

Resolution Number: AC/II(22-23).3.RUS1

S. P. Mandali's

Ramnarain Ruia Autonomous College
(Affiliated to University of Mumbai)



Syllabus for:

**Program: Integrated M.Sc. in Bioanalytical
Sciences**

(T.Y. B.Sc. Sem V Syllabus)

Program Code: RUSBAS

**(Credit Based Semester and Grading System for
the academic year 2023-24)**

GRADUATE ATTRIBUTES

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 work place 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
PO 1	A student completing Bachelor's Degree in Science program in the subject of Bioanalytical Sciences will be able to: This course will impart high quality science education in a vibrant academic ambience with the faculty of distinguished teachers and scientists.
PO 2	It will also equip students for the future who will take up the challenge of doing quality research & teaching and also contribute to industrial production and R & D in the fields of Bioanalysis, Bioinformatics and Nutraceutical Sciences.
PO 3	It will amalgamate classical analytical chemical techniques with modern genomic and proteomic technologies of manufacturing and analysis to better characterize the products useful as medicines as well as nutraceuticals.

Course Code: RUSBAS501
Course Title: Entrepreneurship Skills
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Encouraged to start their own enterprise after getting the insights from the course.
CO2	Prepare for the required skill set of an entrepreneur and also realize the challenges in this area.

Paper Code	Semester V	Lectures
RUSBAS501	ENTREPRENEURSHIP SKILLS	40
501.1 The Entrepreneur		10
<ol style="list-style-type: none"> 1. Entrepreneurial motivation – dynamics of motivation. 2. Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur's role. 3. Case study of Successful Entrepreneurs from India. 		
501.2 Conceptual Frame Work		10
<ol style="list-style-type: none"> 1. Concept, need and process in entrepreneurship development. 2. Change in the Global Business Environment in post Reform Time, LPG Reforms in India. 3. Types of enterprise – Merits and Demerits 4. Government policies and schemes for enterprise development 5. Mudra Yojana, Start Up India. 		
501.3 Business Economics		10
<ol style="list-style-type: none"> 1. Demand analysis, concept & types of demand, law of demand 2. Introduction to Cost & Revenue, its types 3. Cost Classification (Various types of Cost Concepts) 4. STP (segmentation / targeting / positioning) 5. P's of Marketing 6. WTO: Functions and Agreements with Reference to TRIPS, TRIMS and GATS. 7. IPRs and Indian Start Ups, case study approach 		

501.4 Knowledge Management		10
<ol style="list-style-type: none"> 1. Introduction 2. History and Evolution 3. Pillars of Knowledge Management 4. Scope & Significance Technology & Knowledge Management. 5. Critical Success Factors of KM 6. Case Studies 		
RUSBASP501	PRACTICALS	
<ol style="list-style-type: none"> 1. Case Study/Assignment/Project Report/Industrial Visit 2. Work management tools Google sheets 3. Preparing Project plan/ Project management 		

Reference Books:

Entrepreneurship Skills	<ul style="list-style-type: none"> • Eric Ries: The Lean Startup • Kimiz Dalkir: Knowledge Management in theory and Practice • Jugaad Innovation: Radjou, Prabhu, Ahuja
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Course Code: RUSBAS502
Course Title: Biological Sciences V
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Understand and design basic cloning experiments to obtain genetically modified organisms. They should be sensitized regarding ethical guidelines of cloning.
CO2	To identify the importance of phytochemicals as possible drug candidates and learn the techniques to extract phytochemicals from plants

Paper Code	Semester V	Lectures
RUSBAS502	Biological Sciences V	45
502.1: Recombinant DNA Technology		15
Cloning and expression vectors (Plasmids, Phages, Cosmids, YACs, BACs, etc.), Restriction Enzymes, process of generating recombinant DNA, Transgenic Bacteria, Plants and Animals: Commercial applications with suitable examples (Any Two), Application of Transposons as genetic tools, Cloning- current Status, Regulations, Ethics etc.		
502.2: Phytochemistry		15
Primary and secondary metabolites from plants, Classification of Plant Secondary metabolites, Functions of Plant Secondary Metabolites, Chemistry of Phenolics, Terpenoids, Alkaloids, Key factors affecting synthesis of secondary metabolites, Phytochemicals as Drugs, Commercial applications		
502.3: Extraction Technologies for Phytochemicals		15
Extraction of phytoconstituents, Choice of solvent for extraction, classical and modern methods of extraction, Percolation & Maceration, Soxhlet extraction, Steam Distillation & Rotary vacuum evaporator, Liquid- Liquid & Solid Phase Extraction, Ultrasonication, Microwave Assisted Extraction, Supercritical Fluid extraction		
RUSBASP502	PRACTICALS	

1. Extraction of phytoconstituents by maceration, percolation, steam distillation and using Soxhlet extractor
2. Qualitative tests for Phytoconstituents
3. Study of antimicrobial activity of phytoconstituents
4. Extraction of Genomic DNA from suitable plant or microbial material
5. Microscopic evaluation of plants
6. Problems on Restriction enzyme digestion

Reference Books:

Biological Sciences V	<ul style="list-style-type: none">• Molecular Biotechnology: Glick• Biotechnology and Genetic Engineering: Kathy Wilson• Gene Cloning : T.A.Brown• Text book of Pharmacognosy: G.E.Trease, W.C. Evans• Herbal Drug Technology: Agrawal, Paridhavi
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Course Code: RUSBAS503
Course Title: Chemical Sciences V
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	To get acquainted with the basic concepts of atomic and molecular spectroscopy and their applications in bioanalysis also to choose the correct method for analysis based on chemical property of analyte and objective of analysis.
CO2	Introduction to concepts of Raman Spectroscopy and applications of the same.

Paper Code	Semester V	Lectures
RUSBAS503	Chemical Sciences V	45
503.1 Atomic Spectroscopy		15
1. Atomic Absorption Spectroscopy a. Principles & Instrumentation b. Applications 2. Atomic Emission Spectroscopy a. Principles & Instrumentation (Atomic Emission Spectrophotometer, Flame Photometer & Inductively Coupled Plasma- Atomic Emission Spectroscopy, Optical Emission Spectroscopy), Applications 3. Quantitative applications of atomic absorption and flame photometry, calibration curve method, standard addition and internal standard method.		
503.2 Molecular Spectroscopy		15
Molecular Fluorescence and Phosphorescence Spectroscopy: Theory, instrumentation and applications, Dipole moment: Dipole moment, polarization of a bond, bond moment, dipole moment and molecular structure. Rotational Spectrum: Rotational spectrum of a diatomic molecule, rigid rotor, moment of inertia, energy levels, selection rule, nature of spectrum, determination of inter nuclear distance and isotopic shift. Vibrational spectrum: (IR): Vibrational motion, degrees of freedom, modes of vibration, Vibrational		

<p>spectrum of a diatomic molecule, simple harmonic oscillator, energy levels, zero point energy, conditions for obtaining Vibrational spectrum, selection rule, nature of spectrum.</p> <p>Vibrational-Rotational spectrum of diatomic molecule</p> <p>Vibrating rotor, energy levels, selection rule, nature of spectrum, R and P branches, harmonic oscillator: energy levels, selection rule, fundamental band, overtones. Application of vibration rotation spectrum in determining Force constant.</p> <p>Introduction to infrared spectra of simple molecules like H₂O and CO₂.</p>	
<p>503.3 Raman Spectroscopy & IR Spectroscopy</p> <p>Raman Spectroscopy: Scattering of electromagnetic radiation, Rayleigh scattering, Raman scattering, nature of Raman spectrum, Stoke's lines, Anti-Stoke's lines, Raman shift, quantum theory of Raman spectrum, comparative study of IR and Raman spectra, rule of mutual exclusion. (Example of CO₂ molecule)</p> <p>Infrared spectroscopy: Diatomic Molecules, Polyatomic Molecules, Characteristic Vibration Frequencies, Factors Affecting Group Frequencies. Qualitative Analysis –Identification of Structural Features, Quantitative Analysis, Sampling Procedures, Near Infrared Spectrometry, Applications of Infrared Spectroscopy</p>	<p>15</p>

Reference Books:

<p>Chemical Sciences V</p>	<ul style="list-style-type: none"> • Principles of instrumental analysis: Douglas a. Skoog • Introduction to Spectroscopy: Donald L. Pavia • Organic Spectroscopy: William Kemp • Introduction to Molecular Spectroscopy: Gordon M. Barrow • Molecular Luminescence Spectroscopy Methods and Applications John Wiley and sons • Concept Instrumentation and techniques in Atomic Absorption Spectroscopy: Perkin Elmer
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Course Code: RUSBAS504
Course Title: Chemical Sciences VI
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Learn to interpret simple NMR spectra. Introduction to basic concepts of hyphenated techniques which will be useful in studying advanced instrumentation.
CO2	Understand the importance of safe handling of biomatrices. Should be familiar with routine diagnostic tests and advanced instrumentation in pathological testing.

Paper Code	Semester V	Lectures
RUSBAS504	Chemical Sciences VI	45
504.1	Nuclear Magnetic Spectroscopy	15
Chemical shift, Shielding and deshielding of protons, low resolution N.M.R. spectrum of methanol and ethanol. PMR Spectroscopy: Basic theory of NMR, Nature of PMR spectrum, Chemical shift (δ unit), Standard for PMR, Solvents used, Factors affecting Chemical Shift: Inductive effect, Anisotropic effect (with reference to C=C, C \equiv C, C=O and benzene ring), Spin-spin coupling and coupling constant. Proton exchange application of deuterium exchange, Application of PMR in structure determination.		
504.2	Biochemical methods of Analysis	15
Electrophoresis: PAGE, SDS-PAGE, Western Blotting, 2D gel electrophoresis, AGE, ELISA, Microarray		
504.3	Bioanalysis	15
Introduction to Bioanalysis, Different sample matrices and special precautions to be taken while handling clinical samples Biochemical analysis of clinical samples: Glucose, calcium, kidney test, liver test, electrolytes, proteins, complete blood count. Advanced instrumentation in Bioanalysis: Flowcytometer, blood gas analyzer, automatic haematology analyzer, blood glucose analyzer, alcohol breath analyzer		

RUSBASP503 PRACTICALS	
<ol style="list-style-type: none">1. Gravimetric estimation of Nickel as Ni-DMG2. Antioxidant activity of any one sample3. Flame photometric determination- Flame photometric determination of Li/Na/K by Calibration Curve and Standard addition methods4. Spectroscopic Techniques: -<ol style="list-style-type: none">i. Atomic absorption spectroscopy (AAS)- Sample preparation onlyii. Infrared (IR) analysis (Glucose and Glycine)iii. Nuclear Magnetic Resonance (Demo)5. Handling of a biofluid (e.g: Plasma)	

Reference Books:

Chemical Sciences VI	<ul style="list-style-type: none">• Principles of instrumental analysis: Douglas a. Skoog• Introduction to Spectroscopy: Donald L. Pavia• Organic Spectroscopy: William Kemp• Introduction to hyphenated techniques and applications in pharmacy: Patel• Principle and practice of Bioanalysis: Richard F. Venn
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Course Code: RUSBAS505

Course Title: Computational Sciences V

Academic Year 2023-24

T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Comprehend the logic behind dynamic programming algorithms.
CO2	Effectively use bioinformatics algorithms like BLAST and FASTA for sequence alignment and phylogenetic studies.

Paper Code	Semester V	Lectures
RUSBAS505	Computational Sciences V	30
505.1 Dynamic Programming Algorithm		10
<ol style="list-style-type: none"> 1. Needleman & Wunch, Smith & Waterman algorithms for Pairwise alignment 2. Use of pairwise alignments for analysis of Nucleic acid and Protein Sequences and interpretation of results. 3. Overview of BLAST, its variants & working, BLAST algorithm 4. PSI BLAST and PHI BLAST: Working and interpretation of result 		
505.2 Multiple sequence alignment		10
<ol style="list-style-type: none"> 1. Concept of multiple sequence alignment (MSA) 2. Algorithm in MSA and its application 3. Multiple sequence alignment methods 4. PSSM 5. MSA Tool: Clustal Omega- Working 		
505.3 Molecular Phylogenetics		10
<ol style="list-style-type: none"> 1. Phylogenetic analysis 2. Basic concepts in taxonomy and phylogeny. 3. Definition and description of Phylogenetic trees and various methods 4. Clustering method –UPGMA & NJ 5. Cladistic method – Maximum Parsimony 6. Phylogenetic Analysis software Phylip/PAUP 		

RUSBASP504	PRACTICALS
	<ol style="list-style-type: none">1. Working with BLAST2. Basic BLAST<ol style="list-style-type: none">i. Proteinsii. Nucleotides3. Advanced BLAST<ol style="list-style-type: none">i. PHI BLASTii. PSI BLAST4. Working with FASTA<ol style="list-style-type: none">i. Proteinsii. Nucleotides5. Working of Clustal Omega6. Phylogenetic Tree construction & Visualization7. Basics of PHYLIP8. Basics of PAUP

Reference Books:

Computational Sciences V	<ul style="list-style-type: none">• Algorithms and Data structure: Niklaus Wirth• The Art of Computer Programming: Donald E. Knuth• Multiple Sequence Alignment Methods: Russell and Springer• Molecular Evolution and Phylogenetics: Masatoshi Nei and Sudhir Kumar
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Syllabus for:

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(T.Y. B.Sc. Sem VI Syllabus)

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PO 3	It will amalgamate classical analytical chemical techniques with modern genomic and proteomic technologies of manufacturing and analysis to better characterize the products useful as medicines as well as nutraceuticals.

Course Code: RUSBAS601

Course Title: Entrepreneurship Skills

Academic Year 2023-24

T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	To develop innovative ideas which may be commercially viable.
CO 2	Start building knowledge base and skill set which will be useful to start a new enterprise in future.

Paper Code	Semester VI	Lectures
RUSBAS601	ENTREPRENEURSHIP SKILLS	40
601.1 Launching and Organizing An Enterprise		10
<ol style="list-style-type: none"> 1. Environment scanning – Information, sources, schemes of assistance, problems. 2. Enterprise selection, market assessment, enterprise feasibility study 3. SWOT Analysis. 4. Resource mobilisation – How to Manage Finance, Sources of Finance, Technology, Raw material Planning. 5. Quality control and Quality Norms. 		
601.2 Growth Strategies, Networking & Innovation		10
<ol style="list-style-type: none"> 1. Business diversification 2. Future Growth – Techniques of expansion and diversification, vision strategies 3. Types of Business Organisations (Joint Stock, Co-operative, MNCs) 4. Human Resource Management and Start Ups (Training Methods) 5. Case study of Successful Indian Brands. 		
601.3 Principles of Corporate Management		10
<ol style="list-style-type: none"> 1. Principles of Management 2. Functions of management (Planning, Organizing, Directing, Controlling, Coordinating) 3. Quality Circles 4. Management by Wandering Around (MBW) 		

601.4 Innovation	10
<ol style="list-style-type: none"> 1. Introduction 2. Principle 1 Seek Opportunity in adversity 3. Principle 2 Do more with less 4. Principle 3 Think & act flexibly 5. Principle 4 Keep it simple 6. Principle 5 Include the margin 7. Principle 6 Follow your Heart 	
RUSBASP601 PRACTICALS	
<ol style="list-style-type: none"> 1. Case Study/Assignment/Project Report/Industrial Visit 2. Preparing Project plan/ Project management 	

Reference Books:

Entrepreneurship Skills	<ul style="list-style-type: none"> • Jugaad Innovation: Radjou,Prabhu,Ahuja
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Ramnarain Ruia Autonomous College

Course Code: RUSBAS602
Course Title: Biological Sciences V
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Study Phytochemistry with an emphasis on its applications in pharmaceuticals and bioanalysis. To perform and interpret qualitative tests for phytochemicals.
CO 2	To interpret results of molecular biology experiments like PCR and RFLP.
CO 3	Investigate the various aspects and applications of biopharmaceuticals as an upcoming branch in pharmaceuticals.

Paper Code	Semester VI	Lectures
RUSBAS602	Biological Sciences V	45
602.1: Herbal Analysis		15
Classical methods of analysis (Gravimetric & Titrimetric), Chromatographic & Spectroscopic analysis of phytoconstituents Chromatographic fingerprints, Isolation and characterisation of phytoconstituents, Analysis of herbal formulation, Bioactivity guided natural drug discovery		
602.2: Techniques in Recombinant DNA Technology		15
RFLP, AFLP, PCR, RAPD, Nucleic acid probes, Southern Blotting, Northern Blotting, Edible Vaccines, Biosensors and Biochips		
602.3: Introduction to Biopharmaceuticals & Biosimilars		15
Introduction to Biopharmaceuticals, Sources of Biopharmaceuticals (<i>E. Coli</i> , Animal cells, Additional systems), Upstream & Downstream processing, Product Analysis, Therapeutic Hormones, Recombinant Blood Products & Therapeutic Enzymes, Production of antibodies, Vaccines & adjuvants		

RUSBASP602 PRACTICALS

1. Standardization of a solvent for extraction of phytoconstituents
2. Estimation of alkaloids by gravimetry
3. Quantitation of tannins by colorimetry
4. Paper chromatography for Separation of Plant Pigments (Spinach)/ Separation of Amino acids
5. Thin Layer Chromatography of Alkaloids
6. Demonstration of SDS-PAGE
7. Sterility testing of biopharmaceuticals
8. Analysis of Biosimilars by Bradford's method & UV-Visible Spectrophotometer.
9. Study of Chromatographic fingerprint for raw material by: i) HPLTC ii) HPLC iii) GC

Reference Books:

Biological Sciences V	<ul style="list-style-type: none">• The Medicinal Plant Industry: Wojesekera• Pharmaceutical Chemistry: H.J.Roth,A.Kleemann• Pharmacognosy: Tyler,Brody,Robbers• Molecular Biotechnology: Mukesh Pasupuleti• Biosimilars: Regulatory,Clinical and Biopharmaceutical development:Springer
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Course Code: RUSBAS603
Course Title: Chemical Sciences V
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Get associated to the theory and instrumentation of HPLC and GC.
CO 2	To be able to analyze and interpret simple chromatograms.
CO 3	To introduce basics of LC-MS and GC-MS as hyphenated techniques.

Paper Code	Semester VI	Lectures
RUSBAS603	Chemical Sciences V	45
603.1 Liquid chromatography		15
Liquid Chromatography and its development to HPLC and its applications HPLC Instrumentation, Pumps, solvent delivery system, isocratic and gradient programming modes, Sample introduction system, Columns, Detectors. Reversed phase and normal phase chromatography.		
603.2 Gas chromatography		15
Gas Chromatography, Gas Solid and Gas liquid Chromatography and its applications Gas Chromatography Instrumentation, Carrier gas supply, Injectors, Columns, Packed and capillary columns, Column oven and temperature programming, different detectors.		
603.3 Mass spectrometry & Hyphenated techniques		15
Introduction to mass spectroscopy: Concept of mass to charge ratio, study of ionization techniques (electron ionization, chemical ionization, electrospray ionization, atmospheric pressure ionization techniques, thermospray ionization), Components of mass spectrograph. Hyphenation: Need of hyphenation, Interfacing devices Applications of Liquid Chromatography-Mass Spectrometry and Gas chromatography-Mass spectrometry		

Reference Books:

Chemical Sciences V	<ul style="list-style-type: none">● Principles and Practice of Chromatography: B. Ravindranath● High performance liquid chromatography in biotechnology; William S. Hancock● Principle and practice of Bioanalysis: Richard F. Venn● Principles and Techniques of Biochemistry and Molecular Biology by Wilson and Walker● Biochemical methods ; S. Sadasivam, A. Manickam
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Ramnarain Ruia Autonomous College

Course Code: RUSBAS604
Course Title: Chemical Sciences VI
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	To be introduced to basic concepts of drug development and action and understand the importance of a bioanalyst in pharmaceutical industry.
CO 2	Realize the problems involved in analyzing trace elements and complex matrices and learn to choose the suitable bioanalytical method for their analysis.
CO 3	Apply techniques learned in bioanalysis for characterization of nutritional value of a food sample.

Paper Code	Semester VI	Lectures
RUSBAS604	Chemical Sciences VI	45
604.1 Drug development		15
Definition of the following medicinal terms: Pharmacon, Pharmacophore, Drug Formulations Receptors, Drug-receptor interaction, Drug Potency, Drug toxicity, Drug efficiency, Pharmacopoeia. Routes of drug administration with advantages and disadvantages Different dosage forms (emphasis on sustained release formulations) Introduction to Drug Discovery, Design and Development, Discovery of a Lead compound: Screening, drug metabolism studies and clinical observation Classification: Anti-infective agents, Anti-cancer agents, CNS agents Development of drug: Pharmacophore identification, modification of structure or functional group. Different types of chemical transformation of drugs with specific examples. Structure and therapeutic use of Diclofenac sodium (DFS), Aceclofenac, Paracetamol, Phenytoin, Aspirin, Atenolol, Laevodopa, Ciprofloxacin, Metronidazole, Dapsone, Ethambutol		

604.2 Micro analysis and Surface analysis	15
<p>Microanalysis :</p> <p>Problems associated with trace analysis, Special extraction procedures for separating analyte/s from the complex matrix, Extraction of organic/inorganic analyte from organic/inorganic matrix. Special techniques and care to be taken during micro analysis</p> <p>Surface analysis:</p> <p>Surface chemistry, Phenomenon of adsorption, Adsorption isotherms Surface area by BET method, Pore size distribution, Particle size analysis Catalysis, Heterogeneous and homogenous catalysis</p>	
604.3 General Metabolism and Nutrition	15
<p>Overview of mineral metabolism and abnormalities of mineral metabolism with respect to calcium, iron, iodine, fluoride, manganese, selenium</p> <p>Energy metabolism and nutrition: Concepts of calorific value, Respiratory quotient, BMR, RDA, Nutritional indices, proximate principles of diet, protein energy malnutrition, obesity, BMI, diseases related to obesity, glycemic index.</p> <p>Free radicals and anti-oxidants: reactive oxygen species- generation and damage, free radical scavenger systems, inflammation, respiratory, skin and age related diseases, atherosclerosis, lipid per oxidation, preventive and chain breaking anti-oxidants</p>	

RUSBASP603	PRACTICALS
<p>Separation of Organic mixtures:-</p> <ol style="list-style-type: none"> 1. Volatile liquid + Non-volatile liquid (Liquid + Liquid) by fractional distillation method 2. Volatile liquid + Water insoluble solid (Liquid + Solid) by distillation method. <p>Separation Techniques: -</p> <ol style="list-style-type: none"> 1. Column Chromatography of Separation of mixture of dyes/Separation of Plant Pigments (Spinach) 2. Ion Exchange Chromatography of Estimation of sodium using cation exchanger/Estimation of Mg using anion exchange resin column 3. High Performance Thin Layer Chromatography - Menthol and Paracetamol 4. High Performance Liquid Chromatography - Separation of modern drug (Diclofenac sodium) from their combination formulation. 5. Gas Chromatography - Separation of solvent mixtures (Toluene and n-Hexane) 	

Reference Books:

Chemical Sciences VI	<ul style="list-style-type: none">● Pharmaceutical Analysis: David Lee● Excipients and Delivery Systems of Pharmaceutical formulations: Karsa, Stephenson● Microanalysis of solids: Yacobi, Holt, Kazmerski● Surface Analysis Methods in Material Science: Brett Sexton, R. C. Smart● Introduction to nutrition and Metabolism: David A. Bender
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Ramnarain Ruia Autonomous College

Course Code: RUSBAS605
Course Title: Computational Sciences V
Academic Year 2023-24
T.Y.B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Comprehend the programming logic for protein structure prediction, Cheminformatics and drug design.
CO 2	Learn to effectively use bioinformatics tools like Modeller, Marvin Sketch and iGem Dock for basic structural characterization.

Paper Code	Semester VI	Lectures
RUSBAS605	Computational Sciences V	30
605.1 Protein structure prediction		10
<ol style="list-style-type: none"> 1. Protein structure basics 2. Computational prediction methods 3. Homology modeling 4. Protein threading 5. Fold recognition 6. Tools used for prediction 		
605.2 Cheminformatics		10
<ol style="list-style-type: none"> 1. Cheminformatics Introduction 2. Chemical structure storage formats 3. Cheminformatics tools 4. Applications 		
605.3 Computational Drug designing		10
<ol style="list-style-type: none"> 1. Introduction to drugs 2. Steps in drug discovery & development 3. Computational Drug designing 4. Structure based drug designing 5. Virtual Screening 6. Novel drug Targets 		

RUSBASP604	PRACTICALS
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| <ol style="list-style-type: none">1. Introduction to homology modelling using Modeller (demonstration)2. Automated modelling using Swiss Model3. Validation of predicted structures<ol style="list-style-type: none">a. ProSAb. Verify 3Dc. SAVES4. Chemical structure designing- Marvin Sketch/ Marvin View5. Virtual Screening- Docking using various online tools (iGemDock, CB Dock) |
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Reference Books:

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| Computational Sciences
V | <ul style="list-style-type: none">• Cheminformatics: Johann Gastieger• Bioinformatics and drug Discovery: Richard S. Larson |
|-----------------------------|--|