Resolution No. AC/I(21-22).2(II).RUS2

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for

FYBSc

Program: BSc

Program Code: RUSBCH

(Credit Based Semester and Grading System for academic year 2022–2023)

GRADUATE ATTRIBUTE

GA	GA Description **A student completing Bachelor's Degree in SCIENCE program will be able to:**
GA 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
GA 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
GA 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA 7	Follow ethical practices at workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner

PROGRAM OUTCOMES

PO	Description **A student completing Bachelor's Degree in SCIENCE program in the subject of BIOCHEMISTRY will be able to:**
PO 1	Achieve better understanding of the major thrust areas of the disciplines like Chemistry of Biomolecules & their metabolism, Cell biology (Basics, Membrane biochemistry, Cancer), Enzymology, Genetics, Plant Biochemistry, Pharmacology, Microbiology & Immunology.
PO 2	Gain acumen of the fundamental biochemical processes occurring at the molecular and gene level.
PO 3	Understand the role of Biochemistry in food, human nutrition and environmental science.
PO 4	Get insights into multiple important analytical tools for Biochemical testing and apply contextual knowledge and tools of biochemical research for problems solving.
PO 5	Acquire and empower technical knowledge by connecting disciplinary and interdisciplinary aspects of biochemistry.
PO 6	Compile and interpret Biological data using Biostatistics and Bioinformatics tools.
PO 7	Express ideas persuasively through scientific writing and oral presentation which will help in the development of the leadership qualities.
PO 8	Possess scientific temperament by research project-based learning.
PO 9	Procure hands-on real time experience in industries.
PO 10	Get exposure to the strong theoretical and practical understanding of various dimensions of Biochemistry and take up research-oriented courses in the fields of Biochemistry, Nutrition & Dietetics, Molecular Biology, etc.

PROGRAM OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
FYBSc	I	RUSBCH101	Biomolecules	2
		RUSBCH102	Cell Biology	2
		RUSBCHP101	Practicals based on RUSBCH101	1
		RUSBCHP102	Practicals based on RUSBCH102	1
	II	RUSBCH201	Physiology	2
		RUSBCH202	Basics Of Genetics	2
		RUSBCHP201	Practicals based on RUSBCH201	1
		RUSBCHP202	Practicals based on RUSBCH202	1

Semester I

Course Code: RUSBCH101

Course Title: Biomolecules

Academic year 2022-23

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Understand the classification, structures, biological significance of biomolecules - carbohydrates, proteins & lipids which forms the foundation of Biochemistry
CO 2	Acquire knowledge in quantitative & qualitative estimation and understanding the role and functions of biomolecules.
CO 3	Describe the chemistry that governs physical, chemical properties and reactions of carbohydrates, proteins and amino acids & lipids.
CO 4	Comprehend the classification and structures of several monosaccharides, disaccharides and polysaccharides, and explain their functions.
CO 5	Elucidate the structures of amino acid, peptide bond formation and classes of amino acids, identify the four levels of protein structure and summarize the function for a range of proteins.
CO 6	Categorize lipids, identify structure and functions of fats, phospholipids and cholesterol, and explain the structural differences between saturated, monounsaturated and polyunsaturated fatty acids with the functional implications.
CO 7	Enhance their ability to learn important reactions taking place in the biotic world to study metabolic pathways which will be utilized in higher classes of this program.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title Biomolecules RUSBCH101	Credits/ Lectures 2 Credits
I	**1**	**Carbohydrates**	**15L**
	1.1	Definition, Occurrence and functions of carbohydrates	2L
	1.2	Classification (Monosaccharides, Oligosaccharides, Polysaccharides)	
	1.3	Monosaccharides	3L
	1.3.1	Concept of aldoses and ketoses	
	1.3.2	Structures and significance of biologically important monosaccharides: glucose, fructose, galactose, mannose, and ribose.	
	1.4.1	Physical Properties: Chirality: Isomerism D & L, Stereoisomerism: Enantiomers and Diastereomers, Epimers and Anomers, Optical Isomers, Mutarotation	2L
	1.4.2	Chemical reactions: Oxidation to acidic sugars (Aldonic, Aldaric and Uronic acids) (with respect to glucose) Reduction to sugar alcohols (In boiling alkali, Enediol formation) (with respect to glucose and fructose) Osazone formation (with respect to glucose and fructose) Orcinol formation (with respect to ribose)	3L
	1.5	Disaccharides Occurrence and structure of Maltose, Lactose and Sucrose Chemical reaction: Formation of glycosidic bonds	2L
	1.6	Polysaccharides Classification based on structure, occurrence, properties and biological importance Composition: Homopolysaccharides and Heteropolysaccharides with examples Storage: Starch and Glycogen – action of amylase on starch Structural: Cellulose and Chitin	3L
II	**2**	**Amino acids & Proteins**	**15L**
	2.1	Amino acid	3L
	2.1.1	Structure- D & L forms of all 20 amino acids	

	2.1.2	Detailed classification based on: Polarity, Nutritional classification (Essential & Non-essential)	
	2.2.1	Physical Properties: Zwitter ion, pI of amino acids and Amino acids as ampholytes	3L
	2.2.2	Chemical reactions of amino acids with Ninhydrin, Sanger's reagent, Edman's reagent and Dansyl chloride	
	2.3	Non-standard amino acids	2L
	2.4	Functions of amino acids (in brief)	
	2.5	Comparative overview of D- and L-amino acids	
	2.6	Peptides and Proteins ASBC- APS classification on the basis of shape, Function and physical properties & solubilities (Simple, conjugated & derived proteins) Nutritional classification (Complete & incomplete proteins) Properties and colour reactions of proteins	2L
	2.7	Overview of Protein structure	3L
	2.8	A) Primary structure -Formation and characterization of the peptide bond B) Secondary structure -Alpha helix and beta sheet C)Tertiary and Quaternary structures- an introduction with one example of each	
	2.9	Protein denaturation	1L
III	**3**	**Lipids**	**15L**
	3.1.1	Definition and function of lipids	2L
	3.1.2	Classification (Simple, Complex and Derived lipids)	
	3.2	Fatty Acids and Triacylglycerols	3L
	3.2.1	Classification & Chemistry Saturated fatty acids - classification of C2 to C20 (even carbon). Common and IUPAC names Unsaturated fatty acids MUFA, PUFA (2,3,4 double bonds) Omega – 3, 6, 9 fatty acids Triacylglycerol - simple and mixed (names and structure)	
	3.2.2	Chemical Reactions of fats Saponification, Iodination, Ozonolysis, Auto-oxidation, Action of heat on glycerol and choline, Rancidity	4L

		Definition & significance - Acid number, Saponification number, Iodine number, Reichert - Meissel number	
	3.3	Compound Lipids Functions of glycerophospholipids Phosphosphingolipids (ceramide, sphingomyelin) Glycolipids / Cerebrosides (gluco & galactocerebrosides)	4L
	3.4	Steroids and Lipoproteins Steroids - Cholesterol structure and biochemical significance Lipoproteins – Types (Chylomicrons, VLDL, LDL and HDL) and biochemical significance	2L
		Practicals – RUSBCHP101	1 Credit
	1	Safety measures in laboratories.	
	2	Qualitative tests for carbohydrates	
	3	Qualitative test for amino acids, proteins.	
	4	Qualitative tests to detect the unknown carbohydrates and proteins from the given solution	
	5	Isoelectric precipitation of casein	
	6	Qualitative test for lipids	
	7	Saponification value of fat	
	8	Determination of the acid value of a fat	
	9	Estimation of Glycine by Soronsen's method	
	10	Determination of the iodine value of a fat	

References:

1. Lehninger, Albert L, Biochemistry, Kalyani Publishers
2. Zubay, Geoffrey L., Biochemistry; Wm. C. Brown publishers
3. Stryer, Lubert; W.H.; Biochemistry; Freeman publishers
4. U. Satyanarayan, U. Chakrapani; Biochemistry. Elsevier
5. Plummer, David T.; Introduction to practical biochemistry; Tata Mc. Graw and Hill publishers.
6. Biochemical methods by S Sadashivam & A Minackam, New Age International publisher.
7. Sawhney, S.K. and Singh, Randhir; Introductory practical biochemistry; Narosa Publishing House
8. Textbook of Medical Biochemistry (8th Edition) – by MN Chatterjea & Rana Shinde, Jaypee publications

Course Code: RUSBCH102

Course Title: Cell Biology

Academic year 2022-23

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Understand the structure and basic components of prokaryotic and eukaryotic cells and gain insights into its broad classification and differentiation.
CO 2	Acquire knowledge about morphology, types and functions of different types of cell organelles – Mitochondria, Chloroplast, Nucleus, Ribosomes, Endoplasmic Reticulum, Golgi Complex, Lysosomes and Peroxisomes
CO 3	Appraise the role of cytoskeleton and understand its different components, function and distribution.
CO 4	Illustrate the mechanism of cell to cell interaction and cell division, to explain structural and functional aspects of the cells.
CO 5	Provide in depth knowledge of cell cycle and its check points also to learn structure and functions of chromosomes and phases of cell cycle & division.
CO 6	Identify and describe the parts of microscope. To study the distinguishing features, principle components and applications of various types of light and electron microscope.
CO 7	Develop an analytical insight to understand the principle and methodology of centrifugation, different types & application of centrifuge and rotors.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title Cell Biology RUSBCH102	Credits/ Lectures 2 Credits
I	**1**	**Cell Organelles**	**15L**
	1.1	Broad classification of cell types: prokaryotic and eukaryotic cells and their characteristics.	1L
	1.2	Cell wall and Cell membrane	3L
	1.3	Cell Organelles	3L
	1.3.1	Nucleus: Structure & Function of the nucleus, nuclear envelope, nuclear pore complex, nuclear matrix and nucleolus	
	1.3.2	Mitochondria & chloroplast: Structure, function, endosymbiont theory, genome	3L
	1.3.3	Ribosome: Structure & Function	
	1.3.4	Endoplasmic reticulum: RER and SER, Function	3L
	1.3.5	Golgi apparatus: Organization and function Brief overview of cotranslational and post-translational transport of proteins	
	1.3.6	Lysosome: Development of different forms of lysosomes, role in cellular digestion	3L
	1.3.7	Peroxisome: assembly, functions (H_2O_2 metabolism, fatty acid oxidation), glyoxysomes	
II	**2**	**Cytoskeleton, Cell-cell interaction & Cell cycle**	**15L**
	2.1	Introduction and Importance of Cytoskeleton	3L
	2.2	Types (Microtubules, Microfilaments & Intermediate Filaments)	
	2.2.1	Structure, assembly and function of Microtubules: Axonemal and cytoplasmic microtubules (cilia, flagella, centrioles, basal bodies)	
	2.2.2	Microfilaments: Actin & Myosin, Cytoplasmic streaming	2L
	2.2.3	Intermediate Filaments: Anchoring cell junctions	
	2.3	Motor Proteins – Kinesins, Dyneins & Myosins	1L
	2.4	Cell - Cell Interaction	2L
	2.4.1	Cell-Cell Interactions and Cell-Matrix Interactions	
	2.2.4	Components of Extracellular Matrix: Collagen and Non-Collagen Components	
	2.4.3	Tight Junctions; Gap Junctions; Chemical synapses and Plasmodesmata	2L
	2.5	Role & Importance of Cell Interaction	

	2.6	Cell Cycle	2L
	2.6.1	Overview of Cell Cycle	
	2.6.2	Phases of Cell Cycle	
	2.6.3	Role of checkpoints	2L
	2.6.4	Regulation of cell cycle - Cyclins & CDKs	
	2.6.5	Cell Division (Mitosis and Meiosis)	1L
III	**3**	**Tools of Cell Biology (Microscopy & Centrifugation)**	**15L**
	3.1	Microscopy	3L
	3.1.1	Introduction and basic concept of Magnification, Resolving power, Numerical aperture, Limit of resolution, refractive index and role and RI of oil	
	3.1.2	Parts and functions of Compound microscope	
	3.1.3	Light microscope- Bright Field, Dark field, Phase contrast, Fluorescence microscopy (Immunofluorescence and FISH), Confocal Microscopy	4L
	3.1.4	Electron Microscopy	
	3.2	Centrifugation	2L
	3.2.1	Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient	
	3.2.2	Types and applications of centrifuges – Clinical, High speed, Ultra centrifuge - preparative and analytical.	3L
	3.2.3	Centrifuge rotors: vertical, fixed angle, swinging bucket	3L
	3.2.4	Types of centrifugation and its applications– Differential, Rate zonal, Isopycnic	
		Practicals – RUSBCHP102	1 Credit
	1	To study the parts of a microscope	
	2	Cytochemical staining of polysaccharides by PAS	
	3	To study different stages of mitosis by temporary preparation in onion root tip	
	4	To study of cell organelles by using electron micrographs	
	5	To study isolation of mitochondria by differential centrifugation	
	6	Staining and visualization of mitochondria by Janus Green Stain	
	7	Effect of hypotonic, isotonic and hypertonic solutions on the cells	
	8	Visualization of nuclear fraction by acetocarmine stain	

References:

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P.S. Verma, V.K. Agarwal
2. Zubay, Geoffrey L., Biochemistry; Wm. C. Brown publishers
3. Stryer, Lubert; W.H.; Biochemistry; Freeman publishers
4. U. Satyanarayan, U. Chakrapani; Biochemistry. Elsevier
5. Stanier,Ingraham et al ,General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd
6. Analytical Biochemistry by David Holme
7. Biophysical Chemistry, Avinash Upadhyay
8. Keith Wilson & John Walker, Practical Biochemistry, principle and technique, Cambridge University, 5th edition
9. Plummer, David T.; Introduction to practical biochemistry; Tata Mc. Graw and Hill publishers.
10. Boyer, Rodney F., Modern experimental biochemistry
11. Sawhney, S.K. and Singh, Randhir; Introductory practical biochemistry ; Narosa Publishing House
12. Jane B Reece; Neil A Campbell, Campbell biology 9th edition, Boston : Benjamin Cummings / Pearson, ©2011.
13. Bruce albert, Molecular Biology of the cell 6th edition, Taylor & Francis (Garland Science)

Modality of Assessment (SEMESTER I)

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1	One Assignment/poster presentation/Quiz	20
2	One class Test (multiple choice questions / subjective)	20
	TOTAL	40

B) External Examination- 60%- 60 Marks

1. Duration - These examinations shall be of **02 HOURS** duration.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
Q1. A	Any 2 out of 3	04	UNIT I
Q1. B	Any 2 out of 3	06	
Q2. A	Any 2 out of 3	04	UNIT II
Q2. B	Any 2 out of 3	06	
Q3. A	Any 2 out of 3	04	UNIT III
Q3. B	Any 2 out of 3	06	
	TOTAL	60	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Practical I & II
Journal	05
Experimental tasks	15
Total	**20**

B) External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	Practical I & II
Laboratory work	25
Viva	5
Total	**30**

Overall Examination & Marks Distribution Pattern

Semester I

Course	101			102			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	**200**
Practicals	20	30	50	20	30	50	**100**

Semester II

Course Code: RUSBCH201

Course Title: Physiology

Academic year 2022-23

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Enumerate the biological significance and functions of water, acids, bases and buffers.
CO 2	Gain knowledge about the principles of pH measurement, acid-base, buffers and biological buffers its properties and determination of pH using electrodes.
CO 3	Explain difference between weak and strong acids/bases, recognize different ways of expressing concentrations of a solution.
CO 4	Develop practical aspects on study of water, acid, bases and buffers to understand the standardization of laboratory reagents and prepare buffer solutions at a given pH and concentration.
CO 5	Categorize fundamentals and application of physiology to study biological systems and regulate life processes.
CO 6	Comprehensively study digestion for absorption of nutrients through the digestive system.
CO 7	Summarize the flow of respiratory and excretory system and to broadcast its functioning.
CO 8	Holistically understand the different organ systems with respect to their biochemical events that co-ordinate working of the organ system.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title Physiology RUSBCH201	Credits/ Lectures 2 Credits
I	**1**	**Water and Acids, bases & buffers**	**15L**
	1.1	Water	
	1.1.1	Water and its biological significance, water as a universal solvent.	
	1.1.2	Hydrogen bonding and structure	
	1.1.3	Concepts of mole, molar, molar equivalent and normal, Dalton	2L
	1.1.4	Ionization of water, weak acids and weak bases	
	1.1.5	Numericals based on the above concept	
	1.2	Acid and Bases	4L
	1.2.1	Definitions and Introduction of pH Scale, Measurements, Indicators, Strong and Weak Electrolytes	
	1.2.2	Titration Curve of glycine	
	1.2.3	Working of pH meter and glass electrode	1L
	1.3	Buffers	2L
	1.3.1	Mechanism of Buffer Action, Buffering Capacity	
	1.3.2	Preparation of Buffer Solutions – Acidic and Basic Expression of Hendersen–Hasselbalch equation, Henderson equation of acidic and basic buffer solution	4L
	1.3.3	Numericals based on the above concept	
II	**2**	**Digestion & Absorption**	**15L**
	2.1	Histology and Functions of gastro intestinal tract (GIT)	5L
	2.2	Organs and Glands associated with GIT	
	2.3	Secretions and Juices of GIT (Saliva, Gastric juice, Intestinal juice, pancreatic and Bile juice)	3L
	2.4	Introduction to digestion	3L
	2.4.1	Mechanism of Digestion and Absorption of carbohydrates, Lipids & Proteins	
	2.4.2	Physiology of Disorders related to digestive system - Peptic ulcer, Lactose Intolerance, Celiac disease, Pancreatitis	3L
III	**3**	**Respiration & Excretion**	**15L**
	3.1	Respiration	3L

	3.1.1	Components of Respiratory system and their functions	
	3.1.2	Breathing - inspiration and expiration	
	3.1.3	Composition of air and partial pressure of gases	
	3.1.4	Physical exchange of gases - Transport of oxygen and carbon dioxide in blood	4L
	3.1.5	Respiratory disorders – Asthma, pharyngitis, laryngitis, hay fever, pneumonia, occupational lung disease (silicosis & asbestosis), cyanosis, respiratory acidosis and alkalosis	
	3.2	Excretion	3L
	3.2.1	Components of the Excretory system, Functional anatomy of kidney	
	3.2.2	Ultrastructure of nephron: Malpighian Body & Renal tubule	
	3.2.3	Juxta-Glomerular apparatus, Ultrafiltration, GFR (Pressures involved & Regulation)	3L
	3.2.4	Mechanism and Regulation of Urine formation	
	3.2.5	Normal & Abnormal constituents of urine	2L
	3.2.6	Excretory disorder: Nephritis	
		Practicals – RUSBCHP201	1 Credit
	1	Preparation & standardization of laboratory reagents	
	2		
	3	Quantitative estimation of normality of FAS	
	4	Demonstration of pH meter	
	5	Preparation of buffers, phosphate and acetate buffers	
	6		
	7	Determination of pKa of glycine	
	8	Determination of achromic point of salivary amylase	
	9		
		Estimation of total and free gastric juice acidity	
	10	Effect of bile on emulsification of fats	
		Biochemical profile of urine (Physical characteristics & Qualitative assay)	
		Titrable acidity using Neutral red or Phenol red	

References:

1. Keith Wilson & John Walker, Practical Biochemistry, principle and technique, Cambridge University, 5th edition
2. Frelfelder D- Physical Biochemistry
3. Skoog Douglas A – Principles of Instrumental Analysis Harcourt Brace publishers, London
4. Human Physiology –Chatterjee.C.C, Medical Allied Agency
5. Upadhyaya et al – Biophysical Chemistry, Himalaya Publishing Home, New Delhi

6. Textbook of Medical Physiology: Gyton and Hall, Elsevier publishers
7. Sawhney, S.K. and Singh, Randhir: Introductory practical biochemistry, Narosa Publishing House
8. Textbook of medical laboratory technology: Dr. Praful Godkar, Bhalani Publishing House
9. Crash Course Respiratory System – Hickin Renshaw Williams, 4th Ediiton, Mosby Elsevier
10. The Netter Collection of Medical Illustrations - Respiratory Syste 2nd Edition Volume 3 – David A. Kaminsky, Saunders Elsevier
11. Principles of Anatomy and Physiology Gerard J Tortora & Bryan Derrickson, John Wiley & sons publication

Course Code: RUSBCH202

Course Title: Basics of Genetics

Academic year 2022-23

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

COURSE OUTCOME	DESCRIPTION
CO 1	Describe the structure and function of nucleic acid strengthening the basic information of DNA and RNA, understanding nitrogenous bases, their bond formation & reactions of nucleic acids.
CO 2	Gain insights about types, structure and properties of nucleic acids
CO 3	Elaborate on central dogma to overview the process of Replication, Transcription and Translation
CO 4	Learn basic concepts of genetics and transmission of genetic information.
CO 5	Explain derivatives from Mendel's model of the inheritance of traits.
CO 6	Study of Human Pedigree analysis in understanding the inheritance of genes in humans
CO 7	Critically understand the components of DNA and the process of sequencing structural properties of chromosome.
CO 8	Recognize normal and abnormal karyotypes, describing the abnormalities in chromosomal number.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title Basics of Genetics RUSBCH202	Credits/ Lectures 2 Credits
I	**1**	**Nucleic acids**	**15L**
	1.1.1	Introduction to nucleic acids	3L
	1.1.2	Structure - Purine & Pyrimidine bases, ribose, deoxyribose, nucleosides and nucleotides (ATP, CTP, GTP, TTP, UTP)	
	1.2	Formation of phosphodiester bond and shorthand representation of polynucleotide strand	1L
	1.3	RNAs (various types in prokaryotes and eukaryotes) mRNA, hnRNA, rRNA, snRNA & snoRNA - general account, tRNA - clover leaf model, Ribozymes	3L
	1.4	DNA	2L
	1.4.1	Physical evidence of DNA helical structure. Chargaff's rules (chemical evidence), Watson-Crick model of DNA & its features	
	1.4.2	Physical properties of DNA - Effect of heat on physical properties of DNA (Viscosity, buoyant density, UV absorption), Hypochromism, hyperchromism, denaturation of DNA.	3L
	1.5	Reactions of nucleic acids (with DPA and Orcinol)	1L
	1.6	Central Dogma of Life (Overview: Replication, Transcription, Translation & Reverse Transcription)	2L
II	**2**	**Mendelian Inheritance & Chromosomal Abnormalities**	**15L**
	2.1.1	Concept of alleles, genotype & Phenotype	2L
	2.1.2	Mendel's experimental design	
	2.2.1	Monohybrid cross- principle of segregation, Confirmation of principle using back cross	3L
	2.2.2	Dihybrid cross- principle of independent assortment	
	2.3	Deviation from Mendelian genetics	3L
	2.3.1	Multiple allele- ABO blood group, Drosophila eye colour, Relation of multiple allele with molecular genetics	
	2.3.2	Inheritance pattern of single gene- Wild type allele, Mutant allele, Dominant mutant allele & their effect on phenotype	2L

	2.4	Numericals based on above concepts	2L
	2.5.1	Concept of Genes and Chromosomes	3L
	2.5.2	Chromosomal abnormalities (Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome, Cri-du-chat syndrome, Philadelphia Chromosome)	
III	**3**	**Genome Organization & Human pedigree analysis**	**15L**
	3.1	Prokaryotic Genome: Organization of circular chromosome	1L
	3.2	Eukaryotic chromosomes: Organization of DNA into chromosomes (upto Solenoid structure)	2L
	3.3	DNA supercoiling, Topoismerase, Chromatin structure, Euchromatin, Heterochromatin, structure of condensed chromatin, Nucleosomes [Centromere, kinetochrome, telomere], Acetylation & deacetylation of histones, Role of Telomerase	5L
	3.4	Comparison of chromosomal structure in prokaryotes and eukaryotes	1L
	3.5	Transformation: Definition and transformation in *S.pneumoniae*	1L
	3.6	Transduction: Definition; Explain general features with one example	1L
	3.7	Conjugation: Mechanism, F+, F- and Hfr strain	1L
	3.8	Human Pedigree Analysis	3L
	3.8.1	Standard symbols used in pedigree analysis	
	3.8.2	Applications of pedigree analysis – Autosomal recessive and dominant traits, X-linked recessive and dominant traits, Y-linked traits	
	3.8.3	Problems based on this concept	
		Practicals – RUSBCHP202	1 Credit
	1	Qualitative test for nucleic acids	
	2	Cytochemical staining of RNA by Methyl Green Pyronin	
	3	Demonstration of induction of polyploidy in onion roots	
	4	Smear technique to demonstrate sex chromatin in buccal epithelial cells	
	5	Problems on Mendelian genetics –Mono & dihybrid cross, Back cross, Test cross	
	6	Isolation and spooling of DNA from onion/ moong	
	7	Study of abnormal human karyotype and pedigrees (dry lab)	

References:

1. Voet, D. and Voet, J.G. (2004) Biochemistry, 3rd Edition, John Wiley & Sons, Inc. USA. Biochemistry by Zubay, Geoffrey L.; Wm. C. Brown publishers
2. Zubay, Geoffrey L., Biochemistry; Wm. C. Brown publishers
3. Peter J. Russel, i-Genetics
4. Benamin Lewin, Gene VII, Oxford University Press
5. M.W. Strickberger, Genetics
6. Biochemical methods by S. Sadashivam & A. Minackam, New Age International publisher.Experiments in Molecular Biology - Biochemical Applications - Zachary F. Burton, Jon M. Kaguni
7. Jane B Reece; Neil A Campbell, Campbell biology 9th edition, Boston : Benjamin Cummings / Pearson, ©2011
8. Fundamentals of Cell and Molecular Genetics by Arvind Kumar Misra
9. Genetics From Genes to Genomes by Leland Hartwell, Michael L. Goldberg, Janice Fischer, Leroy Hood
10. Molecular Biology of the Gene: Watson, Baker, Bell, Gann, Levine, Losick; Pearson Benjamin Cummings & CSHL Press
11. Gene cloning & DNA analysis: an introduction; seventh edition; T A Brown; Wiley Blackwell publications

Modality of Assessment (SEMESTER II)

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1	One Assignment/poster presentation/Quiz	20
2	One class Test (multiple choice questions / subjective)	20
	TOTAL	**40**

B) External Examination- 60%- 60 Marks

1. Duration - These examinations shall be of **02 HOURS** duration.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
Q1. A	Any 2 out of 3	04	UNIT I
Q1. B	Any 2 out of 3	06	
Q2. A	Any 2 out of 3	04	UNIT II
Q2. B	Any 2 out of 3	06	
Q3. A	Any 2 out of 3	04	UNIT III
Q3. B	Any 2 out of 3	06	
	TOTAL	60	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Practical I & II
Journal	05
Experimental tasks	15
Total	**20**

B) External Examination: 60%- 60 Marks

Semester End Practical Examination:

Particulars	Practical I & II
Laboratory work	25
Viva	5
Total	**30**

Overall Examination & Marks Distribution Pattern

Semester II

Course	201			202			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	**200**
Practicals	20	30	50	20	30	50	**100**
