Resolution number: AC/II(23-24).2.RPS1

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for

Program: M.Sc. in Bioanalytical Sciences

(Postgraduate Syllabus)

Program Code: RPSBAS

(As per the guidelines of National Education Policy 2020- Academic year 2024-25)

(Choice based Credit System)

Elective Course: RPSBAS.O506

Course Title: Analytical Chemistry I

Academic Year 2024-25

M.Sc. I

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO 1	Describe the fundamental concepts of analytical chemistry.
CO 2	Apply concepts of chemistry for preparation of buffers of required pH
CO 3	Evaluate the purpose of various analytical instrumentations for routine procedures in an analytical laboratory

DETAILED SYLLABUS

Paper Code	Semester I Paper VI	Credits/ Hours 3/45
RPSBAS.O506	**Analytical Chemistry I**	
506.1 Fundamentals of Analytical Chemistry		**15**
1. Role of analytical chemist in industry 2. Analytical Problem-solving approach 3. Safety protocols and Good Lab Practices of handling chemicals and glassware, handling hazardous chemicals 4. Sample population and Sampling: Importance of sampling, sampling techniques 5. Methods of expressing concentration of solutions 6. Grades of purity of chemicals, solvents and reagents 7. Calibrations- checks and applicability 8. Optimizing analyses and Understanding measurement errors 9. Documentation practices in Analytical Laboratory-use of Microsoft office for documentation of experimental results.		
506.2 pH and Buffers		**15**
1. Acid- Base concept, Hard and soft acid and base (HSAB) 2. Concept of pH, pKa, pKw, Isoelectric pH, Buffer, Buffering Capacity, Relation between pI, pKa1 and pKa2 for a neutral, acidic and basic amino acid.		

3. Ionic product of water, Activity coefficient, Solubility, Complex formation andorganic complexes, Oxidation and reduction equilibria, Hydrolysis of salts and Solubility product 4. Derivations and physiological buffer 5. Preparation and Numericals based on pH and Buffer	
506.3 Basic Analytical Instrumentation	**15**
1. Basic set up of an analytical laboratory 2. Principle, Instrumentation and applications of the following lab equipments: centrifuge, ultrasonicator (probe and bath), vortex machine rotary shaker (for tubes and flasks), rotary evaporator, hot air oven, autoclave, incubator, cyclomixer, pulveriser 3. Principle, Instrumentation and applications of the following basic analytical instruments: pH meter, colorimeter, weighing balance	

RPSBASP.O506: PRACTICAL	**Credits/Hours 1/30**

1. Stoichiometric calculations and preparation of primary and secondary standard solutions.
2. Calculation of concentration of commercial samples of acids and bases
3. Preparation of analytical standard solutions
4. Analysis of dyes using a colorimeter
5. Calibration of pH meter and preparation of buffers
6. Sample preparation using weighing balance, sonicator, microwave, magnetic stirrer, cyclomixer
7. Preparation/ understanding of MSDS

References:

1. Analytical Chemistry, Séamus P. J. Higson, Oxford University Press
2. Analytical Chemistry, Gary D. Christian, Purnendu K. Dasgupta, Kevin Schug, Kevin A. Schug, Wiley Publications
3. Fundamentals of Analytical Chemistry, Douglas A. Skoog/Donald M. West/F. James Holler/Stanley R. Crouch, Cengage Learning India Pvt. Ltd.

Elective Course: RPSBAS.O507
Course Title: Biochemistry and Molecular Biology I
Academic year 2024-25
M.Sc. I

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO 1	Discuss the methods of biological analysis and will be able to detect and quantitate biomolecules from them.
CO 2	Describe the features of Recombinant DNA technology.

DETAILED SYLLABUS

Paper Code	Semester I- Paper VII	Credits/ Hours
RPSBAS.O507	**Biochemistry and Molecular Biology**	**3/45**
507.1: Biomolecules and their analysis		
1. Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids. 2. Qualitative and quantitative analysis of Biomolecules		**15**
507.2: Basic concepts of Molecular Biology		
1. Concepts of Chromosome, Gene, and Genome 2. Central Dogma of Molecular Biology, Replication, Transcription, Translation		**15**
507.3: Recombinant DNA technology		
1. Cloning and expression vectors (Plasmids, Phages, Cosmids, YACs, BACs, etc.), Restriction Enzymes 2. Process of generating recombinant DNA, Transgenic Bacteria, Plants and Animals: Commercial applications with suitable examples (Any Two) 3. Application of Transposons as genetic tools, Cloning- Current status, regulations, ethics etc.		**15**
RPSBASP.O507: PRACTICAL		**Credits/Hours**
1. Extraction and estimation of carbohydrates, proteins, and lipids from a suitable Biological Source. 2. Agarose Gel Electrophoresis (AGE) of the given sample 3. SDS-PAGE of the given sample.		**1/30**

4. RT-PCR demo 5. Scientific writing (Value Addition): Abstract Writing, Scientific referencing formats, Graphical representation.	

References:

1. iGenetics A molecular Approach: Russell
2. Lehninger's Principle of Biochemistry: David Nelson, Michael Cox: Springer 3. Principles of Gene Manipulation and Genomics: Sandy B. Primrose, Richard Twyman 4. Genomics: Concepts and Applications: Caleb Elliot
5. Genomics and Proteomics- Functional and Computational Aspects: Sándor Suhai

Elective Course: RPSBAS.E516

Course Title: Analytical Chemistry II

Academic Year 2024-25

M.Sc. I

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO 1	Describe the fundamental concepts of classical methods in analytical chemistry
CO 2	Apply concepts of chemistry for analysis of real-life samples
CO 3	Evaluate various research avenues in analytical laboratory

DETAILED SYLLABUS

Paper Code	Semester II	Credits/ Hours 3/45
RPSBAS.E516	**Analytical Chemistry II**	
516.1	Classical methods in analytical chemistry	**15**
1. Gravimetric analysis: Methods of precipitation and criteria for choice of organic reagent as precipitant, purity of precipitate and optimum conditions for precipitation 2. Titrimetric analysis: Requirements for a reaction to be used in titrimetric analysis, classification of titrimetric analysis, principles of acid-base, oxidation–reduction, complexometric titrations and precipitation titration with suitable examples. Concept of titration curves and indicators. 3. Principle, Instrumentation and applications of Viscometry		
516.2	Industrial applications of Analytical chemistry	**15**
1. Quality control of Agrochemicals 2. Analysis of ores and minerals 3. Analysis of natural and synthetic polymers 4. Analysis of crude oil and natural gas 5. Environmental monitoring and food safety		
516.3	Research avenues in Analytical chemistry	**15**

1. Analysis of Biomarkers for diseases 2. Analytical probes for detection of biomolecules 3. Lab on chip assays 4. AI in Analytical chemistry	

RPSBASP.E516	**PRACTICAL**	**Credits/ Hours 1/30**
1. Research review for analytical method development. 2. Gravimetric analysis of Nickel from Ni-DMG complex 3. Different types of titrations- Acid base, Estimation of Vitamin C/ Calcium 4. Determination of viscosity of samples using viscometer 5. Concentration/Drying of samples using rotary vacuum evaporator. 6. Operation of Microsoft excel for laboratory data management		

References:

1. Analytical Chemistry, Séamus P. J. Higson, Oxford University Press
2. Analytical Chemistry, Gary D. Christian, Purnendu K. Dasgupta, Kevin Schug, Kevin A. Schug, Wiley Publications
3. Fundamentals of Analytical Chemistry, Douglas A. Skoog/Donald M. West/F. James Holler/Stanley R. Crouch, Cengage Learning India Pvt. Ltd.

Elective Course: RPSBAS.E517
Course Title: Biochemistry and Molecular Biology II

Academic year 2024-25

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO 1	Describe the techniques in recombinant DNA technology and Cell and Gene Therapy Products.
CO 2	Explain the salient features of Clinical Biochemistry.

DETAILED SYLLABUS

Paper Code	Semester II - Paper VII	Credits/ Hours
RPSBAS.E517	**Biochemistry and Molecular Biology II**	**3/45**
517.1Clinical Biochemistry		
1. Introduction to Bioanalysis, Different sample matrices and special precautions to be taken while handling clinical samples 2. Biochemical analysis of clinical samples: Glucose, calcium, kidney test, liver test, electrolytes, proteins, complete blood count. 3. Advanced instrumentation in Bioanalysis: Flow cytometer, blood gas analyzer, automatic haematology analyzer, blood glucose analyzer, alcohol breath analyser		**15**
517.2 Techniques in recombinant DNA technology		
1. RFLP, AFLP, PCR, RAPD 2. Nucleic acid probes, Southern Blotting, Northern Blotting 3. Edible Vaccines, Biosensors and Biochips		**15**
517.3 Cell and Gene Therapy Products		
1. Meaning of gene therapy, Viral & non-viral methods for gene delivery 2. Gene editing techniques: Conventional homologous recombination, RNAi, ShRNA, Cre-LoxP, Mega nucleases, Zinc Finger Nucleases, TALENS, CRISPR/Cas9 3. Stem cell therapy 4. General overview of assays to determine identity, dose, purity, potency and safety of Cell and gene therapy products as per USP <1046>, USP <1047>		**15**
RPSBASP.E517: PRACTICAL		**Credits/ Hours**

1. Purification of DNA from a suitable plant source. 2. Detection of a gene using Polymerase chain reaction 3. Restriction fragment length polymorphism 4. Scientific writing: Report, Research Paper	**1/30**

References:

1. iGenetics A molecular Approach: Russell
2. Lehninger's Principle of Biochemistry : David Nelson, Michael Cox : Springer 3. Principles of Gene Manipulation and Genomics: Sandy B. Primrose, Richard Twyman
4. Genomics: Concepts and Applications: Caleb Elliot
5. Genomics and Proteomics- Functional and Computational Aspects: Sándor Suhai