AC/II (20-21).2.RPS3

# S. P. Mandali's

# RamnarainRuia AutonomousCollege

*(Affiliated to University of Mumbai)*



RUIA COLLEGE
Explore • Experience • Excel

## Syllabusfor M.Sc Part I-II

## Program: M.Sc

## Program Code: Biotechnology(RPSBTK)

(Credit Based Semester and Grading System for academic year 2020-2021)

# PROGRAM OUTCOMES

| PO | PO Description<br>**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 scientificproblem. Think creatively, experiment and generate a solution independently, check and validate it and modify ifnecessary. |
| **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** | Articulatescientificideas,putforthahypothesis,designandexecute testing tools and draw relevant inferences. Communicatethe 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 scientificdevelopments and relearn and reskill so as to adapt to technological advancements. |

# PROGRAM SPECIFIC OUTCOMES

| PSO | Description<br><br>**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 skillsconsequentlyrefiningtheirabilitiestotroubleshootanyresearch 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,phylo genetics and vitamins | 4 |
| | | RPSBTKP201 and RPSBTKP204 | Practicals based on all four papers<br>Research project(inhouse) | 2 credits each |
| II | III | 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 ofit. |
| **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 analyzying 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**<br><br>Glycosaminoglycans- Heparin, Chondroitin-sulphate Dermatan-sulphate, Keratan-Sulphate. Analytica 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**<br><br>Primary structure of proteins and their determination- end group analysis, cleavage of disulphide bond, characterization of polypeptide cha, aminoacid 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**<br><br>PEM (Kwashiorkor and Marasmus). Diabetes: Type I, Type II, gestational. Glycogen storage disorders - von Gierke's disease, Cori'sdisease, Andersen's disease, McArdle's disease. Aminoacid | 15 |

| | | | |
|---|---|---|---|
| | | metabolism- PKU, Alkaptonuria. Lipids- Tay-Sachs, Gaucher'sdisease.Nucleicacids-Gout,Lesch-Nyhansyndrome.Role of B groupVitamins in metabolicpathways | |
| | 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 mentionedfactors.Introductiontopsychoneurotic and neuropsychiatricdrugs. | 15 |

**References:**


1. Guyton, Text book of Medical Physiology, SaundersPublishers, 12th edition,2010
2. Textbook of Biochemistry with Clinical Correlations, 7thEdition, Thomas M.Devlin, January2010,
3. Proteins:biotechnologyandbiochemistry,1stedition(2001),GaryWalsch,Wiley, USA
4. Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: JohnWiley and Sons, NewYork.
5. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001)Palmer Trevor, Publisher: Horwood Pub.Co.England.
6. Outlines of Biochemistry: 5th Edition, Erice Conn &PaulStumpf ; John Wiley and Sons, USA
7. Fundamentals of Biochemistry. 3rd Edition (2008), DonaldVoet& Judith Voet , John Wiley and Sons, Inc.USA
8. Lehninger,PrinciplesofBiochemistry.5thEdition(2008),DavidNelson&Michael Cox, W.H. Freeman andCompany,NY.
9. Biochemistry: 7th Edition, (2012), Jeremy Berg, LubertStryer, W.H.Freeman and compan

# Practicals
## RPSBTKP101

| Course Code | Title | Credits |
|---|---|---|
| RPSBTKP101 | 1. Preparation of buffers used in laboratory (Phosphate , Citrate , Acetate and Trisbuffer)<br>2. Isolation of starch from potato and its estimation by Anthronemethod.<br>3. Study of phosphorolysis of glycogen in the musculartissue.<br>4. Glucose estimation by paper/chip –Microfluidics<br>5. Study of protein complexesusingPAGE and detection by CBB and silverstaining.<br>6. The isolation and assay of glycogen from liver and skeletal muscles of bird /mammal.<br>7. Estimation of Vitamin C fromfruits.<br>8. Estimation of Creatinine in blood /urine. Estimation of urate/creatinine ratio to diagnose Lesch-Nyhansyndrome<br>9. Chemistry ofthinking:<br>a. Study of different regions of brain usingmodels.<br>b. Stroop test and blind spottest.<br>c. Color blindness and opticalillusions<br>10. Detection of LDH isozymes byelectrophoresis. | 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**<br>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**<br>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**<br><br>Cytokines: properties, receptor, antagonists, diseases, Therapeutic use of cytokines, Experimental immunology: Vaccine development (Recombinant, Combined and polyvalent vaccines), Cancer Immunology – Correlation with MABS, Chimeric humanized antibodies and Notations, Cytokine profiling of T -cells | 15 |
| | IV | **Effector mechanisms:**<br><br>Mucosal immunity, Peyer's patches, gut barriers, oral immunization, Oral tolerance, Cytotoxic response, Effector functions of B, T and NK cells.<br><br>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 | 1. Antigen antibody reactions: VDRL<br>2. Immuno-diffusion andimmune-electrophoresis<br>3. Perform Serum proteinelectrophoresis.<br>4. Perform DOTBLOT<br>5. Separation of T lymphocytes and Blymphocytes using nylon woolcolumn<br>6. 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 techniquies |
| **CO 6** | Interpret the functionality and importance ofepigeneticsand 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 ,<br><br>Transcription in prokaryotes and Eukaryotes, Structure of RNA polymerase (Channel in and | 15 |

| | | | |
|---|---|---|---|
| | | Channel out). Types of RNA polymerases, Types of Promoters, initiation, elongation, termination and anti-termination.Initiationfactor,roleoftranscription factors, Regulation of RNA polymerase. Transcription in cell organelles (Mitochondria and chloroplast). | |
| | II | **Post Transcriptional and translational events**<br><br>Post transcriptional events :<br><br>RNA processing in eukaryotes: modifications, splicing and splicing machinery, processing ofRNA. Editing and amplificationTranslation: in Prokaryotes and Eukaryotes. Initiation, elongation, and termination ,mRNA localization andstability.<br><br>Modification folding and transport protein.Molecular chaperons in folding, Protein sorting and trafficking using signalproteins, | 15 |
| | III | **RNA interferences and epigenetics**<br><br>DNArearrangement,RNAi,regulationoftranslation, RNA interference, Gene silencing, Epigenetic inheritance andRetrotransposons | 15 |
| | IV | **Omic studies**<br><br>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)<br><br>Introduction to proteomics, transcriptomics, metabolomics.<br><br>Whole exome analysis | 15 |

**References:**


1. GenesXI,11thedition(2012),BenjaminLewin,Publisher-JonesandBarlettInc. 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. FundamentalsofMolecularBiology,(2009),PalJ.K.andSarojGhaskadbi,Oxford University Press.India
5. Molecular Biology: genes to proteins, 4th edition (2011), Burton E TroppJones & Bartlett Learning,USA
6. Discovering genomics, Proteomics and Bioinformatics (2006) A. Malcoln Campbell, laurie J. Heyer Benjamin Cummings;2ndedition


## Practicals
## RPSBTKP103

| Course Code | Title | Credits |
|---|---|---|
| RPSBTKP103 | 1. Extraction of genomic DNA from bacteria andblood<br>2. Perform transformation ofbacteria.<br>3. Expression of recombinantprotein.<br>4. Purification of DNA from agarosegel.<br>5. Detection of changes in the conformation of BSAby viscositymeasurement.<br>6. Demonstration ofConjugation.<br>7. Induction of Galactosidase in *E. coli* (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**<br><br>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,<br><br>Real time-PCR ,Gibson assembly,golden gate, CPEC, CRISPR CAS system | 15 |

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|---|---|---|---|
| | | | |
| | II | **Spectroscopy**<br><br>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**<br>Introduction, principle and analysis using HPTLC, HPLC,GLC,Affinitychromatographyanditstypes. Columndetailsandtheoreticalplates,applications. IEF and 2D electrophoresis. Applications of the abovetechniques. | 15 |
| | IV | **Histochemical and Immunotechniques**<br>Antibody generation, blotting techniques,Immuno - precipitation, Flow cytometry and immunofluorescence, detection of antigens in living cells, *in situ* localization by techniques such as FISH and GISH, Microarray | 15 |

**References:**


1. Principles and Techniques of Biochemistry andMolecularBiology,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 experimentalbiochemistry3rd edition Publisher, USA.edition. (2000) Rodney Boyer. PrenticeHall
4. Analytical Biochemistry, 3 edition, (1998), David Holmes, H.Peck , Prentice Hall, UK.

# Practicals
## RPSBTKP104

| Course Code | Title | Credits |
|---|---|---|
| RPSBTKP104 | 1. Use of UV spectrophotometry to determinethe concentration ofprotein<br>2. Separation of sugars in coconut water usingTLC<br>3. Determination of enzyme activity byZymogram.<br>4. Affinity chromatography for purification of immunoglobulins.<br>5. Standardization /optimization of PC<br>6. Demonstration OfHPLC/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 TheoryExamination:**

1. Duration - These examinations shall beof**2.5hrs** duration.
2. Theory question paperpattern:

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

**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 PracticalExamination:**

| **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** | | | **Grand total** |
|---|---|---|---|---|
| | **Internal** | **External** | **Total** | |
| **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**<br>Lipid metabolism: Biosynthesis of fatty acids (saturated, monounsaturated,polyunsaturated), triglycerides and phospholipids.FAS Complex, regulationoffattyacidmetabolism.Biosynthesis and regulation of cholesterol, prostaglandins, membranelipids. | 15 |

| | | | |
|---|---|---|---|
| | II | **Physiological biochemistry**<br>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 abnormalitiesassociated 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**<br>Environmental stresses, salinity, water, stress, heat, chiling, anaerobiosis and heavy metals and their impact on plant brow th 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**<br>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 andCo.
3. Textbook of Physiology,Guyton
4. Principles of Biochemistry, Lehninger, 5thedition, Cox and Nelson, W.H.Freeman and Company,NY.
5. Physiology- Berne andLevy
6. Harper's Biochemistry- 27thedition
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 | 1. Estimation of Niacin by the CNBrmethod<br>2. Isolation of cholesterol and lecithin from eggyolks<br>3. Detection of Flavonoids inPlants.<br>4. Estimation ofleghemoglobin.<br>5. Proline estimation in germinated seeds withand withoutstress<br>6. Estimation ofphospholipids.<br>7. Assay of superoxide dismutase in salt stressedand normalplant.<br>8. Estimation of $Ca^{++}$ / $Zn^{++}$ by EDTA titrimetricmethod<br>9. *In-vitro* demonstration of phagocytosis and calculating phagocyticindex<br>10. Demonstration ofradioimmunoassay<br>11. Demonstration of Plackett-Burman design for formulation of Fermentationmedia. | 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 immunologicaldiseases. |
| **CO 2** | Comment on various factors involved in hypersensitivity reactionsand their emphasis ontreatment. |
| **CO 3** | Discuss the making and role of different types of vaccines |
| **CO 4** | Demonstrate the principle techniques and applications involved in *in-vitro and in vivo* 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**<br><br>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**<br><br>Types of hypersensitivity reactions, Mechanism, Factorsinvolvedandtheirtreatment,Immunologyof transplantation. purified macromolecules as vaccine, Recombinant vector Vaccine, DNA Vaccines,multivalent SubunitVaccines | 15 |
| | III | **CMI and imaging**<br><br>Cell Cytotoxicity, mixed lymphocyte reaction, Apoptosis, Cell cloning, Reporter Assays,Peptibodies- production and application; Cell imaging Techniques- *In vitro*and*In vivo*; Immuno-electron microscopy; *In vivo* cell tracking techniques; Application based microarray, Phage display | 15 |
| | IV | **Psychoneuro- immunology**<br><br>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, IntroductionandHistoryofNeuroendocrinecircuitry, disorder of Thoughts and volition – Schizophrenia, Addition of Action ofDrug. | 15 |

**References:**


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

# Practical
## RPSBTKP202

| Course Code | Title | Credits |
|---|---|---|
| RPSBTKP202 | Research Project Undertaken by students | 2 |

## 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** | Elucidatethebasicmechanismofdifferenttypesofenzymesandtheir widespreadapplications. |

## DETAILED SYLLABUS

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

| | | | |
|---|---|---|---|
| | II | **Food Rheology**<br>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. | 15 |
| | III | **Applications of microbes and enzymes in food processing**<br><br>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.<br><br>Food ingredients and additives prepared by fermentationandtheirpurification;fermentationasa method of preparing and preservingfoods.<br><br>Microbesandtheiruseinpickling,producingcolours andflavours.<br><br>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 | 15 |
| | IV | **Enzymology**<br><br>Enzyme – Concept and kinetics, active site formation and its significance, Michaelis-Mentonequation – Derivation and transformation,<br><br>Enzyme inhibition and types of inhibitors, control of enzyme activity, allosteric regulations, parameters affecting enzyme activity.<br><br>Types of enzymes: isoenzymes, ribozymes, abzymes, substrate specificity and coenzymes | 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 usedfor 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<br><br>(Ex :Gene finding/ exon-intron finding, Signal peptide finding), Motif finding using HMM, ANN (Ex:Prosite)<br><br>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 | **Applications of Bioinformatics**<br><br>Microarray data analysis,Printingtechniques,Features of microarray,Flag features of microarray,Data normalization in microarray,Human genome project and specialised databases under NCBI (Eg OMIM, chromosome, PubMed),Proteomics, Consesnsus sequence, PSSM,Sequencelogo. | 15 |
| | III | **Phylogenetics**<br><br>Darwinism and neo Darwinism theories of evolution. Population genetics and different forces acting on it.<br><br>Bioinformatics tools for phylogenetic analysis. | 15 |
| | IV | **Vitamins**<br><br>National Institutes of Health Office of Dietary Supplements (ODS) for sources, activity of vitamins, deficiency disorders, overconsumption effects of Vitamins:<br><br>Water soluble- B1, 2,3,5,6,7,12<br><br>Fat soluble- A, D, E, K | 15 |

**References:**


1. Bioinformatics – A practical guide to the analysis of genes and proteins byA.D. Baxvanis
2. Bioinformatics by N. Gautam(2006)
3. Bioinformatics:SequenceandGenomeAnalysis(SecondEdition2004),DavidW. Mount , (Coldspring Harbor Laboratory Press)
4. Bioinformatics and Functional Genomics (2003 ), Jonathan Pevsner, JohnWiley andsons.
5. iGenetics by Peter J.Russel, 3rd Edition, PearsonPublications
6. Handbook of Vitamins:https://ods.od.nih.gov/factsheets/list-VitaminsMineral

# Practicals
## RPSBTKP204

| Course Code | Title | Credits |
|---|---|---|
| RPSBTKP204 | 1. Classification of biological databases speciallycover NCBI andINSDC<br>2. Phylogenetic tree usingBootstrap<br>3. BLAST – orthologs, paralogs andhomologs<br>4. Motiffinding<br>5. KEGG<br>6. Structureofproteins-identificationofchainshelices, special groups, metal ionsetc.<br>7. CATH/SCOP classification of a givenprotein<br>8. Homologymodelling | 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 TheoryExamination:**

3. Duration - These examinations shall beof**2.5hrs** duration.
4. Theory question paper pattern:

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

**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:**

**D) External Examination: - 50Marks**

**Semester End PracticalExamination:**

| Particulars | Paper |
|---|---|
| Laboratory work | 40 |
| Journal | 05 |
| Viva | 05 |
| **Total** | **50** |

**SEMESTER II:PRACTICAL COMPONENT**

- RESEARCH PROJECT TO BE EXECUTED FOR THE RESEARCH PROPOSAL SUBMITTED IN SEMESTER I

**Overall Examination & Marks Distribution Pattern**

**Semester II**

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