic year 2015-2016)

B.Sc. DEGREE COURSE IN MICROBIOLOGY

SCHEME OF EXAMINATION

FIRST SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Language	Tamil/Sanskrit - 1	5	3	3	25	75	100
Language	English 1	5	3	3	25	75	100
Core 1 – theory	General Microbiology and Microbial physiology	5	4	3	25	75	100
*Core 1 – Practical	General Microbiology and Microbial physiology	3	4	6	40	60	100
Allied 1 – theory	Biochemistry I	5	4	3	25	75	100
*Allied 1 – Practical	Biochemistry I	3	4	3	40	60	100
Non Major Elective	Cellular Organization	2	2	3	25	75	100
Soft skills	Soft skills I	2	2	3	25	75	100

SECOND SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Language	Tamil/Sanskrit - 2	5	3	3	25	75	100
Language	English 2	5	3	3	25	75	100
Core 2 – theory	Immunology & Microbial Genetics	5	4	3	25	75	100
*Core 2 – Practical	Immunology & Microbial Genetics	3	4	6	40	60	100
Allied 2 – theory	Biochemistry II	5	4	3	25	75	100
*Allied 2 – Practical	Biochemistry II	3	4	3	40	60	100
Non Major Elective	Diversity Life forms	2	2	3	25	75	100
Soft skills	Soft skills II	2	2	3	25	75	100

THIRD SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Language	Tamil/Sanskrit - 3	5	3	3	25	75	100
Language	English 3	5	3	3	25	75	100
Core 3 – theory	Molecular biology	6	4	3	25	75	100
*Core 3 – Practical	Molecular biology	3	4	6	40	60	100
Allied 3 – theory	Bioinstrumentation	6	4	3	25	75	100
*Allied 3 – Practical	Bioinstrumentation	3	4	3	40	60	100
Soft skills	Soft skills III	2	2	3	25	75	100

FOURTH SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Language	Tamil/Sanskrit - 4	5	3	3	25	75	100
Language	English 4	5	3	3	25	75	100
Core 4 – theory	Soil & Agricultural Microbiology	5	4	3	25	75	100
*Core 4 – Practical	Soil & Agricultural Microbiology	3	4	6	40	60	100
Allied 4 – theory	Biostatistics	5	4	3	25	75	100
*Allied 4 – Practical	Biostatistics	3	4	3	40	60	100
Extra disciplinary	Environmental Studies	2	2	3	25	75	100
Soft skills	Soft skills IV	2	2	3	25	75	100

FIFTH SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Core 5 – theory	Medical Bacteriology	6	4	3	25	75	100
Core 6 – theory	Medical Mycology & Parasitology	6	4	3	25	75	100
Core 7 – theory	Medical Virology	6	4	3	25	75	100
*Core 5,6,7 – Practical	Medical Bacteriology, Mycology, Parasitology & Virology	5	4	6	40	60	100
Elective I	Genetic Engineering	5	3	3	25	75	100

SIXTH SEMESTER

Course component	Name of the Subject	Hour allotment /week	Credits	Exam hour	Maximum Mark		
					Internal	External	Total
Core 8 – theory	Environmental Microbiology	6	4	3	25	75	100
Core 9 – theory	Food & Dairy Microbiology	6	4	3	25	75	100
*Core 8,9 – Practical	Environmental, Food & Dairy Microbiology	5	4	6	40	60	100
Elective 2	Industrial and Pharmaceutical Microbiology	5	3	3	25	75	100
Elective 3	Biotechnology	5	3	3	25	75	100

*** Practical examination will be conducted in even semester.**

FIRST SEMESTER

CORE – 1 THEORY : GENERAL MICROBIOLOGY & MICROBIAL PHYSIOLOGY

UNIT I

History of microbiology, microscopy including electron microscope; stains and staining methods. Anatomy of prokaryotic and eukaryotic cells.

UNIT II

Culture media and pure culture techniques. Anaerobic culture techniques. Sterilization and disinfection; Antimicrobial chemotherapy. Methods of bacterial identification-morphological, physiological, biochemical and serological properties.

UNIT III

Physiology of microbial growth and nutrition. Batch – continuous - synchronous cultures; Growth Curve. Nutritional requirements. Transport of nutrients by active and passive transport. Sporulation.

UNIT IV

Respiration. Fermentation. Photosynthesis - oxygenic and anoxygenic.; Bio-geo chemical cycles.

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26. Schelegel, H.G. (1993) General Microbiology,7th Edn. Cambridge University Press, Cambridge.

CORE- 1 PRACTICAL: GENERAL MICROBIOLOGY AND MICROBIAL PHYSIOLOGY

UNIT I

Cleaning of glass wares Sterilization principle and methods- moist heat- dry heat and filtration methods. Media preparation: liquid media, solid media, agar slants, agar plates, basal, enriched, selective media preparation- quality control of media, growth supporting properties, sterility check of media.

UNIT-II

Pure culture techniques: streak plate, pour plate, decimal dilution. Culture characteristics of microorganisms: growth on different media, growth characteristics and description. Demonstration of pigment production.

UNIT-III

Microscopy: light microscopy, bright field microscopy, dark field microscopy. Motility demonstration: hanging drop, wet mount preparation, dark field microscopy, semi solid agar, Craigie's tube method. Staining techniques: smear preparation, simple staining, Gram's staining, acid fast staining, staining of Metachromatic granules

UNIT-IV

Morphology of microorganisms: morphological variations in algae, morphology of fungi, slide culture technique. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. Micrometry: Demonstration of size of yeast and fungal filaments.

UNIT-V

Physiology characteristics: IMViC test, H2S, Oxidase, catalase, urease test. Carbohydrate fermentation test, maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture.

ALLIED 1 THEORY: BIOCHEMISTRY - I

UNIT-I

Chemistry of Carbohydrates Definition and Classification of carbohydrates, linear and ring forms (Haworth formula) for monosaccharides for glucose and fructose. Disaccharides - sucrose and lactose. Physical properties - mutarotation and kiliani cynohydrin synthesis. Chemical properties-Oxidation, reduction, osazone formation. Disaccharide-sucrose and lactose - occurrence, structure; Physical and chemical properties. Polysaccharides: starch and cellulose-occurrence, structure, physical and chemical properties

UNIT-II

Chemistry of aminoacids: Definition and classification of aminoacids, common properties of aminoacids, amphoteric nature, isoelectric point, iselectric pH and Zwitter ion. Reaction with ninhydrin, 1-fluoro-2, 4-dinitronitrobenzene (FDNB) and Sieg Fried-s carbamino reaction.

UNIT-III

Chemistry of Proteins Classifications-shape and size, solubility and physical properties and functional properties. Physical properties: salting in and salting out, denaturation, peptide bond. Structure of protein: primary, secondary, tertiary and quaternary. N-terminal determination-Edman-s and Dansyl chloride method. C-terminal determination-Van-Slyke reaction, Phosgene reaction

UNIT-IV

Chemistry of Lipids, Definition, classification and functions. Occurrence, chemistry and biological functions- simple lipids: tertiary compound lipids (e.g. phospholipids), derived lipids: steroids (e.g. cholesterol). Saturated fatty acids: Butyric, arachidic and stearic acid. Unsaturated fatty acids: Oleic, linoleic and linolenic acid. Physical property emulsification. Chemical properties-saponification, rancidity, definition of acid number, saponification number, iodine number and Reichert-Meissl number. Bile acid and bile salt functions.

UNIT-V

Chemistry of Nucleic acids Definition, nucleoside, nucleotide and polynucleotide. Double helical model of DNA and its biological functions. Structure of RNA: tRNA, mRNA and rRNA-occurrence, chemistry and its biological functions. Differences between DNA and RNA properties: cot curve and cot value, Tm, hypo and hyper chromicity.

References

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.

2. Harper―s Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.

3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.

4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.

6. Biomolecules-C. Kannan , MJP Publishers,Chennai-5.

ALLIED 1 – PRACTICAL I - BIOCHEMISTRY - I

PRACTICAL I Volumetric Estimation

1. Estimation of HCl using Na2CO3 as link and NaOH as primary standard.
2. Estimation of Iron in Ferrous Ammonium Sulphate using potassium permanganate as link solution and oxalic acid as primary standard.
3. Estimation of Glucose by Benedict—s method.
4. Estimation of Glycine by formal titration.
5. Estimation of Ascorbic acid.

SECOND SEMESTER

CORE PAPER-2 –THEORY: IMMUNOLOGY AND MICROBIAL GENETICS

UNIT I

History of immunology; Innate immunity, organs & cells in immune response. Humoral & cell mediated immunity. Complement. Antigens – properties, types. Vaccine. Immunoglobulins – types, structure and functions of different classes of IgG – theories of Antibody formation; Mechanism of immune response;

UNIT II

MHC – structure & types ; Immuno haematology; Hypersensitivity reactions – types ; Transplantation Immunology (types & graft rejection) Immunological techniques – precipitation, agglutination, CFT, RIA, ELISA, IFT, Western blot.

UNIT III

Molecular concept of gene. Bacterial plasmids – structures & properties; Bacteriophage – Lytic & Lysogenic cycle – phage λ . Structures of bacterial Transposons – Types of bacterial Transposons.

UNIT IV

Gene transfer – transformation, Conjugation & transduction; Operon - Lac operon – trp operon. Mutations –types & mechanisms - Ames test, Role of mutation in evolution. Mechanism of Antibiotic resistance

References:

1. Chapel, H. and Halbey, (1986). Essentials of Clinical Immunology. ELBS.
2. Tizard, R.I. (1983) Immunology: An Introduction. Saunders College Publishing, Philadelphia.
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CORE 2- PRACTICAL: IMMUNOLOGY AND MICROBIAL GENETICS

UNIT-I

Blood groups and typing - Coombs's test. Precipitation reaction in Gel-Outchelony double diffusion, Single Radial Immuno diffusion.VDRL, RPR. Agglutination reactions: Slide and Tube methods RBC agglutination IHA, TPHA Bacterial.

UNIT-II

Complement fixation test. Titration of amboceptor and complement (demonstration only). Immunofluorescene, (Demonstration only), ELISA

UNIT-III

Isolation of Buffy coat, using heparin lymphocytes (T cells, B cells), Enumeration of different cell types, Perpheral blood cell counts, absolute cell counts.

UNIT-IV

Antibody productions in rabbits against sheep RBC and its titration (Demonstration). Anaphylactic reactions in guinea pigs. Arthus reaction in rabbits, (Demonstration).

UNIT-V

Skin tests, both immediate and delayed hypersensitivity reactions to egg proteins, bacterial, fungal antigens.

ALLIED 2 – THEORY - BIOCHEMISTRY- II

UNIT-I :

Metabolism Glycolysis,TCA cycle, HMP shunt and its energy yield. Deamination, transamination reaction, SGOT and SGPT. Urea cycle, Biosynthesis of fatty acids, beta oxidation.

UNIT-II :

Metabolic Disorders Jaundice, hypoxia, glycogen storage diseases, pentosuria, ketosis, lipidosis, edema, gout. Dehydration: definition, causes, symptom and prevention.

UNIT-III :

Enzymes Definition, classification of enzymes with one example. Mechanism of enzyme action. Lock and key mechanism, induced fit theory. Property: specificity. Isoenzyme: Definition with one example. Factors affecting enzyme activity: pH, temperature and substrate concentration. Michaleis- Menton equation. Enzyme inhibition: competitive, uncompetitive and non competitive. Biological functions of enzymes.

UNIT-IV :

Molecular Biology Replication: Definition, types, mode of action of replication, mechanism of replication. General mechanism of transcription and translation. Genetic code. DNA and RNA act as genetic material.

UNIT-V :

Vitamins and Minerals A brief outline of occurrence and biological function of Vitamins and minerals (Na, K, Cl, Ca, P, I , Fe, Mg & S)

References

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.

2. Harper—s Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.

3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.

4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.

6. Biomolecules-C. Kannan , MJP Publishers,Chennai-5.

ALLIED 2 – PRACTICAL: BIOCHEMISTRY - II

Qualitative analysis

1. Carbohydrates: Glucose, fructose, galactose, mannose, maltose, lactose and arabinose and xylulose.

2. Amino acids: Arginine, cysteine, tryptophan and tyrosine.

Colorimetric analysis (only for demonstration)

1. Estimation of protein by Biuret method.

2. Estimation of DNA using diphenyl amine.

3. Estimation of glucose by O -Toluidine.

References:

1. Practical Clinical Biochemistry - Harold Varley, CBS, New Delhi.

2. Medical Laboratory Technology-Kanai L. Mukherjee, Tata McGraw Hill., Vol. I, II, III.

3. Clinical Chemistry - Ranjana Chawla.

4. Laboratory manual in Biochemistry - Jayaraman.

5. Biochemical methods - S.Sadasivan and Manickam.

6. Introduction to Practical Biochemistry - David T. Plummer

THIRD SEMESTER
CORE 3 THEORY: MOLECULAR BIOLOGY

UNIT I

DNA structure, various forms (A, B, Z & H), Stability of nucleic acid structures; prokaryotic and eukaryotic genome organizations.

UNIT II

DNA replication, repair and recombination:, Enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.

UNIT III

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA.

UNIT IV

Protein synthesis: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA,

UNIT V

Control of gene expression at transcription and translation level: Regulation of, prokaryotic and eukaryotic gene expression, role of chromatinin regulating gene expression and gene silencing.

References:

1. Brown, T.A. (199). Gene Cloning. 3rd edition. Chapman and Hall Publications, U.S.A.
2. Burrel, M.M. (1993). Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. (1995). Biotechnology – Theory and Techniques, Vol. II, Jones and Burtlett Publishers.
4. Lewin, B. (2000). Genes VII. Oxford University Press, Oxford.
5. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. (2002). Modern genetic analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
6. Blackburn, G.M. and Gait, M.J. (1996). Nucleic acids in chemistry and biology. Oxford University Press.
7. Bruce Alberts, Dennis Brag, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson. (1994). Molecular Biology of cell. Garland Publishing Inc.
8. Hames, B.D. and Rickwood, D. (1990). Gel Electrophoresis – A Practical Approach, Oxford University Press, New York.

9. Sambrook, J and Russell, D.W. (2001). Molecular Cloning – A Laboratory Manual, 3rd Edition, Vol I, II, III, Cold Spring Harbour Laboratory Press, New York.
10. Westermeier, R. (1993). Electrophoresis in Practice, VCH, Federal Republic of Germany.
11. Wilson, K. and Walker (1995). Practical Biochemistry, Principle and Techniques, IV Edition, Cambridge University Press.
12. Old, R. and Primrose, S.B. (1995) Principles of Gene Manipulation: An Introduction to Genetic Engineering, 5th Edn. Blackwell Scientific Publications, Oxford.
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15. Freifelder D. (1996). Molecular Biology, 2nd edition. Narosa Publishing House.
16. Geoffrey L. Zubay (1998). Biochemistry. Wm. C. Brown Publishers, 4th Edition.
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18. George M. Malacinski, David Freifelder. (1998). Essentials of Molecular Biology. Jones and Bartlett Publsihers.
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20. Macinski, G.M. and Freifelder, D. (1998). Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.
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25. Harwod AJ. (1994). Protocols for Gene Analysis. Humana Press.
26. Surzyeki S (2000). Basic Techniques in Molecular Biology. Springer.
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28. Antony JF, Griffiths, Gilbert WM, Lewontin RC and Miller JH (2002). Modern Genetic Analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
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30. Friedberg EC, Walker GC, Siede W. (1995). DNA repair and mutagenesis. ASM press.
31. Malacinski GM and Freifelder D (1998) Essentials of Molecular Biology, 3rd edition, John and Bartlett Publishers.
32. Lewin B. (2000). Genes VII. Oxford University press
33. Maloy SR, Cronan Jr. JE, Freifelder D (1994). Microbial genetics. Jones and Bartlett publishers.
34. Singer M, Berg P. (1991). Genes and Genomes. University Science Books.
35. Balows A, Hansler Jr K.L, Isenberg H.D, Shalomy H.J (1991). Manual of Clinical Microbiology, American Society for
36. Microbiology, Washington DC.

CORE 3 PRACTICAL: MOLECULAR BIOLOGY

UNIT I

Estimation of DNA by diphenylamine method. Estimation of RNA by orcinol method.

UNIT II

Isolation of Plasmid DNA by Alkalysis method.
Isolation of Chromosomal DNA from Eukaryotic cells. Eg. Leaves.

UNIT III

Isolation of RNA from yeast.
Isolation of antibiotic resistant mutants.

UNIT IV

Preparation of competent cells.

UNIT V

Transformation of E.coli.

ALLIED 3 THEORY: BIOINSTRUMENTATION

Unit –1 Basic laboratory Instruments

Common laboratory equipment –anaerobic incubator – Biosafety Cabinent - Principle and working of pH meter, Laminar-air flow. Centrifugation: Types & principles and their applications- Lyophilizer - Flow cytometry.

Unit – 2 Chromatographic techniques

Theory, principles and applications of paper, thin layer, gel filtration, ion exchange,

Unit – 3 Electrophoretic techniques

Basic principles of electrophoresis, theory and application of paper, agarose.

Unit – 4 Spectroscopy

Spectroscopic techniques, theory and applications of UV, Visible, IR, NMR, Fluorescence, Atomic Absorption, CD, ORD, Mass, Raman Spectroscopy.

Unit – 5 Radioisotopic techniques

Use of radioisotopes in life sciences, radioactive labeling, principle and application of tracer techniques, detection and measurement of radioactivity using ionization chamber,

proportional chamber, Geiger- Muller and Scintillation counters, autoradiography and its applications.

ALLIED 3 – PRACTICAL: BIOINSTRUMENTATION

1. Studies on pH titration curves of amino acids/ acetic acid and determination of pKa values and Handerson-Hasselbach equation.
2. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC or Paper Chromatography.
3. Separation of serum protein by horizontal submerged gel electrophoresis.
4. Study of UV absorption spectra of macromolecules (protein, nucleic acid, bacterial pigments).
5. Quantitative estimation of hydrocarbons/pesticides/organic Solvents /methane by Gas chromatography.
6. Demonstration of PCR, DNA sequencer, Fermenter, Flow cytometry

References
Laboratory / online

1. Instrumental Methods of Analysis. 6th Edition by H.H. Willard, L.L. Merritt Jr. and others. 1986. CBS Publishers and Distributors.
2. Instrumental Methods of Chemical Analysis. 1989 by Chatwal G and Anand, S.Himalaya Publishing House, Mumbai.
3. A Biologists Guide to Principles and Techniques of Practical Biochemistry. 1975 by Williams, B.L. and Wilson, K.
4. Spectroscopy. Volume 1. Edited by B.B. Straughan and S. Walker. Chapman and Hall Ltd.
5. Gel Electrophoresis of Proteins- A Practical Approach by Hanes.
6. Chromatography: Concepts and Contrasts- 1988 by James Miller. John Wiley and Sons.Inc., New York.
7. Analytical Biochemistry by Holme.
8. Introduction to High Performance Liquid Chromatography by R R. J. Hamilton and P. A. Sewell.
9. Spectroscopy by B.P. Straughan and S. Walker.
10. John G. Webster. (2004). Bioinstrumentation. University of Wisconsin, John Wiley & Sons, Inc.

FOURTH SEMESTER

CORE 4 THEORY : SOIL AND AGRICULTURAL MICROBIOLOGY

UNIT I

Soil microbiology - quantitative and qualitative micro flora of different soils-role of microbes in soil fertility-tests for soil fertility - soil structure, soil formation - characterization of soil types and importance.

UNIT II

Biogeochemical cycles-role of micro organisms in carbon, phosphorus. sulphur and iron cycles. Methods of studying ecology of soil micro organisms-microbial gas metabolism-carbon dioxide, hydrogen, and methane and hydrogen sulphide.

UNIT III

Microbial interactions between microorganisms, plant and soil. Rhizoplane, rhizosphere, phyllosphere, spermosphere, mycorrhizae. Microbial association with insects-gut micro flora - symbiosis between microbes and insects; organic matter decomposition.

UNIT IV

Nitrogen cycle; ammonification- nitrification- de-nitrification- nitrogen fixation- Bio-fertilizers (bacterial, cyanobacteria and azolla) and crop response-bio-pesticides (bacterial, viral and fungal) saprophytes for pathogen suppression.

UNIT V

Principles of plant infection and defense mechanisms. Symptoms, Etiology, Epidemiology and Management of the following plant diseases: Mosaic disease of tobacco; Bunchy top of banana; Leaf roll of potato; Bacterial blight of paddy; Angular leaf spot of cotton, Late blight of potato; Damping off of tobacco, downy mildew of bajra; Powdery mildew of cucurbits; Head smut of sorghum; Leaf rust of coffee; Blight of maize/sorghum; Leafspot of paddy, Grassy shoot of sugar cane; Root knot of mulberry.

References:

1. Cambell, R. (1983) Microbial Ecology, 2nd Edn. Blackwell Scientific Publications, London.
2. Lynch, J.M. and Poole, N.J.(1979) Microbial Ecology: A. Conceptual Approach. Blackwell Scientific Publications, London.
3. Rheinheimer, G. (1980) Aquatic Microbilogy, 2nd Edn. John Wiley & Sons, New York.
4. Atlas, R.M. and Bartha, R. (1992) Microbial Ecology: Fundamentals and Applications, 2nd Edn. The Benjamin / Cummings Publishing Co.,Redwood City,CA.
5. Mitchell, R. (1974) Introduction to Environmental Microbiology. Prentice – Hall. Inc. New Jersey.
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7. Paul, E.A. and Clark, F.E. (1989) Soil Microbiology and Biochemistry. Academic Press, London.

8. Subbha Rao, N.S. (1995) Biofertilizers in Agriculture and Forestry, 3rd Edn. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.
9. Alexander M. (1977) Introduction to soil microbiology. John Wiley & Sons, Inc., New York.
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11. Ramanathan, and Muthukaruppan SM (2005) Environmental Microbiology. OmSakthi Pathipagam, Annamalai Nagar.
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14. Subba Rao, N. S. 1988. Biological nitrogen fixation: recent developments, Mohan Primlani for Oxford and IBH Pub. Co. (P) Ltd., India.
15. Subba Rao, N.S., G.S. Venkataraman and S. Kannaiyan 1993. Biological nitrogen fixation, ICAR Pub., New Delhi.
16. Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena. 1990. Biofertilizers, Scientific Publishers - Jodhpur.
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19. Mukherji, S. and Gosh, A.K.(2004) Plant Physiology .Tata McGraw Hill Publishers, New Delhi.
20. Bidwell, R.G.S. (1979) Plant Physiology. Macmillon, New Delhi.
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23. Jacob, W.P. (1979). Plant Hormones and Plant Development. Cambridge University Press, Cambridge.
24. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology. Wassworth Publication. Co.. Belmont.
25. Ting, I.P. (1982) Plant Physiology. Addison Wesley Publication, Phillippines
26. Postgate, J. (1987) Nitrogen Fixation,2nd Edn. Cassel, London.
27. Bonner, J. and Varner, J.E. (1979) Plant Physiology. Macmillan, New Delhi.

CORE 4 –PRACTICAL: SOIL AND AGRICULTURAL MICROBIOLOGY

UNIT I

Methods to study soil microorganisms - Isolation and enumeration of Bacteria, Fungi, Bacterio-phages, Algae, Protozoa etc., Microbiological test for fertility - Bacterial and Fungal

UNIT II

Microbiological demonstration of soil enzymes – Amylase, Protease, Lipase, Gelatinase etc.

UNIT III

Isolation and identification of root nodule bacteria- Rhizobium(symbiotic), demonstration of rhizobium in the root nodule(CS of root nodule) Isolation and identification of Azotobacter (Asymbiotic).

UNIT IV

Isolation and identification of nitrogen fixing Cyanobacteria-Anabaena, Nostoc etc., Demonstration of Azolla Demonstration of antagonistic activity –bacterial and fungal.

UNIT V

Study of the following discases: Tobacco mosaic; Bacterial blight of paddy; Downy mildew of bajra; Powdery mildew of cucurbits; Head smut of sorghum; Leaf rust of coffee; Leaf spot of paddy, Red rot of sugar cane, Root knot of mulberry.

ALLIED 4 – THEORY: BIOSTATISTICS

UNIT I

Introduction:

Types of biological data; frequency distributions; cummulative frequency distributions.

Populations and samples:

Populations; samples from populations; random sampling; parameters and statistics.

UNIT II

Measures of Central Tendency:

Mean; median; mode; geometric mean; harmonic mean.

Measures of Dispersion:

Range; variance; standard deviation, coefficient of variation; standard error.

UNIT III

Probability:

Mathematical probability and statistical probability; Laws of probability; addition law and multiplication law; conditional probability.

Probability Distribution:

Normal distribution; binomial distribution and poisson distribution.

UNIT IV

Testing for goodness of fit:

Chi-square test for goodness of fit; statistical significance; statistical errors in hypothesis testing; chi-square test for contingency tables; heterogeneity chi-square test.

Test of hypothesis:

Normal deviation test, tests for proportions, t-test.

UNIT V

Simple linear regression and correlations:

Simple linear regression; testing the significance of a regression; comparison of two slopes; correlation coefficient – hypothesis testing about correlation coefficients; comparison of two correlation co-efficients; rank correlation; intraclass correlation.

Analysis of variance:

One-way classification; two-way classification.

ALLIED 4 PRACTICAL: BIOSTATISTICS

UNIT I

Frequency distribution – Univariate – Bivariate; Measure of central tendency

UNIT II

Measure of dispersion; Correlation, Regression

UNIT III

Fitting distribution – Binomial – Poison – Method of least squares

UNIT IV

Tests of significance – T – F; Tests of significance – Chi-square – Attributes

UNIT V

ANOVA; Design of experiments – CRO, RBD, LSD

References:

1. Arora, P.N. and Malhon P.K., (1996) Biostatistics. Imalaya Publishing House, Mumbai.
2. Sokal and Rohif, (1973) Introduction to Biostatistics - Toppan Co. Japan.
3. Stanton, A and Clantz, Primer of Biostatistics - The McGraw Hill Inc., New York.
4. Sokal and Rohif, (1973) Introduction to Biostatistics - Toppan Co. Japan.
5. Stanton, A and Clantz, Primer of Biostatistics - The McGraw Hill Inc., New York.

FIFTH SEMESTER
CORE 5-THEORY: MEDICAL BACTERIOLOGY

UNIT I

Classification and general properties of medically important bacteria. Recommendation for collection, transport of specimens, isolation of bacteria from clinical specimens.

UNIT II

Primary media for isolation and their quality control - Antibiotic sensitivity discs, testing procedures and their quality control.

UNIT III

Staphylococcus; streptococci and related catalase negative Gram-positive cocci; Neisseria and Branhamella Corynebacterium and related organisms. Mycobacterium - typical and atypical. Aerobic pathogenic actinomycetes.

UNIT IV

Bacillus, B.anthracis, Vibrios, Aeromonas Helicobacter Pseudomonas, Brucella, Haemophilus, Bordettella. Enterobacteriaceae, Salmonella, Shigella, Proteus, Escherichia, Klebsiella.

UNIT V

Clostridia, Mycoplasma, Rickettsiae, Spirochetes, Trepenema, Leptiospira and Borrelia.

References:

1. Gerhardt, P. Murray, R.G., Wood, W.A., and Kreig, N.R. (1994). Methods for General and Molecular Bacteriology, ASM Press, Washington D.C.
2. Ronald M. Atlas, Lawrence C. Pazis (1993) Hand book of Microbiological Media. Ed. LC. CRC Press, London.
3. Balows, A., Hauser Jr K.L., Isenberg, H.D., Shalomy, H.J. (1991). Manual of Clinical Microbiology, ASM, Washington D.C.
4. Lorian, V. (1991) Antibiotics in laboratory medicine, 3rd edition, Williams and Wilkins, Baltimore.
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6. David Greenwood, Richard CD., Slack, John Forrest Peutherer. (1992). Medical Microbiology. 16th edition. ELBS with Churchill Livingstone.
7. Joan Stokes, E., Ridgway GL and Wren MWD (1993). Clinical Microbiology, 7th edition, Edward Arnold. A division of Holder and Stoughton.

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9. Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour edition, S.Chand Publishers, New Delhi.
10. Purohit SS (2005). Microbiology - Fundamentals and Applications. Student Edition Publishers, Jodhpur.
11. Pelczar & Kreig (2006). Microbiology5th edition. Tata McGraw Hill, New Delhi
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13. Delbecco, Eisen & Ginsburg (1990) Microbiology 5th Edition Harper & raw, New York
14. Chaechter M. Medoff G. and Eisenstein BC. (1993) Mechanism of Microbial Diseases 2nd edition. Williams and Wilkins, Baltimore.
15. Patrick R. Murray. (editor chief) (1999) Manual of clinical microbiology, 7th edition, ASM Press, Washington D.C.
16. Prakash M., Arora, C.K. (1998) Pathological techniques - Anmol Publications Pvt. Ltd. N.D.
17. Jewetz, E., Melnic, J.L. and Adelberg, E.A. (2000) Review of Medical Microbiology, 19th Edn. Lange Medical Publications, U.S.A.
18. Ananthanarayan, R. and Jeyaram Paniker, C.K. (1994) Text Book of Microbiology, 6th Edn. Orient Longman, Chennai.
19. Jeyaram Paniker, C.K. (2006) Text Book of Parasitology. Jay Pee Brothers, New Delhi.

CORE 6- THEORY: MEDICAL MYCOLOGY AND PARASITOLOGY

UNIT I

Morphology, Taxonomy, Classification of fungi. Characteristics of Zygomycetes, Ascomycetes, Basidiomycetes and Duteromycetes.

UNIT II

Dermatophytes and agents of superficial mycoses. Trichophyton, Epidermophyton and Microsporum. Opportunistic mycoses-Candidiasis, Cryptococcosis, Aspergillosis. Systemic mycoses-Histoplasmosis, Coccidioidomycosis, Blastomycosis. Subcutaneous mycoses- Sporotrichosis, Mycetoma.

UNIT III

Collection, transport of specimens, isolation of fungi from clinical specimens. Newer methods in diagnostic mycology. Mycotoxins, Antifungal agents, testing methods and quality control.

UNIT IV

Introduction to medical Parasitology – Classification, Protozoa – Entameoba – Plasmodium, Leishmania – Trypanosoma –Giardia – Trichomonas – Balantidium.

UNIT V

Platyhelminthes – Taenia – Fasciola – Paragonimus – Schistosoma. Nematihelminthes – Ascaris – Ankylostoma – Enterobius – Trichuris – Trichinella – Wuchereria – Dracanculus. Laboratory techniques in parasitology. Examination of faeces for ova and cysts – Concentration methods. Blood smear examination for parasites. Cultivation of protozoan parasites.

References:

1. Alexopoulus CJ and C W. Mims.(1993).Introductory Mycology (3rd edition) WileyEastern Ltd, New Delhi.

2. Elizabeth Moore-Landecker. (1996). Fundamentals of the fungi.(4th edition). PrenticeHall International, Inc, London
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14. Chatterjee (1986) Medical Parasitology. Tata McGraw Hill, Calcutta.

CORE 7 THEORY: MEDICAL VIROLOGY

UNIT I

General Properties of viruses – Dectection of viruses and antigens in clinical specimens – Serological diagnosis of virus infections. Cultivation of Viruses.

UNIT II

Arthropod borne and rodent borne virus diseases – Picorna viruses and diseases. Hepatitis viruses: Rabies and other neuro viruses: Orthomyxo and Paramyxoviruses.

UNIT III

Pox, Adeno, Herpes, Reo, Rota and HIV Viruses, Oncogenic viruses, Viral vaccines, their Preparation and their immunization schedules.

UNIT IV

Viruses of importance to bacteria – Bacteriophages – Their Structure, types – Uses in Microbiology.

UNIT V

Applied virology – Viral diseases, epidemiology diagnosis, prevention and treatment. Vaccines and interferons – Antiviral agents.

References:

1. Jewetz, E., Melnic, J.L. and Adelberg, E.A. (2000) Review of Medical Microbiology, 19th Edn. Lange Medical Publications, U.S.A.
2. Ananthanarayan, R. and Jeyaram Paniker, C.K. (1994) Text Book of Microbiology, 6th Edn. Orient Longman, Chennai
3. Conrat HF, Kimball PC and Levy JA. (1988). Virology. II edition. Prentice Hall, Englewood Cliff, New Jersey.
4. Timbury, M.C. (1986) Medical Virology, 9th Edn. Churchill Livingstone, London.
5. Topley & Wilsons's. (1990) Principles of Bacteriology, Virology and Immunity, VIII edition, Vol. III Bacterial Diseases, Edward Arnold, London.
6. Luria, S.E., Darnel, J.E., Jr., Baltimore, D. and Campbell, A. (1978) General Virology, 3rd Edn. John Wiley & Sons, New York.
7. Fenner, F. and White, D.O. (1970) Animal Virology. Academic Press,New York.
8. Hayes, W. (1968) The Genetics of Bacteria and their Viruses. Blackwell Scientific Publications, London.
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10. Lennette, E.H. (1974) Diagnostic Procedures for Viral and Rikettsial Diseases. American Public Health Association, New York.
11. Hoeprich, P.D. (1977) Infectious Diseases, 2nd Edn. Harper & Row Publishers, New York.

12. Roger Hull (2002). Mathews' Plant Virology. (4thEdition). Academic press-A Harcourt Science and technology company, New York.
13. Calendar, R. (1988) Bacteriophages Vols. I, II and III. Plenum Press.

CORE 5,6 AND 7 – PRACTICAL: MEDICAL BACTERIOLOGY, MYCOLOGY, PARASITOLOGY AND VIROLOGY

UNIT I

GENERAL requirements of collections, transport of clinical Specimens – Methods of enriched, selective and enrichment culture techniques used to isolate organisms from clinical materials. Simple, differential and Special staining of clinical materials viz: Throat swab, Pus, Urine, Sputum, Stool etc. Enumeration of Bacteria in Urine, Quantitative Urine Culture.

UNIT II

Isolation and identification of bacterial pathogens from clinical specimens their biological reactions. Antimicrobial Sensitivity testing by disc-diffusion technique and determination of MIC.

UNIT III

Identification of pathogenic viruses in Slides/ Smears / Spotters. Isolation of phage from natural sources.

UNIT IV

KOH and Lactophenol preparations for skin scrapings for dermatophytes. Microscopic identification and cultural characteristics of medically important fungi and lab contaminants.Germ tube, carbohydrate assimilation and fermentation tests for yeasts.

UNIT V

Direct examination of faeces- wet mount and Lugol's iodine method- demonstration of protozoan cysts and helminthes eggs. Concentration techniques of stool specimen- floatation and sedimentation methods. Examination of blood for malarial parasites- thin and thick smear preparation. dentification of pathogenic parasites in slides/ specimens as spotters.

ELECTIVE 1 – THEORY: GENETIC ENGINEERING

UNIT I

Vectors: Plasmid vectors: pSC101, pBR322, pUC series and Ti plasmids based vectors; Bacteriophage vectors: Lambda phage based vectors, phagemids, cosmids, and M13 based vectors; Viral vectors: Vaccinia, Retroviral, SV40 and Baculoviral system;

UNIT II

Principles and methods in genetic engineering: Host cell restriction; Restriction modification; Restriction enzymes: Types and applications;; DNA finger printing; RFLP Nucleases, Ribonucleases, DNA ligases, Tag DNA Polymerases, Methylases, Topoisomerases, Gyrases, and Reverse Transcriptases.

UNIT III

Basic steps of cloning techniques; Genomic DNA and cDNA library Construction; Screening methods; Cloning in *E. coli*, Expression systems; Gene fusion and Reporter genes; Gene targeting; Methods of Gene transfer – transformation, transfection, Electroporation, microinjection and biolistics.

UNIT IV

Analysis of Recombinant DNA; Polymerase chain reaction; Principles and techniques of nucleic acid hybridization; Southern, Northern, Western blotting techniques; Microarray technique.

UNIT V

DNA and protein sequencing; Applications of genetic engineering in agriculture; health and industry.

References:

1. Winnacker, E.L. (1987). From genes to Clones: Introduction to Gene technology. VCH Publications, Federal Republic of Germany
2. Glover, D.M. (1984) Gene Cloning:. The Mechanism of DNA Manipulation. Chapman and Hall, London.
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6. Burrell, MM. (1993) Enzymes of Molecular Biology, Humana Press.
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16. Primrose SB (1994) Molecular Biotechnology, 2nd edition, Blackwell Scientific Publications.
17. DNA Cloning, Vols, 1,2,3 and 4, IRL Press
18. Gerd Gellissen - 2005. Production of Recombinant Proteins: Novel Microbial and Eukaryotic Expression Systems . Viley VCH Publishers, 426 pages.

SIXTH SEMESTER

CORE 8- THEORY: ENVIRONMENTAL MICROBIOLOGY

UNIT I

Introduction: Organization of the biosphere and components of ecosystem, Natural habitats of microorganisms, Microbial communities in aquatic and terrestrial habitats, Microorganisms as components of ecosystem-as producers and decomposers.

UNIT II

Microbial life in extreme environments: Effect of temperature, pH, Pressure, salt and heavy metals such as As, Sb,Hg, Pb and Cd, Microbial life in conditions of high irradiation, Radiosensitivity; mechanism of damage and recovery, Growth in nutrient limited environment – mechanism of adaptations, Microbes in space.

UNIT III

Microbes in aquatic environments: The nature of aquatic habitats, Methods used in the study of aquatic (fresh and marine water) microbial community, Pollution of aquatic habitats, Water quality criteria, Water-borne diseases, Microbiological analysis of water purity, Indicator organisms, ground water quality and home treatment system.

UNIT IV

Microbes in air: Composition of Air; Number and kinds of organisms in air; Distribution and sources of air borne organisms; Droplet and droplet nuclei; Assessment of air quality; Air sanitation; Airborne diseases;

UNIT V

Environmental application: Waste –types; Treatment of solid wastes –composting, Vermiform composting, silage, Pyrolysis and scarification; Treatment of liquid wastes, degradation of liquid industrial wastes; Degradation of pesticides and detergents; Degradation of lignin; synthetic polymers; Xenobiotic compounds; Alkyl benzyl sulphonates; Petroleum and hydrocarbon degradation.

References:

1. Atlas Ronald, M., Bartha, and Richard (1987). Microbial Ecology 2nd Edition. Benjamin/Cummings Publishing Company, California.
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18. Paul, E.A. and Clark, F.E. (1989) Soil Microbiology and Biochemistry. Academic Press, London.
19. Subbha Rao, N.S. (1995) Biofertilizers in Agriculture and Forestry, 3rd Edn. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.
20. Moo-Young, M., Anderson, W.A. and Chakrabarty, A.M. 1996. Environmental biotechnology: Principles and applications. Boston, Mass.: Kluwer Academic Publishers.
21. Aaronson S. (1970) Experimental Microbial Ecology, Academic Press, New York
22. Benson H.J (1994). Microbiological Applications, WmC Brown Publishers, Oxford
23. Clesceri L.S, Greenberg A.E, Eaton AD. (1998) Standard methods for examination of water & waste water American Public Health Association.

CORE 9- THEORY: FOOD AND DAIRY MICROBIOLOGY

UNIT I

Food as a substrate for microorganisms–Microorganisms important in food microbiology; Molds, yeasts and bacteria–General Characteristics–Classification and importance.

UNIT II

Principles of food preservation – Asepsis – Removal of micro organisms, anerobic conditions – High temperature – Low temperature- Drying –Food additives.

UNIT III

Contamination and spoilage- Cereals, sugar products, vegetables and fruits, meat and meat products, milk and milk products – Fish and sea foods – poultry, spoilage of canned foods.

UNIT IV

Food borne infections and intoxications – bacterial, non-bacterial – Food borne disease outbreaks – Laboratory testing – preventing measures – Food sanitation – plant sanitation – Employees' heals standards – waste treatment and disposal –quality control.

UNIT V

Food fermentation: Bread cheese, vinegar, fermented vegetables, fermented dairy products. Spoilage and defects of fermented dairy products – oriental fermented foods.

References:

1. Adams MR and Moss MO. (1995). Food Microbiology, The Royal Society of Chemistry, Cambridge.
2. Andrews AT, Varley J. (1994) Biochemistry of milk products. Royal Society of Chemistry.
3. Banwart GJ. (1989), Basic food microbiology, Chapman & Hall, New York.
4. Frazier WC and Westhoff DC. (1988) Food microbiology, TATA McGraw Hill Publishing Company Ltd. New Delhi.
5. Hobbs BC and Roberts D. (1993) Food poisoning and food hygiene, Edward Arnold (A division of Hodder and Stoughton), London.
6. Jay JM. (1987) Modern food microbiology, CBS Publishers and distributors, New Delhi.
7. Robinson RK. (1990) The microbiology of milk. Elsevier Applied Science, London.
8. Robinson RK. (1990) Dairy Microbiology, Elsevier Applied Science, London.
9. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1995) Principles of Fermentation Technology, 2nd Edn. Pergamon Press, Oxford.
10. Banwart, G.J. (1989) Basic Food Microbiology. CBS Publishers and Distributors, New Delhi.
11. Casida, J.E. (1968) Industrial Microbiology. Wiley Eastern, New Delhi.
12. Adams, M.R. and Moss, M.O. (1995) Food Microbiology. Royal Society of Chemistry, Cambridge.

CORE 8 AND 9- PRACTICAL: ENVIRONMENTAL, FOOD AND DAIRY MICROBIOLOGY

UNIT I

Detection of number of Bacteria in milk by breed count. Detection of number of bacteria in milk by standard plant count.

UNIT II

Determination of quality of milk sample by methylene blue reductase test and Resorzurin method.

UNIT III

Isolation of yeast and molds from spoiled nuts, fruits, and vegetables. Bacteriological examination of specific food a) Curd b) Raw meat c) Fish d) Ice cream.

UNIT IV

Determination of BOD and COD of wastewater. Water analysis a) MPN method b) Memberane filter method.

UNIT V

Quantification of microorganisms in air by settle plate and air sampler methods. Detection of aflatoxin B_1 from moldy grains using thin layer chromatography.

ELECTIVE 2 – THEORY: INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

UNIT I

General introduction to fermentation process. Microbial growth kinetics-batch, continuous and fed batch culture. Large scale cultivation of industrially important microbes (Streptomyces, Saccharomyces, Hansenela, Spirulina and Penicillium) Fermentation media-desired qualities- media formulation strategies- carbon, nitrogen, vitamin, mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams.

UNIT II

Types of fermentation-fermentors-basic functions, design and components, asepsis and containment requirement. Specifications of fermentors- sterilization of fermentors-aseptic inoculation methods. Brief idea on monitoring control device.

UNIT III

Microbial products of commercial use-penicillin, ethanol, vinegar, vitamin B12, protease, citric acid and glutamic acid.

UNIT IV

Down stream processing - objective and criteria, foam separation, precipitation methods, filtration, industrial scale centrifugation and cell disruption methods. Liquid-liquid extraction, solvent recovery- chromatography. Two phase aqueous extraction, super – critical fluid extraction, ultra filtration, drying device, crystallization and whole broth processing.

UNIT V

Ecology of microorganisms affecting pharmaceutical industries- atmosphere-water-raw materials- packaging- equipment. Factors affecting microbial spoilage of pharmaceutical products - Control of contamination during manufacture- good pharmaceutical manufacturing process. Quality control of pharmaceutical products. Manufacture of sterile pharmaceutical products- injections and ophthalmic preparations.

References:

1. Casida, J.E. (1968) Industrial Microbiology. Wiley Eastern, New Delhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1995) Principles of Fermentation Technology, 2nd Edn. Pergamon Press, Oxford.
3. Peppler, H.J. and Pearl Man, D. (1979) Fermentation Technology, Vol 1 & 2, Academic Press, London.
4. Vedpal's S. Malik, Padma Sridhar, Sharma, M.C. and Polasa, H. (1992). Industrial Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
5. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology. ASM Press.
6. Hugo WB and Russell AD. (1989) Pharmaceutical Microbiology IV edition. Blackwell Scientific Publication, Oxford.

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8. George Edward Trease and W.C. Evans - Pharmacognosy 12th edition, English Language Books Society, Baelliere Tindall.
9. Handa, S.S. and Kapoor, V.K. Pharamcognosy by 2nd Edition, Vallabh Prakashan Publishers, New Delhi.
10. Jain, S.K (1980) Indian Medicinal plants.
11. Kokate, C.K., Durohit, A.P. and Gokhale, S.R., Pharmacognosy by 12th edition - Nirali Prakasham Publishers, Pune.
12. Kumar N.C. (1993) An Introduction to Medical Botany and Pharmacognosy.
13. Nadkarni (1981) Indian Materia Medica.
14. Shah, S.C. and Qudary (1990) A text book of Pharmacognosy.
15. Wallis, T.E, Text book of pharmacognosy by 5th edition. CBS publishers and distributors, New Delhi.

ELECTIVE 3 – THEORY: BIOTECHNOLOGY

UNIT I

Biotechnolgy–definition & history; Microbial production of industrial enzymes; methods for immobilization of enzymes; kinetics of soluble and immobilized enzymes; application of soluble and immobilized enzymes; enzyme-based sensors.

UNIT II

Principles and application of genetic recombinant technology and strain improvement (mutational, rDNA technologies). Production of biotechnological products: Food –SCP (algae, yeast, mushroom). Biofertilizer (BGA, VAM) Biopesticides (Bacillus thruingiensis). Fuel –ethanol; Pharmaceuticals – antigens, interferons, vaccines, insulin, gene-therapy methods.

UNIT III

Architecture of plant genome; plant tissue culture techniques; methods of gene transfer into plant cells; production of secondary metabolites using suspension/immobilized cell culture;

UNIT IV

Methods for plant micro propagation; crop improvement and development of transgenic plants.

UNIT V

Animal cell metabolism and regulation; cell cycle; primary cell culture; nutritional requirements for animal cell culture; techniques for the mass culture of animal cell lines; transgenic animals.

References:

1. Balasubramanian, D., Bryce, C., Dharmalingam, K., Green, J. and Jayaraman, K. (1999). Concepts in Biotechnology, University Press, India. M.Sc. Applied Microbiology: Syllabus (CBCS) 58
2. Colin Ratledge and Bjorn Kristiansen (2001). Basic Biotechnology, Cambridge University Press, U.K.
3. Joshi, V.K.and Ashok Pandey. (1999). Biotechnology, Food fermentation (Microbiology, Biochemistry and Technology) Vol. I & II Basic, Educational Publishers and Distributors, Ernakulam.
4. Vedpal's S. Malik, Padma Sridhar, Sharma, M.C. and Polasa, H. (1992). Industrial Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
5. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology. ASM Press.
6. Glick, B.R. and Pasternak, J.J. (1998). Molecular Biotechnology, II Edition, ASM Press, New York.
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8. Tortora, G.J., Fernke, B.R. and Case, C.L. (2001), Microbiology – An Introduction, Benjamin Cummings.
9. Venkataraman, L.V. (1983). A monograph on Spirulina platensis, CFTRI, Mysore. M.Sc. Applied Microbiology: Syllabus (CBCS) 61
10. Murray Moo (1992) Plant Biotechnology. Young, Pergamon Press.
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18. Glazer AN, Nikaido H. (1994) Microbial Biotechnology - Fundamentals of Applied Microbiology WH Freeman and Company, New York
19. Chirikjian JG Eds (1995). Biotechnolgy - Theory and Techniques, Vol. 1, Jones and Burtlett Publishers

SYLLABUS FOR NON-MAJOR ELECTIVE SUBJECTS
Non Major Elective 1- Cellular Organization

UNIT I

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

UNIT II

Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

UNIT-III

Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

UNIT IV

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

UNIT-V

Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response.

Non Major Elective 2- Diversity Life Forms

UNIT I

Principles and methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants, animals and microorganisms.

UNIT II

Levels of structural organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy.

UNIT III

Outline classification of plants, animals and microorganisms: Important criteria used for classification in each taxon; classification of plants, animals and microorganisms; evolutionary relationships among taxa.

UNIT IV

Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of the subcontinent.

UNIT V

Organisms of health and agricultural importance: Common parasites and pathogens of humans, domestic animals and crops.

References:

1. Abbas, A.K., Lichtman, A.H. and Pober, J.S. (1994) Cellular and Molecular Immunology, 2nd Edn. WB Saunders, USA.
2. Lodish, H., Baltimore, O., Berk, A., Zipursky, S.L.,Matsudaira ,P.and Darnell, J. (1995). Molecular Cell Biology, Scientific American Books, New York USA.
3. Microbial Diversity by Colwd, D. 1999, Academic Press.
4. Microbiology: dyanamics and diversity by perry.

SYLLABUS FOR ALLIED MICROBIOLOGY SUBJECTS FOR B.SC., BIOCHEMISTRY AND B.SC., BIOTECHNOLOGY

ALLIED MICROBIOLOGY FOR B.SC., BIOCHEMISTRY

Title of the paper	**Allied Microbiology I**		
Category : **Part III - Allied Theory**	Year & Semester Second Year/third Semester	Credits 4	Teaching hours 6 hours/week

Unit I

Evolution of Microbiology. Classification of micro-organisms. Basic microbiological techniques. Cleaning of glassware. Sterilization of glassware and media. Stroak plate, spread plate, pour plate enrichment culture, single spore isolation, serial dilution, standard plate count. Lyophilization. Types of culture media. Staining techniques-simple and differential.

Unit II

Structural characteristics of Bacteria. Actinomycetes, Mycoplasma and viruses.Structural characteristics of micro algae (Oscillatoria Volvox and Chiorella), fungi (molds and yeasts) and Protozoa Entemoeba Plasmodium and Euglena)

Unit III

Measurement of microbial growth (turbidity, biomass, cell count, arrea, pigments). Microbiology of Soil. Microbes in soil, rhizophers and rhizoplane. Nitrogen-fixing, nitrifying and denitryfying bacteria. Sulphur bacteria. Biofertilizers.

Unit IV

Microbiology of water. Potable water. Municipal water purification. Sewage disposal and treatment-Physical and biological.

Title of the paper	Allied Microbiology I		
Category : **Part III - Allied Practical**	Year & Semester Second Year/third Semester	Credits 3	Teaching hours 3 hours/week

UNIT I

Cleaning of glass wares Sterilization principle and methods- moist heat- dry heat and filtration methods.

UNIT-II

Media preparation: liquid media, solid media, agar slants, agar plates, basal, enriched, selective media preparation- quality control of media, growth supporting properties, sterility check of media.

UNIT-III

Pure culture techniques: streak plate, pour plate, decimal dilution. Culture characteristics of microorganisms: growth on different media, growth characteristics and description. Demonstration of pigment production.

UNIT-III

Microscopy: light microscopy, bright field microscopy, dark field microscopy. Motility demonstration: hanging drop, wet mount preparation, dark field microscopy, semi solid agar, Craigie's tube method.

UNIT-IV

Staining techniques: smear preparation, simple staining, Gram's staining, acid fast staining, staining of Metachromatic granule

Title of the paper	Allied Microbiology II		
Category : **Part III - Allied Theory**	Year & Semester Second Year/fourth Semester	Credits 4	Teaching hours 6 hours/week

Unit I

Microbiology of air. Microbes in air. Methods of purification of air. Food microbiology. Microbial spoilage of food. Food preservation techniques with special emphasis on preservation of home foods by tunneric, salt, spices, oil and sugar.

Unit II

Microbiology of milk. Microbes in milk and their sources. Pasteurization. Phosphatase and reduetase tests. Dairy products. Industrial microbiology. Microbes in the production of organicacids, antibiotics and alcoholic beverages.

Unit III

Microbes and diseases. Pathogenesis. Immune system. Active and passive immunity. AIDS.

Unit IV

Control of microbes-physical and chemical methods. Personal hygiene and sanitation. A brief account of genetic engineering and biotechnology.

Title of the paper	Allied Microbiology II		
Category : **Part III – Practical Theory**	Year & Semester Second Year/fourth Semester	Credits 3	Teaching hours 3 hours/week

UNIT-I

Morphology of microorganisms: morphological variations in algae, morphology of fungi, slide culture technique. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. Micrometry: Demonstration of size of yeast and fungal filaments.

UNIT-II

Physiology characteristics: IMViC test, H_2S, Oxidase, catalase, urease test. Carbohydrate fermentation test, maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture

UNIT-III

Observation of pond water for the presence of microorganism-Volvox , Chiorella, Oscillatoria, Entamoeba. Paramoccium and Euglena. Study of photomicrographs of different types of bacteria and viruses

UNIT-IV

Identification of organisms that spoil the following: Citrus fruits, Grapes, Emblica fruits. Coconut Kernal, Milk Products, bread and jam. Phosphatase and reductase tests. Study of organisms and their substrates in the formation of the following - tactic acid, acetic acid, cathanol, pencillin, streptomysin dairy products and alcoholic beverages.

Reference Books:

1. Ananthanarayanan, R. and Panicker, J. 1986.Text Book of Microbiology. Orient longmants
2. Boyd, R.F. 1988. General Microbiology. Times Mirror/Mosby College publishers.
3. Burrows., W. 1978. Text book of Microbiology. W.B. Saunders.
4. Carpenter. P.L. 1990. Microbiology. W.B. Saunders.
5. Frazier, W.C. 1978. Food Microbiology. McGraw Hill.
6. Frobisher, M. 1974. Fundamentals of Microbiology. W.B. Saunders.
7. Jay J.M. 1970. Modern Food Microbiology. Van Nostrand.
8. Ketchum P.A. 1988. Microbiology John Wilcy & Sons.
9. Lakshmanan, M.etal. 1971.Laboratory Experiments in Microbiology and Molecular Biology. Higginbothams (private) Ltd.
10. Peizar and Reid. 1986. Microbiology. Tata McGraw Hill.
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12. Salle, A.J. 1986.Fundamental Principles of Bacteriology. Tata McGraw Hill.

1964.Bacterial flora of milk and milk products in India. ICAR Publishers.

ALLIED MICROBIOLOGY FOR B.SC., BIOTECHNOLOGY

Title of the paper	**Allied Microbiology**		
Category : **Part III** - **Allied Theory**	Year & Semester first Year/first Semester	Credits 4	Teaching hours 6 hours/week

UNIT- I

History and Scope of Microbiology- Anatomy of Prokaryotes and Eukaryotes- Bacteria, Fungi, Algae, Protozoa and Viruses- structure and functions of the cellular components- Growth and nutrition- media and culture.

UNIT- II

Classification of microbes- DNA analysis, Ribosomal RNA analysis- Numerical taxonomy- Molecular taxonomy- methods of microbial identification.

UNIT- III

Environmental Microbiology- role of microorganisms in the productivity of ecosystems- Role of microorganisms in food production; dairy and non-dairy products- fermented foods and alcoholic beverages- production of food (single cell protein), Fuel (ethanol).

UNIT- IV

Medical Microbiology- Pathogenic microbes- Bacterial, Viral, Fungal and Protozoan diseases. Cure, control and prevention- Pharmaceuticals (antibiotics, vaccines etc.), Biofertilizers (BGA), Biopesticides, biopolymers, biosurfactants.

UNIT- V

Industrial use of microbes- fermentation products- bioconversions- products of industrial microbiology- Streptomyces, yeasts (Saccharomyces, Hansenula), Spirulina and Penicillium.

Title of the paper	Allied Microbiology		
Category : **Part III – Practical Theory**	Year & Semester first Year/first Semester	Credits 3	Teaching hours 3 hours/week

UNIT I

Cleaning of glass wares Sterilization principle and methods- moist heat- dry heat and filtration methods. Media preparation: liquid media, solid media, agar slants, agar plates, basal, enriched, selective media preparation- quality control of media, growth supporting properties, sterility check of media.

UNIT-II

Pure culture techniques: streak plate, pour plate, decimal dilution. Culture characteristics of microorganisms: growth on different media, growth characteristics and description. Demonstration of pigment production.

UNIT-III

Microscopy: light microscopy, bright field microscopy, dark field microscopy. Motility demonstration: hanging drop, wet mount preparation, dark field microscopy, semi solid agar, Craigie's tube method. Staining techniques: smear preparation, simple staining, Gram's staining, acid fast staining, staining of Metachromatic granules

UNIT-IV

Morphology of microorganisms: morphological variations in algae, morphology of fungi, slide culture technique. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. Micrometry: Demonstration of size of yeast and fungal filaments.

UNIT-V

Physiology characteristics: IMViC test, H2S, Oxidase, catalase, urease test. Carbohydrate fermentation test, maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture.

1. Pelczar, M.J., Chan, E.C.S., King, N.R., 2001. Microbiology- Concepts and Applications. Tata McGraw – Hill, New Delhi.
2. Ananthanarayan, R. and Paniker, C.K.J. 2000. A text book of Microbiology. 6th edition. Orient Longman Ltd., Hyderabad.
3. Pelzar. 2000. Microbiology. 5th edition. Tata McGraw Hill., New Delhi.
4. Ingraham, J.L., and Ingraham, C.A. 2000. Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA.