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

(Post-graduate syllabus)

Program Code: RPSBAS

As per guidelines of National Education Policy 2020-Academic Year 2024-25

(Choice Based Credit System)

GRADUATE ATTRIBUTES

GA	GA Description **A student completing Bachelor's/Master's Degree in Science program will be able to:**
GA1	Demonstrate in depth understanding in the relevant science discipline. Recall, explain, extrapolate and organize conceptual scientific knowledge for execution and application and also to evaluate its relevance.
GA2	Critically evaluate, analyze and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
GA3	Access, evaluate, understand and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
GA4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
GA5	Demonstrate initiative, competence and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups.
GA6	Use an objective, unbiased and non-manipulative approach in collection and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and be sensitive to environmental and sustainability issues and understand its scientific significance and global relevance.
GA7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills and lead a team for planning and execution of a task.
GA8	Understand cross disciplinary relevance of scientific developments and relearn and reskill so as to adapt to technological advancements.

PROGRAM OUTCOMES

PO	Description **A student completing Integrated Master's Degree in Science program in the subject of Bioanalytical Sciences will be able to:**
PO1	Gain high quality science education in a vibrant academic ambience with the faculty of distinguished teachers and scientists.
PO2	Take up the challenge of doing quality research and teaching and also contribute to industrial production and R & D in the fields of Bioanalysis, Bioinformatics and Nutraceutical Sciences.
PO3	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: RPSEBASO604 (Elective Course)

Course Title: Xenobiotic Analysis

Academic year 2024-25

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO1	Give an overview of Xenobiotics
CO2	Explain the generation and identification of xenobiotic metabolites
CO3	Elaborate on the strategies involved in analysis of Xenobiotics from different matrices

DETAILED SYLLABUS

Paper Code	Semester III- Paper IV	Credits/ Hours
RPSEBASO604	**Xenobiotic Analysis**	**3/45**
604.1: Introduction to Xenobiotics		**15**
1. Xenobiotics and their types 2. Environmental impact of Xenobiotics, bioremediation 3. Volatile organic compounds 4. Pharmaceutical Xenobiotics and their biotransformation- Phase reactions 5. Methods for metabolite generation 6. Isolation and identification of drug metabolites 7. Application of accelerated solvent extraction and micro extraction techniques in the analysis of organic contaminants, bioactive and nutritional compounds 8. Safety testing of Drug metabolites		
604.2: Mass spectrometry of Xenobiotics		**15**
1. Quantitation of Biomarkers and Metabolites using LC-MS and LC-MS/MS 2. Quantitation of Biomarkers and Metabolites using HPTLC-MS and GCMS e.g. Headspace Gas 3. Introduction to ICP-MS and its industrial applications. 4. Impurity profiling of drug and drug products 5. Trends in pesticide and residual solvent analysis		
604.3: Other methods for Analysis of Xenobiotics in biological and environmental matrices		**15**
1. Immunoassay of small molecule drugs in Biological fluids(pharmaceuticals and excreted xenobiotic and endogenous metabolites) 2. Capillary electrophoresis in the analysis of drug and drug products 3. Rapid analysis of environmental toxicants 4. Structural elucidation of drug metabolites using NMR		
RPSEBASPO604: PRACTICALS		**Credits/Hours**
1. Extraction and analysis of drug/metabolite from suitable body fluid 2. Detection of pesticide from plasma using suitable chromatographic techniques 3. Analysis of residual solvents using HS-GC/GCMS. 4. Analysis of a drug using Capillary Electrophoresis 5. Structural elucidation of a compound using IR, MS and NMR.		**1/30**

References

1. Principles of Instrumental Analysis, Author: Skoog, Holler, Crouch
2. Environmental Xenobiotics: Mervyn Richardson
3. Advances in the Determination of Xenobiotics in Foods: Belen Gomara, Maria Luisa Marina
4. Method Development for the Analysis of Xenobiotics in Biological Matrix: Roberto Pérez Viera

5. Biotransformation and Metabolite Elucidation of Xenobiotics- Characterization and Identification: In Ala F. Nassar
6. Metabolism of Drugs and Other Xenobiotics: In Pavel Anzenbacher, Ulrich M. Zanger
7. Application of Mass Spectrometric Methods to Analysis of Xenobiotics in Biological Systems: M. L. Gross

Course Code: RPSEBASO605 (Elective Course)

Course Title: Cancer Biology

Academic year 2024-25

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO1	Give an overview of Cancer and causative agents for the same
CO2	Explain the genetic mechanisms involved in cancer
CO3	Elaborate on the diagnosis and therapeutics of cancer

DETAILED SYLLABUS

Paper Code	Semester III- Paper V	Credits/ Hours
RPSEBASO605	**Cancer Biology**	**3/45**
605.1: Introduction to Cancer Biology 1. Understanding tumours, cancers, oncogene, tumour suppressor genes 2. Introduction to carcinogens and their identificaton, 3. Factors controlling metastasis; Angiogenesis, neo-angiogenesis		**15**
605.2: Genetics of cancer 1. Apoptosis and its signal transduction pathways 2. Genetic pathways that protect cells from uncontrolled growth, Pathways regulating tumor initiation and/or its progression, etc 3. Defects in apoptosis leading to cancer 4. Cancer Genome Project		**15**
605.3: Diagnosis and Therapeutics in Cancer		**15**
1. Current diagnostic tools in cancer: Blood biomarkers, Histopathology and Imaging 2. Cancer controlling strategies: Surgery, Chemotherapy, Hormone therapy and Radiation 3. Role of stem cells in cancer therapy		
RPSEBASPO605 PRACTICALS		**Credits/Hours**
1. Amplification of DNA by PCR for cancer detection 2. Gene polymorphism study by RFLP. 3. Nuclear protein determination by Immunohistochemistry method on paraffin embedded tissue. 4. Protein profiling for cancer prediction/detection 5. Bioinformatics tools for cancer prediction (BLAST, MSA, Phyllip) 6. Determination of anticancer potential of natural extracts		**1/30**

References

1. The biology of cancer: Robert Allan Weinberg
2. Introduction to Cancer Biology: Robin Hesketh
3. Cancer Biology: Roger John Benjamin King
4. Cancer Biology and Advances in Treatment: Phuc Van Pham

Course Code: RPSEBASE613

Course Title: Biopharmaceuticals & Biosimilars (Elective Course)

Academic year 2024-25

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO1	Give an account of Biopharmaceutical Industry
CO2	Describe the development and regulations for Biopharmaceuticals & Biosimilars
CO3	Explain the strategies involved in analysis of Biopharmaceuticals and Biosimilars

DETAILED SYLLABUS

Paper Code	Semester IV- Paper III	Credits/Hours
RPSEBASE613	**Biopharmaceuticals & Biosimilars**	**3/45**
613.1: Introduction to Biopharmaceuticals & Biosimilars		**15**
1. Biopharmaceutics Classification System, Types of Biosimilars 2. Cell and gene therapy products 3. Current status of Biopharmaceutical Industry		
613.2: Biopharmaceuticals: Development and Regulations		**15**
1. Development of Biopharmaceuticals 2. Pharmacology, Toxicology, Therapeutic Dosage Formulations, and Clinical Response 3. Regulatory Aspects (United states & Japan) 4. Development and Regulatory framework of Biopharmaceuticals in India		
613.3: Analysis of Biopharmaceuticals and Biosimilars		
1. Analytical methods for analysis of Biopharmaceuticals and Biosimilars 2. Structural and functional characterization of Biosimilars using chromatography and spectroscopy 3. Method Development and validation for Biosimilar and Biopharmaceutical Analysis 4. Bioanalysis of Biopharmaceuticals and Biosimilars		15
RPSEBASPE613: PRACTICALS 1. Study of biopharmaceuticals and Biosimilars (types and assays) 2. Analysis of a Biosimilar using Capillary Electrophoresis 3. Protein purification and analysis 4. Shelf life, stability study of biopharmaceutical 5. Quality control tests for finished biopharmaceuticals		**Credits/Hours** **1/30**

References

1. Biopharmaceutics Applications in Drug Development: Rajesh Krishna & Lawrence Yu
2. Bioavailability and Bioequivalance in Pharmaceutical technology: T. K. Pal, P. K. Ganesan
3. Biopharmaceuticals: S.N. Jogdand
4. Biopharmaceuticals: Biochemistry and Biotechnology: Gary Walsh
5. Biopharmaceutics - From Fundamentals to Industrial Practice: In Hannah Batchelor
6. Biopharmaceutics & Pharmacokinetics: V Venkateswarlu
7. Biosimilars- Regulatory, Clinical, and Biopharmaceutical Development: In Hiten J. Gutka, Harry Yang, Shefali Kakar
8. Biosimilars: A New Generation of Biologics- Jean-Louis Prugnaud, Jean-Hugues Trouvin

Course Code: RPSEBASE614

Course Title: Analytical Instrumentation in disease and disorder diagnostics (Elective Course)

Academic year 2024-25

COURSE OUTCOMES

COURSE OUTCOME	DESCRIPTION
CO1	Give an overview of disease and disorder detection strategies
CO2	Explain spectroscopic diagnostic tools for detection of disease and disorders
CO3	Explain chromatographic diagnostic tools for detection of disease and disorders

DETAILED SYLLABUS

Paper Code	Semester IV- Paper IV	Credits/Hours
RPSEBASE614	**Analytical Instrumentation in disease and disorder diagnostics**	**3/45**
614.1: Introduction to diagnosis		**15**
1. Disease vs Disorder 2. Importance of Biomarkers and establishments of thresholds 3. Classification of Biomarkers 4. Biomarkers in Monitoring and Therapy of Diseases/Disorders		
614.2: Spectroscopic techniques in diagnosis		**15**
1. Application of Raman Scattering in detection of Kidney stones, bone disease and diabetes 2. Magnetic Resonance spectroscopy in neural disorders with suitable example 3. Fluorescence Spectroscopy for tracking abnormalities with suitable example		
614.3: Chromatographic techniques in diagnosis		**15**
1. Application of Chromatography in inborn errors 2. Application of GC in diagnosis of infectious diseases 3. Application of HPLC in blood disorders 4. Application of Chromatography in management of disorders		
RPSEBASPE614: PRACTICALS		**Credits/Hours**
1. Estimation of Hemoglobin using spectroscopic methods 2. Estimation of blood glucose levels 3. Quantitation of hemoglobin using HPLC 4. Detection of infectious diseases 5. Liver profiling using spectroscopic tools 6. Study of biomarkers for Cancer		**1/30**

References

1. Clinical Biochemistry: Techniques And Instrumentation: A Practical Course: John S Varcoe
2. Fundamentals of Clinical Chemistry and Molecular Diagnostics: Carl A. Burtis, David E. Bruns
3. Analytical Techniques for Clinical Chemistry- Methods and Applications: Gyula Záray, Sergio Caroli
4. Laboratory Instrumentation: Gregory A. Tetrault, Jerald R. Schenken, Mary C. Haven