

(Abstract)

MSc Microbiology Programme (CBCSS) - Open Elective Course included and Credit of Elective Courses reduced from 3 to 2 in the third semester - Modified Scheme and Syllabus implemented in the University Department - w.e.f. 2021 Admission - Orders issued.

ACADEMIC C SECTION

Acad/C4/12615/2020 (I)

Dated: 29.12.2022

- Read:-1. U.O. No. Acad/C4/12615/2020 dated 18.02.2021
2. Minutes of the meeting of the IQAC, held on 27.07.2022
3. Minutes of the meeting of the Department Council, Dept of Biotechnology & Microbiology dated 17.10.2022
4. Email from HoD, Dept. of Biotechnology & Microbiology dated 23.12.2022 forwarding the modified Scheme and Syllabus

ORDER


1. As per paper read (1) above, the Scheme, Syllabus of MSc Microbiology Programme (CBCSS) was revised and implemented in the University Department - w.e.f 2020 admission.
2. Meeting of Internal Quality Assurance Cell held on 27.07.2022 as per paper read (2) above, resolved that all the Teaching Departments should offer Open Elective Courses, compulsorily in the third semester.
3. As per paper read (3) above, the Department Council, Department of Biotechnology & Microbiology resolved to opt one Elective with 2 Credits, and one Open Elective with 4 Credits from other Department, in third semester and also to incorporate the following modifications in the syllabus of MSc Microbiology Programme (CBCSS) for implementation from 2021 admission onwards
 1. Open Elective Course MSMBY03O01-BASIC IN MICROBIOLOGY introduced in 3rd semester
 2. Credits of Elective Courses in third semester reduced from 3 to 2 keeping total credit as 80
4. As per paper read (4) above, the Head, Dept. of Biotechnology & Microbiology submitted the modified Scheme and Syllabus of MSc Microbiology Programme (CBCSS) for implementation with effect from 2021 admission.
5. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under section 11 (1) Chapter III of Kannur University Act 1996, accorded sanction to implement the modified Scheme and Syllabus of MSc Microbiology Programme (CBCSS) in the Department of Biotechnology & Microbiology, Dr. Janaki Ammal Campus, Palayad as detailed in para (3) above, with effect from 2021 admission, and to report to the Academic Council.
6. The modified Scheme & Syllabus of MSc Microbiology Programme (CBCSS) implemented with effect from 2021 admission are appended and uploaded on the University Website.(www.kannuruniversity.ac.in).
7. The UO read (1) above stand modified to this effect
Orders are issued accordingly.

Sd/-

BALACHANDRAN V K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: 1. The Head, Department of Biotechnology & Microbiology
Dr. Janaki Ammal Campus, Palayad

Copy To: 1. The Examination Branch (through PA to CE).
2. PS to VC / PA to PVC / PA to R
3. DR / AR I/ AR II (Acad), EXCI, EPIV
4. The Web Manager (for uploading in the Website), Computer Programmer
5. SF / DF /FC

Forwarded/ By Order

SECTION OFFICER

KANNUR UNIVERSITY

DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY

SCHEME AND SYLLABUS

MSc MICROBIOLOGY

2021 ADMISSION ONWARDS

**Scheme and Syllabus of M.Sc. Microbiology
Programmes Under the Choice Based Credit and Semester System
with effect from 2021 Admission**

About the Department

The Department of Biotechnology and Microbiology of Kannur University established in the year 2000 at Palayad, Thalassery offers M.Sc., Ph.D. and Post-doctoral programmes in Biotechnology and Microbiology. The Department is a **Centre of Excellence in Biosciences**, receiving research funds from state, national and international agencies. Our vision is to improve quality of life through research and molding future scientists and individuals who will be a workforce to make a better tomorrow.

M.Sc. PROGRAMMES

M.Sc. Biotechnology – 12
Seats
M.Sc. Microbiology – 12
Seats

PROGRAMME SPECIFIC OUTCOMES (PSOS):

A post-graduate student upon completion of the programme is expected to gain the following attributes:

- To train students drawn from different disciplines at Post-Graduate level in frontier and multidisciplinary areas of Biotechnology and Microbiology so as to equip them to be future scientists, teachers and entrepreneurs.
- Competence for research and innovation in Biotechnology/Microbiology.
- Gaining technical skills for the betterment of planet Earth.
- Critical thinking ability to review scientific literature as stepping stone to research
- Gain confidence for career choice.
 - Gain ability to work independently in choosing research topics as well as be part of teamwork with collaborative skills.
 - To attain confidence in scientific conversation and writing skills and knowing ethical behaviour.

DURATION OF THE PROGRAMME

The whole programme is divided into four semesters (two years)

ELIGIBILITY FOR ADMISSION

Bachelor's degree in any of the subjects such as Biotechnology/Microbiology/Biochemistry/ Chemistry/ Zoology/ Botany/Plant Sciences/Life Science or any other subject with Microbiology/ Biotechnology as one of the subjects of study at degree level with not less than 50% marks in aggregate (excluding languages). Those who are awaiting final year B.Sc. results also can apply but they have to fulfil the eligibility criteria before the admission. Eligible relaxation in the percentage of marks will be given to candidates belonging to SC and ST. Reservation policies of the University/State are followed for admission.

ADMISSION PROCEDURE

Admissions are notified in national newspapers inviting applications for the M.Sc. Programmes (Biotechnology and Microbiology) of the Department.

All the eligible applicants have to appear for a written entrance test. Duration of the entrance test will be 120 minutes with 200 objective type multiple choice questions for 100 marks. Questions will be of undergraduate standard. There will be 25% negative marks for wrong answers. A rank list will be prepared based on the entrance test. The admission will be as per the rank in the list and reservation policy.

The subjects and their weightages in the Entrance Test will be as given below.

Physics	10%
Chemistry	15%
Botany and Zoology	25%
Biotechnology, Microbiology, Biophysics, Biochemistry, Molecular biology etc	50%

M.Sc. CURRICULUM

The M.Sc. curriculum of both Biotechnology and Microbiology closely follows the level and extent as conceived by the national curriculum development centers of UGC/DBT. The Choice Based Credit System

(CBCS) provides an opportunity for the students to choose courses from the prescribed courses comprising core and elective courses. The evaluation of the courses will be through grading system evaluation and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in internal and external examinations.

COURSES AND CREDITS

Definitions

(i) '**Academic Programme**' means the entire course of study including its programme structure, details of the course, evaluation methods etc. This will be carried out by teaching and evaluation process in the parent department / centre or jointly under more than one such Department / Centre

(ii) '**Course**' means a subject that is part of an Academic Programme

(iii) '**Programme Structure**' includes the list of courses (Core, Elective, Open Elective) that forms an Academic Programme which specifies the syllabus, credits, hours of teaching, evaluation process and examination schemes, the minimum credits required for successful completion of the programme etc. prepared in conformity to University Rules, eligibility criteria for admission

(iv) '**Core Course**' means a course that a student admitted to a particular programme must successfully complete compulsorily to receive the degree and that which cannot be substituted by any other course

(v) '**Elective Course**' means an optional course to be selected by a student out of such courses offered in the same or any other Department / Centre

(vi) '**Open Elective**' means an elective course which is available from recognized online resources like Swayam / MOOCS or offered by other departments within the framework of the subject.

(vii) '**Credit**' is the value assigned to a course which indicates the level of instruction; 1 hour of lecture per week equals 1 credit, 3 hours practical class per week equals 1 credit.

(viii) '**SGPA**' means Grade Point Average of the semester calculated for individual semester.

(ix) 'CGPA' is Cumulative Grade Points Average calculated for all courses completed by the students at the end of the programme. A formula for conversion of CGPA into percentage marks will be given in the marksheet.

A minimum of 80 credits are mandatory for the successful completion of the programme.

Students can opt for one elective (open elective) course relevant to Biotechnology programme from online sources approved by the University (Swayam Platform or similar platforms) or other Departments during second and third semester. The choice of the student must be reported to the Head of the Department and approved by the Department Council. **The minimum credits per semester is 16 and the maximum credits per semester (core and elective inclusive) cannot cross 24. All students have to opt for equal number of electives in each semester.**

If the student does not earn the required credits by not appearing for the exam or due to other reasons, the course will have to be repeated along with the concurrent semester of the next batch after the approval by the DC. **PROJECTWORK**

Students have to take up a research project of 5 months duration in the fourth semester for which they are encouraged to go to national research institutes. The students may also get opportunity to undergo 1-2 weeks training in industrial/ research institutions in the field of applied biology.

EVALUATION

The marks for Continuous Evaluation and End Semester Examination will be in the ratio 40:60. Allocation of marks for each component under continuous evaluation of theory courses shall be as given below.

Continuous Evaluation: Theory Paper (40 Marks)

Assignment	Test papers	Seminar	Total
8	16	16	40

Continuous Evaluation: Practical (40 Marks)

Midsemester	Record	Total
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test/viva		
30	10	40

EndSemesterExaminationPractical:(60Marks)

The teacher conducting the practical examination will decide the components of the exam

EndSemesterExaminationTheory:Writtenexaminationfor60MarksAT

TENDANCE:

The minimum attendance required for each course in a semester shall be 60% of the total number of classes conducted for the course. Only those who secure the minimum attendance requirement in the semester will be allowed to register for the EndSemesterExamination.

TENURE

A student has to complete the entire program within four years from the date of registration

Courses offered in the M.Sc. Microbiology Programme - Total credits 80

Semester

I Core: 6 (Theory: 4 Practical: 2) Electives: 2

Credits: Core: 16 Elective: 6 Total: 22 Credits

SL No	Course code	Title of the course	Contact hours /week			Marks			Credits
						ESE	CE	Total	
		Core course	L	T/S	P				
1	MSMBY01C01	Biochemistry	3	2		60	40	100	3
2	MSMBY01C02	General Microbiology	3	2		60	40	100	3
3	MSMBY01C03	Cell Biology	3	2		60	40	100	3
4	MSMBY01C04	Genetics	3	2		60	40	100	3
5	MSMBY01C05	Practical I Biochemistry & General Microbiology			3+3	60	40	100	2
6	MSMBY01C06	Practical III Cell Biology & Genetics			3+3	60	40	100	2
		Elective courses: 2/2							
7	MSMBY01E01	Biostatistics	3	2		60	40	100	3
8	MSMBY01E02	Instrumentation	3	2		60	40	100	3
	Total Credits								22

SemesterII

Courses:Core:3(Theory:2,Practical :1) Electives:

4(Students have to choose 4 elective courses from

5)Credits:Core: 8, Elective:12,Total=20

SL. No	Coursecode	Titleofthecourse	Contact hours /week			Marks			Credits
						ES	CE	Total	
		Corecourses	L	T/S	P				
9	MSMBY02C07	SystematicBacteriology	3	2		60	40	100	3
10	MSMBY02C08	FoodMicrobiology	3	2		60	40	100	3
11	MSMBY02C09	PracticalIII SystematicBacteriologyan dFoodMicrobiology			3+3	60	40	100	2
		Electivecourses (4/5)							
12	MSMBY02E03	Microbial Physiology andMetabolism	3	2		60	40	100	3
13	MSMBY02E04	Immunology	3	2		60	40	100	3
14	MSMBY02E05	HumanPhysiologyandDev elopmentalBiology	3	2		60	40	100	3
15	MSMBY02E06	MolecularBiology	3	2		60	40	100	3
16	MSMBY02E07	EthicsPatencyand IPR	3	2		60	40	100	3
	Total credits								20

Semester III

Core(Theory:4 Practical:2) Electives:2

Credits: Core:16 Elective:6

Total:22 Credits Students have to choose Two

Electives from Four

SL No	Course code	Title of the course	Contact hours /week			Marks			Credits
						ESE	CE	Total	
		Core course	L	T/S	P				
17	MSMBY03C10	Microbial Technology	3	2		60	40	100	3
18	MSMBY03C11	Environmental Microbiology	3	2		60	40	100	3
19	MSMBY03C12	Diagnostic and Clinical Microbiology	3	2		60	40	100	3
20	MSMBY03C13	Virology, Mycology, Parasitology	3	2		60	40	100	3
21	MSMBY03C14	Practical IV Microbial Technology & Environmental and Agricultural Microbiology			3+3	60	40	100	2
22	MSMBY03C15	Practical V Virology, Mycology, Protozoology & Diagnostic and Clinical Microbiology			3+3	60	40	100	2
		Elective course 1/4							
23	MSMBY03E08	Bioinformatics	2	2		60	40	100	2
24	MSMBY03E09	Marine Microbiology	2	2		60	40	100	2
25	MSMBY03E10	Recombinant DNA Technology	2	2		60	40	100	2
26	MSMBY03E11	Veterinary Microbiology	2	2		60	40	100	2
27		Open elective	4	2		60	40	100	4
Total credits									22

Students have to select one elective from the above list and one open elective from other departments.

Semester IV –

ProjectCORE:1

Credits:16

SL. No	Coursecode	Title of the course	Contact hours /week			Marks			Credits
			L	T/S	P	ESE	CE	Total	
		Corecourse	L	T/S	P				
27	MSMBY04C16	Project		5	25	60	40	100	16
									16

The continuous evaluation of the project work shall be done by the researchsupervisor based on the performance of the student in the lab. The endsemesterevaluationincludespresentationandavivavocebasedontheproject.

SEMESTER I (Total Credits Required: 22)

MSMBY01C01BIOCHEMISTR

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3 CREDITS

(48 Hours)

Course Objectives:

1. Understand structure and function of biological macromolecules.
2. Understand chemical changes taking place in the living cells.
3. Understand transport across biological membranes.
4. Understand the role of small molecules in the biological system.

Course Outcome:

Upon completion of this course, students will be able to explain and demonstrate the structure, function and dispersal of the basic building blocks of life - the chemical components of living organisms

Course

Content Module

I

Introduction: Molecular logic of living system, Biological macromolecules. Importance of Biochemistry in contemporary medicine and its perspectives.

Membranes: Structure and functions of different membranes and reasons for their composition.

Membrane transport: Passive transport, co-transport, anti-transport, active transport, secondary active transport, Pumps and channels and their significance, Membrane proteins.

(10 Hrs)

Module II

Carbohydrates: Definition and classification, Structure, conformation and functions of monosaccharides, disaccharides, polysaccharides. Starch, glycogen, dextrin, cellulose, amino sugars, Glycoproteins, Glycolipids, Mucopolysaccharides.

Lipids: Definition and classification, structure, function, physical and chemical properties

– Fatty acids, Fats, Waxes, Phospholipids, Sphingolipids, Cerebrosides, Gangliosides, Sterols, lipoproteins. Eicosanoids-

Formation of prostaglandins; prostacyclin and thromboxane from unsaturated fatty acids, Saponification number, acid number and iodine number of fats.

(14 Hrs)

Module III

Proteins: Properties of peptides and proteins, Amino acids, their properties, and their classification according to the polarity of their side chains and according to the acid-base properties. Essential and non-essential amino acids, Structure of peptides and proteins,

their primary structure, structures of higher order and their meaning for the function of peptides and proteins. Protein-protein interaction.

Nucleic acids: Definition and classification, structure, function, physical and chemical properties - Purines and pyrimidines, base pairing, Hoogsteen base pairing.

(12Hrs)

Module IV

Vitamins and minerals: chemistry, source and functions of water soluble and fat-soluble vitamins. Role of vitamins as cofactors. Source and functions of macroelements and trace elements, Hormones & Related Molecules: Chemistry, synthesis and functions of various hormones (Plant & Animal), pigments (Plant & Animal), Pheromones and neurotransmitters

(12Hrs)

REFERENCE

1. Lehninger: Principle of Biochemistry. Nelson LD and MM Cox.
2. Biochemistry. Jeremy M. Berg, John and Tymoczko Lubert Stryer.
3. Biochemistry with Clinical Correlation. Thomas M Devlin. Wiley-Liss
4. Biochemistry. Donald Voet, Judith G Voet, Charlotte Pratt. John Wiley
5. Biochemistry. Jeffrey Zubay. Wm C Brown Pub.
6. Biochemistry. Mathews CK and KE. van Holde. Benjamin Cumming Pub.
7. Biochemistry. Vol 1 & 2 David Metzler.

**MSMBY01C02GENERA
LMICROBIOLOGY**

3Credits

(48Hours)

CourseObjectives:

1. Students will be able to isolate and identify bacteria and fungi
2. They will be able to characterize microorganisms
3. Students will acquire sufficient skills to analyse microorganisms present in various substances
4. Students will get skills to do basic microscopic analysis

CourseOutcome:

On completion of the General Microbiology course students will get theoretical knowledge and laboratory skills to do basic operations in a Microbiology Laboratory.

CourseContent:

CourseContent:

MODULE I

Milestones in the history of Microbiology. Early discoveries and scientists. Five Kingdoms and Woese's Three Domain classification of living system. Bacterial, fungal and viral classifications. Bergey's Manual of determinative bacteriology. Laboratory procedures for identification of bacteria. Molecular phylogeny. **(12Hrs)**

MODULE II

Microbial morphology and colony characteristics. Microscopy: Bright field, dark field, fluorescent, phase contrast, interference, polarization and electron microscopies. Specimen preparation and staining in microscopy. Growth curve, Cultivation of bacteria, Culture media and methods, Storage and transport of microbes **(10 Hrs)**

MODULE III

Ultra-structure of bacterial cells. Difference between bacterial and fungal cells: Different staining procedures and study of bacterial and fungal morphology. Cell wall, cell membrane and transport system, chromosome and extra chromosomal genetic materials; flagella, pili, capsule, endospore. Virus, Structure and multiplication of Virus, Viral Diseases—Emerging and re-emerging viral infections. Fungal Reproduction **(10Hrs)**

MODULE IV

Microbial nutrition and Nutritional groups of bacteria. Photo autotrophy and bacterial photosynthesis. Chemoautotrophy, Heterotrophic metabolism. Aerobic and anaerobic respiration (fermentation). Physical and chemical methods of sterilization, Methods of testing antimicrobial substances, Drug resistance of microbes. Genetically Modified Microorganisms. (16 Hrs)

REFERENCE

1. Microbiology—Prescott
2. General Microbiology—Stanier
3. Fundamentals of microbiology—Frobisher
4. Principles of Microbiology—Ronald M Atlas
5. Antimicrobial Drug Resistance, Bryan, LE (eds.) Academic Press
6. Microbiology—Bernad D Davis et al, Harper International edition.
7. Microbiology Concepts and Applications Pelzar Jr. Chan. Kreic. McGraw-Hill, Inc. Microbiology.
8. Zinsser Microbiology Prentice-Hall International Inc. Manual of Methods for General Bacteriology. Gerhaldt Petal (eds.) American Society for Microbiology
9. Textbook of Microbiology 9th Edition, Ananthanarayan, Paniker, Universities Press

MSMBY01C03C

CELL BIOLOGY

3 Credits

(48 Hours)

Course Objectives:

1. Understand the molecular nature and functioning of the cell components and how they interact with the external environment.
2. Understand the molecular nature of replication of the cell
3. Understand the consequences arising out of error in replication including cancer and how the cell passes from one phase of replication to the next.
4. Understand how a cell responds to an external signal and the mechanisms involved.

Course Outcome:

Students will gain knowledge about the complexities of the cell. They will be able to gain advanced knowledge of molecular cell mechanisms.

Course content:

MODULE I

General organization of prokaryotic and eukaryotic cells.

Differentiation of the cell surface, Constituents of the Extra-cellular matrix.

Cell junctions: tight junctions, desmosomes and gap junctions, cell coat. Cell-cell adhesion

Cytoskeleton: microtubules, microfilaments and intermediate filaments **(12**

Hrs) MODULE II

Cell communication: general principles, signaling pathways.

Cellular Organelles and Membrane Trafficking Endoplasmic reticulum, Golgi complex, processing and trafficking of biomolecules, lysosomes, plant vacuoles, endocytosis, posttranslational modification of proteins **(14 Hrs)**

MODULE III

Nucleus: Nuclear envelope, nuclear matrix. Organization of chromatin: nucleosomes, higher order folding of chromatin. Structure of centrioles, structure of mitotic spindle, synaptonemal complex. Nucleolus in ribosome synthesis.

Replication of prokaryotic, eukaryotic DNA. Enzymes and proteins of replication.
DNA repair. (10 Hrs)

MODULE IV

Cell cycle: Phases of cell cycle. Cascade of phosphorylation and dephosphorylation associated with cell cycle progress. Kinases, cyclins and related proteins and their role in cell cycle regulation. Apoptosis and Introduction to Cancer biology. (12 Hrs)

REFERENCE

Molecular Cell Biology Gerald Karp 9th Edition Wiley 2020

Molecular Biology of The Cell Alberts 6th Edition 2014 Garland

Science Molecular Cell Biology Lodish 8th Edition W.H. Freeman 2016

Genes XI Benjamin Lewin Jones and

Bartlett Learning 2014 Molecular Biology of the Gene Watson 7th Edition Pe

arson India 2017. Cell Biology A Laboratory Handbook 3rd Edition

Elsevier Inc 2006 Cell and Molecular Biology Lab Manual

David A Thompson 2009

MSMBY01C04GEN

ETICS

3Credits

(48 Hours)

CourseObjectives:

1. Understand the basic principles of genetics and heredity and Mendelian laws of inheritance
2. Understand chromosome theory of inheritance, sex determination, linkage and mapping.
3. Familiarize with prokaryotic gene transfer methods.
4. Understand extrachromosomal inheritance and population genetics

CourseOutcome

Completion of the course would familiarize the student with carriers of heredity and mechanisms of inheritance in eukaryotes and prokaryotes.

CourseContent:

MODULE I

Mendel and his contribution to Genetics. Monohybrid crosses and principle of segregation. Dihybrid crosses and principle of independent assortment. Rediscovery of Mendel's principles. Multiple alleles. Modification of dominance relationships. Gene interactions. Essential and lethal genes. Environmental impact on genes **(12 hrs)**

MODULE II

Genetic linkage. Chromosomal exchange. Genetic maps. Tetrad analysis, Mitotic recombination. Chromosomal and gene mutations. Mitosis & Meiosis. Chromosome theory of inheritance. Sex determination. Analysis of sex-linked traits in humans.

(12Hrs)

MODULE III

Cellular basis of differentiation, Gametogenesis and fertilization. Genetic basis of cell differentiation. Gene expression control. Oncogenes and tumour suppressor genes. Conjugation in bacteria. Transformation in bacteria. Transduction in bacteria. Mapping of genes in bacteria. Mapping of genes in bacteriophages. **(12Hrs)**

MODULE IV

Bacterial transposons. Eukaryotic transposable elements. Cytosomic inheritance, Inheritance through mitochondria and chloroplasts and their mapping. Genetic variation in populations and measuring. Hardy - Weinberg Equilibrium, Inbreeding. Genetic Drift. Gene flow. Natural selection. Molecular evolution. **(12Hrs)**

REFERENCE

1. Genetics by Strickberger
2. Plant breeding by B D Singh
3. A text book of Genetics by Veer Bala Rastogi
4. Genetics by Gardner, Simmons and Snustad
5. Genetics by Ursula Goodenough
6. Basic Genetics. Robert F. Weaver II edn. Philip W.C. B1995.
7. An Introduction to genetic Analysis Griffith et al

MSMBY01C05
PRACTICAL I
(BIOCHEMISTRY & GENERAL MICROBIOLOGY)

2 CREDITS

(96 Hours)

Biochemistry

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of proteins.
3. Qualitative analysis of lipids.
4. Estimation of protein
5. Estimation of lipids (cholesterol, phospholipids, triacylglycerols).
6. Estimation of carbohydrates (glucose, fructose, lactose, starch).
7. Denaturation studies on proteins.
8. Estimation of lycopene from tomato
9. Estimation of Urea
10. Estimation of Uric acid
11. Determination of acid values of fat and oils
12. Determination of iodine number of fats and oil
13. Extraction and estimation of total lipids from seed
14. Extraction of total nucleic acids from plant tissue
15. Preparation of buffers of required pH.
16. Purification of proteins using dialysis.
17. Separation of amino acids using paper chromatography.

REFERENCE

1. David Plummer, An Introduction to Practical Biochemistry, McGraw Hill
2. Harold Varley, Practical Clinical Biochemistry, by Gowenlock A.H., CBS.
3. Hans Bisswanger, Practical Enzymology. Wiley VCH.
4. Robert E. Szent-Györgyi, Enzyme Assays: A Practical Approach, Oxford University Press
5. Sadasivam & Manickam, Biochemical Methods, New Age International
6. DM Vasudevan & Subir Kumar Das, Practical Textbook Of Biochemistry, Jaypee Brothers

7. SK. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International

General Microbiology

1. Microscopy-structure and organization of compound microscope
2. Sterilization Techniques
3. Staining: simple, negative, Gram's, capsular, spore, metachromatic Granule, Fungal staining
4. Preparation of media & inoculation, Isolation of organisms from various environments. Serial Dilution
5. Growth curve using breeds count, turbidimetry and CFU
6. Effect of pH, temp, oxygen and salinity on bacterial growth in liquid media.
7. Anaerobic culturing by liquid paraffin overlay and pyrogallol.
8. Starvation induced sporulation of bacteria.
9. Efficiency testing of bacterial proof filters and autoclave
10. Fungal culture and sporulation
11. Antibiotic sensitivity tests, Biochemical Tests for identification of bacteria

REFERENCE

Techniques in Microbiology: A Student Handbook 1st Edition by John M. Lammert (Author). ISBN-13: 978-0132240116

Handbook of Techniques in Microbiology: A Laboratory Guide to Microbes Paperback - 1 December 2007. by A.S. Karawa (Author), M. K. Rai (Author), H.B.T. Singh (Author) Scientific Publishers

Basic Practical Microbiology - A Manual. Society for General Microbiology (SGM). ISBN 095368 3834. www.microbiologyonline.org.uk

MSMBY01C06

Practical III

CELL BIOLOGY AND GENETICS

2 CREDITS

(96 Hours)

Cell Biology

1. Cell Fractionation: chloroplast: differential centrifugation.
2. Cell Fractionation: mitochondria: differential centrifugation.
3. Isolation of DNA/RNA from liver/spleen.
4. Estimation of nucleic acid by spectrophotometric method.
5. Estimation of RNA by Orcinol test.
6. Estimation of DNA by Diphenylamine test.
7. Study of Barr Body (Buccal smear).
8. Polytene Chromosome (Drosophila).
9. Karyotyping.
10. Study of staining methods.
11. Determination of melting temperature of

DNA. REFERENCE:

1. Cell Biology A Laboratory Handbook 3rd Edition Elsevier Inc 2006
2. Cell and Molecular Biology Lab Manual David A Thompson 2009

Genetics

1. Study of mutations by Ames test.
2. Assay of antibiotics and demonstration of antibiotic resistance.
3. Bacterial transformation.
4. Transduction.
5. Conjugation.
6. Isolation of plasmids.
7. Mitosis
8. Meiosis

REFERENCE

1. Cell and Molecular Biology Lab Manual David A Thompson 2009.
2. Molecular Cloning - A Laboratory Manual Sambrook, J., Fritsch, E. F. and Maniatis, T.

1989. Second Edition. Cold Spring Harbor Laboratory Press.
3. Zinsser Microbiology Prentice-Hall International Inc. Manual of Methods for General Bacteriology. Gerhaldt Petal (eds.) American Society for Microbiology.
4. Hayes, W., 1994. Genetics of Bacteria and their viruses. 2nd Edn, CBS Publishers and Distributors, New Delhi
5. Methods in Molecular Biology Vol. 28. Protocols for Nucleic acid analysis by non-radioactive probes. Edited by Issac P. G. Human Press,

MSMBY01E01

BIOSTATISTICS

3 CREDITS

(48 Hours)

Course Objectives:

1. Understand data types and data presentations.
2. Understand the concepts of averages and dispersion of measurement values.
3. Understand the concept of probability and probability distributions.
4. Understand the method of testing statistical hypotheses.

Course Outcome:

Students shall be able to

1. Make graphical/diagrammatic representation of given statistical data.
2. Calculate measures of central tendencies and measures of dispersion of a given set of values.
3. Explain different probability distributions.
4. Test hypothesis using normal, student's-t, chi square and F distributions.

Course content:

Module I

Collection, classification and diagrammatic representation of statistical data: Variables and constants, Different types of numerical data, Collection of data, Sampling techniques, Random sampling, Stratified random sampling. Classification and tabulation of data, frequency distribution. Graphical/diagrammatic representation of data: line charts, Bar charts, Pie-chart, Histograms, frequency polygons, ogives. **(12 Hrs)**

Module II

Measures of central tendency: Arithmetic mean, Median, Mode, Geometric and Harmonic

mean. Measures of dispersion: Range, Inter-

quartile range, Variance and Standard Deviation, coefficient of variation.

Correlation and Regression: Relation between two variables, scatter diagram, definition of correlations, Pearson's correlation coefficient, Spearman Rank correlation coefficient. Definition of regression: regression lines. Fitting lines using method of least squares. **(14Hrs)**

Module III

Probability and probability distributions: Permutation and combination, types of events, Definition of probability, addition and multiplication theorems of probability. Probability distributions: Binomial, Poisson and Normal distributions. Skewness and Kurtosis: Definitions, Karl Pearson's coefficient of Skewness and Kurtosis, moments. **(10Hrs)**

Module IV

Normal distribution and statistical inference: Central Limit Theorem, Concept of confidence interval: Estimation, confidence limit, level of significance, standard error. Statistical hypotheses, Tests of significance of means, difference between two means and proportion. Student's t-distribution and testing of hypothesis for small samples. Chi-square distribution, Chi-squared tests for independence and for goodness of fit, F-distribution and Analysis of variance. **(12 Hrs)**

References:

1. Principles of Biostatistics- Pagano M. & Kimberlee G. Duxbury Press
2. Probability and Statistical Inference- Hogg R. V. Tanis E. A., Prentice Hall, New Jersey
3. Experimental Design Data Analysis for Biologists- Quinn G. P. & Keough M. J. Cambridge University Press
4. Statistical Methods in Biology- 3rd edition, Bailey N. T. J., Cambridge University Press
5. Biostatistical analysis - 4th edition, Zar, J. H. Pearson Education.
6. Fundamentals of Biostatistics- P. Hanmanth Rao and K. Janardhan, I. K. International Publishing House, New Delhi.
7. Introduction to Biostatistics and Research Methods- P. S. S. Sundar Rao and J. Richard, PHI Learning Pvt Ltd, New Delhi.