MAHARSHI DAYANAND SARASWATI UNIVERSITY
AJMER

B.Sc. with BIOTECHNOLOGY

CURRICULUM 2023-24

Scheme for assessment of courses

1. Each theory paper will be assessed in two parts. The continuous assessment shall be marked out of 30 marks and the end term assessment shall be out of 70 marks.
2. The duration of the end semester examination shall be 3 hours.All Question Papers for the End Semester will be set out of a maximum of 70 marks.It will be divided in two parts i.e. Part A and Part-B.
3. Part-A will consist of 10 compulsory questions. There will be at least three questions from each unit and answer to each question shall be limited upto 50 words. Each question will carry two marks. Total 20 Marks.
4. Part-B will consist of 10 questions. At Least three questions from each unit be set and students will have to answer five questions, selecting at least one question from each unit. The answer to each question shall be limited to 400 words. Each question carries 10 Marks. Total 50 Marks.

Practical examinations: Practical examination shall be of 50 marks. There will be a panel of examiners consisting of one external and one internal examiner.

Following is the distribution of marks in practical courses:

S. No.	Item	Maximum marks
1	Experimental work assigned during examination	25
2	Attendance	5
3	Record	10
4	Viva voce	10

Course Framework for BSc with Biotechnology

Course	Credit					
Year	Year I		Year II		Year III	
Semester	I	II	III	IV	V	VI
Discipline Specific Core Courses	6(4+2)	6(4+2)	6(4+2)	6(4+2)	-	-
	BTC5101T-C Biomolecules: Structure and Function (4L)	BTC5201T-C Introduction to Microbiology and Principles of asepsis (4L)	BTC6301T-C Molecular and Cellular Biology (4L)	BTC6401T-C Comparative Physiology (4L)		
	BTC5102P-C Laboratory Practices and Analytical Techniques in Biochemistry (2P)	BTC5202P-C Biotechnological Skills & Aseptic Techniques(2P)	BTC6302P-C Experimental Cell Biology (2P)	BTC6402P-C Experimental Physiology (2P)		
Discipline Specific Elective Interdisciplinary					6(4+2)	6(4+2)
					BTC7501T-E Industrial Biotechnology(4L) + BTC7502P-E Experiments in Industrial Biotechnology(2P) or BTC7503T-E Immunology & Immunotechnology (4L)	BTC7601T-E Bioinformatics(4L) + BTC7602P-E Bioinformatics in silico (2P) or BTC7603T-E Medical Biotechnology (4L)

					+ BTC7504P-E Experimental Immunology or BTC7505T-E Genomics & Proteomics (4L) + BTC7506P-E Experimental Genomics & Proteomics (2P)	+ BTC7604P-E Experimental Medical Biotechnology (2P) or BTC7605T-E Food Biotechnology (4L) + BTC7606P-E Experimental Food Technology (2P)
Discipline Centric Core II (Other than subject)	**6(4+2)**	**6(4+2)**	**6(4+2)**			
Discipline Centric Core III (Other than subject)	**6(4+2)**	**6(4+2)**	**6(4+2)**			
Ability Enhancement Course (Hindi/English/Rajasthani)	**2**	**2**				
Skill Enhancement course	**-**	**-**	**2**	**2**	**2**	**2**

			BTC6303T-S **Biotechniques (2L)**	**BTC6403T -S** **rDNA Technology (2L)**	**BTC7507T-S** **Bioethics, Biohazards and IPR (2L)**	**BTC7607T-S** **Enzyme Technology (2L)**

Course Content

Semester I

BTC5101T-C Biomolecules : Structure and Function (4L)

Objectives:
1. To understand the atomic, molecular structures and bonding.
2. To understand the occurrence and structure of carbohydrates.
3. To correlate the protein functions with their native conformations.
4. To differentiate the different classes and forms of lipids.
5. To comprehend the basic characteristics of nucleic acids and enzymes.

Course Outcomes:
1. At the completion of the course, the student would be able to
2. Recognize the different classes and forms of carbohydrates and their occurrence in the ecosystem.
3. Interpret the functions of proteins relative to their native structures.
4. Describe the various forms of lipids and their functions relative to their location.
5. Utilize the structure of nucleic acids for the understanding of central dogma of life.
6. Interpret the mechanism of enzyme actions and kinetics.

Unit I
Thermodynamics and Bioenergetics: First and second laws of thermodynamics, enthalpy, entropy, free energy change, standard free energy change, equilibrium constant and spontaneous reactions. Coupled reactions and additive nature of standard free energy change.
Carbohydrates: Monosaccharides: aldoses and ketoses, epimers, mutarotation and anomers of glucose, Haworth projection formulae for pyranose form of glucose, furanose form of fructose, chair and boat forms of glucose, sugar derivatives- glucosamine, galactosamine, muramic acid, N-acetyl neuraminic acid.
Disaccharides: concept of reducing and non-reducing sugars, Haworth projections of maltose, lactose, and sucrose.
Polysaccharides: storage polysaccharides-starch and glycogen, structural polysaccharides- cellulose, peptidoglycan and chitin.

Unit II
Lipids: Introduction to storage and structural lipids. Storage lipids: triacylglycerols, building blocks, fatty acids structure and properties, essential fatty acid, saponification.
Structural lipids: phosphoglycerides- building blocks, structure of phosphatidylethanolamine and phosphatidylcholine; sphingolipids- building blocks, structure of sphingosine, ceramide, general structure and functions of sphingomyelin,
cerebroside and ganglioside. Introduction to lipid micelles, monolayers, bilayers and liposomes.

Unit III

Proteins: The building blocks-amino acids: classification, biochemical structure and notation of standard protein amino acids, general formula of amino acids. Concept of zwitterion, titration curve of amino acid and its significance. Ninhydrin reaction. Nonprotein amino acids: beta-alanine, D-alanine and D- glutamic acid. Oligopeptides: structure and functions of glutathione, aspartame, insulin. Protein structure: primary, secondary- peptide unit salient features, α helix, β sheet, β turn, tertiary and quaternary human hemoglobin as an example. Forces involved in protein folding.
Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types & theories, Clinical significance-inborn errors (phenyl ketone urea).

Suggested Reading:

1. Berg, J.M., Tymoczko, J.L., Gatto, G.J., and Stryer, L. (2019). Biochemistry. 9th edition. W.H. Freeman and Company, UK.
2. Campbell, M.K., Farrell, S.O. and McDougal, O.M. (2017). Biochemistry. 9th edition. Cengage Learning, USA.
3. Nelson, D.L. and Cox, M.M. (2017). Lehninger Principles of Biochemistry. 7th edition. W.H. Freeman and Company, UK.
4. Voet, D. and Voet, J.G. (2016). Biochemistry. 5th edition. John Wiley and Sons, UK.
5. Robert K. Murray, Daryl K. Granner and Victor W. Rodwell, “Harper’s Illustrated Biochemistry”. McGraw Hill Education (Asia), 2006.
6. Jeremy M. Berg, John L. Tymozko and Lubert Stryer, “Biochemistry”, Fifth edition, W.H. Freeman and Company, New York, 2002.

BTC5102P-C Laboratory Practices and Analytical Techniques in Biochemistry (2P)

Course Objectives:
1. To educate students about the importance of laboratory safety and instill good laboratory practices. They should also learn how to handle chemicals, dispose of waste and maintain a clean and organized laboratory environment.
2. To enable students to develop essential laboratory skills, including accurate documentation of lab records glassware handling and measurements, ensuring precision and minimizing errors.
3. To introduce students to key analytical techniques commonly used in laboratories, such as titration and spectrophotometry. They should also understand the applications and limitations of these techniques in scientific research and experimentation.

Expected Outcomes
1. Students will demonstrate knowledge of laboratory safety protocols and understand the importance of good laboratory practices, ensuring a safe and productive working environment relevant to the industrial scenario.
2. Students will be able to apply basic analytical techniques used in laboratory experiments and will demonstrate proficiency in instrument handling, calibration, data analysis and experiments

1. Safety and Lab Equipment Orientation: Familiarize students with the layout of the laboratory, safety guidelines, emergency procedures, and location of safety equipment (fire extinguishers, eyewash stations, etc.). Introduce students to common laboratory materials such as pipettes, wash bottles, balances, centrifuges, and microscopes. MSDS and their use in laboratory, safety signs.
2. Introduce the laboratory glassware (desiccator, Petri plates, pipettes and their types, Haffkin bottles, Durham tubes, Erhlenmeyer flasks, separating funnels, volumetric flasks, vacuum filtration flasks, distillation unit etc. Demonstrate proper glassware washing procedures, draining and drying.
3. Laboratory Glassware Handling and Measurements: Provide students with a variety of laboratory glassware (Petri plates, beakers, flasks, graduated cylinders, volumetric flasks) and instruct them on proper handling techniques. Discuss different classes of glassware and plasticware and their importance and usage in the biotechnology lab
4. Teach students how to accurately measure volumes using different glassware and reinforce good pipetting skills. Perform Calibration of volumetric apparatus using water for precise measurements and calibration.
5. Solution Preparation and Dilution Techniques: Guide students through the process of preparing different types of solutions (e.g., stock solutions, serial dilutions), need of stock solutions, Introduce the concepts of molarity, normality, percent solutions with accurate concentrations. Emphasize the importance of labelling solutions correctly and calculating dilution factors. Prepare some standard alkali and acid solutions.
6. pH Measurement and Adjustment: Demonstrate the use of pH meters, pH paper/strips and universal indicator for measuring the pH of solutions. Instruct students on how to adjust pH using appropriate acids or bases.
7. Study the effect of end point determining tools (pH meter, conductivity meter and chemical indicator) in a strong acid strong base titration and their accuracy and precision analysis.
8. Buffers and their buffering capacity by monitoring pH change on adding strong acid or base.
9. Demonstrate the principles of solid-liquid and liquid-liquid extraction techniques by extracting plant pigments from spinach leaves. Discuss the choice of solvents based on their properties that affects the efficiency and selectivity of extraction.
10. Compare and discuss the extraction efficiency and yield obtained from the solid-liquid and liquid-liquid extraction techniques. Relate the principles of extraction demonstrated in this exercise to their relevance in various biological and biochemical applications.
11. Microscopy Techniques: Introduce students to the parts and functions of a light microscope. Provide prepared microscope slides and samples for students to observe and practice focusing, adjusting magnification, and using different objective lenses. Calculation of magnification of a microscope. Importance of refractive index and numerical aperture in resolution and magnification Prepare a slide of any biological material and observe after staining. Discuss stains and dyes and their need in microscopy.
12. Spectrophotometry: Introduce students to spectrophotometers and their use in measuring the absorbance of substances at specific wavelengths. Guide students in preparing samples, setting up the instrument, and recording

absorbance readings. Demonstrate its application in measuring the absorbance of a copper sulphate solution at a specific wavelength. Preparation of a standard curve and estimation of concentration in an unknown solution. Discuss laws applicable to spectrophotometric measurements.

13. Verification of Beer's Law Spectrophotometrically
14. Estimation of protein by Lowry method
15. Determination enzyme activity (amylase/ protease).
16. Determination of Iodine number of a fat
17. Estimation of RNA by Orcinol method
18. Estimation of DNA by diphenyl amine method
19. Sugar estimation in samples by anthrone method
20. Reducing sugars DNS method
21. Demonstrate the principle of chromatography and separate different plant pigments /Amino acids /sugars using paper chromatography or TLC.

Semester II

BTC5201T-C Introduction to Microbiology (4L)

Objectives

1. Understand the basic principles and concepts of microbiology
2. Explore microbial structure and function
3. Investigate microbial growth and control
4. Study microbial diversity and classification

Learning outcomes

By the end of the course the student will be able to

1. Demonstrate a fundamental understanding of the principles, concepts, and scope of microbiology.
2. Describe the structure, function, and metabolic processes of microorganisms.
3. Analyse the factors influencing microbial growth and apply microbial control methods.
4. Classify microorganisms based on their phylogenetic relationships and ecological roles.
5. Understand the nutritional requirements of microorganisms
6. Have a good understanding of the microbial world.

Unit I

Prokaryotic and eukaryotic cell structure- Cell membrane, cell wall, and cytoplasmic structures Flagella, pili, and other cellular appendages.

Microbial Diversity and Classification- Classification systems: binomial nomenclature, taxonomy, and phylogenetic relationships, Major groups of microorganisms: bacteria, acellular self-replicating particles, fungi, and protozoa- Features distinguishing different groups (e.g., cell type, reproduction, mode of nutrition)

Unit II

Microbial Growth- Phases of microbial growth: lag phase, exponential phase, stationary phase, death phase.

Environmental Factors Affecting Microbial Growth -Temperature requirements and microbial growth ranges, pH and its effects on microbial growth, Oxygen requirements and different types of microorganisms based on oxygen tolerance.
Microbial Growth Control and Sterilization Techniques- Physical methods of control: heat, filtration, radiation, Chemical methods of control: disinfectants, antiseptics, antibiotics.
Sterilization techniques: autoclaving, dry heat, ethylene oxide

Unit III
Nutritional Requirements of Microorganisms
Macronutrients: carbon, nitrogen, phosphorus, sulfur, oxygen, and hydrogen
Micronutrients: trace elements required by microorganisms
Growth factors: vitamins, amino acids, and nucleotides
Nutritional Strategies of Microorganisms- Autotrophs and heterotrophs: different carbon sources for microbial growth, Chemotrophs and phototrophs: energy sources for microbial metabolism Mixotrophs and facultative organisms: versatility in nutrient utilization.
Culture Media and Growth Conditions- Types of culture media, Enrichment culture techniques and isolation of microorganisms

Suggested Readings

1. Black, 2016.Textbook of microbiology. Freeman Publishers

Reference Books

2. Pelczar MJ, Chan ECS and Krieg. NR. Microbiology, Tata McGraw Hill Edition, New Delhi, India
3. Ananthanarayan, CK Jayaram Panikars. Textbook of Microbiology, 2005, Orient Black swan Publishers

BTC5202P-C Biotechnological Skills & Microbiological Techniques(2P)

Objectives
1. To familiarize students with the importance and implementation of SOPs and GMP in a laboratory or manufacturing setting.
2. General laboratory safety, good laboratory practices, biosafety measures (first-aid practices to be followed in case of burn, acid spills and injury), safety symbols, lab safety equipment (fire extinguisher, fume hood, safety glasses), classes of laboratory chemicals, maintenance and handling of chemicals (Labels, Quality -LR/ AR/ Molecular biology grade/ HPLC grade; Expiry date; Precautions for use), Disinfectants, Biocontainment, Disposal of hazardous chemicals, radioactive and biological waste, Laboratory waste management.
3. Calculate cell size using micrometer.
4. Calculate number of cells (pollen/spores) using haemocytometer.
5. To optimize the concentration of plant growth regulators for callus induction in plant tissue culture.
6. To propagate plantlets through the process of shoot multiplication using plant tissue culture techniques.
7. To preserve plant germplasm using cryopreservation techniques.
8. Practical session on biosafety practices and the proper use of PPE, including lab coats, gloves, masks, and safety glasses. Students practice donning and doffing

PPE correctly and understand their importance in maintaining aseptic conditions and personal safety.
9. Demonstrate different sterilization techniques used in aseptic practices. Introduce to the concept of dry heat, wet heat, filtration, tyndallisation, pasteurization).
10. Culture media preparation for plant tissue culture/ animal cells/bacteria and Media sterilization by autoclaving, plating and subculturing, aseptic transfer of microbial cultures
11. Demonstrate ubiquity of microorganisms
12. Surface sterilization of leaves and or stem segments using disinfectants like bleach or ethanol or mercuric chloride and comparative analysis of their microbial content before and after sterilization
13. Bacterial enrichment and isolation using the streak plate method
14. Effectivity of UV sterilization and subsequent photoreactivation.
15. Antimicrobial susceptibility testing

Sem III

BTC6301T-C (4L) Molecular and Cellular Biology

Unit I

Introduction to Molecular Cell Biology - Definition and Scope of Molecular Cell Biology, Importance of Cell Biology in Understanding Living Organisms

Cell Structure and Function -Cell Types and Diversity, Cell Organelles: Structure and Function, Cell Membrane Dynamics, Cytoskeleton and Cell Motility

Cell Cycle and Division - Cell Cycle Phases, Cell Cycle Regulation, Mitosis and Meiosis, Cell Division and its Control

Unit II

Cellular Signaling - Cell Signaling Pathways, Signal Transduction, Receptors and Second Messengers, Cell Communication and Response

Biomolecules in Cellular Processes - DNA Structure and Replication, RNA Structure and Transcription, Protein Structure and Synthesis, Enzymes and their Roles in Cellular Reactions

Unit III

Genetics and Inheritance - Mendelian Genetics, Chromosomal Basis of Inheritance, Genetic Variation and Mutation

Gene Expression and Regulation - Transcriptional and Post-transcriptional Regulation, Regulation of Protein Synthesis, Epigenetics and Chromatin Structure

Cell Death and Differentiation - Apoptosis and Necrosis, Cell Differentiation, Stem Cells and Development

BTC6302P-C (2P) Experimental Cell Biology

1. Mitosis and the Cell Cycle in Onion Root-Tip Cells
2. Meiosis in Pollen mother cells of plants
3. Preparation of stained mounts of anatomy of monocot and dicot's root, stem & leaf.
4. Protein purification by salt precipitation
5. Polyacrylamide gel Electrophoresis of proteins
6. Genomic DNA isolation by CTAB method
7. Agarose gel electrophoresis for DNA separation
8. Affinity Chromatography
9. Osmosis by plasma membrane
10. Periodic acid Schiff staining for polysaccharides
11. Sudan black staining for lipids
12. Feulgen reaction for DNA histochemistry
13. Cell fractionation and determination of enzyme activity in organelles using sprouted seed or any other suitable source.

BTC6401T-C (4L) Comparative Physiology

Objectives

To gain

1. Comprehensive understanding of cellular metabolism
2. An insight into energy generation mechanisms across living systems
3. Understanding biomolecule synthesis and breakdown

Learning Outcome

1. a deep understanding of the diverse strategies used by eukaryotes and prokaryotes to obtain and utilize nutrients and energy production mechanisms
2. insights into the molecular processes involved in the synthesis, breakdown, and recycling of essential biomolecules.

Unit I

Nutritional strategies of eukaryotes and prokaryotes, Differences in nutrient uptake and utilization mechanisms

Carbon fixation: Photosynthesis-Photosynthetic pigments, apparatus, light reaction, Anoxygenic and Oxygenic photosynthesis, Carbohydrate biosynthesis, Gluconeogenesis, Glycogenesis, starch and cellulose synthesis, Glycogenolysis, Respiration and energy production, Glycolysis, oxidative phosphorylation, EMP Pathway, Gluconeogenesis, HMP pathway, ED pathway, Modified ED pathway in

Archaea, Phosphoketolase pathway, Citric acid cycle, Replenishment of TCA cycle intermediates, Incomplete TCA fork and Reductive TCA cycle, Electron transport (oxidative phosphorylation) Pentose phosphate pathway, photorespiration, Fermentation pathways (lactic acid, butyric acid, acetic acid, ethanol) Anaerobic respiration using alternative electron acceptors

Unit II

Lipid biosynthesis Fatty acids, Triglycerides and phospholipids, Lipolysis and its role in lipid metabolism and energy production, Fatty acid oxidation, Ketogenesis and ketolysis, Isoprenoid biosynthesis, Steroidogenesis

Amino acid biosynthesis, Shikimate pathway, Deamination, decarboxylation, transamination and other reactions involved in amino acid breakdown, Collagen synthesis, Proteolysis and enzymes involved in protein degradation, Urea cycle and disposal of nitrogenous wastes, Assimilation of nitrogen in plants, animals and bacteria

Unit III

Nucleotide biosynthesis (Pyrimidine and purine synthesis), Purine and pyrimidine degradation pathway, Salvage pathway, Autophagy and its role in nutrient re-mobilization and stress response.

BTC6402P-C (2P) Experimental Physiology

1. Finding the coagulation time of blood
2. Determination of blood groups
3. Counting of mammalian RBCs
4. Determination of TLC and DLC
5. Determination of Haemoglobin
6. Demonstration of plasmolysis by Tradescantia leaf peel
7. Demonstration of opening & closing of stomata
8. Demonstration of guttation on leaf tips of grass and garden nasturtium or any other plant
9. Separation of photosynthetic pigments by paper chromatography.
10. Demonstration of aerobic respiration.
11. Preparation of root nodules from a leguminous plant.

BTC7601T-C Industrial Biotechnology (4L)

Objective

1. To impart knowledge on various industrial bioprocess.
2. To study about fermentative production of primary metabolites.

3. To endow the students with the fermentative concept of secondary metabolite production.
4. To comprehend the methods of producing enzymes and other biological products.
5. Understand the application of modern biotechnology products.

Learning Outcome

Upon completion of this course, the students will be able to

1. Understand the various industrial bioprocesses
2. Identify commercially important primary metabolites and their usage
3. Evaluate thoroughly the manufacturing processes of various secondary metabolites
4. Assess the various methods for producing industrially relevant enzymes
5. Identify the recombinant proteins used for therapeutic and diagnostic application

Unit 1

Introduction to Industrial Biotechnology

Metabolic Stoichiometry: Stoichiometry of Cell growth and product formation, elemental balances, degrees of reduction, yield coefficients of biomass and product formation and heat evolution in aerobic cultures.

Strain Improvement: Techniques of strain improvement- Random mutation, Auxotrophic mutation, rDNA technology and protoplasmic fusion.

Unit 2

Production of primary metabolites

A brief outline of processes for the production of some commercially important organic acids (e.g. Citric acid, Lactic acid, Acetic acid); Amino acids (Glutamic acid, Phenylalanine, Aspartic acid etc.,) and alcohols (Ethanol, Butanol etc.,).

Production of secondary metabolites- Study of production processes for various classes of secondary metabolites: Antibiotics: Beta-lactams (Penicillin, Cephalosporin etc.), Aminoglycosides (Streptomycin)

Unit 3

Production of industrial enzymes such as Proteases, Amylases, Lipases, Cellulases etc., Production of Biopesticides, Biofertilisers, Bio preservatives (nisin), Cheese, Biopolymers (Xanthan gum, PHB), Single cell protein.

Production of recombinant proteins having therapeutic and diagnostic applications, Production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture.

Suggested Reading

Principles of Fermentation Technology by Peter F. Stanbury, Allan Whitaker
Bioprocess Engineering Basic Concepts Michael L. Shuler, Fikret Kargi
Bioprocess Engineering Principles by Pauline M.Doran
Introduction to Biochemical Engineering by D.G.Rao

Fermentation Technology by M.L. Srivastava
Biochemical Engineering Fundamentals by Bailey and Ollis
M.L.Shuler and F. kargi Bioprocess engineering, Prentice Hall of India 1992
D.G.Rao, Introduction to Biochemical Engineering, McGraw-Hill, 2005.
Fermentation Microbiology and Biotechnology E.M.T. El-Mansi, C.F.A. Bryce, A.L.Demain, A.R..Allman
Cruger, W., Crueger, A. (2005). Biotechnology: A Textbook of Industrial Microbiology, Panima Publishing Corporation, Second Edition.
CasidaJr, L.E. (2015). Industrial Microbiology, New Age International (P) Ltd., 4th Edition, New Delh
Jogdand, S.N. (2006). Industrial Biotechnology: Approach to Clean Technology, Himalaya Publishing House, 2nd Edition, Mumbai.
Murrey Moo & Young. (2011). Comprehensive Biotechnology, Elseiver Publication, 2 Nd Edition.
https://ebookcentral.proquest.com/lib/hindustanuniv/detail.action?docID=588366
https://books.google.co.in/books?isbn=3527630244

BTC7502P-E (2P) Experiments in Industrial Biotechnology

1. Study different parts of fermenter.
2. Microbial fermentations for the production and estimation (qualitative and quantitative) of:
    (a) Enzymes: Amylase and Protease.
    (b) Amino acid: Glutamic acid.
    (c) Organic acid: lactic acid/ Acetic Acid
3. Fermentative production of antibiotics/ vitamins
4. Determine thermal death time of given bacteria
5. Fermentative production of enzyme – Amylase/lipase
6. Fermentative production of alcohol using Sacharomyces cerevisiae
7. Fermentative production of wine using fruit juice.
8. Fermentative production of organic acid (Citric acid)
9. Estimation of ascorbic acid from given food sample/fermented broth by titrimetric method
10. Estimation of penicillin/streptomycin by chemical assay
11. Comparative analysis of design of a batch and continuous fermenter
12. Calculation of Mathematical derivation of growth kinetics.

BTC7503T-E (4L) Immunology and Immunotechnology

Course Objectives:

1. To explain the basics of immune system in humans and cellular mechanisms involved
2. To demonstrate the different immune systems in determining infection and immunological disorders including tumor

3. To translate the concepts in better diagnosis of diseases and their probable treatment

Learning Outcome:

1. Relate various immunological components in body's defense mechanism
2. Appraise of cellular functions in monitoring immunity
3. Make use of cellular activity in defining immune system
4. Translate the immune mechanisms in determining infection and immunological disorders
5. Development of different diagnostic techniques and applications
6. Appraisal of different therapeutic techniques and applications

Unit I

Immune system: An overview & significance of immunology. Hematopoiesis: Origin and differentiation of Lymphocytes and phagocytic cells- receptors and signals that control lymphocyte lineage commitment. Cytokines.Cells and tissues of the immune system-Lymphoid organs

Immunity types: Innate and acquired immunity. Elements of Immunity – B lymphocytes and thymus derived (T) Lymphocytes. Immunogens and antigens, complement system

Unit II

Humoral& Cellular Immunity: Immunoglobulins - Classes and subclasses, organization and expression of immunoglobulin genes.

Immunoglobulin gene rearrangement –antibody diversity – B-cell development & activation. TCR, TCR diversity, T cell receptor gene rearrangement. T-cell development & activation Antigen processing and presentation: Classes of MHC – MHC/HLA genetic loci. Molecular structure and assembly of MHC molecules, Antigen presenting cells- antigen processing and presentation. Immunity to infection, Hypersensitivity

Reactions and autoimmunity: An overview of immune response to infections, Hypersensitivity reactions, Immunological tolerance- B & T cell tolerance. Autoimmunity: - an overview of the immunopathogenic mechanisms of autoimmunity.

Unit III

Immunology of tumors and transplantation: Tumors: Immune response to tumors-types of tumor antigens. Transplantation: Types,immunological mechanisms of graft rejection- immunological strategies to prevent graftrejection-role of immunosuppressive drugs.

Immunotechnology: Hybridoma technology - Production and purification of monoclonal antibodies;polyclonal antibodies Antibody engineering. Immunotechniques: ELISA, ELISpot, Immunofluorescence, Flow Cytometry, immunohistochemistry Immunodiagnostics &immunotherapeutics: Current trends & applications

Suggested readings

1. Roitt I, Male, Brostoff. (2002). Immunology, Mosby Publ., 2nd Edition.
2. Kindt, T.J., Goldsby, R.A., Osborne, B.A., Kuby, J., Kuby. (2007). Immunology, W.H. Freeman, 4th Edition.
3. Chakravarthy, A. (2008). Immunology, Tata McGraw-Hill, 3rd Edition.
4. Punt, J., Stranford, S., Jones, P., Owen, J.A., Kuby. (2018). Immunology, Macmillan Learning publisher, 8th Edition.
5. https://books.google.co.in/books?isbn=1118451643
6. https://books.google.co.in/books?id=rhRrAAAAMAAJ

BTC7504P-E (2P) Experimental Immunology

1. Antigen-Antibody reactions – Agglutination (Blood grouping testing).
2. Antibody titration (Ouchterlony Double Diffusion).
3. Antigen-Antibody reactions – Immuno-electrophoresis,
4. Rocket immuno-electrophoresis.
5. Antigen-Antibody reactions – Coomb's test.
6. Antigen-Antibody reactions – ELISA.
7. Haemagglutination inhibition assay
8. Separation of serum from blood
9. Hemolysis testing

SUGGESTED READING

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition WileyBlackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg. 6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

BTC7505T-E (4L) Genomics and Proteomics

Objectives

The objectives of this course is to provide introductory knowledge concerning genomics, proteomics and their applications.

Learning outcomes

On completion of this course, Students should be able to: Students should be able to acquire knowledge and understanding of fundamentals of genomics and proteomics, transcriptomics and metabolomics and their applications in various applied areas of biology.

Unit I

Introduction to Basics of Genomics and Proteomics- Introduction to prokaryotic and eukaryotic genome organization- Genome Sizes, c- Value Paradox, extra-chromosomal DNA: bacterial plasmids, mitochondria and chloroplast. Central

Dogma of Molecular Biology, Significance of studying genomes and proteomes with respect to basic and applied sciences.

Conventional and modern methods of Genome Mapping - Genetic and physical maps; markers for genetic mapping; methods and techniques used for gene mapping, linkage analysis, recombination frequency calculation-based gene mapping, cytogenetic techniques, Fluorescent in situ Hybridization technique in gene mapping, somatic cell hybridization, radiation hybrid maps, comparative gene mapping, physical mapping

Unit II

Genome Sequencing for physical mapping - Methods for isolation of DNA and preliminary characterization of Genomic and ExtraChromosomal DNA. Methods for DNA fragment/ Whole

Genome Sequencing. Chemical Modification based DNA sequencing, Sanger‘s DNA sequencing Method. Automated Sanger‘s DNA sequencing Method. Next Generation Sequencing Methods (Pyrosequencing, Ion Torrent sequencing, Reversible Chain Termination Sequencing), 3rd Generation Sequencing (Nanopore Sequencing & Single Molecule Real Time Sequencing). Raw Sequence Reads from 1st Generation, NGS and 3rd Generation Sequencing Platforms, Quality Assessment of Raw Reads, Assembly and Annotation of the Sequence Reads

Genome Projects Comparative and Evolutionary Genomics- Human Genome Project, genome sequencing projects for microbes, plants and animals,accessing and retrieving genome project information from the web. Identification and classification of organisms using molecular markers- 16S rRNA typing/sequencing, SNPs; use of genomes to understand evolution of eukaryotes, track emerging diseases and design new drugs; determining gene location in genome sequence.

Unit III

Proteomics and Metabolomics- Aims, strategies and challenges in proteomics; proteomics technologies: 2D-PAGE, isoelectric focusing, mass spectrometry, MALDI-TOF, yeast 2-hybrid system, proteome databases. protein-protein and protein-DNA interactions; protein chips and functional proteomics; clinical and biomedical applications of proteomics; introduction to metabolomics, lipidomics,metagenomics and systems biology.

Recommended Textbooks and References:

1. Arthur M. Lesk: Introduction to Genomics
2. Brown TA: An Introduction to Genomes
3. Jamil Momand, Alison McCurdy: Concepts in Bioinformatics and Genomic

BTC7506P-E (2P) Experimental Genomics and Proteomics

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. Softwares for Protein localization.
6. Hydropathy plots
7. Native PAGE
8. SDS-PAGE

SUGGESTED READING

1. Genes IX by Benjamin Lewin, Johns and Bartlett Publisher, 2006.
2. Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
3. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition,
4. B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.
5. Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III,
6. Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001.
7. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and SonsInc.
8. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition.
9. Benjamin Cummings. 12. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

BTC7601T-E Bioinformatics

UNIT I

History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web

Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web

UNIT II

Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry

Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

UNIT III

Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools.

BTC7602P-E (2P) Bioinformatics in silico

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W.

SUGGESTED READING

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

BTC7603T-E (4L) Medical Biotechnology

Course Objectives:

1. To enlighten the knowledge of the Students on different areas of Medical Biotechnology.
2. To train the Students in a hospital based setup and familiarize them with the clinical diagnostics of diseases.
3. To make Students acquainted with the fundamental concepts of nanotechnology and develop an understanding to employ its principles in modern biotechnology applications.

Course Learning Outcomes:

Students will be able to

1. Explain insights about genetic diseases and also about the molecular aspects related to human disease
2. Gain new insights into molecular mechanisms of nucleic acid and gene therapy
3. Gain knowledge about therapeutic recombinant proteins and immunotherapy for the treatment of different diseases.

UNIT – I

Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis).

Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketonuria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia.

Unit II

Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues.

Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Therapeutic proteins and peptides – Erythropoietin, Tissue plasminogen activator, clotting factor VIII.

Antibody Engineering and Therapeutic Antibodies. Phage therapy.

Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy, application of gene therapy in medicine.

Unit III

Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment.

Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sources and types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cell ethics.

BTC7604P-E (2P) Experimental Medical Biotechnology

1. Biochemical test for identification of bacteria
2. Extraction and separation of Antigen proteins from Bacteria & protozoa
3. Estimation of blood glucose.
4. Estimation of cholesterol in blood.
5. Estimation of iron in blood.
6. Biological synthesis of nanoparticles
7. Detection of plasmodium pathogen using peripheral smear
8. Karyotyping of normal and abnormal human chromosome sets
9. Human pedigree analysis
10. Estimation of C-reactive protein
11. Dot ELISA
12. Genotyping of candidate genes for diseases by RFLP
13. Detection of DNA damage by comet assay

Suggested Reading

1. Glick B.R. and Pasurank..Molecular biotechnology – Principle and Applications of Recombinant DNA- J.I.(4th edition), ASM Press. 2010.
2. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4th edition), Wiley – liss publishers, 2006.
3. Hornyak. G.L , Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008.

Further Reading:

4. Jogdand. S. N. Medical Biotechnology –, (4th edition), Himalayan publishing house, 2004.
5. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition) , Wiley – Liss publishers, 2007.

BTC7605T-E (4L) Food Biotechnology

Objective

To provide students with an understanding of the composition of food, nutritional requirements, and the relationship between food and health.

Learning Outcomes:

Understand how biotechnology is contributing to the food industry and understand the peospects of a biotechnologist in such an industry

UNIT I

Basics of Food Science and Nutrition: Understanding the composition of food Nutritional requirements and considerations, Relationship between food and health

Enzymes in Food Processing, Types of enzymes used in food industry, Applications of enzymes in food quality improvement

UNIT II

Lactic acid bacteria-put a dash distribution, classification and physiology; antimutagenic, antimicrobial and health-promoting effects; malo-lactic. Protective factors of lactic bacteria in food preservations. Yeasts and moulds associated fermented food. Technology for the production of Sauerkraut, Kimchi, Bamboo shoot, rice beer, idli, dosa, yogurt, dahi, kefir, cheese, miso, tempeh and salami, traditional fermented food of India, nutritional changes.

UNIT III

Microbes in food technology: microbial starters for industrial production; sources, propagation, preservation, and use of starters. Improvement of starters by classical and molecular biological techniques. Microbial protein as food and feed: SCP and economics of SCP and microbially derived additive flavours and odors, Pathogenic microbes – infections; bacterial toxins and mycotoxins sources, physiological effects; methods of prevention and control in foods and feeds.

Suggested Reading

1. Food biotechnology Ed .dietrich knorr, Marcell dekker inc.
2. Handbook of food analysis (vol I & vol II) Leo M Nollet, Marcel Dekker
3. Food microbiology _ W.C Frazier; Mc Graw Hill Book Co.
4. Modern food microbiology J. M. Jay, D. Van; Nostrand co.
5. Fermented food (7)-Ed. by A.H Rose; Academics Press
6. Microbial food poisoning _Ed.A.R. Elev. Chapmam & Hall
7. Principles of enzymology for food science – whittaker ,J.R Marcle Dekker
8. Introduction to fermentation technology –Whittaker
9. Biochemical Reactors _JM Lee; Prentice Hall Inc,USA
10. Bioprocess technology: Fundamentals and application, KTH, Stocholm

BTC7606P-E (2P) Experimental food technology

1. Proximate analysis of food samples- moisture, total fiber
2. Determination of chemical constituents- titratable acidity, phenolic components, reducing/nonreducing sugars, ascorbic acid

3. Microbiological analysis of food- Microbiological analysis of milk by MBRT method, Analysis of coliforms by presumptive and confirmatory testing
4. Food preservation: SPC of heterotrophs in canned/preserved food
5. Food fermentations: Preparation of fermented foods
6. Enzymes in food processing- Demonstrate and estimate protease activity in meat tenderization/ amylase activity in bread making/diastase activity in malting

Skill Enhancement Courses for BSc with Biotechnology

BTC6303T-S (2L) Biotechniques

Course Objectives:

1. To impart knowledge and skills in using various analytical instruments
2. Expertise of the concepts, principles and contemporary issues
3. Illustration and analysis of techniques and skills of modern Bio engineering instruments

Expected Course Outcome:

1. Define and relate the standard operating techniques of various instruments.
2. Compare and optimize instrumentation for bioassays
3. Interpret and identify the principle and applications of biological instruments
4. Examine test samples to know the error and for standard analysis
5. Experiment with analytical instruments for bimolecular estimations and their result analysis
6. Impart the knowledge of molecular Biology Techniques

Unit I

GLPs – Standard Operating Procedures - Documentation - record maintenance. Laboratory and Notebooks - Specifications and Report Sheets Analytical Methods and Validations- -Calibration

Maintenance Logs.

Qualitative and quantitative analysis:

Titrimetric and volumetric analyses , Mass analyses – gravimetric techniques - pH meter principles and components - potentiometric titration - principles and components conductivity meter and conductimetric titration

Unit II

Principles and uses of Spectrophotometry : working principle, instrumentation, sample preparation and its applications and types(UV –VIS, AAS, AES, Spectroflurometry)

IR, MS & NMR Spectroscopy: Principles and applications of IR, FTIR, Mass spectrometer, Nuclear magnetic resonance (NMR)

Unit III

Electrophoresis: Theory of electrophoresis and types of electrophoresis zonal, moving boundary and pulse field – their principles and applications. Capillary electrophoresis, 2D. Optical densitometry

Chromatography Theory of Chromatography and types (Paper, TLC, HPTLC, column, GC, HPLC) – their principles and applications

Suggested Reading

Keith Wilson and John Walker Principles and Techniques of Biochemistry and Molecular Biology, Sixth Edition 2015
Reference Books
Fifield F.W., 2016. Principles and Practice of Analytical Chemistry. Blackwell, Scientific Publishers.
AvinashUpadhyay; KakoliUpadhyay; NirmalenduNath 2015 Biophysical chemistry: (principles and techniques) Himalaya Pub. House Mumbai.
Nag, A. 2016. Analytical Techniques In Agriculture Biotechnology And Environmental Engineering. Prentice Hall India, New Delhi.
Philopose P.M. 2016. Analytical Biotechnology. Domihant Publishers & distributors, New Delhi.
Lack, C. 2015. Ewing`s analytical instrumentation handbook. Marcel and Dekker Inc.
Boyer, Rodney F. 2015 Biochemistry laboratory: modern theory and techniques. 2nd edition

BTC6403T-S (2P) rDNA Technology

Unit I

Molecular Tools and Enzymes - Restriction enzymes, ligases, polymerases, alkaline phosphatase.
Principle and applications of Polymerase Chain Reaction (PCR), Primer design and RT-PCR.

Unit II

Gene Recombination and Transfer - Transformation, Episomes, Plasmids, and other cloning vectors.
Gene transfer techniques: Microinjection, Electroporation, Ultrasonication.

Unit III

Genetic Engineering Techniques - Restriction Systems and Mapping - Restriction and modification systems, restriction mapping.
Hybridization Techniques and Libraries -Southern and Northern hybridization.
Genomic and cDNA library preparation
Screening of recombinants

BTC7507T-S (2L) Bioethics, Biohazards and IPR

Unit I
Biosafety and risk assessment issues; Regulatory framework; National biosafety policies and law, The Cartagena protocol on biosafety, WTO and other international agreements related to biosafety, Cross border movement of germplasm; Risk management issues - containment. Ecological aspects of GMOs and impact on biodiversity; Monitoring strategies and methods for detecting transgenics; Radiation safety and nonradio isotopic procedure.
Unit II
General principles for the laboratory and environmental biosafety; Health aspects; toxicology, allergenicity, antibiotic resistance, etc; Impact on environment: gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms, creation of superweeds/superviruses, etc.
Unit III

The WTO and other international agreements; Intellectual properties, copyrights,trademarks, trade secrets, patents, geographical indications, etc; Protection of plant variety and farmers right act; Indian patent act and amendments, patent filing; Convention on biological diversity; Implications of intellectual property rights on the commercialization of biotechnology products.

BTC7607T-S (2L) Enzyme Technology

Unit I Fundamentals of Enzymology

Introduction to Enzymes - Definition, classification, and nomenclature of enzymes.

Overview of enzyme structure and function, Enzyme Kinetics, enzyme-substrate interactions, Michaelis-Menten kinetics and enzyme inhibition, Factors Influencing Enzyme Activity- Temperature, pH, and substrate concentration effects on enzyme activity.Cofactors and coenzymes in enzymatic reactions.

Unit II Enzyme Engineering and Modification

Protein Engineering : Rational design and directed evolution of enzymes. Applications in industry and medicine.Immobilization Techniques, Benefits and

applications of immobilized enzymes. Site-Directed Mutagenesis -Designing enzymes with altered properties for specific applications.

Unit III: Industrial Applications of Enzymes

Enzymes in Bioprocessing - Enzymes in food processing, brewing, and biofuel production. Application of enzymes in pharmaceutical manufacturing.Enzymes in Medicine, Therapeutic applications of enzymes, Enzymes in diagnostics and disease treatment., Enzymes in Environmental Biotechnology , Enzymatic approaches for waste treatment and pollution control.

26/2/24

MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER

Minutes

A meeting with reference to letter no. 3674-75 dated 13.02.2024 was held on 21.02.2024 and 23.02.2024 and the following agenda was resolved.

1. The syllabus of UG for All courses B.A, B.Com/B.Sc./B.Sc.(Home Sc.)/BBA/BCA second year- Semester-III and Semester-IV and third year- Semester-V and VI to be developed as per the pattern mentioned below:-

Discipline wise minimum credit required

Course	Credit					
	Year-I		Year-II		Year-III	
	I	II	III	IV	V	VI
DCC	6 (4+2)	6 (4+2)	6 (4+2)	6 (4+2)	-	-
DSE Interdisciplinary	-	-	-	-	6 (4+2)	6 (4+2)
DSE Interdisciplinary	-	-	-	-	6 (4+2)	6 (4+2)
DSE Interdisciplinary	-	-	-	-	6 (4+2)	6 (4+2)
DCC (Other than subject)	6 (4+2)	6 (4+2)	6 (4+2)	6 (4+2)	-	-
DCC (Other than subject)	6 (4+2)	6 (4+2)	6 (4+2)	6 (4+2)	-	-
AEC(Hindi/English/Rajasthani)	2	2	-	-	-	-
SEC	-	-	2	2	2	2
Total Credit	20	20	20	20	20	20

2. The convenor and the member of each BOS/COC should note that one Discipline Centric Core Course (DCC)and one Skill Enhancement Course (SEC) to be prepared for second year- Sem III and Sem IV separately.
3. They should also prepare three Discipline Specific Effective Course(DSE) and one Skill Enhancement Course for Third year -Sem V and Sem VI separately.
4. For Second Year- Sem III and Sem IV, a candidate has to choose one SEC from the discipline for each Semester.
5. With reference to Third year Sem V and Sem VI, a candidate has to opt one Discipline Specific Elective (DSE) from each subject and three from discipline and one SEC from the discipline separately.
6. The examination Scheme will remain as applicable for firs year- Sem I&II under NEP-2020.

Prasad 23/2/2024
(Prof. Shiv Prasad)

23/2/2024
(Prof. Subroto Dutta)

पाठ्यक्रमों में एकरूपता लाने हेतु गाईडलाईन

अध्ययन बोर्ड/पाठ्यक्रम समिति के संयोजको से निवेदन है कि आप द्वारा कार्यालय को उपलब्ध कराये गये पाठ्यक्रमों में एकरूपता लाने के उद्देश्य से अभी केवल प्रथम वर्ष के सेमेस्टर-प्रथम एवं द्वितीय के पाठ्यक्रमों में निम्नानुसार **आवश्यक संशोधन कर, दिनांक 23.08.2023 (बुधवार) तक पाठ्यक्रम की दो-दो हार्ड कॉपी एवं दो-दो सी.डी. आपके एवं संबंधित विषय के संकायाध्यक्ष महोदय के हस्ताक्षर करवाकर कार्यालय को उपलब्ध कराने** का श्रम करावें । आप द्वारा निम्नानुसार पाठ्यक्रम में आवश्यक परिवर्तन किये जाने हैं:-

1. Faculty of Arts, Faculty of Management, Faculty of Humanities, Faculty of Social Science एवं Faculty of Commerce में 03 Disciplinary Centric Core Course सेमेस्टर-प्रथम में एवं सेमेस्टर-द्वितीय में 03 Disciplinary Centric Core Course 06 क्रेडिट के होंगे तथा Faculty of Science में 03 Disciplinary Centric Core Course सेमेस्टर-प्रथम में एवं सेमेस्टर-द्वितीय में 03 Disciplinary Centric Core Course 4+2 क्रेडिट के होंगे ।
2. सेमेस्टर-प्रथम में Ability Enhancement Course के रूप में अंग्रेजी, हिन्दी एवं राजस्थानी विषय होंगे, जो कि 02 क्रेडिट के होंगे । इन तीनों विषयों में से किसी एक विषय को विद्यार्थी के द्वारा Opt किया जाना है । इसी प्रकार सेमेस्टर-द्वितीय में Ability Enhancement Course अंग्रेजी कम्यूनिकेशन स्कील, हिन्दी कम्यूनिकेशन स्कील एवं राजस्थानी कम्यूनिकेशन स्कील का होगा, जिसके 02 क्रेडिट होंगे । इन तीनों विषयों में से किसी एक विषय को विद्यार्थी के द्वारा Opt किया जाना है । उक्त Ability Enhancement Course अंग्रेजी, हिन्दी एवं राजस्थानी विषय के अध्ययन बोर्ड/पाठ्यक्रम समिति के द्वारा पृथक से तैयार कर उसकी अलग से दो-दो हार्डकॉपी एवं दो-दो सी.डी. उपलब्ध करायी जानी है ताकि उन्हें पृथक से सभी संकायों के लिए वैबसाईट पर अपलोड कराया जा सके । उक्त Ability Enhancement Course सभी संकायों में लागू होगा । Ability Enhancement Course 100 अंक का होगा, जिसमें सैद्धांतिक पेपर 70 अंक का एवं आंतरिक मूल्यांकन 30 अंक का होगा, जो कि सभी संकायों पर समान रहेगा ।
3. अध्ययन बोर्ड/पाठ्यक्रम समिति को **केवल प्रथम वर्ष के सेमेस्टर-प्रथम एवं द्वितीय** के पाठ्यक्रम के कंटेंट एवं Continues Evaluation Scheme ही देना है । **परीक्षा स्कीम निम्नानुसार होगी जिसे आपके द्वारा तैयार किये जा रहे पाठ्यक्रम के मुख्य पृष्ठ, जिस पर विश्वविद्यालय का नाम एवं पाठ्यक्रम का नाम लिखा है, उसके पश्चात् के द्वितीय पृष्ठ पर डालनी** है:-

Scheme of examination

"Scheme of examination for end of semester examination applicable to all undergraduate courses (Pass course[redacted]).

The question paper of semester Examination for the Disciplinary Centric Core Course (DCCC), Discipline specific elective (DSE), Ability Enhancement Course (AEC), Value Added Course (VAC) and Skill Enhancement Course (SEC) will be of 70 marks and it will be divided in two parts i.e. Part A and Part-B. Part-A will consist of 10 compulsory questions. There will be at least three questions from each unit and answer to each question shall be limited upto 50 words. Each question will carry two marks. Total 20 Marks.

Part-B will consist of 10 questions. Atleast three questions from each unit be set and student will have to answer five question, selecting atleast one question from each unit. The answer to each question shall be limited to 400 words. Each question carries 10 Marks. Total 50 Marks.

4. सत्र 2023-24 हेतु यदि आपके द्वारा ऑनर्स विषय के पाठ्यक्रम तैयार किये गये है, तो उन्हें अभी कार्यालय को उपलब्ध नहीं कराने हैं ।
5. Faculty of Arts, Faculty of Management, Faculty of Humanities, Faculty of Social Science एवं Faculty of Commerce में एक Disciplinary Centric Core Course जिसका क्रेडिट 06 है, का सैद्धांतिक पेपर 70 अंक का एवं आंतरिक मूल्यांकन 30 अंक का होगा एवं Faculty of Science में 70 अंक का सैद्धांतिक एवं 30 अंक का आंतरिक मूल्यांकन होगा तथा प्रयोगिक परीक्षा 50 अंक की होगी ।
6. पाठ्यक्रम 03 यूनिट का तैयार किया जाना है ।
7. Internal Assessment- Continuous Evaluation, संबंधित अध्ययन बोर्ड/पाठ्यक्रम समिति के द्वारा पाठ्यक्रम में समाहित किया जाना है ।

(प्रो. शिव प्रसाद)

(प्रो. सुब्रतो दत्ता)