



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in Biotechnology

I & II Semester Syllabus

Bachelor of Science

**With effect from
2024-25 and onwards**

Department Name: Biotechnology

Semester - I

Course Title: Cell biology and Genetics	Course Code: 24MJBTEC1L
Total Contact Hours: 56 Hrs	No. of Credits: 04
L:T:P: 4:0:0	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Would be able to comprehend the structure of a cell with its organelles.
2. Can distinguish between the structure of prokaryotic and eukaryotic cell.
3. Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations

Unit	Description	Hours
1	Cell as a Basic unit of Living Systems and Cellular Organelles: Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of a eukaryotic cell- (Both plant and animal cells), Surface Architecture: Structural organization and functions of plasma membrane and cell wall of eukaryotes. Cellular Organelles: Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).	12Hrs
2	Chromosomes and Cell Division: General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi-stranded hypothesis, folded- fibre and nucleosome models. Special type of chromosomes: Salivary gland and Lampbrush chromosomes. Cell Division: Cell cycle, phases cell division. Mitosis and meiosis, regulation of cell cycles cell cycle checkpoints, and enzymes involved in regulation, Significance of cell cycle, mitosis and meiosis interphase nucleus, achromatic apparatus, synaptonemal complex Cell Cycle and regulation, mitosis and meiosis. Cell Senescence and programmed cell death.	11Hrs

3	<p>Genetics: History of genetics: Introduction and brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross. Deviations to Mendelian inheritance, complementary, supplementary and interaction of genes (13:3 ratio), epistasis. Maternal Inheritance: Plastid inheritance in <i>Mirabilis</i>, Petite characters in yeast and Kappa particles in paramecium, Sex-linked inheritance, Chromosome theory of inheritance. Gene interaction: Supplementary factors: comb pattern in fowls, Complementary genes- Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis– Plumage colour in poultry, Multiple allelism: Blood groups in Human beings.</p>	11Hrs
4	<p>Linkage and Crossing Over: Introduction, Coupling and repulsion hypothesis, Linkage in maize and <i>Drosophila</i>, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize. Mutations: Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Mutations in plants, animals and microbes for economic benefit of man.</p>	11Hrs
5	<p>Chromosomal variations and Human genetics: Chromosomal variations: A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton. Sex Determination in Plants and animals: Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types. Human Genetics: Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner’s syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).</p>	11Hrs
<p>References:</p> <ol style="list-style-type: none"> 1. Molecular Biology of Cell - Bruce Alberts et al, Garland publications. 2. Animal Cytology and Evolution- MJD, White Cambridge University Publications 3. Molecular Cell Biology-Daniel, Scientific American Books 4. Cell Biology - Jack d Bruke, The William Twilkins Company 5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications 6. Cell Biology-Ambrose &Dorothy M Easty, ELBS Publications 7. Fundamentals of Cytology- L. W. Sharp, McGraw Hill Company 8. Cytology-Willson&Marrison, Reinform Publications 9. Molecular Biology- Christopher Smith, Faber & Faber Publications 10. Cell Biology & Molecular Biology – EDP De Robertis& EMF Robertis, Saunder College. 11. Cell Biology- C.B Powar, Himalaya Publications 12. Basic Genetics- Daniel L. Hartl, Jones &Barlett Publishers USA 13. Human Genetics and Medicine lark Edward Arnold P London 14. Genetics – Monroe W Strickberger, Macmillain Publishers, New York 15. Genes V - Benjamin Lewin, Oxford University Press. 16. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi 17. Genes II - Benjamin Lewin, Wiley & Sons Publications 		

18. Genes III- Benjamin Lewin, Wiley & Sons Publications
 19. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky, McGraw-Hill.
 20. Genetics – Edgar Altenburg Oxford & IBH publications
 21. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications
 22. Genetics- P.K.Gupta, Rastogi Publication, Meert, India

Department Name: Biotechnology

Semester - I

Course Title: Cell biology and Genetics Lab	Course Code: 24MJBTEC1P
Total Contact Hours: 56 Hrs	No. of Credits: 02
L:T:P: 0:0:4	
Internal Assessment Marks: 10	Duration of SEE: 03 Hours
Semester End Exam Marks: 40	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Identify and outline the structure of a eukaryotic cell at different magnification, measure the cell length and breadth using micrometry, differentiate stages of Mitosis and meiosis.
2. Identify and distinguish different blood cells, to solve simple genetic problems and analyses Human karyotype and pedigree

List of Experiments

Sl.No	Experiment
1	Study and maintenance of simple and compound microscope
2	Use of Micrometre and calibration, measurement of onion epidermal cells and yeast
3	Study of divisional stages in mitosis from onion root tips
4	Study of divisional stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
5	Mounting of polytene chromosomes
6	Buccal smear - Barr bodies
7	Karyotype analysis - Human and Onion, Human – Normal and Abnormal – Down and Turner's syndromes
8	Isolation and staining of Mitochondria

9	Isolation and staining of Chloroplast
10	RBC cell count by Haemocytometer
11	Simple genetic problems based on theory
References: <ol style="list-style-type: none">1. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc2. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill	

Note: • Each student is required to submit 5 permanent slides of mitosis & meiosis

Department Name: Biotechnology

Semester - II

Course Title: Microbiological Methods	Course Code: 24MJBTEC2L
Total Contact Hours: 56 Hrs	No. of Credits: 04
L:T:P: 4:0:0	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Understand and explain basic principles and different kinds of microscope
2. Explain the process of different sterilization and staining techniques
3. Understand and compare various types of stains and dyes
4. Understand the role of drugs in disease control and their mechanism of action

Unit	Description	Hours
1	Instruments used in Biotechnology Microscopy: Principles of Microscopy- resolving power, numerical aperture, working principle and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, confocal microscope, Electron Microscopes- TEM and SEM. Analytical techniques: Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper and TLC.	12Hrs
2	Sterilization techniques Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, micro biostatic agent and antimicrobial agent. Physical methods of control: Principle, construction and applications of moist heat sterilization Boiling, Pasteurization, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization-Incineration and hot air oven. Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA; Radiation: Ionizing radiation- γ rays and non-ionizing radiation- UV-rays Chemical methods: Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.	11Hrs
3	Microbiological techniques Culture Media: Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media Pure culture methods: Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of	11Hrs

	anaerobic bacteria	
4	Staining techniques Stains and staining techniques: Principles of staining, Types of stains-simple stains, structural stains and differential stains.	11Hrs
5	Antimicrobial agents Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA, NDM-1 Antibiotic sensitivity testing methods: Disc and Agar well diffusion techniques	11Hrs

References:

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

Department Name: Biotechnology

Semester - II

Course Title: Microbiological Methods Lab	Course Code: 24MJBTEC2P
Total Contact Hours: 56 Hrs	No. of Credits: 02
L:T:P: 0:0:4	
Internal Assessment Marks: 10	Duration of SEE: 03 Hours
Semester End Exam Marks: 40	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Describe the good lab practices and biosafety measures to be adopted while working in a microbiology lab and identify various instruments commonly used for microbiological experiments
2. Gaining knowledge and hands on experience on general microbiological concepts like staining, enrichment and isolation of microbes
3. Demonstrate different cultivation methods for various microbial groups

List of Experiments

Sl.No	Experiment
1	To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
2	Sterilization of medium using Autoclave and assessment for sterility
3	Sterilization of glassware using Hot Air Oven and assessment for sterility
4	Sterilization of heat sensitive material by membrane filtration and assessment for sterility.
5	Preparation of culture media for bacteria, fungi and their cultivation
6	Plating techniques: Spread plate, pour plate and streak plate.
7	Isolation of bacteria and fungi from soil, water and air
8	Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
9	Colony characteristics study of bacteria from air exposure plate
10	Staining techniques: Bacteria– Gram, Negative, Capsule, Endospore staining, Fungi – Lactophenol cotton blue staining
11	Water analysis - MPN test

12	Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis
13	Bacterial cell motility - hanging drop technique
References: <ol style="list-style-type: none">1. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited2. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications3. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications4. Introductory Biotechnology-R.B Singh C.B.D. India (1990)5. Fundamentals of Bacteriology - Salley6. Frontiers in Microbial technology-P.S. Bison, CBS Publishers.7. Biotechnology, International Trends of perspectives A. T. Bull, G.8. General Microbiology –C.B. Powar	

**Question Paper Pattern for UG Semester End Examination with
effect from the AY 2024-25
(Major Theory Paper)**

Paper Code:

Paper Title:

Time: 3 Hours

Max. Marks: 80

Instruction: Answer all Sections

SECTION-A

1. Answer the following sub-questions, each sub-question carries **TWO** marks. (05X2=10)

- a).
- b).
- c).
- d).
- e).

Note for Section-A: One-question from each unit.

SECTION-B

Answer any **SIX** of the following questions, each question carries **FIVE** marks. (6X5=30)

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

Note for Section-B: Minimum One question from each unit

SECTION-C

Answer any **FOUR** of the following questions, each question carries **TEN** marks. (4X10=40)

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

Note for Section- C: Minimum one question from each unit. Sub-questions such as 'a' and 'b' may be given for a question in section-C only.

Paper Code:

Paper Title:

Time: 3 Hours

Max Marks: 25

- Q. 1. Write a principle, procedure and perform the given experiment....and write a report on result obtained (Major experiment) - 15M
- Q. 2a. Write procedure and perform Minor experiment-1 - 8M
- 2b. Write procedure and perform Minor experiment-2/ Answer the given problem - 8M
- Q. 3. Identification - 6M
- 3A. Identify & comment
- 3B. Identify & comment
- 3C. Identify & comment
- Q. 4. Record submission - 3M

Modalities of Elementary Research Project to be carried by UG students during 6th semester

Course	B.Sc. Biotechnology 6th semester	
Subject	Elementary Research Project	
Code	24MJBT6R	
L-T-P	0-0-4	
Suggestive topics	Fungal Biotechnology and Bio-pesticides/Enzyme and Microbial Technology/Biocatalysts/Biosensor & Biofuel cell/Single cell proteins/ Biological Control of Insect Pests/Soil microbiology/Environmental bioremediation/Bioprocess development (upstream to downstream)/ Nanobiotechnology/Green technology/Phytopharmacology/Medical Biotechnology/ other area related to biotechnology	
Selection of Topics	Based on current issues and possibilities to perform in-house/field visit may be finalized in consultation with respective guide	
Time and Duration	The students should complete the research project during vacation soon after 5 th semester/weekly 4hour during weekend and arrange to submit the report during the 6 th semester (Max. 5 students per group)	
Mode of evaluation in SEE	Final presentation of complete project report (Power point presentation)	10 Marks
	Viva-voce	10 Marks
	Final report	20 Marks
	Total	40 Marks

IA (10M): Presentation

IA-1 (Presentation): Finalization of topic, framing objectives, Review of literature, Methodology, <u>expected</u> outcome	05 Marks
IA-2 (Presentation): Result and discussion and Major findings	05 Marks
Total	10 Marks

SKILL PAPERS

Paper Code:

Paper Title:

Time: 1.5 Hours

Max. Marks: 40

There shall be Theory examinations of **Multiple Choice Based Questions [MCQs]**with **Question Paper of A, B, C and D Series** at the end of each semester for **Skill papers for the duration of 1.5 hour. The Answer Paper is of OMR (Optical Mark Reader) Sheet.**
