

B.Sc., Biotechnology: Choice based credit system

B.Sc., -II Semester W.E.F. 2020-21

BT-201: Microbiology, Cell Biology and Molecular Biology

Course Objectives:

To acquaint students with concepts of microbiology, cell and molecular biology. This course is aimed to give an understanding of the basics of microbiology, dealing types of microbes, classification and their characterization, structure and function of prokaryotic and eukaryotic cell organelles, cell division and basics of molecular biology including DNA replication, transcription, translation and regulation of gene expression.

Unit-I- Scope and Techniques of Microbiology

History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming. Ultrastructure of bacteria. Bacterial growth curve. Pure culture techniques. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

Unit-II-Microbial Taxonomy

Concepts of microbial species and strains. Classification of bacteria based on pH, temperature, nutrition and oxygen requirements. Bacterial toxins, tuberculosis, typhoid. General characteristics, transmission and cultivation of viruses. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage). Emerging and re-emerging viruses (dengue virus), zoonotic viruses (SARS-CoV-2).

Unit-III- Cell Structure and Functions

Structure, properties and functions of cellular organelles (Plant Cell wall, Cytoskeleton, Endoplasmic Reticulum, Golgi bodies, Chloroplasts, Mitochondria, Ribosomes, lysosomes, glyoxysomes, peroxisomes, centrioles and Vacuoles) of eukaryotic cells. Cell cycle and cell division (mitosis and meiosis). Chemical composition and dynamic nature of the membrane,

Unit-IV- DNA Replication, Repair and Regulation of Gene Expression

DNA replication in prokaryotes (semiconservative, dispersive, conservative, uni and bidirectional, rolling circle). Mechanism of DNA replication, enzymes and protein involved in DNA replication. DNA damage and repair. Regulation of gene expression in prokaryotes-Lac operon concept.

Unit – V - Central Dogma of Molecular Biology

Genome organization of prokaryotic and eukaryotic organisms. Genetic code. Mechanism of transcription and translation in prokaryotic cells. Enzymes and proteins involved in prokaryotic transcription and translation. Brief note on post-transcriptional modification (Capping Polyadenylation), Post-translational modification (glycosylation and phosphorylation) and splicing in eukaryotes.

List of Practicals:

1. Cleaning and preparation of glassware
2. Preparation of nutrient agar medium for bacteria
3. Preparation of PDA medium for fungi
4. Sterilization techniques (autoclave, hot air oven, filter)
5. Isolation of bacteria from soil
6. Simple staining technique
7. Differential staining technique
8. Microbial counting by Haemocytometer
9. Identification of different bacteria
10. Motility test by hanging drop
11. Biochemical identification of bacteria
12. Preparation of pure culture by slab, slant, streak culture
13. Study of stages of mitotic cell division
14. Study of stages of meiotic cell division
15. Isolation of chloroplast
16. Extraction and isolation of DNA from bacteria.

Mandatory 10 Practicals.*SCHEME OF VALUATION FOR PRACTICALS -50 M**

1. Major Experiment I- 20M
2. Major Experiment II – 20 M
3. Record – 10M

Textbooks for Microbiology, Cell and Molecular Biology

1. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY
2. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA
3. Textbook of Microbiology, Anantnarayan and Paniker (2017)

4. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., & Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003.
5. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc. USA
6. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.; Cold Spring Harbour Lab. Press, Pearson Pub.
7. Molecular Biology, 5th Edition, (2011), Weaver R.; McGraw Hill Science. USA
8. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi; Oxford University Press.
9. Molecular Biology: Genes to Proteins, 4th edition (2011), Burton E Tropp Jones& Bartlett Learning, USA.
10. Cell and Molecular Biology: Concepts and Experiments, 6th Edition, Karp, G. 2010.; John Wiley & Sons. Inc.
11. Cell and Molecular Biology, 8th edition. De Robertis, E.D.P. and De Robertis, E.M.F. 2006; Lippincott Williams and Wilkins, Philadelphia.
12. Cell Biology, (2017), De Robertis& De Roberis, Blaze Publishers & Distributors Pvt. Ltd.
13. The Cell: A Molecular Approach. 5th edition. Cooper, G.M. and Hausman, R.E. 2009. ASM Press& Sunderland, Washington, D.C.; Sinauer Associates, MA.
14. The World of the Cell, 7th edition, Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 Pearson Benjamin Cummings Publishing, San Francisco.
15. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
16. P.Gunasekaran. 2007. Laboratory Manual in Microbiology. New Age International.
17. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
18. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by Ron Jon Publishing. Incorporated.
19. Gunasekaran, P. 2009. Laboratory Manual in Microbiology. 1st Edition. New Age International Publishers.
20. Dr. T. Sundararaj. Microbiology Laboratory Manual. 2005. Dr.A.L. MPGIBMS,

University of Madras, Taramani, Chennai – 600 113.

21. James G. Cappuccino and Natalie Sherman. 2013. Microbiology: A Laboratory Manual. 10th Edition. Benjamin Cummings.
22. Dr. David A Thompson. 2011. Cell and Molecular Biology Lab Manual.
23. George M. Malacinski. 2013. Freifeder's Essentials of Molecular Biology. Narosa Publishing House.

Web Links:

1. <https://nptel.ac.in/courses>
2. <http://illl.du.ac.in/>
3. <http://epgp.inflibnet.ac.in>
4. <https://courses.lumenlearning.com/boundless-microbiology>
5. <https://www.futurelearn.com/courses/introduction-to-microbiology>
6. <https://www.onlinebiologynotes.com/>
7. <https://www.youtube.com/ricochetscience>
8. <https://www.youtube.com/user/ndsuvirtualcell>
9. <http://www.sumanasinc.com/webcontent/animations/molecularbiology.html>
10. <https://libguides.cmich.edu/biology/multimedia>
11. <https://www.youtube.com/channel/UCXI0uGh6LOOgvtPjPb1PD6A>

Virtual Lab Links

1. <https://libguides.cmich.edu/biology/multimedia>
2. <https://library.csi.cuny.edu/oer/virtuallabs-simulations>
3. <https://li.wsu.edu/teaching-tool-boxes/options-for-virtual-labs-and-simulationsfor-laboratory-based-courses/>
4. <https://www.labster.com/new-products/>
5. <https://www.labster.com/simulations/>
6. <https://www.vlab.co.in/>
7. <https://praxilabs.com/>
8. <https://digitalllearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-labresources/>
9. <https://vlab.amrita.edu/index.php>
10. <https://sites.dartmouth.edu/teachremote/remote-lab-activities-and-experiences/>
11. <http://www.bio-alive.com/animations/microbiology.htm>