AC/II(20-21).2.RUS3

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for

Program: UG Biotechnology

Program Code: RUSBTK

(Credit Based Semester and Grading System for Academic Year 2020–2021)

PROGRAM OUTCOMES

PO	PO Description **A student completing Bachelor's Degree in Science program will be able to:**
PO 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.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
PO 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.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
PO 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.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 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.
PO 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 SPECIFIC OUTCOMES

PSO	Description **A student completing Bachelor's Degree in Science program in the subject of Biotechnology will be able to:**
PSO 1	Adept in basic sciences along with a thorough understanding of biotechnology principles and chemical sciences to create a foundation for higher education with the insights into interdisciplinary approach.
PSO 2	Demonstrate the applications of fundamental biological processes from the molecular, cellular, industrial and environmental perspective.
PSO 3	Develop effective communication skills with improved individual and team work abilities in the domain of scientific research writing. Showcase their innovative ideas and research work efficiently.
PSO 4	Reflect, analyse and interpret information or data for investigating the problem in fields of biotechnology. Acquire scientific and entrepreneur skills to furnish sustainable solutions to coeval problems
PSO 5	Illustrate the relevance of ethical implications and standard laboratory practices in tissue culture techniques, forensic biology, developmental biology and other fields of biotechnology.
PSO 6	Apply the conceptual knowledge to develop coherent, efficacious and proficient practical, technical and analytical skills.

PROGRAM OUTLINE

YEAR	SEMESTER	COURSE CODE	COURSE TITLE	CREDITS
I	I	RUSBTK101	Basic chemistry I	2
		RUSBTK102	Bioorganic Chemistry	2
		RUSBTKP101	Practicals based on RUSBTK101 & RUSBTK102	2
		RUSBTK103	Biodiversity and cell biology	2
		RUSBTK104	Microbial techniques	2
		RUSBTKP103	Practicals based on RUSBTK103 & RUSBTK104	2
		RUSBTK105	Introduction to Biotechnology	2
		RUSBTK106	Molecular Biology-II	2
		RUSBTKP105	Practicals based on RUSBTK105 & RUSBTK106	2
		RUSBTK107	Foundation Course	2
I	II	RUSBTK201	Basic Chemistry-II	2
		RUSBTK202	Physical Chemistry	2
		RUSBTKP201	Practicals based on RUSBTK201 & RUSBTK202	2
		RUSBTK203	Physiology and Ecology	2
		RUSBTK204	Genetics	2

		RUSBTKP203	Practicals based on RUSBTK203 & RUSBTK204	2
		RUSBTK205	Tissue Culture & Scientific Writing and Communication Skills	2
		RUSBTK206	Enzymology, Immunology and Biostatics	2
		RUSBTKP205	Practicals based on RUSBTK205 & RUSBTK206	2
		RUSBTK207	Foundation Course	2
II	**III**	RUSBTK301	Biophysics	2
		RUSBTK302	Applied Chemistry- I	2
		RUSBTKP301	Practicals based on RUSBTK301 & RUSBTK302	2
		RUSBTK303	Immunology	2
		RUSBTK304	Cell Biology and Cytogenetics	2
		RUSBTKP303	Practicals based on RUSBTK303 & RUSBTK304	2
		RUSBTK305	Molecular Biology	2
		RUSBTK306	Bioprocess Technology & General Microbiology	2
		RUSBTKP305	Practicals based on RUSBTK305 & RUSBTK306	2

		RUSBTK307	Research Methodology and Scientific Writing	2
II	**IV**	RUSBTK401	Biochemistry	2
		RUSBTK402	Applied chemistry II: Physical Chemistry	2
		RUSBTKP401	Practicals based on RUSBTK401 & RUSBTK402	2
		RUSBTK403	Medical Microbiology	2
		RUSBTK404	Environmental Biotechnology	2
		RUSBTKP403	Practicals based on RUSBTK403 & RUSBTK404	2
		RUSBTK405	Biostatistics and Bioinformatics	2
		RUSBTK406	Molecular Diagnostics	2
		RUSBTKP405	Practicals based on RUSBTK405 & RUSBTK406	2
		RUSBTK407	Entrepreneurship Development	2
III	**V**	RUSBTK501	Cell Biology	2.5
		RUSBTK502	Biochemistry	2.5
		RUSBTKP501	Practicals based on RUSBTK501 & RUSBTK502	3
		RUSBTK503	Genetics and Molecular Biology	2.5
		RUSBTK504	Industrial Biotechnology	2.5

		RUSBTKP502	Practicals based on RUSBTK503 & RUSBTK504	3
		RUSBTK505	Forensic sciences-I	2
		RUSBTKP503	Practicals Based on RUSBTK505	2
III	**VI**	RUSBTK601	Immunology, Virology and Instrumentation	2.5
		RUSBTK602	Developmental biology and transgenesis	2.5
		RUSBTKP601	Practicals Based on RUSBTK601 & RUSBTK602	3
		RUSBTK603	Pharmacology	2.5
		RUSBTK604	Biosafety and Plant biotechnology	2.5
		RUSBTKP602	Practicals Based on RUSBTK603 & RUSBTK604	3
		RUSBTK605	Forensic sciences-II	2
		RUSBTKP603	Practicals Based on RUSBTK605	2

SEMESTER III

Course Code: RUSBTK301

Course Title: Biophysics

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Discuss the characteristics and properties of Optics and lasers.
CO 2	Differentiate between various types of spectrophotometer based on its working and construction.
CO 3	Illustrate the applications of spectroscopy and microscopy in analysis & identification of various biological samples.
CO 4	Examine the propagation of different sound waves.
CO 5	Describe the significance of heat and temperature in the construction of temperature sensors and probes.
CO 6	Discriminate the components of various samples based on their migration in the electric field and demonstrate the separation of various biomolecules using the technique of electrophoresis.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK301	**I**	**Spectro Optics and Electromagnetic Radiations** **Introduction to Optics and Lasers:** ***Optics* :** Properties of Light - Reflection, Refraction, Dispersion, Interference. ***Lasers* :** Properties of Lasers, Stimulated Emissions, Laser Action; Applications of Laser. **Electromagnetic Radiations:** Introduction to Electromagnetic radiations **:** Types and Properties of Spectra; Basic Laws of Light Absorption. Spectrophotometer:-Principle, Instrumentation and Applications; UV-Vis Spectrophotometer, Single and Dual Beam Spectrophotometer. **Microscopy:** Types of Microscopy; Electron Optics; Electron Microscopy- Preparation of Specimen, SEM, TEM and Immuno-Electron Microscopy. Fluorescence Microscopy.	**15**
	II	**Heat, Sound, Magnetism and Fluid Dynamics** Heat: Concept of Temperature; Modes of Heat Transfer; Measuring Temperature; Platinum Resistance Thermometer; Thermocouple and Thermistors. Sound:	**15**

		Types of Sound Waves Audible, Ultrasonic and Infrasonic Waves; Doppler Effect; Applications of Ultrasonic Waves. Magnetism: Magnetic Field; Magnetism of Earth; Paramagnetism, Diamagnetism, Ferromagnetism. Nuclear Magnetism and Biomagnetism. Fluid Dynamics: Viscosity: Definition Flow of Liquids through Capillaries; Stokes' Law; Terminal Velocity. Determination of 'η' by Falling Sphere Method; Viscosity Estimation by Oswald's Viscometer. *Surface Tension*: Definition- Surface Tension and Surface Energy; Capillary Action; Angle of Contact; Wettability; Temperature Dependence of Surface Tension. Applications in Biology.	
	III	**Electrophoresis:** Migration of Ions in an applied electric field; Factors affecting Electrophoretic Mobility; Moving Boundary Electrophoresis; Paper Electrophoresis; AGE; Native and SDS PAGE (reducing and nonreducing, continuous and discontinuous); IEF and 2D PAGE, Pulse field and Capillary electrophoresis. Staining and Detection Methods; Gel –Documentation, Applications in Biology	15

References:

1. Principle and techniques of Biochemistry – Wilson and Walker
2. Biophysical Chemistry – Upadhyay, Upadhyay & Nath
3. Principles and techniques of biophysics – V. Kumaresan
4. Introduction to electrodynamics – David Griffiths
5. Elements of electromagnetics – Sadiku
6. A textbook of heat and mass transfer – R. K. Rajput

7. Fundamentals of heat and mass transfer – C P Kothandraman

Course Code: RUSBTK302

Course Title: Applied Chemistry – I

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Discuss the factors affecting the solubility of a precipitate.
CO 2	Enumerate the different steps involved in a precipitation gravimetry.
CO 3	Explain the effect of various experimental factors on the particle size of the precipitate.
CO 4	Define the various terms involved in titrimetric analysis.
CO 5	Explain the theory of acid-base indicators and choose a suitable indicator for a particular acid-base titration.
CO 6	Relate some of the properties of the water to its chemical makeup.
CO 7	Determine the aesthetic quality of water by examining its physical, chemical & biological parameters.
CO 8	Propose the benefits of green chemistry in chemical synthesis.
CO 9	Formulate the synthesis of various green reagents which are environment and eco- friendly.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK302	**I**	**Classical methods of analysis** **Gravimetric analysis:** Introduction to gravimetric analysis, types of gravimetric analysis, conditions for a reaction to be used in gravimetric analysis, solubility and solubility product, factors affecting solubility: temperature, common and diverse ion effect, pH, nature of the solvent, complexation. Unit operations in gravimetric analysis, precipitation, homogeneous and heterogeneous precipitation, relative supersaturation, nucleation and crystal growth, their effect on particle size, Ostwald's ripening, impurities associated with precipitate formation, filtration, washing of the precipitate, drying and incineration, use of thermal methods. **Titrimetric analysis** Introduction to titrimetric analysis, conditions for a reaction to be used in titrimetric analysis, terms involved: titrant, titrand, indicator, equivalence point, endpoint, titration error, types of titrations. **Acid –base titrations** Acid base indicators, theory of acid base indicators, conditions for choosing an indicator. Types of acid base titrations, titration curves. Construction of the titration curves and the choosing of the indicator for A) strong acid –strong base	**15**

		B) strong acid –weak base C) weak acid – strong base D) weak acid –weak base Titration of dibasic acid with a strong base, condition for obtaining two separate equivalence points, qualitative description of the titration curve, determination of the dissociation constant Titration of phosphoric acid with a strong base	
	II	**Environmental Chemistry** Chemistry of water Water as a natural resource: Physical and Chemical properties of water, significance of water as a universal solvent and its properties viz. pH, Dielectric constant, boiling point. Anomalous behavior of water. Hydrological cycle. Chemical composition of groundwater. Factors affecting solubility of gases in water. Solubility of CO_2 and O_2 in water. Water quality: Parameters for determining water quality i) Physical parameters: - pH, pE, conductivity, TS, TSS, TDS ii) Chemical Parameters- acidity, alkalinity, hardness, salinity, chlorine demand, DO, COD, iii) Biological parameter – BOD, MPN Standards for Potable and industrial water	**15**
	III	**Green Chemistry & Nanomaterials** **Green Chemistry and Synthesis:**	**15**

		Introduction to Green Chemistry; Need and Relevance of Green Chemistry; Principles of Green Chemistry. Green Synthesis in Industry: Green Materials, Green Reagents, Green Solvents and Green Catalysts. **Nanomaterials:** Introduction to Nanomaterials. Forms of Nanomaterials: Nanoparticles, Nanofilms and Nanotubes Synthesis and Characterization of Nanomaterials. Applications of Nanomaterials.	

References:

1. University General Chemistry, 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India

2. Physical Chemistry University for biological sciences, 1st edition, (2005), Chang R., Science Books, USA

3. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.

4. Concise Inorganic Chemistry .5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.

5. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)

Course Code: RUSBTKP301

Course Title: Practicals Based on RUSBTK301 & RUSBTK302

DETAILED SYLLABUS

Course Code	Title	Credits
RUSBTKP301	1. Determination of Purity of Plasmid DNA using UV Spectrophotometry. 2. Study of the Structure and Function of an Electron Microscope (Visit / Video Demonstration - including Sample Preparation and Staining). 3. Demonstration of Structure and Working of a Fluorescence Microscope (Stained Preparation). 4. Electrophoresis of Proteins by PAGE. 5. Chemical and Biological Synthesis of Silver Nanoparticles and its Characterisation by UV- VIS Spectrophotometer 6. To study the kinetics of the reaction between $K_2S_2O_8$ and KI for equal concentration 7. To determine the amount of strong acid in the given solution by conductometric titration. 8. To determine the amount of strong acid in the given solution by pH-metric titration. 9. Organic preparation and their purification: 10. Use 0.5-1.0g of the organic compound. Purify the product by recrystallization. Report theoretical yield, percentage yield and melting point of the purified product. Preparation of: a. m-Dinitrobenzene from nitrobenzene	**2**

	b. Phthalic anhydride from phthalic acid by sublimation c. P-bromoacetanilide from acetanilide 11. Quantitative determination of salts such as copper sulphate pentahydrate, nickel chloride hexahydrate, anhydrous cupric chloride using standard volumetric methods (any 1) 12. Gravimetric estimation of Nickel (II) as Ni-DMG.	

References:

1. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
2. SYBSc Chemistry Laboratory Manual.

Course Code: RUSBTK303

Course Title: Immunology

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Examine the molecules involved in immune effector response and mechanism.
CO 2	Discriminate the significance of molecules in eliminating the foreign antigen
CO 3	Establish the mechanism by which the effector molecules distinguish self from non-self-cells.
CO 4	Differentiate the precipitation and agglutination reactions using suitable examples and effectively determine various tests used for detection of antigens.
CO 5	Analyse the significance and applications of advanced immuno techniques.
CO 6	Apply the advanced immuno techniques for detection of pathogens.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK303	**I**	**Effectors of Immune Response** Haematopoiesis; Complement System- Classical, Alternate and Lectin; Regulation and Biological Effects of Complement System; Deficiencies of Complement System	**15**

	II	**Antigen antibody interaction techniques- Precipitation Reactions:** Immunoprecipitation, Immunoelectrophoresis, CIEP, Rocket Electrophoresis and 2-D Immunoelectrophoresis **Agglutination Reactions:** Passive, Reverse Passive, Agglutination Inhibition. Coomb's Test; Complement Fixation Tests. Synthesis of Monoclonal antibodies & Applications.	**15**
	III	RIA, ELISA, ELISPOT, Chemiluminescence, Western Blot, Immunofluorescence, Flow Cytometry. Alternatives to Antigen- Antibody Reactions	**15**

References:

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY

2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India

3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.

4. Introduction to Immunology- C V Rao- Narosa Publishing House

Course Code: RUSBTK304

Course Title: Cell Biology & Cytogenetics

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Discuss the structure and components of cytoskeleton.
CO 2	Examine the essential proteins required for muscle contractility.
CO 3	Describe the proteins integral to the structure and function of cell membrane.
CO 4	Devise the techniques to study the movement of protein and lipid molecules in the cell membrane
CO 5	Deduce the formation of heterochromatin and Euchromatin and apply diverse techniques to examine the chromosomes.
CO 6	Analyse the syndrome associated with the improper formation of heterochromatin.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK304	**I**	**Cytoskeleton:** Overview of the Major Functions of Cytoskeleton. Microtubules: Structure and Composition.	**15**

		MAPs: Functions- Role of Mitosis, Structural Support and Cytoskeleton Intracellular Mobility. Motor Proteins: Kinesins, Dynein; MTOCs. Dynamic Properties of Microtubules. Microtubules in Cilia and Flagella. Microfilaments: Structure, Composition, Assembly and Disassembly. Motor Protein: Myosin. Muscle Contractility: Sliding Filament Model. Actin Binding Proteins; Examples of Non Muscle Motility. Intermediate Filaments: Structure and Composition; Assembly and Disassembly; Types and Functions.	
	II	**Cell Membrane:** Uptake of Nutrients by Prokaryotic Cells; Overview of membrane functions, History on Plasma membrane structure, Chemical composition of membranes-Membrane carbohydrates & Membrane lipids. Integral, Peripheral & Lipid anchored membrane proteins, Importance & maintenance of Membrane fluidity, Asymmetry of membrane lipids, Lipid rafts, Diffusion of Membrane proteins after cell fusion, Restrictions on Protein and Lipid mobility, Red Blood cell – An example of Plasma membrane structure.	**15**

	III	**Cytogenetics:** Structure of Chromosome- Heterochromatin, Euchromatin, Polytene Chromosomes. Variation in Chromosomal Structure and Number: Deletion, Duplication, Inversion, Translocation, Aneuploidy, Euploidy and Polyploidy and Syndromes- Klinefelter, Turner, Cri-du-chat, Trisomy -21, Trisomy 18 and Trisomy 13. **Sex Determination and Sex Linkage:** Mechanism of Sex Determination (XX-XY, ZZ-ZW, XX-XO) Dosage Compensation and Barr Body. **Genetic Linkage, Crossing Over and Chromosomal Mapping:** Tetrad Analysis, Two-point Cross, Three Point Cross, Pedigree Analysis	**15**

References:

1. Cell and Molecular Biology – De Robertis- Lippincott Williams& Wilkins
2. Cell and Molecular Biology- Concepts and Experiments—Karp – Wiley International
3. Essential iGenetics- Peter Russell -Pearson Education
4. Microbial Genetics- Freifelder –Narosa Publishing House
5. Genetics, (2006) Strickberger MW - (Prentice Hall, India)
6. Human Genetics- A. M. Winchester – MacMillan Press

Course Code: RUSBTKP303

Course Title: Practicals Based on RUSBTK303 & RUSBTK304

DETAILED SYLLABUS

Course Code	Title	Credits
RUSBTKP303	1. WIDAL test – Qualitative & Quantitative 2. ELISA (Kit based). 3. Dot ELISA 4. Single radial immunodiffusion 5. Ouchterlony's double immunodiffusion 6. Study of Abnormal Karyotyping (Chromosomal Aberration) - Deletion, Duplication, Inversion, Translocation and Syndromes- Trisomy 21, Trisomy 13, Trisomy 18, Klinefelter, Turner and Cri-du-Chat. (By usage of Software) 7. Video demonstration of G- banding 8. Induction of Polyploidy by PDB/ Colchicine/ UV Treatment Using Suitable Plant material 9. Study of Polytene Chromosomes 10. Mapping based on Tetrad Analysis and Three Point Cross. 11. Pedigree Analysis- Autosomal and Sex- Linked.	**2**

References:

1. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India

2. Genetics, (2006) Strickberger MW - (Prentice Hall, India)

3. Human Genetics- A. M. Winchester – MacMillan Press

Course Code: RUSBTK305

Course Title: Molecular Biology

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Examine the steps involved in the transcription of prokaryotes and eukaryotes.
CO 2	Discuss the role of RNA polymerase in the process of transcription.
CO 3	Explain the phenomenon of Wobble hypothesis.
CO 4	Express the in-depth mechanism of protein synthesis.
CO 5	Determine the significance of operon in gene expression.
CO 6	Illustrate the importance of jumping genes in maize

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK305	**I**	**Gene Expression – Transcription** Gene Expression- an Overview. Transcription Process in Prokaryotes: RNA Synthesis; Promoters and Enhancers; Initiation of Transcription at Promoters; Elongation and Termination of an RNA Chain. Transcription in Eukaryotes Transcription of Protein Coding Genes by RNA Polymerase	**15**
	II	**Gene Expression- Translation** **Nature of Genetic Code.** **Wobble Hypothesis.** **Translation:** Process of Protein Synthesis (Initiation, Elongation, Translocation, Termination)	**15**

	III	**Regulation of Gene Expression** In prokaryotes: In Bacteria: *Lac* operon of *E. coli, trp* Operon of *E. coli.* In Eukaryotes: Operons in Eukaryotes; Control of Transcriptional Initiation Jumping genes in maize	**15**

References:

1. Genes XI, 11th edition (2012), Benjamin Lewin, Publisher - Jones and Barlett Inc. USA

2. Molecular Biology of the Gene, 6th Edition (2008), James D. Watson, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc. USA

3. Molecular Biology, 5th Edition (2011), Weaver R., McGraw Hill Science. USA

4. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi, Oxford University Press.

5. Molecular Biology: genes to proteins, 4th edition (2011), Burton E Tropp Jones& Bartlett Learning, USA

Course Code: RUSBTK306

Course Title: Bioprocess technology & General Microbiology

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Develop an understanding of the various aspects of Bioprocess Technology.
CO 2	Determine the techniques used for screening of organisms.
CO 3	Develop skills associated with enrichment and screening of Industrially Important Strains.
CO 4	Establish principles underlying design of Fermenter and Fermentation Process.
CO 5	Illustrate the concept of air sanitation & air borne diseases.
CO 6	Develop the fundamentals of analysis of potable water and demonstrate the significance of media to characterise the organisms.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK306	**I**	Microorganisms in Industrial Processes Types of Microorganisms used in Industrial Processes: Bacteria, Fungi, Algae (Microalgae, Macroalgae & Cyanobacteria), Potentials & Challenges.	**15**

		Screening and Maintenance of Strains: Primary Screening and Secondary Screening; Cultivation; Preservation of Industrially Important Microbial Strains. Strain improvement, Inoculum development – One example each.	
	II	**Fermenter, Fermentation Processes & Industrial Productions** Design of a fermenter: Stirred Tank Fermenter, Air lift, Pneumatic, Bubble column, Tower fermenter, - Basic Design; Parts of a Typical Industrial Fermenter. Process Parameters: *pH*, Temperature, Aeration, Agitation, Foam, Pressure, Inlet and exit gas analysis, Dissolved oxygen. Carbon dioxide electrodes, microbial biomass, Safety valves. Study of Representative Fermentation Processes: Outline of Penicillin, Ethanol, and Streptomycin & Vinegar Production by Fermentation along with a *flow-diagram.*	**15**
	III	**Microbiology of Air** The atmosphere, Aero-microbiological pathway, Number and kind of microorganisms in air, Airborne diseases, Dust, Droplet & Droplet nuclei, Sampling, Quantitative & Qualitative	**15**

		methods for enumeration of bacteria in air, Air sanitation (Chemical & Physical methods) **Microbiology of water** Introduction to aquatic microbiology, Distribution of aquatic environment, Types of microorganisms. Microbiology of potable water a. Introduction – Definition & characteristics, standards, demand & use, various sources, water borne diseases. b. Analysis of potable water – Physical, Chemical & Biological parameters. **Microbiology of Soil** Nature of soil, Microorganisms in soil, Functions of microorganisms in soil.	

References:

1. Industrial Microbiology- A. H. Patel
2. Industrial Microbiology- L. E. Casida- John Wiley & Sons
3. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY
4. Presscott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGraw-Hill Science Engineering, USA

Course Code: RUSBTKP305

Course Title: Practicals Based on RUSBTK305 & RUSBTK306

DETAILED SYLLABUS

Course code	Title	Credits
RUSBTKP305	1. Study of *E. coli* Diauxic Growth Curve- (Lactose and Glucose) 2. Expression of β- galactosidase and Measurement of Activity. 3. Screening for an Antibiotic Producing Strain of Microorganism 4. Screening for an Acid producing strain of microorganism 5. Lab Scale Production of Penicillin (Static and Shaker) 6. Lab Scale Production of Ethanol 7. Estimation of Penicillin from Recovery Broth by Chemical (Iodometric) Method. 8. Estimation of Penicillin from Recovery Broth by Biological (Bioassay) Method. 9. Estimation of Alcohol from Recovered Broth by Dichromate Method. 10. Isolation, Quantitative Analysis and AGE of Genomic DNA from Bacteria and Yeast. 11. Enrichment of microorganisms from air. 12. Enrichment of microorganisms from water 13. Enrichment of organisms from soil 14. Study and preparation of Winogradsky's column 15. Contact slide method 16. Demonstration of Reference Management Software (Mendley) 17. Introduction to Grammar software	**2**

References:

1. Principles of fermentation technology – Stanbury and Whittaker.
2. General Microbiology (Volume I) – C B Powar
3. General Microbiology (Volume II) – C B Powar

Course Code: RUSBTK307

Course Title: Research Methodology & Scientific writing

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Illustrate the meaning and objectives of research methodology.
CO 2	Identify the problems involved in research
CO 3	Explain the need and significance of research designs.
CO 4	Determine the significance of data collection and its relationship with research interpretation.
CO 5	Analyse the process of scientific writing.
CO 6	Organize the data for writing a research paper

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK307	**I**	**Introduction to Research Methodology and Research Problem** Meaning of Research; Objectives of Research; Motivation in Research; Types of Research; Research Approaches; Significance of Research; Research Methods versus Methodology;	**15**

		Research Process; Criteria of Good Research; Problems Encountered by Researchers in India; What is a Research Problem? Selecting the Problem; Necessity of Defining the Problem; Technique Involved in Defining a Problem	
	II	**Research Design, Data Collection Interpretation and Report Writing** Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design; Different Research Designs; Basic Principles of Experimental Designs; Developing a Research Plan- Collection of Primary Data; Observation Method; Interview Method; Collection of Data through Questionnaires; Collection of Data through Schedules; Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different steps in report writing, Layout of research report, Types of report, Mechanics of writing a research report, Precaution for writing a research report.	**15**
	III	**Scientific writing** Process of Scientific Writing: Thinking, Planning, Rough Drafts and Revising Contents. Introduction	**15**

		to Scientific Reports and Writings Compilation of Experimental Data, Communication Methods in Science, Examples of Scientific and Unscientific Writing. Writing Papers, Reviews, Bibliography Plagiarism--Introduction to Plagiarism, Examples of Plagiarism. Introduction to Reference Management software (Mendley) & Grammarly software.	

References:

1. Research methodology: Methods and techniques – C R Kothari
2. Research Methodology - T Bhaskara Rao
3. The Craft of Scientific writing – Michael Alley
4. The Scientist's guide to writing – Stephen Heard
5. Writing Science – Joshua Schimel

Modality of Assessment (SEMESTER III)

Theory Examination Pattern:

A. Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1	One Assignment (Animations/Presentations/Posters/ Video Making/ Skits/ Written assignments/Mind maps/ Concept Maps / Info graphs)	20
2	One class Test (multiple choice questions or objective & one sentence)	20
	Total Marks	40
	TOTAL	**40**

B. External Examination- 60%- 60 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **02 hours** duration.

2. Theory question paper pattern:

i. There shall be **03** questions each of **20** marks. On each unit there will be one question. All questions shall be compulsory with internal choice within the questions.

ii. 60% options will be provided.

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1) A)	Any 5 out of 8	05	Unit I
Q.1) B)	Any 3 out of 5	15	
Q.2) A)	Any 5 out of 8	05	Unit II

Q.2) B)	Any 3 out of 5	15	
Q.3) A)	Any 5 out of 8	05	Unit III
Q.3) B)	Any 3 out of 5	15	
	TOTAL	**60**	

Practical Examination Pattern:

A. **Internal Examination: 40%- 40 Marks**

Particulars	
Journal	10
Experimental tasks	30
Total	**40**

Note- Similar pattern for internal practical will be followed for all three Practical papers.

B. **External Examination: 60%- 60 Marks**

Semester End Practical Examination:

Particulars	**Paper**
Experimental tasks	RUSBTKP301, RUSBTKP303, RUSBTKP305
Laboratory work	60
2 major practicals	40
1 minor practical	10
Viva / Spots	5 + 5
Total	**60**

Overall Examination & Marks Distribution Pattern

SEMESTER III

Course	RUSBTK301			RUSBTK302			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP301						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK303			RUSBTK304			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP303						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK305			RUSBTK306			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP305						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK307			Grand Total
	Internal	External	Total	
Theory	40	60	100	100

SEMESTER IV

Course Code: RUSBTK401

Course Title: Biochemistry

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Discuss the mechanism and steps involved in the reactions of carbohydrate metabolism and devise appropriate biochemical tests for their detection.
CO 2	Explain the regulation and ATP formation in the breakdown and synthesis pathways.
CO 3	Analyse the energy formation via Oxidative phosphorylation.
CO 4	Estimate the role of amino acids in providing energy and excretion.
CO 5	Differentiate between Glucogenic and Ketogenic amino acids.
CO 6	Analyse the lipid metabolism pathway & correlate between the steps and the reaction energetics.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK401	**I**	**Carbohydrate Metabolism, ETS** **Carbohydrate Metabolism:** Glycolytic Pathway and its Regulation, Homolactic Fermentation; Alcoholic Fermentation; Energetics of Fermentation; Citric Acid Cycle and its Regulation **Electron Transport System:** Electron Transport and Oxidative Phosphorylation. Inhibitors of ETS	**15**
	II	Amino Acid Metabolism Amino Acid Breakdown: Deamination, Transamination, Urea Cycle, Breakdown of Glucogenic and Ketogenic Amino Acids. Amino Acids as Biosynthetic Precursors	**15**
	III	**Lipid Metabolism** Mobilization, Transport of Fatty Acids. Beta, Alpha and Omega Oxidation of Saturated Fatty Acids; Oxidation of Unsaturated Fatty Acids, Oxidation of Odd Chain Fatty Acids. Energy Yield, Ketone Body Breakdown to Yield Energy.	**15**

		(Sequence of Reactions, Regulation, Energy Yield and Metabolic Disorders of the above Pathways)	

References:

1. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA

2. Principles of Biochemistry, 4th edition (1997), Jeffory Zubey, McGraw-Hill College, USA

3. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.

4. Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA

5. Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H.Freeman and company, NY

Course Code: RUSBTK402

Course Title: Applied Chemistry – II

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Apply the concepts of Gibbs' and Helmholtz Free Energy to EMF measurements.
CO 2	Describe the types of Electrodes and Electrochemical Cells.
CO 3	Derive Nernst Equation and can give its applications.
CO 4	Calculate the pH for strong and weak electrolytes and Buffer Action.
CO 5	Apply the theoretical principles of chromatography learned to separate and quantify different components present in a sample.
CO 6	Explain the basic principle involved in quantitative analysis using UV-Vis spectroscopy.
CO 7	Describe the function of the different components of a colorimeter and spectrophotometer.
CO 8	Explain the basic principle involved in different types of conductometric titrations.
CO 9	Enlist the advantages and limitations of conductometric titrations.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK402	**I**	**Physical Chemistry** Electrochemistry: Electromotive Force of Galvanic Cells Electrochemical cells, galvanic cells, reversible cells and reversible electrodes, conventions to represent Galvanic cells. Types of electrodes, standard electrode potential, electrochemical series. Cell potential and standard cell potential. Nernst equation and its importance. Calculation of thermodynamic parameters: ΔG, ΔH, ΔS and equilibrium constant from EMF data. Classification of galvanic cells: chemical cells and concentration cells Determination of pH using glass electrode and quinhydrone electrode. pH and Buffers pH concept, calculation of pH for strong and weak electrolytes Buffer, Henderson's equation for acidic and basic buffer Buffer Capacity. Numerical Problems based on Buffers.	**15**
	II	**Separation techniques in analytical chemistry** Introduction to separation Techniques Separation and its importance in analytical chemistry, estimation without separation.	**15**

		Classification of separation methods physical and chemical Chemical methods, precipitation, complex formation. Physical methods of separation**,** precipitation, fractional precipitation**,** volatilization, distillation, fractional distillation, vacuum distillation. Solvent extraction Nernst's distribution law, partition coefficient, distribution ratio, Percentage extraction, extraction efficiency, percentage extraction for single step and multistep process with the same total volume of the extracting solvent Modes of extraction: Chelation, ion-pair formation and solvation. Batch and continuous extraction, Counter current extraction Chromatography Introduction, Stationary and mobile phase, common features of all chromatographic techniques, classification of chromatographic methods on the basis of physical state of the two phases. Paper chromatography Introduction and basic principles. Stationary phase, transfer of the sample, mobile phase. Methods of developing the chromatogram, methods of detection, physical, chemical and enzymatic. Applications. Comparison of the paper and thin layer techniques. Thin layer chromatography Introduction, mechanism of separation, retardation factor, basic principles.	

		Stationary phase, preparation and transfer of the sample, mobile phases and their nature. Methods of development of the chromatogram, detection methods, physical and chemical. Applications, for determination of purity, following the course of a chemical reaction. High Performance Thin Layer Chromatography Introduction, choice of stationary and mobile phases, sample application, development and recording in HPTLC. Detectors used, single beam and double beam detectors, fluorometric detectors, quantitative determination, applications of HPTLC, advantages and limitations. Comparison between TLC and HPTLC.	
	III	UV- Visible Absorption spectroscopy: Recapitulation of basic concept of spectroscopy. Terms involved in absorption spectroscopy, monochromatic and polychromatic radiation, radiant power, absorbance, transmittance, absorptivity, molar extinction coefficient, wavelength of maximum absorption, Statement of Beer's law & Lamberts' law combined mathematical expression for Beer- Lambert's Law, deviations from Beer-Lambert's law, types of deviations. Components of an optical instrument and their functions, photometers and spectrophotometers. Photometers: Sources, monochromators, sample containers and detectors, block diagram for a single and double beam photometer, (Numerical problems expected.) Photometric titrations	**15**

		Basic principles, experimental set up and operational procedures, Requirements for a photometric titration, types of photometric titration curves, and determination of equivalence point. Advantages and limitations Conductometric titrations Conductometry and conductometric titrations, basic principles, operational procedure, determination of the equivalence point., Conductometric titration curves for the titration of 1] Acid –base titrations of all types 2] Mixture of a weak acid and a strong acid vs. strong base and vice versa. 3] Mixture of acid and salt ag. base 4] Precipitation titrations 5] Complexometric titrations Advantages and limitations.	

References:

1. University General Chemistry, 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India.

2. Physical Chemistry University for biological sciences, 1st edition, (2005), Chang R., Science Books, USA

3. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.

Course Code: RUSBTKP401

Course Title: Practicals Based on RUSBTK401 & RUSBTK402

DETAILED SYLLABUS

Course code	Title	Credits
RUSBTKP401	1. Determination of blood glucose levels for detection of Diabetes mellitus. 2. Organ Function Tests: Liver (SGPT, SGOT) 3. Kidney function tests (Urea from Serum). 4. Qualitative Detection of Ketone Body in Urine. 5. Isolation of Mitochondria and Demonstration of ETC using a Marker Enzyme. 6. Determination of acid number and iodine number of oil/ fats. 7. To determine dissociation constant of weak acid by incomplete titration method using pH meter. 8. Qualitative Analysis of bi-functional organic compounds (minimum four) on the basis of a. Preliminary examination b. Solubility profile c. Detection of elements C, H, (O), N, S and X. d. Detection of functional groups e. Determination of physical constants (M.P/B.P) f. Confirmatory tests to be performed. g. Solid or liquid Compounds containing not more than two functional groups from among the following classes may be given for analysis: Carboxylic acids, phenol, carbohydrates, aldehydes, ketones, ester, amides, nitro, anilides, amines, and alkyl and aryl halides 9. Chromatography:	**2**

	a. Separation of cations: Fe(III), Ni(II) and Cu(II) in a sample by paper chromatography b. Separation of a mixture of o-and p-nitrophenols by thin layer chromatography (TLC).	

References:

1. Biochemical Methods.1st, (1995), S.Sadashivam, A.Manickam, New Age International Publishers, India

2. Analytical Biochemistry, 3 edition, (1998), David Holmes, Peck, Prentice Hall, UK

3. SYBSc Chemistry Laboratory Manual

Course Code: RUSBTK403

Course Title: Medical Microbiology

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Examine the mechanism and pattern of infection.
CO 2	Focus on the importance of vectors in disease acquisition
CO 3	Identify the organisms associated with skin and respiratory tract infection.
CO 4	Illustrate the preventive measures which can be taken to curb the infections.
CO 5	Indicate the organisms associated with GI tract infections & devise suitable tests for clinical studies.
CO 6	Identify the treatment and prophylaxis associated with GI tract infections

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK403	**I**	Infectious Diseases Host Parasite Relationship:	**15**

		Normal Flora; Factors Affecting the Course of Infection and Disease; Mechanisms of Infection and Virulence Factors. Infection: Patterns of Infection; Types of Infections; Signs and Symptoms; Epidemiology and Epidemiological Markers. Diseases: Origin of Pathogens; Vectors; Acquisition of Infection; Koch's Postulates.	
	II	**Medical Microbiology** **Causative Organisms- I** **Skin :** *S. aureus*, *S. pyogenes.* **Respiratory Tract Infections :** *M. tuberculosis, S. pneumonia* (Characteristics Transmission, Course of Infection, Lab Diagnosis, Management of TB, Prevention and Control, Immuno and Chemoprophylaxis, DOTS and MDR **Urinary tract infections***:* *E.coli* : Characteristics, Virulence, Clinical disease and *E.coli* Infections	**15**

	III	**Medical Microbiology - Causative Organisms- II** **GI Tract Infections :** *Salmonella and Shigella spps.* (Characteristics, Virulence-Pathogenesis and Immunity, Clinical Disease, Carriers Lab Diagnosis, Phage Typing Prophylaxis and Treatment). Sexually Transmitted Diseases : Syphilis and Gonorrhoea. Nosocomial Infections : *Ps. Aeruginosa*	**15**

References:

1. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY

2. Presscott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGraw-Hill Science Engineering, USA

3. Text book of Medical Microbiology, Anantnarayan

Course Code: RUSBTK404

Course Title: Environmental Biotechnology

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Focus on the significance of renewable energy resources.
CO 2	Develop new renewable energy resource
CO 3	Determine the different xenobiotic compounds which are released into the environment
CO 4	Analyse the mechanisms by which these xenobiotic compounds can be degraded
CO 5	Discuss the various bioremediation strategies
CO 6	Devise the plan of action for treatment of wastewater.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK404	**I**	**Renewable sources of energy** Biogas technology- Biogas plant & types, Bio - digester. Biogas composition, production and factors affecting production, uses. Biofuels – ethanol production. Microbial hydrogen production, Biodiesel, Petrocrops.	**15**

	II	**Xenobiotics & wastewater treatment** Definition and types of recalcitrant xenobiotic compounds, Hazards from xenobiotics, Biodegradation of xenobiotics, Aerobic wastewater treatment Measurement of level of pollution, Process – Preliminary, primary, secondary, tertiary & sludge treatment. Anaerobic treatment of wastewater – Microorganisms in sludge treatment.	**15**
	III	**Bioremediation** Concept of Bioremediation. Microorganisms in Bioremediation, Myco remediation and Phytoremediation. Bioremediation Technologies. Measuring Bioremediation in the Field. Bioaugmentation and Biostimulation. Monitoring the Efficacy of Bioremediation.	**15**

References:

1. Ecology – P.S. Verma and Agarwal- S. Chand Publications
2. Biotechnology: Environmental Processes- Rehm and Reed- Wiley
3. Environmental Biotechnology – Indu Shekhar Thakur

Course Code: RUSBTKP403

Course Title: Practicals Based on RUSBTK403 & RUSBTK404

DETAILED SYLLABUS

Course Code	Title	Credits
RUSBTKP403	1. Identification of *S. aureus*-Isolation, Catalase, Coagulase Test. 2. Identification of *E. coli*-Isolation, Sugar Fermentations, IMViC. 3. Identification of *Pseudomonas* - Isolation, Urease test, Oxidase Test, TSI Slant. 4. Identification of *Streptococcus pyogenes*. 5. Identification of *Klebsiella pneumoniae*. 6. Identification of *Salmonella typhi* 7. Identification of *Shigella* 8. RPR Test (Kit Based). 9. Permanent Slide- *Mycobacterium*. 10. Determination of total solids from an effluent sample. 11. Study of physico-chemical (pH, colour, turbidity, BOD, COD) parameters of any one industrial effluent sample. 12. Effects of different types on stresses on plant growth using an appropriate plant model system. 13. Stresses: Salinity, water stress, temperature stress (heat/cold), heavy and metal stress. Appropriate controls to be used and data analysed using appropriate software for analysis. 14. Most Probable Number (MPN) – Presumptive, Confirmed and Completed Tests. 15. Bioremediation of Metal. 16. Visit to STP / CETP	**2**

References:

1. Biotechnology: Environmental Processes- Rehm and Reed- Wiley

2. Environmental Biotechnology Allan Scragg Oxford University press

3. Environmental Biotechnology Indu Shekhar Thakur IK International (Basic concepts and applications)

4. Textbook of Medical Microbiology, Anantnarayan

5. Microbiology- Frobisher

6. General Principles of Microbiology- Stanier

Course Code: RUSBTK405

Course Title: Bioinformatics and Biostatistics

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Explore the tools available in Bioinformatics.
CO 2	Classify between the raw and processed database.
CO 3	Compare and contrast between different biological databases.
CO 4	Explore the BLAST tool.
CO 5	Extend the use of software in visualization of 3D structures
CO 6	Apply various statistical tools for analysis of biological data.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK405	**I**	**Introduction to Computers and Biological Databases** MS Word, PowerPoint, Excel, Coral Draw **Biological Databases:** Classification of Databases - Raw and Processed Databases; Primary (NCBI),	**15**

		Secondary (PIR) and Tertiary or Composite (KEGG) Databases; Structure and Sequence Databases. Specialized Databases Protein Pattern Databases; Protein Structure and Classification Databases (CATH/SCOP). **Genome Information Resources:** DNA Sequence Databases Specialized Genomic Resources.	
	II	**BLAST & Structural bioinformatics** **BLAST:** BLAST and its Types; Retrieving Sequence using BLAST, BLAST based searching, FASTA & Dot Plot Method, Introduction to molecular representations on computers, Visualization of biomolecular structures (Protein, DNA, RNA, drugs), Analysis of biological structures.	**15**
	III	**Biostatistics** Theory and Problems based on – Coefficient of Correlation and Regression Analysis; Steps in Testing Statistical Hypothesis; Parametric Tests: - Z Test – Single Mean and Two Means, t- Test – Single Mean, Paired and Unpaired; Chi-Square Test.	**15**

References:

1. Introductory Biostatistics. 1st edition. (2003), Chap T. Le. John Wiley, USA

2. Methods in Biostatistics- B. K. Mahajan –Jaypee Brothers

3. Bioinformatics- methods and S.C.Rastogi, N. Mendiratta, PHL Course Pvt. Ltd.

Course Code: RUSBTK406

Course Title: Molecular Diagnostics

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Discuss basic principles used in Molecular Diagnosis.
CO 2	Develop different and precise protocols for extraction and detection of nucleic acids.
CO 3	Construct new techniques for target DNA amplification
CO 4	Develop analytical skills to understand new Diagnostic Methods.
CO 5	Apply the knowledge and skills gained in the course should be useful in developing new Diagnostic Kits
CO 6	Identify the role of molecular diagnostics in diagnosis of infectious diseases.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK406	**I**	**Basics of Molecular Diagnostics** **Introduction to Molecular Diagnostics:** Overview of Molecular Diagnostics; History of Molecular Diagnostics; Molecular Diagnostics in Post Genomic Era; Areas used in Molecular Diagnostics; Future Prospects -	**15**

		Commercializing Molecular Diagnostics, Personalized Medicine, Theranostics. Characterization and analysis of Nucleic – Acids and Proteins: Extraction, Isolation and Detection of DNA, RNA and Proteins; Restriction Endonucleases and Restriction Enzyme Mapping.	
	II	**Nucleic Acid Amplification and hybridization Methods** Target amplification: PCR - General Principle; Components of a Typical PCR Reaction; Experimental Design; Primer Designing; Control of PCR Contamination and Mispriming; PCR Product Clean-up and Detection. Types of PCR Reverse Transcriptase, Real time, Multiplex & Nested PCR. Hybridization Techniques: Southern, Northern, Western and FISH; Markers, Probes and its Clinical Applications.	**15**
	III	**Molecular Biology based Diagnostics** DNA Polymorphism and Identification: RFLP and Parentage Testing; RFLP and Sickle-Cell Anaemia. Molecular Diagnostics for Infectious Diseases Molecular Testing for *Neisseria,* Molecular Diagnosis for HIV-1; Genetic Counselling and Molecular Diagnosis	**15**

		Genetic Testing-Need and Uses; genetic Counselling. Case Studies- Diagnostic Testing for Cystic Fibrosis; Fragile X Diagnostic and Carrier Testing. Ethical, Social and Legal Issues to Molecular - Genetic Testing	

References:

1. Applications Genomics, Proteomics P.Rastogi 3rd edition and Drug discovery

2. Molecular diagnostics- Fundamentals, methods and clinical applications – Buckingham and Flaws F.A. Davis Company Philadelphia.

Course Code: RUSBTKP405

Course Title: PRACTICALS BASED ON RUSBTK405 & RUSBTK406

DETAILED SYLLABUS

Course Code	Title	Credits
RUSBTKP405	1. Familiarization with NCBI, EMBL, DDBJ, PIR, KEGG Databases. 2. Use of NCBI BLAST Tool. 3. Classification of Proteins using CATH/SCOP. 4. Visualization of proteins using Rasmol. 5. Visualization of biomolecular structures – PyMOL, Chimera. 6. Analysis of three-dimensional structures – Similarity, interactions. 7. Handling and Calibration of Micropipette. 8. Isolation and Detection of RNA from Bacteria and Yeast. 9. RFLP- Kit Based. 10. Primer Designing through Open Online Source NCBI-BLAST. 11. DNA Amplification – PCR. 12. Excel based Biostatistics Practicals. 13. Poster of any recently published paper.	**2**

References:

1. Molecular Biotechnology- Glick and Pasterman ASM Press
2. Molecular diagnostics for the clinical laboratorian by Coleman and Tsongalis, Humana press

Course Code: RUSBTK407

Course Title: Entrepreneurship Development

Academic year 2020-21

COURSE OUTCOMES:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Develop a systematic and critical thinking attitude for a start-up plan.
CO 2	Select and screen a Business Idea.
CO 3	Design strategies for setting up successful business idea.
CO 4	Creation of unique ideas for business development
CO 5	Analyse the problems encountered by entrepreneurs
CO 6	Devise a suitable method to find out the solution for commonly encountered problems.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title	Lectures
RUSBTK407	**I**	Entrepreneurship Development Concept of Entrepreneur; Entrepreneurship; Need and Importance Factors responsible for shaping an entrepreneur. Entrepreneurship development process	**15**

		Difference between entrepreneur and manager.	
	II	Setting up the Business and Management Aspect Launching of an enterprise. Enterprise selection, analysis of suitable market, feasibility study, SWOT analysis of business Resource mobilization - financial, technological, raw material. Evaluation of project designing business plan. Principles of management, quality circles, MBO, MBW, TQM	**15**
	III	Innovation and entrepreneurship development Innovation and Marketing Management Marketing management and business development Marketing plan, sales promotion, market segmentation - STP analysis Principles of innovation, business diversification Strategies and innovative ideas	**15**

References:

1. Entrepreneurship – Kurup

2. Handbook of Entrepreneurship development- Basotia and Sharma

Modality of Assessment (SEMESTER IV)

1. Theory Examination Pattern:

A. **Internal Assessment- 40%- 40 Marks**

Sr No	Evaluation type	Marks
1	One Assignment (Animations/Presentations/Posters/ Video Making/ Skits/ Written assignments/ Mind maps/ Concept maps/ Info graphs)	20
2	One class Test (multiple choice questions or objective & one sentence)	20
	TOTAL	**40**

B. **External Examination- 60%- 60 Marks**

Semester End Theory Examination:

1. Duration - These examinations shall be of **02 hours** duration.

2. Theory question paper pattern:

i. There shall be **03** questions each of **20** marks. On each unit there will be one question. All questions shall be compulsory with internal choice within the questions.

ii.60% options will be provided.

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1) A)	Any 5 out of 8	05	Unit I
Q.1) B)	Any 3 out of 5	15	

Q.2) A)	Any 5 out of 8	05	Unit II
Q.2) B)	Any 3 out of 5	15	
Q.3) A)	Any 5 out of 8	05	Unit III
Q.3) B)	Any 3 out of 5	15	
	TOTAL	**60**	

Practical Examination Pattern:

A. **Internal Examination: 40%- 40 Marks**

Particulars	
Journal	10
Experimental tasks	30
Total	**40**

Note- Similar pattern for internal practical will be followed for all three Practical papers.

B. **External Examination: 60%- 60 Marks**

Semester End Practical Examination:

Particulars	**Paper**
Experimental tasks	RUSBTKP401, RUSBTKP403, RUSBTKP405
Laboratory work 2 major practicals 1 minor practical Viva / Spots	60 40 10 5 + 5
Total	**60**

Overall Examination & Marks Distribution Pattern

SEMESTER IV

Course	RUSBTK401			RUSBTK402			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP401						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK403			RUSBTK404			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP403						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK405			RUSBTK406			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Course	RUSBTKP405						
	Internal			External			
Practicals	40			60			100

Course	RUSBTK407			Grand Total
	Internal	External	Total	
Theory	40	60	100	100