ERA UNIVERSITY, LUCKNOW
STUDY & EVALUATION SCHEME (Effective from Session 2024-25)
B.Sc. BIOTECHNOLOGY
YEAR I, SEMESTER – I

	Course category	Course code	Course title	Hours/Week			EVALUATION SCHEME				Course Total	C	Attributes						
				L	T	P	Mid Sem Exam	TA	Total	End Sem Exam			Employability	Entrepreneurship	Skill Development	Gender	Environment Sustainability	Human values	Professional Ethics
THEORY																			
1.	Major Own Faculty	B020101T	Basics of Cell Biology & Genetics	3	1	0	12	18	30	70	100	4	√	√					
2.	Major Own Faculty	B020102T	Fundamentals of Chemistry	3	1	0	12	18	30	70	100	4	√	√	√				
3.	Vocational	I020103T	Animation I (Fundamentals of Design in Multimedia)	2	0	2	12	18	30	70	100	3	√		√				
4.	Co-Curricular	H020104T	Food, Nutrition & Hygiene	2	0	0	12	18	30	70	100	2	√	√	√				
PRACTICALS																			
5.	Major Own Faculty	B020105P	Cell Biology & Genetics Lab	0	0	4	12	18	30	70	100	2	√	√	√				
6.	Major Any Faculty	B020106P	Chemistry Lab	0	0	4	12	18	30	70	100	2	√	√	√				
Total											**600**	**17**							

L- Lecture T- Tutorial P- Practical C- Credit TA- Teacher Assessment

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

Course Name: Basics of Cell Biology and Genetics		**Course Code:** B020101T	**Year:** Ist	**Semester:** Ist
Co-curricular/Vocational/Core/Elective: Core				
Credits: 4	**Total No. of Lectures:** 60 **Lecture-Tutorial-Practical (in hours/week) L-T-P:** 3-1-0			
Evaluation Spread	**Internal Continuous**	30	**End Term Exam**	70
Course Objective	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, membranes, and organelle and how these cellular components are used to generate and utilize energy in cells; cellular components underlying mitotic cell division and applying their knowledge of cell biology to selected examples of changes or losses in cell function. To understand basic principles of inheritance at the molecular and cellular levels; to understand the causal relationships between molecule/cell level phenomena ("modern" genetics) and organism-level patterns of heredity ("classical" genetics).			
Course Outcome	*After the successful course completion, learners will develop following attributes:* CO1: Illustrate the fundamental structural units and define the function of all living things, and understand the basics of cell components, cytoskeleton structure and functions. CO2: This gives them a strong foundation of chromosomal organization, gene structure and organization. At the end of the course, the student has a strong foundation on the functions of the cell, genes, and cell division CO3: Students will be taught mendelian genetics, their principles, gene interaction and population genetics. They learn about chromosomal aberrations and structure of chromosomes. CO4: Illustrate the different types of mutations and their impact. Demonstrate Knowledge, practical and analytical skills of genetic diseases. CO5: Illustrate different techniques of cell biology & Genetics			
Pedagogy	Interactive, discussion-based, student-centered, Presentation			
Internal Evaluation	Sessional Test; Quiz; Assignments; Attendance; Presentations			

UNIT	**Topic**	**No. of Lectures**
I	●Introduction and history of Biotechnological science with special reference to contribution of Indian scholars in biological sciences ● Prototype structure of animal and plant cells, Diversity of cell size and shape	**2**
II	●Cell theory ● C-value paradox ●Cell Membrane: Chemical components of biological membranes, organization and Fluid Mosaic Model, and membrane transport. ●Transport across the membrane ●Na^+-K^+ Pump and Na^+ - Glucose pump ●Cytoskeleton and Extra cellular matrix	**8**
III	**Structure and Function of Cell organelles:**	

	●Lysosomes: Vacuoles and micro bodies: Structure and functions ●Ribosomes: Structures and function including role in protein synthesis. ●Mitochondria: Structure and function, Genomes, biogenesis. ●Chloroplasts: Structure and function, genomes, biogenesis ●Nucleus: Structure and function, nuclear envelope ●Endoplasmic Reticulum: Structure and function ●Golgi body: Structure and function ●Centrioles and basal bodies: Structure and function	**9**
IV	**Chromosome structure:** ●Chromosomes: chromatin and chromosomes organization, euchromatin and heterochromatin, nucleosome, metaphase chromosome, genes and chromosomes. ●DNA as genetic material, Structure of DNA ●Structural and numerical changes in human chromosomes and ploidy in plants. ●Mutations: Types of mutations, spontaneous and induced mutations, Physical and chemical mutagens	**9**
V	**Cell cycle, Cancer and Cell Signalling:** ●Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in higher organisms ●Cell signalling ●Cell receptors: cytosolic, nuclear and membrane bound ●Cell programmed cell death ●Cancer-chromosomal disorders, oncogenes and tumor suppressor genes	**7**
VI	**Genetics, Mendelian genetics and allelic and non-allelic Interactions:** History of Genetics and importance of genetics in biotechnology. Mendelian genetics: Mendel's law of inheritance, monohybrid and dihybrid crosses, back cross, test cross, allele, multiple alleles, pseudo allele, genotype. Allelic Interactions: Concept of dominance, recessiveness, incomplete dominance, pleiotrophism, co-dominance. Non allelic Interactions: Supplementary and complementary.	**8**
VII	**Chromosomal aberrations and sex determination:** Numerical and structural chromosomal aberrations: Deletion, duplication, inversion, translocation, ploidy and their genetic consequences- Kleinefelter, Turner, Cri-du-chat and Down syndromes. Sex determination in plants and animal: genetic balance Theory, Extra-chromosomal inheritance: Mitochondrial inheritance.	**8**
VIII	**Linkage, recombination, crossing over, and population genetics:** Concept of linkage and recombination, Genetic maps and physical maps. Genetic Code: deciphering genetic code; degeneracy, unusual codons in mitochondria. Mutations: Types of mutations: point mutations, and frameshift mutations. Population genetics: Gene pool and allele frequency, Genetic Drift, Hardy Weinberg Law of equilibrium, Factors affecting allele frequency: mutation, migration, genetic drift, natural selection. **Important Techniques:** Karyotyping, Fluorescence *in Situ* Hybridization (FISH)	**9**

Suggested Readings

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). Molecular Biology of the Cell (6th Ed.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.). Washington: ASM ; Sunderland.
3. Karp, G. Cell and Molecular Biology. Concepts and experiments. John Harris, D., Wiley & sons, New York
4. Iwasa J., Marshal W. Karp's Cell Biology(2018) (8th edition) Wiley & Sons, NY
5. Iwasa J., Marshal W. Karp's Cell and Molecular Biology . Concepts and experiments. (2015) (8th edition) Wiley & sons, New York
6. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). Molecular Biology of the Gene (5th ed.). Pearson
7. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman
8. Gupta P.K. Cell and Molecular Biology 2018. 5th edition Rastogi Publication India.
9. Hartl, D. L., & Jones, E. W. (1998). Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett.
10. Pierce, B. A. (2005). Genetics: a Conceptual Approach. New York: W.H. Freeman.
11. Tamarin, R. H., & Leavitt, R. W. (1991). Principles of Genetics. Dubuque, IA: Wm. C. Brown.
12. Smith, J. M. (1998). Evolutionary Genetics. Oxford: Oxford University Press Genetics: Principles and Analysis – Hartl and Jones.
13. Gardner EJ, Simmons MJ, Sunstad DP. Principles of Genetics. 8th Edition. John Wiley and Sons.
14. Snustand DP, Simmons MJ. Principles of Genetics. (2016) 7th Edition. John Wiley and Sons.
15. Verma PS, Agarwal VK. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. (2004). S Chand and Company Ltd.
16. Satyanarayana U (2020). Biotechnology. Books and Allied (P) Ltd
17. Singh BD. (2015). Biotechnology: Expanding Horizons (4th edition). Kalyani Publishers
18. Dubey RC. (2014) A Textbook of Biotechnology(5th edition) S Chand and Company Ltd.

UNIT	MAPPED CO
I	CO1
II	CO1, CO2
III	CO1, CO2
IV	CO2, CO5
V	CO2
VI	CO3
VII	CO3
VIII	CO3, CO4,CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√		√		√	√	√	
CO2	√	√	√	√	√	√	√		√		√		√	√	√	
CO3	√	√	√	√	√	√	√		√		√		√	√	√	
CO4	√	√	√	√	√	√	√		√		√		√	√	√	
CO5	√	√	√	√	√	√	√		√		√		√	√	√	

Course created by: **Approved by:**

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

Course Name: Fundamentals of Chemistry		**Course Code:** B020102T	**Year:** I	**Semester:** I
Co-curricular/Vocational/Core/Elective: Core				
Credits: 4	**Total No. of Lectures:** 60 **Lecture-Tutorial-Practical (in hours/week) L-T-P:** 3-1-0			
Evaluation Spread	**Internal Continuous**	30	**End Term Exam**	70
Subject prerequisites	To study this subject, a student must have had biology in class 12th			
Course Objective	The objective of this course is to develop the understanding about the structure of atom and chemical bonding, how it came to be, and its role in organizing chemical diversity; to understand the formations of millions of organic compounds, how can they get a proper name and the role of their structure; information to a wide variety of chemical problems? To learn the laboratory skills needed to design, safely conduct and interpret chemical research and to learn the periodic tables, element's properties as well as their physical characteristics to acquire a foundation in inorganic and physical chemistry.			
Course Outcome	*After the successful course completion, learners will develop following attributes:* CO1: Students will gain and apply knowledge of chemistry concepts such as orbital shape, size and orientations in space, formation of chemical bonds along with molecular orbital and valence bond theory. CO2: Students will be able to write a proper name of organic compound, to draw absolute geometry of compound as well as know the isomerism and reactive species of organic compounds. CO3: Students will be able to design and develop the physical laws and processes in chemistry. CO4: Students will be able to design and develop the elemental analysis based on proper description of periodic table.			
Pedagogy	Interactive, Discussion-Based, Student-Centered, Presentation			
Internal Evaluation	Sessional Test; Quiz; Assignments; Attendance; Presentations			

UNIT	**Topic**	**No. of Lectures**
I	**Atomic Structure:** Electromagnetic radiations, Quantum theories (Line spectrum of hydrogen atom, Schrodinger wave equation, and de-Broglie equation); Heisenberg uncertainty principle Pauli exclusion principle; Hund's rule; Aufbau principal & electronic configuration; Quantum numbers.	**8 Hrs**
II	**Chemical Bonding:** Chemical bonding (Ionic bond, covalent bond, and coordinate bond, hydrogen bond; bond properties (bond length, bond order, bond angle and dipole moment); Molecular orbital theory, Valence bond theory, VSEPR theory and Hybridization.	**8 Hrs**
III	**Introductory Organic Chemistry:** Nomenclature of organic compounds, Inductive effect, Resonance, Hyperconjugation, Electrophiles, Nucleophiles, Carbocation, Carbanion; Carbon free radicals.	**8 Hrs**
IV	**Isomerism in Organic Chemistry:** Isomerism (Structural, Geometrical, Optical and Conformational); Enantiomers, Diastereomers, Projection	**8 Hrs**

	structures (Fischer, Sawhorse, Newman, Flying-Wedge projection) of simple molecules containing one or two asymmetric carbon atom, Meso-compounds, Racemic mixture; chirality of organic molecules without chiral centre.	
V	**Mole concept and Calculation:** Mole concept, Chemical formulae, Expression of concentrations (Mass percentage, volume percentage, strength, mole fraction, molarity, molality, and normality), Determination of atomic mass and equivalent mass.	**8 Hrs**
VI	**Basics of Physical Chemistry:** Intermolecular forces, Gas laws; Ideal gas and real gases, Vander Waal's equation, Theories of acids and bases: Arrhenius theory, Bronsted and Lowry's concept, Lewis concept, pH calculation and buffer solution.	**8 Hrs**
VII	**Introductory Inorganic Chemistry:** Periodic properties (atomic radii, ionic radii, ionization energy, electron affinity, electronegativity); Properties of elements (diagonal relationship, anomalous behaviour, inert pair effect, inter-halogen compounds and pseudo halogens).	**6 Hrs**
VIII	**Coordination Chemistry:** Nomenclature of coordination compounds; Werner's theory of co-ordination compounds; Chelation; mono, bi and polydentate ligands; valence bond and crystal field theories; Geometrical & optical isomerism.	**6 Hrs**

Suggested Readings

1. Organic chemistry Solomon's & Fryhle, John Wiley (Wse); Recent Edition
2. Organic Chemistry, Paula Y. Bruice, Recent Edition, Prentice-Hall, Intl Edition.
3. Physical Chemistry by R. L. Madan, S. Chand & Company Ltd.
4. Physical Chemistry, Atkins & de Paula, Oxford; 9 Edition (2010).
5. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press,
6. Oxford.
7. Organic Chemistry by R. L. Madan, S. Chand & Company Ltd.
8. Concise Inorganic Chemistry, JD Lee, 5th Edition (1996), Chapman & Hall, London.

UNIT	MAPPED CO
I	CO1
II	CO1
III	CO1, CO2
IV	CO1, CO2
V	CO1, CO2
VI	CO1, CO2
VII	CO1, CO3
VIII	CO3, CO4

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√		√		√	√	√	
CO2	√	√	√	√	√	√	√		√		√		√	√	√	
CO3	√	√	√	√	√	√	√		√		√		√	√	√	
CO4	√	√	√	√	√	√	√		√		√		√	√	√	

Course created by: **Approved by:**

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

Course Name: Animation I Fundamental of Design in Multimedia	**Course Code:**	**Year: 1**	**Semester: 1**
Co-curricular/Vocational/Core/Elective: Vocational			
Credits: 3	**Total No. of Lectures: 60** (prorated for 30 theory + 30 practical hours) **Lecture-Tutorial-Practical (in hours/week) L-T-P: 1:0:2**		
Evaluation Spread	**Internal Continuous** 30	**End Term Exam**	70 (Practical+Theory) (50 + 20)
Course Objective	The course on "Fundamentals of Design in Multimedia" imparts knowledge on multimedia concepts, design principles, and other important practical skills. It emphasizes creating engaging multimedia content using diverse media formats and tools.		
Course Outcome	CO1: Understanding the tools for crafting digital art, altering images, designing multi-page and print media layouts CO2: Understanding of the visual and technical skills necessary to pursue and appreciate digital mediums CO3: Understanding and applicability of principles of composition and visual contrast CO4: Understanding visual content for diverse media, and in advertising, it's used to create compelling ads that captivate, intrigue, evoke desire, and drive actions		
Pedagogy	Demonstrations, Art Excursion, Interactive and activity based class sessions, skills-based activities		
Internal Evaluation Mode	Sessional Test: 10 marks Practical: 12 marks Viva: 04 marks Assignments: 02 marks Attendance: 02 marks		

UNIT	**Topic**	**No. of Lectures**
I	**Introduction to Design:** • Components and Types of graphic design • Composition	5
II	**Raster software:** Introduction to Adobe Photoshop • History and evolution • Interface and workspace	9
III	**Digital Imaging and Editing:** • Image Editing Techniques • Matte painting • Digital painting • Photo retouching • 3D text and objects	18
IV	**Visual Arts and Design** • **Elements of design:** Balance, Emphasis, Proportion, Rhythm, Unity, and Variety • **Principals of design:** Line, Shape, Color, Texture, Space, and Value	7
V	**Multimedia system in Fundamentals of Advertising:** • Role of Multimedia: Enhancing engagement and interactivity • Advertisement campaigns	5

VI	**Concept of Colour Theory** • Properties of colour • Colour wheel	5
VII	**Designs for Print and Web Media:** • Differences and similarities • Resolution and Color Modes	6
VIII	**Portfolio creation and critique :** • Purpose and types of portfolios • Documentation process of creating portfolio	5

Suggested Readings:

1. https://www.youtube.com/watch?v=L1CK9bE3H_s
2. Adobe Photoshop workspace basics
3. 7 Elements of Design: Everything You Should Know | Renderforest
4. Elements of Design: Understanding the 7 Elements of Design (founderjar.com)
5. The basic principles of design—and how to apply them (paperform.co)

MAPPED CO's WITH PO's & PSO's

UNITS	MAPPED CO
I	CO2,
II	CO1
III	CO1
IV	CO2, CO3
V	CO2, CO3
VI	CO2, CO3
VII	CO2, CO3, CO4
VIII	CO4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1		√	√		√		√		√		√	√	√			
CO2	√	√			√	√	√	√		√	√	√	√	√		
CO3			√	√	√		√	√		√		√	√	√	√	√
CO4	√	√			√	√	√	√		√	√	√	√	√		

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

Course Name: Food Nutrition & Hygiene		**Course Code:** H020104T	**Year:** I	**Semester:** I
Co-curricular/Vocational/Core/Elective: Co-Curricular				
Credits: 2	**Total No. of Lectures:** 30 **Lecture-Tutorial-Practical (in hours/week) L-T-P:** 2-0-0			
Evaluation Spread	**Internal Continuous**	30	**End Term Exam**	70
Subject prerequisites	To study this subject, a student must have had biology in class 12th			
Course Objective	The objective of this course is to provide the knowledge of basic terminology and several aspects of nutrition and the functions of food in healthy life sustenance and to equip students with knowledge and understanding of modern aspects of nutritional science and novel food usage.			
Course Outcome	*After the successful course completion, learners will develop following attributes:* CO1: To learn the basic concept of the Food and Nutrition. CO2: To study the nutritive requirement during special conditions like pregnancy and lacation. CO3: To learn meal planning. CO4: To learn 1000 days Nutrition Concept. CO5: To study common health issues in the society. CO6: To learn the special requirement of food during common illness.			
Pedagogy	Interactive, discussion-based, student-centered, Presentation			
Internal Evaluation Mode	Sessional Test; Quiz; Assignments; Attendance; Presentations			

UNIT	Topic	No. of Lectures
I	**Concept of Food and Nutrition:** (a) Definition of Food, Nutrients, Nutrition, Health, balanced Diet (b) Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition (c) Meal planning- Concept and factors affecting Meal Planning (d) Food groups and functions of food.	**8 Hrs**
II	**Nutrients:** Macro and Micro RDA, Sources, Functions, Deficiency and excess of (a) Carbohydrate (b) Fats (c) Protein (d) Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc (e) Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K (f) Water (g) Dietary Fibre.	**7Hrs**
III	**1000 days Nutrition:** (a) Concept, Requirement, Factors affecting growth of child (b) Prenatal Nutrition (0 - 280 days): Additional Nutrients' Requirement and risk factors during pregnancy (c) Breast / Formula Feeding (Birth – 6 months of age) Complementary and Early Diet (6 months -2 years of age).	**8 Hrs**
IV	**Community Health Concept:** (a) Causes of common diseases prevalent in the society and Nutrition requirement in the following:	**7Hrs**

	Diabetes, Hypertension (High Blood Pressure), Obesity, Constipation, Diarrhea, Typhoid (b) National and International Program and Policies for improving Dietary Nutrition (c) Immunity Boosting Food.	

Suggested Readings

1. Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018.
2. 1000Days-Nutrition_Brief_Brain-Think_Babies_FINAL.pdf
3. https://pediatrics.aappublications.org/content/141/2/e20173716
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/
5. Sheel Sharma, Nutrition and Diet Therapy, Peepee Publishers Delhi, 2014, First Edition.

UNIT	MAPPED CO
I	CO1, CO3
II	CO2
III	CO2, CO4
IV	CO5, CO6

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√		√		√	√	√	
CO2	√	√	√	√	√	√	√		√		√		√	√	√	
CO3	√	√	√	√	√	√	√		√		√		√	√	√	
CO4	√	√	√	√	√	√	√		√		√		√	√	√	
CO5	√	√	√	√	√	√	√		√		√		√	√	√	
CO6	√	√	√	√	√	√	√		√		√		√	√	√	

Course created by: **Approved by:**

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

Course Name: Cell Biology & Genetics Lab		**Course Code:** B020105P	**Year:** I	**Semester:** I
Co-curricular/Vocational/Core/Elective: Core				
Credits: 2	**Total No. of Lectures:** NIL **Lecture-Tutorial-Practical (in hours/week) L-T-P:** 0-0-4			
Evaluation Spread	**Internal Continuous**	30	**End Term Exam**	70
Subject prerequisites	To study this subject, a student must have had biology in class 12th			
Course Objective	The objective of this course is to develop the understanding of use of Micrometer and calibration, measurement of onion epidermal cells and yeast, Cell division processes: Mitotic and meiotic studies, Chromosomes: polytene chromosomes, Karyotype analysis – with the help of slides and how to make Blood smear – differential staining and Buccal smear -Barr bodies.			
Course Outcome	*After the successful course completion, learners will develop following attributes:* CO1: To find out the stages of Cell division. CO2: To prepare solutions and buffers CO3: Sex chromatin determination by performing a Barr body experiment. CO4: Differentiate the bacterial cells. CO5: Karyotype analysis			
Pedagogy	Interactive, Discussion-Based, Practical's			
Internal Evaluation Mode	Sessional Test; Viva; Attendance; Lab Record			

Lab Course	**List of Experiments**	**Practical (in Hrs)**
Cell biology I	1. Introduction to safety measures in Laboratories. 2. To prepare solutions and buffers. 3. To learn equipment handling and pipetting. 4. To study the structure of any prokaryotic and eukaryotic cell. 5. To Staining of Sex chromatin (Barr body). 6. To study the cell division in onion root. 7. Vital Staining of Mitochondria with Janus green B.	**30Hrs**
Genetics II	1. Demonstration of Sex chromatin in buccal smear. 2. Karyotype preparation. 3. Genetics problems based on: (i) Mendel's law (ii) Gene mapping and (iii) Transposable elements. 4. Ames test for mutagenesis. 5. Preparation of polytene chromosomes from salivary gland of Chironomous larvae	**30Hrs**

Suggested Readings

1. Karp, G. Cell and Molecular Biology. Concepts and experiments. John Harris, D., Wiley & sons, New York
2. Iwasa J., Marshal W. Karp's Cell Biology (2018) (8th edition) Wiley & Sons, NY
3. Iwasa J., Marshal W. Karp's Cell and Molecular Biology. Concepts and experiments. (2015) (8th edition) Wiley & sons, New York
4. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). Molecular Biology of the Gene (5th ed.). Pearson
5. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman.
6. Gupta P.K. Cell and Molecular Biology 2018. 5th edition Rastogi Publication India.
7. Hartl, D. L., & Jones, E. W. (1998). Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett.

UNIT	MAPPED CO
I	CO1, CO2, CO4
II	CO3, CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO2	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO3	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO4	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO5	√	√	√	√	√	√	√		√	√	√		√	√	√	

Course created by: **Approved by:**

ERA UNIVERSITY
Department of Biotechnology
Course Outline
Academic Year: 2024-25

<table>
<tr><td colspan="2">Course Name: Chemistry Lab</td><td colspan="2">Course Code: B020106P</td><td>Year: I</td><td>Semester: I</td></tr>
<tr><td colspan="6">Co-curricular/Vocational/Core/Elective: Core</td></tr>
<tr><td>Credits: 2</td><td colspan="5">Total No. of Lectures: NIL Lecture-Tutorial-Practical (in hours/week) L-T-P: 0-0-4</td></tr>
<tr><td>Evaluation Spread</td><td>Internal Continuous</td><td>30</td><td colspan="2">End Term Exam</td><td>70</td></tr>
<tr><td>Subject prerequisites</td><td colspan="5">To study this subject, a student must have had biology in class 12th</td></tr>
<tr><td>Course Objective</td><td colspan="5">The objective of this course is to develop the understanding of use of Micrometer and calibration, measurement of onion epidermal cells and yeast, Cell division processes: Mitotic and meiotic studies, Chromosomes: polytene chromosomes, Karyotype analysis – with the help of slides and how to make Blood smear – differential staining and Buccal smear -Barr bodies.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After the successful course completion, learners will develop following attributes:
CO1: Getting knowledge for the preparation of stains, buffers, standard solutions for various biochemical assays.
CO2: Using chromatography techniques, students will able to separate pigments and amino acids from a mixture of samples.</td></tr>
<tr><td>Pedagogy</td><td colspan="5">Interactive, Discussion-Based, Practical’s</td></tr>
<tr><td>Internal Evaluation Mode</td><td colspan="5">Sessional Test; Viva; Attendance; Lab Record</td></tr>
<tr><td>Lab Course</td><td colspan="4">List of Experiments</td><td>Practical</td></tr>
<tr><td>Chemistry I</td><td colspan="4">1. Systematic qualitative analysis of organic compounds (Single compound: Benzoic Acid, Pthalic acid, Cinnamic acid, β-naphthol, p-nitro-aniline, m-dinitrobenzene, urea and thiourea) for nature, functional group, elements, derivatives and physical constant.
2. Determination of surface tension and density of the given liquid using stalagmometer and picnometer.
3. Determination of viscosity and density of the given liquid using Ostlwald’s viscometer and picnometer.
4. Volumetric Analysis: Oxidation- reduction titration using $KMnO_4$ and $K_2Cr_2O_7$.</td><td>60 Hrs</td></tr>
<tr><td colspan="6">Suggested Readings
Organic chemistry Solomons&Fryhle, John Wiley (Wse); Recent Edition
Organic Chemistry, Paula Y. Bruice, Recent Edition, Prentice-Hall, Intl Edition.
Physical Chemistry by R. L. Madan, S. Chand & Company Ltd.</td></tr>
</table>

UNIT	MAPPED CO
I	CO1, CO2

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO
CO1	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO2	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO3	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO4	√	√	√	√	√	√	√		√	√	√		√	√	√	
CO5	√	√	√	√	√	√	√		√	√	√		√	√	√	

Course created by: **Approved by:**