

AC/II (21-22).2.RPS3

S. P. Mandali's
RamnarainRuia Autonomous College
(Affiliated to University of Mumbai)



RUIA COLLEGE
Explore ● Experience ● Excel

Syllabus for PG Biotechnology

Program: M.Sc I

Program Code: Biotechnology(RPSBTK)

(Credit Based Semester and Grading
System for academic year 2021-2022)

PROGRAM OUTCOMES

PO	PO Description
	A student completing Master's Degree in Science program will be able to:
PO 1	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.
PO 2	Critically evaluate, analyze and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
PO 3	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.
PO 4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
PO 5	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.
PO 6	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.
PO 7	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.
PO 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill so as to adapt to technological advancements.

PROGRAM SPECIFIC OUTCOMES

PSO	Description
	A student completing Master's Degree in Science program in the subject of Biotechnology will be able to:
PSO 1	Perceive the fundamental and advanced concepts in depth in the areas of biochemistry, molecular biology, immunology, medical microbiology and applying the conceptual knowledge to address the real time problems and exploring plausible solutions.
PSO 2	Annotate the vast amount of biological data by retrieving, processing and analyzing through various tools of bioinformatics and biostatistics.
PSO 3	Criticize and assess the phases encountered from laboratory to premarketing stages in clinical research along with reviewing case studies.
PSO 4	Identify local and global environmental issues and establish scientific strategies to devise economical solutions converging towards sustainable development
PSO 5	Comprehend the process of patent documentation .Employ the relevance of legal and ethical implications in intellectual property rights, GMO ,developmental biology and other fields of biotechnology.
PSO 6	Outline, execute ,Analyze experimental procedures and research proposal thus ameliorate their scientific writing temperament and soft skills consequently refining their abilities to troubleshoot any research problems.
PSO 7	Deduce the underlying principle of nanotechnological and biotechnological processes and develop the skills to offer contemporary solutions.

PROGRAM OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
I	I	RPSBTK101	Biochemistry	4
		RPSBTK102	Immunology	4
		RPSBTK103	Molecular Biology	4
		RPSBTK104	Biophysical and biochemical techniques	4
		RPSBTKP101,102,103,104	Practicals based on all four papers	2 credits each
	II	RPSBTK201	Metabolism	4
		RPSBTK202	Immunology	4
		RPSBTK203	Bioprocess Technology	4
		RPSBTK204	Bioinformatics, phylogenetics and vitamins	4
		RPSBTKP201 and RPSBTKP204	Practicals based on all four papers Research project(inhouse)	2 credits each
II	III	RPSBTK301	Nanotechnology	4
		RPSBTK302	Medical Microbiology	4
		RPSBTK303	GMO and Environment	4
		RPSBTK304	Developmental Biology	4

		RPSBTKP301	Practicals based on RPSBTK301	2
--	--	------------	----------------------------------	---

		RPSBTKP302	Practicals based on RPSBTK302	2
		RPSBTKP303	Practicals based on RPSBTK303	2
		RPSBTKP304	Practicals based on RPSBTK304	2
	IV	RPSBTK401	Nanotechnology	4
		RPSBTK402	IPR & protection of inventions	4
		RPSBTK403	Clinical Studies	4
		RPSBTK404	Biostatistics	4
		RPSBTKP401 to RPSBTKP404	Project	2 credits each

SEMESTER I**Course Code:RPSBTK101****Course Title: Biochemistry****Academic year 2020-21****COURSE OUTCOMES:On course completion, the student should be able to:**

COURSE OUTCOME	CO DESCRIPTION
CO 1	Elucidate the concept of different types of complicated carbohydrate molecules ,their structure and analytical methods for detection
CO 2	Differentiate between biosynthesis of nucleic acids and its consequences in dysregulation of it.
CO 3	Assess physiological significance of important co factors and molecules like lipids, peptides, endorphins, prostaglandins vitamins and co enzymes
CO 4	Discuss different types of inborn errors related to metabolism, glycogen storage, amino acid metabolism, nucleic acid metabolism
CO 5	Enumerate the concept of Neurobiology and establish a basic link to the immune system.
CO 6	Demonstrate practical skills in analyzing biomolecules in various biological samples and understand their significance.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK101	I	Biochemistry of mucopolysaccharide and nucleic acid Glycosaminoglycans- Heparin, Chondroitin-sulphate Dermatan-sulphate, Keratan-Sulphate. Analytical methods for carbohydrate analysis. Formation, structure and functions of Eicosanoid: Prostaglandins and Thromboxanes, Glycoprotein's (N6, O6, GPI6 linked and proteoglycans), Glycolipids and Lectins, Biosynthesis and degradation of purines and pyrimidines with regulation.	15
	II	Protein Biochemistry Primary structure of proteins and their determination- end group analysis, cleavage of disulphide bond, characterization of polypeptide chain, amino acid composition determination, specific peptide cleavage reaction, separation and purification of peptides, sequence determination, peptide mapping, Super secondary structures. Secondary structure peptide group, Ramchandranplot, helical structure, beta structure, fibrous and globular structure, protein stability, electrostatic forces, hydrogen bond, hydrophobic interaction, disulphide bond, protein denaturation, stability of thermostable proteins. Quaternary structure- subunit interaction, symmetry, subunit composition determination.	15
	III	Inborn errors of metabolism and nutritional disorders PEM (Kwashiorkor and Marasmus). Diabetes: Type I, Type II, gestational. Glycogen storage disorders - von Gierke's disease, Cori's disease, Andersen's disease, McArdle's disease. Amino acid	15

		metabolism- PKU, Alkaptonuria. Lipids- Tay-Sachs, Gaucher's disease. Nucleic acids- Gout, Lesch-Nyhan syndrome. Role of B group Vitamins in metabolic pathways	
	IV	Neurobiology and Neurochemistry Structure and functions of neuron, types and physiologic anatomy of the Synapse, transmission of nerve impulses, ion channels, Neurotransmitters and neuropeptides, Electrical events during neuronal excitation and inhibition. Neurotoxins. Neurochemistry: Special senses-taste, vision, odor, hearing. Factors which enhance epinephrine inhibitors, Synapses, Addictions. Examples of each of the above mentioned factors. Introduction to psychoneurotic and neuropsychiatric drugs.	15

References:

1. Guyton, Text book of Medical Physiology, Saunders Publishers, 12th edition, 2010
2. Textbook of Biochemistry with Clinical Correlations, 7th Edition, Thomas M. Devlin, January 2010,
3. Proteins: biotechnology and biochemistry, 1st edition (2001), Gary Walsch, Wiley, USA
4. Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: John Wiley and Sons, New York.
5. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer Trevor, Publisher: Horwood Pub. Co. England.
6. Outlines of Biochemistry: 5th Edition, Eric Conn & Paul Stumpf; John Wiley and Sons, USA
7. Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA
8. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and Company, NY.
9. Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H. Freeman and company

Practicals

RPSBTKP101

Course Code	Title	Credits
RPSBTKP101	<ol style="list-style-type: none"> 1. Preparation of buffers used in laboratory (Phosphate , Citrate , Acetate and Trisbuffer) 2. Isolation of starch from potato and its estimation by Anthronemethod. 3. Study of phosphorolysis of glycogen in the muscular tissue. 4. Glucose estimation by paper/chip -Microfluidics 5. Study of protein complexes using PAGE and detection by CBB and silver staining. 6. The isolation and assay of glycogen from liver and skeletal muscles of bird /mammal. 7. Estimation of Vitamin C from fruits. 8. Estimation of Creatinine in blood /urine. Estimation of urate/creatinine ratio to diagnose Lesch-Nyhan syndrome 9. Chemistry of thinking: <ol style="list-style-type: none"> a. Study of different regions of brain using models. b. Stroop test and blind spot test. c. Color blindness and optical illusions 10. Detection of LDH isozymes by electrophoresis. 	2

Course Code:RPSBTK102

Course Title: Immunology
Academic year 2020-21

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Elucidatetheconceptofantigenpresentationandrecognitionpatterns
CO 2	Analyze the basics,role and differentiate between complement pathways.
CO 3	CommentonroleandfunctionofCytokinesandcytokineprofillingand interprettheroleofoncogenesanddifferenttumorsofimmunesystem
CO 4	Discuss methods and procedure of safe sterile Vaccine development
CO 5	Criticize the path chosen by different effector molecules undervarious threats to immunesystem
CO 6	.Show the skills to develop,executeimmuno based assays

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK102	I	Molecular immunology Organization and expression of immunological genes (BCR and TCR genes). Antibody genes and antibody engineering. T cell and B cell activation.InflammationKeymediatorsofinflammation ,inflammation process,anti inflammatory drugs	15
	II	Cancer Immunology Origin and terminology, malignant transformation of cell, oncogenes and cancer induction, tumors of the immune system, tumour antigens, immune response totumor,	15

		tumor evasion of the immune system , cancer immunotherapy	
	III	Clinical immunology Cytokines: properties, receptor, antagonists, diseases, Therapeutic use of cytokines, Experimental immunology: Vaccine development (Recombinant, Combined , polyvalent vaccines, RNA ,conjugate vaccines)Cancer Immunology - Correlation with MABS, Chimeric humanized antibodies and Notations, Cytokine profiling of T - cells	15
	IV	Effector mechanisms: Mucosal immunity, Peyer's patches, gut barriers, oral immunization, Oral tolerance, Cytotoxic response, Effector functions of B, T and NK cells. Immune response during bacterial, parasitic, viral infection with one example of each	15

References:

1. Immunology by Janis Kuby, W.H.Freeman& Co Ltd; 5thRevisededition.
2. Fundamental Immunology 6th edition (August 2003): by WilliamE., Md.Paul (Editor) By Lippincott Williams & WilkinsPublishers
3. Essential Immunology, Ivan M. Roitt (1994)- Blackwell ScientificPub,Oxford.
4. Cellular and Molecular Immunology, 3rd Ed, Abbas, Saunders; 7 edition (11June 2011)

Practicals RPSBTKP102

Course Code	Title	Credits
RPSBTKP102	<ol style="list-style-type: none">1. Antigen antibody reactions: VDRL2. Immuno-diffusion and immune-electrophoresis3. Perform Serum protein electrophoresis.4. Perform DOTBLOT5. Separation of T lymphocytes and B lymphocytes using nylon wool column6. Sheep RBC rosetting	2

Course Code:RPSBTK103
Course Title: Molecular Biology
Academic year 2020-21

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Construct the details of chromatin structure and its functional implications.
CO 2	Elucidate the basis of gene expression and basic control processes involved in it
CO 3	Comment on different post translational events , the underlying functional importance along with concepts of protein folding,transport and protein sorting
CO 4	Explain the techniques and principles involved in various next generation sequencing methods as an important aid the field of genomics
CO 5	Acquire the skills to perform advanced molecular biology techniques
CO 6	Interpret the functionality and importance of epigenetics and RNA interference

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK103	I	Chromatin structure and gene expression Chromatin structure and transcription. Regulation of chromatin structure , Transcription in prokaryotes and Eukaryotes, Structure of RNA polymerase (Channel in and	15

	<p>Channel out). Types of RNA polymerases, Types of Promoters, initiation, elongation, termination and anti-termination. Initiation factor, role of transcription factors, Regulation of RNA polymerase. Transcription in cell organelles (Mitochondria and chloroplast).</p>	
II	<p>Post Transcriptional and translational events</p> <p>Post transcriptional events :</p> <p>RNA processing in eukaryotes: modifications, splicing and splicing machinery, processing of RNA. Editing and amplification Translation: in Prokaryotes and Eukaryotes. Initiation, elongation, and termination ,mRNA localization and stability.</p> <p>Modification folding and transport protein. Molecular chaperons in folding, Protein sorting and trafficking using signal proteins,</p>	15
III	<p>RNA interferences and epigenetics</p> <p>DNA rearrangement, RNAi, regulation of translation, RNA interference, Gene silencing, Epigenetic inheritance and Retrotransposons</p>	15
IV	<p>Omic studies</p> <p>Omes and Omics, concepts and applications, genome overview at the level of chromosomes (with model organisms as example), strategies for large scale DNA sequencing. EST and STS, Whole Genome Analysis techniques. Next generation sequencing methods, organization, structure, and mapping of genomes (with model organisms as example)</p> <p>Introduction to proteomics, transcriptomics, metabolomics.</p> <p>Whole exome analysis</p>	15

References:

1. GenesXI, 11th edition (2012), Benjamin Lewin, Publisher-Jones and Bartlett 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., McGrawHill Science. USA
4. Fundamentals of Molecular Biology, (2009), Pal J. K. and Saroj Ghaskadbi, Oxford University Press. India
5. Molecular Biology: genes to proteins, 4th edition (2011), Burton E Tropp Jones & Bartlett Learning, USA
6. Discovering genomics, Proteomics and Bioinformatics (2006) A. Malcolm Campbell, Laurie J. Heyer Benjamin Cummings; 2nd edition

Practicals
RPSBTKP103

Course Code	Title	Credits
RPSBTKP103	<ol style="list-style-type: none"> 1. Extraction of genomic DNA from bacteria and blood 2. Perform transformation of bacteria. 3. Expression of recombinant protein. 4. Purification of DNA from agarose gel. 5. Detection of changes in the conformation of BSA by viscosity measurement. 6. Demonstration of Conjugation. 7. Induction of Galactosidase in <i>E. coli</i> (and effect of inducers). 	2

Course Code:RPSBTK104
Course Title: Biophysical and biochemical techniques
Academic year 2020-21
COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Summarize advanced and state of the art techniques with various types of electron microscopy.
CO 2	Compare different types of PCR and their applications.
CO 3	Enumerate different types of advanced molecular cloning methodology.
CO 4	Discuss on the variety of spectroscopic techniques with respect to molecular analysis
CO 5	Develop skills in handling and performing different chromatographic techniques.
CO 6	Analyze different aspects of immunological and histochemical techniques.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK104	I	Advanced microscopic and PCR techniques Details of Scanning tunnelling microscopy and Scanning probe microscopy, atomic force microscopy, fluorescent microscopy, sample preparation and working for electron microscopy types of PCR: Multiplex PCR, Nested PCR, RT-PCR, Real time-PCR ,Gibson assembly,golden gate, CPEC, CRISPR CAS system	15

	II	Spectroscopy Introduction, principle and analysis using fluorescence spectroscopy, circular dichroism ORD, NMR and ESR spectroscopy, Molecular structure determination Using X-ray diffraction, X-ray crystallography and NMR, Molecular Analysis using light scattering, mass spectrometry and LC-MS, GC-MS and surface plasma resonance methods, IR.	15
	III	Chromatography Introduction, principle and analysis using HPTLC, HPLC, GLC, Affinity chromatography and its types. Column details and theoretical plates, applications. IEF and 2D electrophoresis. Applications of the above techniques.	15
	IV	Histochemical and Immunotechniques Antibody generation, blotting techniques, Immunoprecipitation, Flow cytometry and immunofluorescence, detection of antigens in living cells, <i>in situ</i> localization by techniques such as FISH and GISH, Microarray	15

References:

1. Principles and Techniques of Biochemistry and Molecular Biology, 7th edition Wilson K.M., Walker J.M., Cambridge University Press, UK (2010),
2. Biochemical spectroscopy. Vol 46 of Methods in Enzymology. (1995) Kenneth Sauer. Academic Press, USA
3. Modern experimental biochemistry 3rd edition Publisher, USA. edition. (2000) Rodney Boyer. Prentice Hall
4. Analytical Biochemistry, 3 edition, (1998), David Holmes, H. Peck, Prentice Hall, UK.

Practicals
RPSBTKP104

Course Code	Title	Credits
RPSBTKP104	<ol style="list-style-type: none">1. Use of UV spectrophotometry to determine the concentration of protein2. Separation of sugars in coconut water using TLC3. Determination of enzyme activity by Zymogram.4. Affinity chromatography for purification of immunoglobulins.5. Standardization / optimization of PC6. Demonstration of HPLC/NM	2

Modality of Assessment (SEMESTER I)

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1.	One Assignment/Case study/Project based / written assignment/ Presentations	20
2.	One Class Test (multiple choice questions/objectives/ match the column)	20
	TOTAL	40

B) External Examination- 60%- 60Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of 2.5hrs duration.
2. Theory question paper pattern:

- There shall be 4 questions each of 15 marks. On each unit there will be one question.
- All questions shall be compulsory with internal choice within the questions.

Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the external examinations (Semester End) may be conducted online as per the instructions/circulars received from the University of Mumbai and Maharashtra State notifications from time to time. The conventional mode of external examination will commence again only after the declaration of normalcy by the Government authorities.

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1)A)	Any 1 out of 2		Unit I
Q.1)B)	Compulsory		
Q.2)A)	Any 1 out of 2		Unit II
Q.2)B)	Compulsory		
Q.3)A)	Any 1 out of 2		Unit III
Q.3)B)	Compulsory		
Q.4)A)	Any 1 out of 2		Unit IV
Q.4)B)	Compulsory		
	TOTAL	60	

Practical Examination Pattern:**B) External Examination: - 50Marks****Semester End Practical Examination:**

Particulars	Paper
Laboratory work	40
Journal	05
Viva	05
Total	50

SEMESTER I: PRACTICAL COMPONENT

- RESEARCH PLAN TO BE PROVIDED BY EACH STUDENT IN SEMESTER I

Overall Examination & Marks Distribution Pattern**Semester I**

Course	RPSBTK101/102/103/104		Total	Grand total
	Internal	External		
Theory	40	60	100	400
Practicals		50	50	200

SEMESTER II**Course Code:RPSBTK201****Course Title: Metabolism****Academic year 2020-21****COURSE OUTCOMES: On course completion, the student should be able to:**

COURSE OUTCOME	CO DESCRIPTION
CO 1	Comment on the biosynthesis of various types of fatty acids and its significance and regulation.
CO 2	Explain the importance and levels of regulation of acid-base balance in body, their disorders and treatments
CO 3	Comprehend the various stress experienced by plants and their consequences on growth and metabolism.
CO 4	Interpret the role played by secondary metabolites in plant defence system
CO 5	Differentiate between the various carbon fixation cycles in plants and interaction of microbes with the environment.
CO 6	Elucidate the molecular structure and role of nitrogenase in the nitrogen cycle and importance of ammanox reactions in nature.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK201	I	Lipid Metabolism Lipid metabolism: Biosynthesis of fatty acids (saturated, monounsaturated, polyunsaturated), triglycerides and phospholipids. FAS Complex, regulation of fatty acid metabolism. Biosynthesis and regulation of cholesterol, prostaglandins, membrane lipids.	15

	II	Physiological biochemistry Regulation of acid-base balance, types and functions of acid-base buffers, respiratory mechanism of acid-base balance, renal control of acid base balance, clinical abnormalities associated with acid base imbalance. Water and electrolyte balance, clinical abnormalities. Kidney Diseases and diuretics: Acute renal failure, chronic renal failure, specific tubular disorders, treatment of renal failure.	15
	III	Stress Metabolism in plants Environmental stresses, salinity, water, stress, heat, chilling, anaerobiosis and heavy metals and their impact on plant growth and metabolism, criteria of stress tolerance. Secondary metabolites in plants- Nature, distribution and their role in plant protection. Steroid biotransformation	15
	IV	Plant and microbial metabolism Hatch slack pathway, Crassulacean acid metabolism, photorespiration and glyoxylate pathway with significance. Photosynthetic formation of hydrogen. Nitrogen fixation and role of nitrogenase, anammox reactions. Plant symbiosis with fungi: Arbuscular, mycorrhiza, Ectomycorrhiza	15

References:

1. Biochemistry, L Stryer, Freeman and Co, NY
2. Biochemistry, Zubay, Addison Wesley and Co.
3. Textbook of Physiology, Guyton
4. Principles of Biochemistry, Lehninger, 5th edition, Cox and Nelson, W.H. Freeman and Company, NY.
5. Physiology- Berne and Levy
6. Harper's Biochemistry- 27th edition
7. Text book of Human Biochemistry- Ed. G. P. Talwar
8. Essentials of food and nutrition M Swaminathan Vol. II, Applied aspects (1974), Ganesh Pub, Madras
9. Human biochemistry - James Orten and Otto Neuhaus, 10th ed , CV Mosbyco London

10. Human nutrition and dietetics-Davidson andPassmore
11. Plant physiology, Salisbury and Ross (2007) CBS publishers anddistributors
12. BiochemistryandPhysiologyofPlantHormones,ThomasMoore,SpringerVerlag NewYork
13. Plant Biochemistry- Hans Walter Heldt, 3rd Edition, ElesvierAcademicPress
14. Introduction to Plant Biochemistry- T.W. Goodwin and E.L.Mercer
15. Plant Physiology- Devlin, CBSPublisher
16. Plant Biochemistry- Dey, Academic Press,1999

Practicals RPSBTKP201

Course Code	Title	Credits
RPSBTKP201	<ol style="list-style-type: none"> 1. Estimation of Niacin by the CNBr method 2. Isolation of cholesterol and lecithin from egg yolks 3. Detection of Flavonoids in Plants. 4. Estimation of hemeoglobin. 5. Proline estimation in germinated seeds with and without stress 6. Estimation of phospholipids. 7. Assay of superoxide dismutase in salt stressed and normal plant. 8. Estimation of Ca^{++} / Zn^{++} by EDTA titrimetric method 9. <i>In-vitro</i> demonstration of phagocytosis and calculating phagocytic index 10. Demonstration of radioimmunoassay 11. Demonstration of Plackett-Burman design for formulation of Fermentation media. 	2

Course Code:RPSBTK202

Course Title: Immunology
Academic year 2020-21

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Differentiate between different intricate aspects of various immunological diseases.
CO 2	Comment on various factors involved in hypersensitivity reactions and their emphasis on treatment.
CO 3	Discuss the making and role of different types of vaccines
CO 4	Demonstrate the principle techniques and applications involved in <i>in-vitro</i> and <i>in vivo</i> imaging.
CO 5	Interpret how the psychology affect the immunological aspects of human body.
CO 6	Enumerate the implications of various disorders associated with dysregulation of pschyoneuroimmunology.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK202	I	Immunological diseases Autoimmunity mechanisms, Altered antigens, Systemic Lupus erythematosus, Graves diseases, Rheumatoid arthritis, Myasthenia Gravis, Multiple sclerosis, animal models of autoimmunity, GvH, Immunodeficiency (Primary & secondary): phagocytic, humoral, CMI, combined HLA association with disease.	15

	II	Hypersensitivity and Transplantation Types of hypersensitivity reactions, Mechanism, Factors involved and their treatment, Immunology of transplantation. purified macromolecules as vaccine, Recombinant vector Vaccine, DNA Vaccines, multivalent Subunit Vaccines	15
	III	CMI and imaging Cell Cytotoxicity, mixed lymphocyte reaction, Apoptosis, Cell cloning, Reporter Assays, Peptibodies- production and application, Cell imaging Techniques- <i>In vitro</i> and <i>In vivo</i> ; Immunoelectron microscopy; <i>In vivo</i> cell tracking techniques; Application based microarray, Phage display	15
	IV	Psychoneuro- immunology Connections of CNS to immune system and vice versa. Psychological modulation of immunity, stress and immunity, implication for diseases, functional significance - inflammation and acute phase response, role of glucocorticoids, stress response, energy demand and balance, Introduction and History of Neuroendocrine circuitry, disorder of Thoughts and volition - Schizophrenia, Addition of Action of Drug.	15

References:

1. Immunology 5th edition Janis Kuby
2. Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul (Editor) By Lippincott Williams & Wilkins Publishers
3. Essential Immunology, Ivan M. Roitt (1994)- Blackwell Scientific Pub, Oxford.
4. Cellular and Molecular Immunology, 3rd edition, Abbas
5. Psychoneuroimmunology, Stress, and Infection, By Herman Friedman, Thomas W. Klein, Andrea L. Friedman, CRC Press, 1996

**Practical
RPSBTKP202**

Course Code	Title	Credits
RPSBTKP202	Research Project Undertaken by students	2

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Course Code:RPSBTK203

Course Title: Bioprocess Technology

Academic year 2020-21

COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Explain the effect of process parameters on fermentation and their measurement and control.
CO 2	Differentiate between the rheological properties of various food textures.
CO 3	Comprehend on enzyme functions and reactions in food process.
CO 4	Analyze the role of microbes in processing the food and developing commercial food products.
CO 5	Summarize the mechanism of enzyme reactions in detail and the role of inhibitors on them.
CO 6	Elucidatethebasicmechanismofdifferentsypesofenzymesandtheirwidespreadapplications.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK203	I	Aeration and agitation in bioprocess Large scale animal and plant cell cultivation; Aeration and agitation in bioprocess; KLa, Measurement and control of bioprocess parameters.	15

	<p>II Food Rheology Introduction to Food Rheology, Food rheology vs Food texture, Rheology of food dispersion, Food polymers and gels, foams and dough rheology, processing and food rheology, test and application of food rheology.</p>	15
	<p>III Applications of microbes and enzymes in food processing</p> <p>Enzymic bioconversions e.g. starch and sugar conversion processes; High-Fructose Corn Syrup; Interesterified fat; Hydrolyzed protein and their downstream processing; baking by amylases, deoxygenation and desugaring by glucoses oxidase.</p> <p>Food ingredients and additives prepared by fermentation and their purification; fermentation as a method of preparing and preserving foods.</p> <p>Microbes and their use in pickling, producing colours and flavours.</p> <p>Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products; Bacteriocins from lactic acid bacteria - Production and applications in food preservation</p>	15
	<p>IV Enzymology</p> <p>Enzyme - Concept and kinetics, active site formation and its significance, Michaelis-Mentonequation - Derivation and transformation,</p> <p>Enzyme inhibition and types of inhibitors, control of enzyme activity, allosteric regulations, parameters affecting enzyme activity.</p> <p>Types of enzymes: isoenzymes, ribozymes, abzymes, substrate specificity and coenzymes</p>	15

References:

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall,Engelwood Cliffs,1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2ndEdition, Prentice Hall, Engelwood Cliffs,2002.
3. Stanbury RF and Whitaker A., Principles of FermentationTechnology,Pergamon press, Oxford,1997.
4. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2ndEdition, McGraw-Hill Book Co., New York,1986.
5. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2ndEdition, University of Tokyo press,Tokyo,1973.
6. Comprehensive Biotechnology: The Principles, Applications and Regulations of BiotechnologyinIndustry,AgricultureandMedicine,Vol1,2,3and4.YoungM.M., Reed Elsevier India Private Ltd, India,2004.
7. El-Mansi, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK,2007.
8. Biochemistry, L Stryer, Freeman and Co,NY
9. Principlesofbiochemistry,Lehninger,5thedition,CoxandNelson,W.H.Freeman company.

**Practical
RPSBTKP203**

Course Code	Title	Credits
RPSBTKP203	Research Project Undertaken by students	2

Course Code:RPSBTK204
Course Title: Bioinformatics,Phylogenetics and vitamins
Academic year 2020-21
COURSE OUTCOMES: On course completion, the student should be able to:

COURSE OUTCOME	CO DESCRIPTION
CO 1	Classify different types of biological databases.
CO 2	Summarize about various computational methods and tools used for protein secondary structure prediction and genome analysis
CO 3	Describe various sequence alignment tools and its significance.
CO 4	Identify and understand important terms in evolution and population genetics
CO 5	Compare different bioinformatic tools for phylogenetic analysis.
CO 6	Comprehend the sources, biological function and dietary disorder associated with water soluble and fat soluble vitamins.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Lectures
RPSBTK204	I	Introduction to Bioinformatics – Sequence Analysis Database search using ENTREZ (G Query) , Hidden Marker Model, Equation (Ex :Gene finding/ exon-intron finding, Signal peptide finding), Motif finding using HMM, ANN (Ex:Prosite) Sequence alignment, MSA- algorithm under Clustal W ,Protein sequence analysis,Protein structure analysis, Secondary, (Chou Fasman algorithm, GOR algorithm, Tertiary (Homology modelling, Threading, Ab initio, Structure prediction)	15

	II	<p>Applications of Bioinformatics</p> <p>Microarray data analysis, Printing techniques, Features of microarray, Flag features of microarray, Data normalization in microarray, Human genome project and specialised databases under NCBI (Eg OMIM, chromosome, PubMed), Proteomics, Consensus sequence, PSSM, Sequence logo.</p>	15
	III	<p>Phylogenetics</p> <p>Darwinism and neo Darwinism theories of evolution. Population genetics and different forces acting on it.</p> <p>Bioinformatics tools for phylogenetic analysis.</p>	15
	IV	<p>Vitamins</p> <p>National Institutes of Health Office of Dietary Supplements (ODS) for sources, activity of vitamins, deficiency disorders, overconsumption effects of Vitamins:</p> <p>Water soluble- B1, 2,3,5,6,7,12</p> <p>Fat soluble- A, D, E, K</p>	15

References:

1. Bioinformatics - A practical guide to the analysis of genes and proteins by A.D. Baxvanis
2. Bioinformatics by N. Gautam (2006)
3. Bioinformatics: Sequence and Genome Analysis (Second Edition 2004), David W. Mount, (Cold Spring Harbor Laboratory Press)
4. Bioinformatics and Functional Genomics (2003), Jonathan Pevsner, John Wiley and sons.
5. iGenetics by Peter J. Russel, 3rd Edition, Pearson Publications
6. Handbook of Vitamins: <https://ods.od.nih.gov/factsheets/list-VitaminsMineral>

Practicals

RPSBTKP204

Course Code	Title	Credits
RPSBTKP204	<ol style="list-style-type: none">1. Classification of biological databases specially cover NCBI and INSDC2. Phylogenetic tree using Bootstrap3. BLAST - orthologs, paralogs and homologs4. Motif finding5. KEGG6. Structure of proteins - identification of chain, helices, special groups, metal ion etc.7. CATH/SCOP classification of a given protein8. Homology modelling9. Analysis of 3D structures - similarity and interactions	2

Modality of Assessment (SEMESTER II)

Theory Examination Pattern:

C) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1.	One Assignment/Case study/Project based / written assignment/ Presentations	20
2.	One Class Test (multiple choice questions/objectives/ match the column)	20
	TOTAL	40

D) External Examination- 60%- 60Marks

Semester End Theory Examination:

3. Duration - These examinations shall be of 2.5hrs duration.

4. Theory question paper pattern:

- There shall be 4 questions each of 15 marks. On each unit there will be one question.
- All questions shall be compulsory with internal choice within the questions.

Paper Pattern:

Question	Options	Marks	Questions Based on
Q.1)A)	Any 1 out of 2		Unit I
Q.1)B)	Compulsory		
Q.2)A)	Any 1 out of 2		Unit II
Q.2)B)	Compulsory		
Q.3)A)	Any 1 out of 2		Unit III
Q.3)B)	Compulsory		
Q.4)A)	Any 1 out of 2		Unit IV
Q.4)B)	Compulsory		
	TOTAL	60	

External Examination- 60%- 60 Marks

Semester End Theory Examination: (Deviation from the usual modality)

Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the external examinations (Semester End) may be conducted online as per the instructions/circulars received from the University of Mumbai and Maharashtra State notifications from time to time. The conventional mode of external examination will commence again only after the declaration of normalcy by the Government authorities.

Practical Examination Pattern:**D) External Examination: - 50Marks****Semester End Practical Examination:**

Particulars	Paper
Laboratory work	40
Journal	05
Viva	05
Total	50

SEMESTER II: PRACTICAL COMPONENT

- Owing to the pandemic situation prevailing in 2020 and continuing in 2021, the following are alternative for Research project

Overall Examination & Marks Distribution Pattern**Semester II**

Course	RPSBTK 201/202/203/204		Total	Grand total
	Internal	External		
Theory	40	60	100	400
Practicals		50	50	200