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DANTULURI NARAYANA RAJU COLLEGE (Autonomous)

(Reaccredited at 'B++' by NAAC)

(Affiliated to Adikavi Nannaya University, Rajamahendravaram)

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DEPARTMENT OF BIOTECHNOLOGY

Course Name : Cell Biology	BTY101	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C101.1	Understand cellular respiration, focusing on electron transport chain as final stage of aerobic respiration.	L2
C101.2	Understand cell cycle regulation mechanisms involving cyclins, CDKs, and checkpoint proteins controlling cell cycle progression.	L2
C101.3	Understand mitochondria structure, function, and significance in cellular physiology.	L2
C101.4	Analyze chloroplast structure and function, including morphology, organization, and roles in photosynthesis.	L4
C101.5	Illustrate passive transport mechanisms: diffusion, facilitated diffusion, osmosis, and factors influencing molecular movement across membranes.	L3
C101.6	Analyze oxidative phosphorylation as the final stage of aerobic respiration in cellular respiration.	L3

Course Name : Biomolecules	BTY102	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C102.1	Explain the detailed knowledge of biomolecules in living systems.	L2
C102.2	Demonstrate the importance of various biomolecules in living organisms.	L3
C102.3	Describe the concept of structural organization and characterization of proteins.	L2
C102.4	Analyze the differences and similarities between the structures of DNA and RNA.	L4

C102.5	List and explain the salient features of bacterial and plant lipids.	L2
C102.6	Describe the role of nucleotides as energy carriers and their other important functions.	L2

Course Name : Microbiology	BTY103	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C103.1	Describe the vast diversity of microbial life. ²	L2
C103.2	Apply knowledge of yeast biology to identify different yeast species based on their morphology and life cycle.	L3
C103.3	Investigate the relationships between the structure and function of bacterial cellular components.	L4
C103.4	Use classification keys to identify various Actinomycetes & Archaeobacteria based on their morphology and ecological characteristics.	L3
C103.5	Classify bacteria into different nutritional categories based on their specific requirements.	L3
C103.6	Compare and contrast the structures of viroids and prions through visual aids and diagrams.	L3

Course Name : Analytical Techniques	BTY104	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C104.1	Explain the principles and methodologies behind Southern blotting.	L2
C104.2	Apply and optimize Isoelectric Focusing (IEF) experiments to achieve optimal separation of protein mixtures.	L3
C104.3	Classify various types of centrifugation techniques based on their principles and applications.	L4
C104.4	Describe the applications of Scanning Electron Microscopy (SEM).	L2
C104.5	Demonstrate chromatographic separations.	L3
C104.6	Explain isotope atomic structures and the factors influencing their stability.	L2

Course Name : Cell Biology Lab	BTY105	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C105.1	Explain the principles behind various qualitative tests for proteins.	L2
C105.2	Execute quantitative protein assays and accurately record the protein concentration in different samples.	L3

C105.3	Identify the key steps and reagents involved in qualitative tests for carbohydrates.	L2
C105.4	Implement quantitative assays to measure carbohydrate content and record the results accurately.	L3
C105.5	Outline the procedures and reagents used for the qualitative analysis of lipids.	L2
C105.6	Analyze the techniques used for the separation of cell organelles and evaluate the efficiency of the separation process.	L4

Course Name : Biomolecules Lab	BTY106	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C106.1	Explain the principles behind various qualitative tests for proteins.	L2
C106.2	Execute quantitative protein assays and accurately record the protein concentration in different samples.	L3
C106.3	Identify the key steps and reagents involved in qualitative tests for carbohydrates.	L2
C106.4	Implement quantitative assays to measure carbohydrate content and record the results accurately.	L3
C106.5	Outline the procedures and reagents used for the qualitative analysis of lipids.	L2
C106.6	Apply techniques for the quantitative analysis of nucleic acids.	L3

Course Name: Microbiology Lab	BTY107	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C107.1	Demonstrate the use of different sterilization techniques in a laboratory setting.	L3
C107.2	Prepare liquid and solid media for growing microorganisms according to standard protocols.	L3
C107.3	Analyze the results of bacterial isolation and determine the effectiveness of the serial dilution technique.	L4
C107.4	Conduct staining procedures (simple, acid-fast, spore, Gram's) on bacterial samples.	L3
C107.5	Describe the purpose and procedure of various biochemical tests for bacteria.	L2
C107.6	Implement pure culture techniques (streak plate, spread plate, pour plate) to isolate single colonies of microorganisms.	L3

Course Name : Analytical Techniques Lab	BTY108	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C108.1	Explain the principles behind various qualitative tests for proteins.	L2
C108.2	Describe the methodologies used for the quantitative analysis of proteins.	L2
C108.3	Conduct qualitative tests to detect carbohydrates in different samples and document the observations.	L3
C108.4	Implement quantitative assays to measure carbohydrate content and record the results accurately.	L3
C108.5	Outline the procedures and reagents used for the qualitative analysis of lipids	L2
C108.6	Perform agarose gel electrophoresis to qualitatively assess nucleic acids.	L3

Course Name : Molecular Biology	BTY201	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C201.1	Explain the process of replication in prokaryotes and eukaryotes.	L2
C201.2	Describe the role of proteins involved in the processes of replication.	L2
C201.3	Summarize the mechanisms of DNA repair and the types involved in it.	L2
C201.4	Identify the general features of the genetic code and the structural components of ribosomes.	L2
C201.5	Demonstrate the integration of processes involved in protein synthesis in prokaryotes and eukaryotes.	L3
C201.6	Analyze and illustrate the ubiquitin proteasome pathway and its occurrence.	L4

Course Name : Enzymology	BTY202	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C202.1	Explain the fundamental principles of enzyme catalysis.	L2
C202.2	Describe the basics of enzyme activity and substrate specificity.	L2
C202.3	Analyze the importance of enzyme regulation in cellular processes and enzymatic activity.	L4

C202.4	Summarize the fundamental principles of enzyme functions.	L2
C202.5	Analyze the basic principles of enzyme catalysis and the role of enzymes in biological reactions.	L4
C202.6	Illustrate the process of enzyme-substrate interaction in catalysis through examples.	L3

Course Name : Immunology	BTY203	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C303.1	Explain the components and mechanisms of different types of immunity and the immune system.	L2
C303.2	Apply the principles of hybridoma technology to model antibody production.	L2
C303.3	Describe the principles of ELISA and the role of antibodies.	L2
C303.4	Demonstrate the functions of the cellular composition of the immune system.	L3
C303.5	Describe the concept and classification of hypersensitivity reaction.	L2
C303.6	Analyze the mechanisms by which the immune system recognizes and responds to foreign antigens.	L4

Course Name : Bioinformatics and Biostatistics	BTY204	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C204.1	Describe the scope of computers in current biological research, including basic operations and architecture.	L2
C204.2	Explain the different types of biological databases and their significance in bioinformatics.	L2
C204.3	Use online and offline bioinformatics tools to search biological databases such as NCBI, EMBL, and GenBank.	L3
C204.4	Apply sequence alignment techniques to perform pairwise and multiple sequence alignments.	L3
C204.5	Analyze different measures of central tendency and dispersion, and interpret their significance in biological data analysis.	L4
C204.6	Evaluate the application of statistical tests such as t-test, Chi-square test, and ANOVA in biological research.	L4

Course Name : Molecular Biology Lab	BTY205	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C205.1	Perform the isolation of DNA from bacterial, plant, and animal cells.	L3
C205.2	Apply techniques to isolate RNA specifically from yeast cells. L3	L3
C205.3	Use UV absorption method to quantify DNA and RNA, and assess nucleic acid purity.L3	L3
C205.4	Conduct agarose gel electrophoresis for RNA and DNA samples, and perform gel blotting techniques. L3	L3
C205.5	Analyze and interpret sugar and phosphate ratios in DNA and RNA samples. L4	L4
C205.6	Analyze data to determine the melting temperature (T _m) of DNA.L4	L4

Course Name : Enzymology Lab	BTY206	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C206.1	Describe the process of amylase assay from saliva.	L2
C206.2	Conduct an acid phosphatase assay experiment using potato samples.	L3
C206.3	Describe how substrate concentration influences enzyme activity.	L2
C206.4	Conduct a time-course experiment to monitor enzyme activity at different time intervals.	L3
C206.5	Design and conduct experiments to explore the effects of varying pH and temperature on enzyme activity.	L3
C206.6	Explain the principle of electrophoretic separation and staining techniques for LDH isoenzymes.	L2

Course Name : Immunology Lab	BTY207	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C207.1	Apply knowledge of blood group determination techniques to identify specific blood groups in individuals.	L3
C207.2	Analyze the diagnostic procedures for typhoid fever, including the principles, methods, and interpretation of results.	L4
C207.3	Demonstrate the application of VDRL test procedures for detecting syphilis.	L3
C207.4	Apply knowledge of bleeding and clotting mechanisms to measure bleeding time and clotting time	L3

C207.5	Understand the procedure and significance of total white blood cell count in diagnosing various conditions.	L2
C207.6	Analyze and demonstrate the principles and techniques of radial immunodiffusion, rocket immunoelectrophoresis, and ELISA, including their applications in immunology.	L4

Course Name : Bioinformatics and Biostatistics Lab	BTY208	CourseYear:	2021-2022
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C208.1	Utilize search strategies to retrieve specific data from NCBI databases.	L3
C208.2	Describe the functionalities and tools available on EMBL.	L2
C208.3	Explain how to search for structural data in the PDB.	L2
C208.4	Describe the features and functions of the NCBI Genome Map viewer.	L2
C208.5	Compare and evaluate results from BLAST searches and sequence alignments.	L4
C208.6	Explain the concepts of measures of dispersion, correlation coefficient calculation, and one-way ANOVA.	L3

Course Name : Cell Culture Technology and Tissue Engineering	BTY301	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C301.1	Summarize the composition and preparation methods of culture media in plant tissue culture.	L2
C301.2	Explain the factors influencing in-vitro behaviour in plant tissue culture.	L2
C301.3	Apply the understanding of these processes of somatic embryogenesis, organogenesis, and plant regeneration to design experiments in plant tissue culture.	L3
C301.4	Outline the techniques used to establish and maintain primary and established cell line cultures.	L2
C301.5	Explain the production methods and applications of artificial tissues and organs.	L2
C301.6	Apply knowledge of stem cell types to predict their potential applications in tissue regeneration.	L3

Course Name : Plant Biotechnology	BTY302	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C302.1	Describe the mechanism of gene transfer by TI and RI plasmids as vect plant genetic engineering.	L2
C302.2	Describe the different types of molecular markers and their significance in plant genetic studies.	L2
C302.3	Understand the principles and mechanisms of biotechnological strategies for enhancing abiotic stress tolerance in plants.	L2
C302.4	Apply the knowledge of chloroplast transformation to predict potential and challenges in using this technique for expressing bacterial, viral, and eukaryotic genes in plants.	L3
C302.5	Apply knowledge of laboratory culture techniques for microalgae and their application in large-scale biomass production.	L3
C302.6	Outline the types and benefits of biofertilizers and biopesticides derived from algae, bacteria, and mycorrhizae.	L2

Course Name : Animal and Aquaculture Biotechnology	BTY303	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C303.1	Describe the processes involved in In-vitro fertilization (IVF) for humans and cattle, including sperm and oocyte handling, embryo culture, and transfer techniques.	L2
C303.2	Explain the process of somatic cell nuclear transfer (SCNT) in humans.	L2
C303.3	Summarize the applications of molecular pharming and animal cloning	L2
C303.4	Apply knowledge of biotechnological tools to propose strategies for improving aquaculture productivity.	L3
C303.5	Apply knowledge of pearl culture principles to identify suitable environments for pearl farming.	L3
C303.6	Explain the techniques used for hormone manipulation in determining the sex of fishes.	L2

Course Name : Medical and Environmental Biotechnology	BTY304	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C304.1	Apply knowledge of recombinant DNA technology to predict the production methods for specific healthcare products like insulin or Hepatitis-B vaccines.	L3
C304.2	Apply knowledge of genetic disease mechanisms to propose gene therapy strategies for specific genetic disorders.	L3
C304.3	Explain the types and sources of environmental pollution related to industrial effluents, chemical herbicides, and fertilizers.	L2
C304.4	Describe biotechnological methods including bioremediation, biomass energy production, and bioleaching for waste treatment and environmental remediation.	L2
C304.5	Apply knowledge of microbial metabolism and fermentation techniques to optimize the production of biofuels and biodiesel.	L3
C304.6	Describe the mechanisms and effects of ozone depletion, UV-B radiation, and the greenhouse effect on the environment.	L2

Course Name : Cell Culture Technology and Tissue Engineering Lab	BTY305	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C305.1	Explain the composition and preparation steps of MS and B5 media for plant tissue culture.	L2
C305.2	Apply techniques to successfully establish callus cultures from carrot cambial tissues and cell cultures.	L3
C305.3	Perform embryo culture techniques to culture maize and Crotalaria embryos under controlled conditions.	L3
C305.4	Describe the process of organogenesis and regeneration from tobacco explants.	L2
C305.5	Explain the process and significance of anther culture in producing haploids.	L2
C305.6	Apply micropropagation techniques to propagate potato or Solanum plants using tissue culture methods.	L3

Course Name : Plant Biotechnology Lab	BTY306	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C306.1	Explain the composition and preparation steps of MS and B5 media for plant tissue culture.	L2
C306.2	Apply techniques to successfully establish callus cultures from carrot cambial tissues and cell cultures.	L3
C306.3	Perform embryo culture techniques to culture maize and <i>Crotalaria</i> embryos under controlled conditions.	L3
C306.4	Describe the process of organogenesis and regeneration from tobacco explants.	L2
C306.5	Explain the process and significance of anther culture in producing haploids.	L2
C306.6	Apply micropropagation techniques to propagate potato or <i>Solanum</i> plants using tissue culture methods.	L3

Course Name : Animal and Aquaculture Biotechnology Lab	BTY307	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C307.1	Prepare animal cell culture media and perform membrane filtration in a laboratory setting.	L3
C307.2	Describe the principles and purpose of the MTT assay for cell viability and growth.	L2
C307.3	Explain the anatomical features of the human ovary, testis, and aborted human embryos.	L2
C307.4	Identify commercially important aquatic species based on their characteristics.	L3
C307.5	Measure dissolved oxygen, alkalinity, and hardness in water samples using standard techniques.	L3
C307.6	Partially characterize the identified fish and shrimp pathogens to understand their pathogenic mechanisms and implications for disease management.	L4

Course Name : Medical and Environmental Biotechnology Lab	BTY308	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C308.1	Perform the estimation of dissolved oxygen in various water samples using appropriate techniques.	L3
C308.2	Describe the concept of salinity and its significance in water quality assessment.	L2
C308.3	Carry out COD and BOD tests on water samples and industrial effluents.	L3
C308.4	Define suspended solids and explain their relevance in industrial effluent analysis.	L2
C308.5	Discuss various biological methods used for the removal of color and reduction of pollution load in industrial effluents.	L2
C308.6	Demonstrate the PCR technique in the laboratory, including the preparation of samples and setting up the reaction.	L3

Course Name : Industrial Biotechnology	BTY401	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C401.1	Explain the classification of the transformation and production of recombinant proteins.	L2
C401.2	Apply knowledge of bioreactor principles to design a basic bioreactor setup.	L3
C401.3	Summarize the methods used for in vitro purification of recombinant proteins.	L2
C401.4	Implement techniques for the production of a specific industrially important product.	L3
C401.5	Outline the data and techniques involved in cell immobilization.	L2
C401.6	Apply labelling techniques to identify different stages of SCP production.	L3

Course Name : Genetic Engineering and Gene Transfer Techniques	BTY402	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C402.1	Illustrate the use of specific molecular tools in experimental setups.	L3
C402.2	Summarize the key principles of genetic engineering.	L2
C402.3	Use gene cloning and DNA manipulation techniques in laboratory experiments.	L3
C402.4	Demonstrate the use of genetic tools in specific applications.	L3
C402.5	Outline the steps involved in gene transfer in plants and animals.	L2
C402.6	Utilize different vectors in gene cloning experiments.	L3

Course Name : Proteomics & Genomics	BTY403	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C403.1	Apply advanced techniques in proteome analysis and genomics to experimental data.	L3
C403.2	Describe techniques used for protein sequencing and structural analysis.	L2
C403.3	Use knowledge of proteomics and genomics to explain specific biological processes.	L3
C403.4	Assess the quality and relevance of data from protein sequence and structural databases for specific research questions.	L4
C403.5	Implement the use of advanced tools for analyzing protein and genomic sequences.	L3
C403.6	Outline the principles and methodologies of proteomics and genomics.	L2

Course Name : Bioethics, IPR And Research Methodology	BTY404	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C404.1	Comprehend and explain the ethical concerns associated with GMOs.	L2
C404.2	Explain the ethical considerations and concerns related to cloning and the exploitation of individuals.	L2
C404.3	Apply various research methodologies to different case studies.	L3
C404.4	Illustrate and apply the steps involved in the entire life cycle of a research project.	L3
C404.5	Analyze and determine the criteria for patentability in various	L4

	scenarios.	
C404.6	Analyze the roles and impacts of various international organizations on global issues.	L4

Course Name : Industrial Biotechnology Lab	BTY405	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C405.1	Explain the process of batch fermentation to produce protease/amylase.	L2
C405.2	Describe the method of immobilizing whole cells using gel entrapment for enzyme/antibiotic production.	L2
C405.3	Perform soil sample screening to isolate bacteria, fungi, and actinomycetes.	L3
C405.4	Carry out the fermentation process using <i>S. cerevisiae</i> to produce alcohol.	L3
C405.5	Conduct the fermentation process with <i>A. niger</i> to produce citric acid.	L3
C405.6	Outline the steps involved in the production of red wine from grapes.	L2

Course Name : Genetic Engineering and Gene Transfer Techniques Lab	BTY406	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C406.1	Perform the steps required to isolate DNA from a blood sample in a laboratory setting.	L3
C406.2	Describe the procedure for isolating RNA from yeast and explain its significance.	L2
C406.3	Use blotting techniques to detect specific nucleic acids or proteins in a given sample.	L3
C406.4	Analyze the results obtained from blotting techniques to identify specific genetic or protein markers.	L4
C406.5	Summarize the various gene transfer techniques and their applications in genetic engineering.	L2
C406.6	Interpret the results of a PCR experiment to determine the presence or absence of a target DNA sequence.	L4

Course Name : Proteomics & Genomics Lab	BTY407	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C407.1	Utilize databases to find information related to specific genes, markers, and maps.	L3
C407.2	Retrieve and use information from OMIM and Medline for research on specific genetic diseases.	L3
C407.3	Use relevant software to design oligonucleotide primers for PCR.	L3
C407.4	Explain the process of enzyme immobilization and its significance.	L2
C407.5	Describe the process of affinity purification of Histidine Tagged proteins and the principles of western blotting.	L2
C407.6	Outline the steps involved in expressing eukaryotic proteins in a prokaryotic system.	L2

Course Name : Bioethics, IPR And Research Methodology Lab	BTY408	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C408.1	Demonstrate the steps involved in e-filing a patent or trademark application.	L3
C408.2	Conduct an online search for a specific patent and interpret the results.	L3
C408.3	Identify the steps involved in conducting an online public search for patents, trademarks, and designs.	L2
C408.4	Explain the process and benefits of using e-filing services for designs, geographical indications (GI), and intellectual property status checks.	L2
C408.5	Summarize key points from various intellectual property case studies.	L2
C408.6	Conduct a search in the WIPO online database for specific intellectual property information.	L3

Course Name: Project	BTY409	CourseYear:	2022-2023
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By the end of the course the student will be able to

Course Name	Statements	Taxonomy
C408.1	Identify and assess genomic DNA analysis and RFLP genotyping for detecting genetic disorders.	L2
C408.2	Apply and assess biomolecule extraction, purification, and analysis techniques from patient samples.	L3
C408.3	Design and evaluate in silico screening for potential disease inhibitors.	L4
C408.4	Distinguish and analyze microbial identification and antibiotic resistance processes.	L 4

C408.5	Build and develop genetic manipulation techniques, generating truncated proteins, and modifying bacterial genes.	L4
C408.6	Design next-generation multi-epitope-based peptide vaccines using computational approaches and propose studies on DNA replication mechanisms.	L3