

# **KVR GOVT. COLLEGE FOR WOMEN(A):: KURNOOL**

## **B.Sc., Biotechnology: Choice based credit system**

### **B.Sc., I Semester W.E.F. 2020-21**

#### **BT-101: Bio-molecules, Analytical Techniques, Bioenergetics & Biostatistics**

**Course Objectives:** To ensure students gain knowledge about the structure, properties and functions of biomolecules and characterization of biomolecules using analytical techniques. To learn the basics of Bioenergetics & Biostatistics.

#### **Unit-I-Carbohydrates and Lipids**

Classification, structure and functions of carbohydrates. Fischer and Haworth projection of Glucose, Isomers in monosaccharides (Optical isomers, Enantiomers, Diastereomers, Epimers and Anomers), Glycosidic bond, Reducing and non-reducing sugars. Classification of lipids based on structural complexity. Classification, Nomenclature and structure of saturated and unsaturated fatty acids. Isomers of fatty acids and its significance. Structure and functions of glycolipids, phospholipids, and cholesterol.

#### **Unit-II- Nucleic acid and Proteins**

Composition of nucleic acids. Structural units of nucleic acids- Nucleoside, Nucleotide and Oligonucleotide. Watson and Crick structure of DNA. Structure and types of RNA. Structure and properties of amino acids (amphoteric nature, absorbance, isomerism), Classification of amino acids (R group & Nutrition), peptide bond. Structural organization of proteins (primary, secondary, tertiary, quaternary). Renaturation and denaturation of DNA and proteins.

#### **Unit-III-Centrifugation, Chromatography and Electrophoresis**

Basic principles of sedimentation, Concept of RCF. Principle & applications of Differential and Density gradient centrifugations. Partition principle, Partition coefficient, Brief account of Paper and TLC. Principle, instrumentation and application of ion exchange, gel permeation, and affinity chromatography. Basic principles of electrophoresis, factors affecting electrophoretic migration. Principle and applications of Agarose gel electrophoresis and SDS-PAGE.

#### **Unit - IV-Spectroscopy, Microscopy and Laser Techniques**

Beer-Lambert law, light absorption and transmission. Extinction coefficient, Principle and application of photoelectric calorimeter and UV-visible spectrophotometer. Basic principles

of microscopy –Numerical aperture, resolution and magnification. Principle and applications of compound, confocal and electron microscopy (TEM, SEM). Radioactive and stable isotopes, rate of radioactive decay, units of radioactivity, measurement of radioactivity (scintillation counter and autoradiography)

### **Unit –V- Bioenergetics and Biostatistics**

Free energy, entropy, enthalpy and redox potential. High energy compounds (ATP, PEP) Glycolysis, TCA cycle, Electron-Transport System and Oxidative Phosphorylation. Mean, median, mode, standard deviation, One-way and Two-way Anova.

#### **List of Practicals:-**

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowry / Biuret method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease /amylase activity
9. Preparation of starch from potato and its hydrolyze by salivary amylase
10. Preparation of standard buffer and pH determination
11. Titration curve of Glycine
12. Separation of amino acids by paper chromatography
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

#### **Textbooks for Biomolecules and Analytical Techniques**

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffery Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India

8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1<sup>st</sup> edition, (2001), Gary Walsch; Wiley, USA
10. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
11. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath
12. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher: Horwood Pub. Co., England.
13. Analytical Biochemistry, 3<sup>rd</sup> edition, (1998), David Holmes, H. Peck, Prentice-Hall, UK
14. Introductory Biostatistics, 1<sup>st</sup> edition, (2003), Chap T. Le; John Wiley, USA.
15. Methods in Biostatistics, (2002), B. K. Mahajan –Jaypee Brothers.
16. Statistical methods in biology, (1995), Bailey, N. T.; Cambridge university press

### **Web Links for Additional information:**

1. <https://nptel.ac.in/courses>
2. <http://illl.du.ac.in/>
3. <http://epgp.inflibnet.ac.in>
4. <https://www.biologysimulations.com/cell-energy>
5. <https://www.onlinebiologynotes.com/>
6. <https://www.youtube.com/watch?v=9f34MaHVy-E>
7. <https://youtu.be/Pl2K4hn7N9Y>
8. <https://youtu.be/wvTv8TqWC48>
9. <https://www.youtube.com/ricochetscience>

### **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-simulations-for-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://digitallearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-lab-resources/>
9. <https://vlab.amrita.edu/index.php>
10. <https://sites.dartmouth.edu/teachremote/remote-lab-activities-and-experiences>

## **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 reemerging 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 bi-direction, 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.

### **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, 7<sup>th</sup> 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-simulations-for-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://digitallearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-lab-resources/>
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>

