JAYPEE INSTITUTE OF INFORMATION AND TECHNOLOGY

INTEGRATED M. TECH BIOTECHNOLOGY

3rd Semester

Course Code	**15B11MA302**	**Semester: Odd**	**Semester: III,** **Session:**2022-2023 **Month:** Aug 2022- Dec 2022
Course Name	**Probability and Statistics**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Richa Sharma	
	Teacher(s) (Alphabetical)	Dr. Richa Sharma	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C202.1	demonstrate different diagrammatic representation of data and explain the measures of central tendency, dispersion and asymmetry.	Understanding Level (C2)
C202.2	explain the concepts of probability theory and Bayes' theorem.	Understanding Level (C2)
C202.3	explain and solve the problems of probability distributions along with their mean, variance & moment generating functions.	Applying Level (C3)
C202.4	explain sampling theory and apply test of hypothesis on small and large samples.	Applying Level (C3)
C202.5	apply the method of least squares for curve fitting and explain correlation and regression.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Classification of Data	Classification of data, graphic and diagrammatic representation of data, measures of central tendency and dispersion i.e. mean and standard deviation, measures of skew ness and kurtosis.	6
2.	Probability	Sample space and events, Permutations and combinations, Probability of an event, Axioms of probability, Equiprobable spaces, Conditional probability,	10

		Multiplication and addition theorems, Bayes' theorem, Independent events.	
3.	Random Variables	Random Variable, Discrete and continuous distributions, Mean and variance of a random variable	4
4.	Probability Distributions	Binomial, Uniform, Normal and Poisson distributions.	8
5.	Sampling Theory	Test of hypothesis and significance. Test based on Exact (Small) Sampling- Chi-square test, t test and F test.	10
6.	Correlation Regression	Curve fitting by the method of least squares, Correlation and regression.	4
		Total number of Lectures	**42**

Project Based Learning: Each student in a group of 7-8 students will apply the concepts of sampling theory, correlation and Regression to solve some real life problems.

Evaluation Criteria Components	**Maximum Marks**	
T1	20	
T2	20	
End Semester Examination	35	
TA	25 (Quiz , Assignments, Tutorials, PBL)	
Total	**100**	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Walpole, R.E, Myers, R.H., Myers S.I and Ye. K**., Probability and Statistics for Engineers and Scientists, 8th Ed., Pearson, 2007
2.	**Papoulis, A. & Pillai, S.U.**, Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill, 2002.
3.	**Spiegel, M.R.,** Statistics (Schaum's oulines), McGraw-Hill, 1995
4.	**Veerarajan, T.,** Probability, Statistics and Random Processes, 3rd Ed. Tata McGraw-Hill, 2008.
5.	**Johnson, R.A.**, Miller and Freund's Probability and Statistics for Engineers, 8th Ed., PHI Learning Private limited, 2011

6.	**Palaniammal, S.,** Probability and Random Processes, PHI Learning Private limited, 2012

Course Code	15B11BT211	**Semester** Odd **(Specify Odd/Even)**	**Semester III Session 2022-2023** Month from July-Dec
Course Name	**Biochemistry**		
Credits	4	**Contact Hours**	4 (3+1)
Faculty (Names)	**Coordinator(s)**	Dr. Garima Mathur	
	Teacher(s) (Alphabetically)	Dr. Garima Mathur Dr. Ankisha Vijay	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C211.1	Summarize concepts of cell biology	Understand level (Level II)
C211.2	Explain the structure and function of biological molecules	Understand level (Level II)
C211.3	Analyze enzyme kinetic data and regulation of enzyme activity	Analyze level (Level IV)
C211.4	Identify the key molecules involved in regulation of metabolic pathways and disorders	Apply level (Level III)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Molecular design of life**	Cell structure and function Biological Membranes: structure and function	**4**
2.	**Structure and properties of biomolecules**	Structure & properties of carbohydrates Structure & properties of proteins Structure & properties of lipids Structure & properties of nucleic acids	**7**
3.	**Enzymes**	Mechanisms of Enzyme action, Enzyme Kinetics Enzyme Regulation, Enzyme inhibition	**5**
4.	**Metabolism: Basic concepts and design**	Types of metabolic pathways, energy transformation in cellular processes, Energetic coupling, Phosphoryl transfer potential, ATP-ADP cycle, regulation of metabolic pathways	**2**
5.	**Carbohydrate metabolism and regulation**	Glycolysis, gluconeogenesis, TCA, oxidative phosphorylation, Glyoxylate cycle, Glycogen metabolism, Pentose phosphate pathway	**8**
6.	**Metabolism of fatty acids and regulation**	Biosynthesis of fatty acids Oxidation of saturated and unsaturated Fatty acids Ketogenesis	**6**

		Lipid transport and storage	
7.	**Metabolism of amino acids and regulation**	Protein turn over and amino acid degradation, urea cycle and its regulation	**4**
8.	**Metabolism of nucleotides and regulation**	Nucleotide biosynthesis: Salvage and de Novo pathway	**3**
9.	**Metabolic integration**	Integration of metabolic pathways Inborn errors in metabolism	**3**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class test 1, Class test 2, Assignment)
Total	**100**

Project based learning: Each student will be asked to choose a topic for presentation on how enzymes are regulating the metabolic processes occurring inside the living organisms. They will understand the perspective of why the study of enzyme kinetics is important, how do enzymes work and how can they predict enzymes behaviour in a living system.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	V.B. Rastogi, K.R. Aneja. Zubay's Principles of Biochemistry, Fifth Edition, Medtech, 2017
2.	J. M. Berg, J. L. Tymoczko, L. Stryer, Biochemistry, 8th Edition. Freeman and company, 2015
3.	D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, 7th Edition, W. H. Freeman, 2017

Course Code	**15B11HS211**	**Semester: ODD (specify Odd/Even)**	**Semester:** III **Session 2022-2023.** **Month from:** July to December
Course Name	**Economics**		
Credits	03	**Contact Hours**	2-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Praveen Sharma, Dr. Sakshi Varshney	
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal, Dr. Anshu Banwari, Dr. Kanupriya Misra Bakhru, Mr. Manas Ranjan Behra, Dr. Mukta Mani, Dr. Praveen Sharma, Dr. Sakshi Varshney, Dr. Shirin Alavi	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206-1.1	Explain the basic micro and macroeconomics concepts.	Understanding (Level 2)
C206-1.2	Analyze the theories of demand, supply, elasticity and consumer choice in the market.	Analyzing (Level 4)
C206-1.3	Analyze the theories of production, cost, profit and break even analysis	Analyzing (Level 4)
C206-1.4	Evaluate the different market structures and their implications for the behavior of the firm.	Evaluating (Level 5)
C206-1.5	Examine the various business forecasting methods.	Analyzing (Level 4)
C206-1.6	Apply the basics of national income accounting and business cycles to Indian economy.	Applying (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Micro and Macroeconomics. Production Possibility Curve. Circular flow of economic activities.	2
2.	Basics of Demand, Supply and Equilibrium	Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.	3
3.	Theory of Consumer Choice	Theory of Utility and consumer's equilibrium. Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.	2

4.	Demand forecasting	Regression Technique, Time-series Smoothing Techniques: Exponential, Moving Averages Method	6
5.	Production theory and analysis	Production function. Isoquants, Isocostlines, Optimal combination of inputs. Stages of production, Law of returns, Return to scale.	3
6.	Cost Theory and Analysis	Nature and types of cost. Cost functions- short run and long run Economies and diseconomies of scale	3
7.	Market Structure	Market structure and degree of competition Perfect competition, Monopoly, Monopolistic competition, Oligopoly	5
8	National Income Accounting	Overview of Macroeconomics, Basic concepts of National Income Accounting,	3
9	Macro Economics Issues	Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.	3
		Total number of Lectures	30

Project based learning: Students have to form a group (maximum 5 students in each group) and have to do an economic analysis on the topic assigned. An economic impact analysis assesses the impact of an event on the economy in a particular area. It generally measures the effect on revenue, profits, wages and jobs. The knowledge gained in conducting economic analysis will enhance student's decision-making skills.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Test +Quiz+ Attendance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	H.C. Petersen, W.C. Lewis, *Managerial Economics*, 4th ed., Pearson Education 2001.
2.	D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Thomson Asia, 2015.
3.	S. Damodaran, Managerial Economics, 2nd ed., Oxford University Press, 2010.
4.	M. Hirschey, Managerial Economics, 15th ed., Thomson Asia, 2019.
5.	P.A. Samuelson, W.D. Nordhaus, Economics, 19th ed., Tata Mc-Graw Hill, 2010.
6.	S.K. Misra & V. K. Puri, Indian Economy, 37th ed., Himalaya Publishing House, 2019.

Course Code	**15B11EC211**	**Semester (specify Odd/Even)**	**Semester** III **Session 2022-2023** **Month from** July to December
Course Name	**Electrical Science -2**		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Ashish Goel, Satyendra Kumar	
	Teacher(s) (Alphabetically)	Atul Kumar Shrivastava, Deeksha Chandola, Garima Kapur, Jyoti Vyas, Kaushal Nigam, Kirmender Singh, Madhu Jain, Mandeep Narula , Nisha Venkatesh, Priyanka Kwatra, Rachna Singh, Ruby Beniwal, Sajai Vir Singh, Shradha Saxena, Shruti Kalra, Vimal Kumar Mishra	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C203.1	Study and analyze the first-order and second-order passive circuits.	Analyzing Level (C4)
C203.2	Demonstrate the operational amplifier and logic gates and their applications in analog and digital system design.	Understanding Level (C2)
C203.3	Define the basics of signals, systems and communication.	Remembering Level (C1)
C203.4	Illustrate the electrical machines, transformers and analogous of electrical & mechanical systems.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Transient Analysis	First order network analysis, sequential switching, Differential equation approach for DC and Non constant source, second order network analysis using differential equation approach for DC and non- constant source.	8
2.	Operational Amplifiers	Introduction to Operational Amplifiers, Basic Concepts and their Applications like Comparators, Inverting and Non-inverting Amplifier, Subtractor, Adder, Integrator and Differentiator circuits.	6
3.	Basics of digital electronics	Introduction to Boolean algebra, logic circuits and logic gates, multiplexers and decoders. Introduction to Flip-flops.	10
4.	Introduction of Signals and Systems	Basic overview of Signals and Systems, Signal types and their representation- Time Domain, Frequency Domain.	4

5.	Introduction of Communications	Basics of digital and communication analogue communication.	3
6.	Machines	Introduction to dc motors and dc generators, three phase and single phase induction motors.	3
7.	Single Phase Transformer	Principle of operation, construction, e.m.f. equation, equivalent circuit, power losses, efficiency (simple numerical problems), introduction to auto transformer.	4
8.	Analogous Electrical and Mechanical Systems	Analogy between mechanical and electrical quantities: Analogous quantities, Analogous equations. Conversion between systems: electrical to mechanical and mechanical to electrical systems.	3
		Total number of Lectures	41

Project Based Learning: Students will learn about the transient responses of the first/second order circuits, which is the utmost requirement for electronic circuit design. Also, the students with the knowledge of OP-AMP and filters, can design and analyse the circuits for the signal processing applications.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Dorf, R.C. and Svoboda, J.A., Introduction to Electric Circuits. John Wiley & Sons.
2.	Mano, M.M., Digital Design. Pearson Education Asia.
3.	Oppenheim, A.V., Willsky, A.S. and Nawab, S.H., Signals and Systems. Prentice-Hall.
4.	A. Anand Kumar, Signals and Systems, PHI Learning Private Limited
5.	A.E. Fitzgerald, C. Kingsley Jr. and At. D. Umans, Electric Machinery, Fifth edition, Mc Graw Hill.
6.	D.C. Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill.
7.	I. J Nagrath and M. Gopal, Control Systems Engineering, New age International, Fifth edition, Fifth edition, 2009.

Subject Code	**19B13BT211**	**Semester: ODD**	**Semester:** III **Session: 2022-2023** **Month from:** July to December
Subject Name	**Environmental Studies**		
Credits	**0**	**Contact Hours**	**3**
Faculty (Names)	**Coordinator(s)**	1. Prof. Krishna Sundari S	
	Teacher(s) (Alphabetically)	1. Dr. Susinjin Bhattacharya 2. Prof. Krishna Sundari S 3. Prof. Neeraj Wadhwa 4. Prof. Rachana	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO205.1	Explain diversity of environment, ecosystem resources and conservation.	Understand Level (C2)
CO205.2	Identify hazards related to environmental pollution and safe management practices	Apply Level(C3)
CO205.3	Apply modern techniques for sustainable Urban planning and Disaster management	Apply Level(C3)
CO205.4	Recall Government regulations, Environmental Policies, Laws & ethics	Understand Level (C2)
CO205.5	Survey ground situation on specific environmental aspects, examine risks involved, make a field report and present the findings	Analyzing Level(C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	The Multidisciplinary nature of environment, Biodiversity	Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity, Case studies.	6
2.	Natural resources, Energy consumption & conservation	Water, Land, Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Global Conventions on Energy, Kyoto protocol, Case studies.	10
3.	Pollution, hazardous waste management	Air, Water & Land, chemical, noise pollution, sources & causes, effects, Electronic waste, nuclear hazards, Case studies.	8

4.	Urban planning, human communities, Disaster management	Sustainable building, Disaster Management and Contingency Planning, human population, resettlement, rehabilitation environmental movements, environmental ethics, Critical issues concerning Global environment Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc Case studies.	8
5.	Environmental Policies, Laws, Regulations & ethics	Regulation of technology and innovation, Policy and laws, Different Acts such as: Environmental Protection Act, Air and Water Acts, Wildlife and Forest Acts), US-EPA, National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities, Case studies.	4
6	Field Work/	Explore the current environment related occurrences at national and international level, Study of successful sustainable measures, a know-how of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site- Urban/Rural /Industrial / Agricultural, Study of simple ecosystems.	6
Total number of Lectures			**42**

PBL Component: Field work on environmental matters involving real-world learning associating issues to current or past environmental disturbances, involves constructive analytical thinking to suggest sustainable solutions for environmental crisis resolution. Student submit their field work report/e-poster/powerpoint presentation.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Benny Joseph, Environmental Studies Simplified, 3rd Edition, McGraw Hill Education, India, Published 2nd August, 2017
2.	Erach Bharucha, Textbook of Environmental Studies for UG Courses, 3rd Edition, Orient Black Swan, Published 1st Jan 2013
3.	Issues of the Journal: Down to Earth, Published by Centre for Science and Environment (CSE), Delhi

EVALUATION:

Mid Semester Examination - 30 marks (To be held along with T-2 Exam) End Semester Examination - 40 marks

Teachers Assessment (TA) - 30 marks

Structure of Grading Academic Performance: Mandatory to Pass, grade will be awarded

Course Code	15B17BT371	**Semester** ODD **(specify Odd/Even)**	**Semester** III **Session :2022-2023** Month from July to December
Course Name	THERMODYNAMICS AND CHEMICAL PROCESSES LAB		
Credits	1	**Contact Hours**	2**(C-1,C-2,C-3)**
Faculty (Names)	**Coordinator(s)**	Dr EKTA BHATT	
	Teacher(s) (Alphabetically)	PROF. PAMMI GAUBA PROF. SHWETA DANG Dr EKTA BHATT	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C270.1	Apply and Demonstrate the concept of Heat capacity and Specific gravity and Heat Transfer	Applying (Level 3)
C270.2	Explain and Apply the concept of Material Balance	Applying (Level 3)
C270.3	Demonstrate movement of solute and solvent	Understanding (Level 2)
C270.4	Make use of Computational tools to study the thermodynamic properties	Applying (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**CO**
1.	**Heat Capacity**	To study Specific Heat capacity of metals and rate of drying of samples.	CO1
2.	**Specific Gravity**	To study specific gravity of fluids.	CO1
3.	**Enthalpy of Neutralization**	To study heat of solution and enthalpy of neutralization.	CO1
4.	**Eutectic point**	To study Eutectic point of mixtures of solids.	CO1
5.	**Material Balance**	To study the concept of material balance and chemical changes. To design experiments for Material balance	CO2
6.	**Movement of solute and solvent**	To determine movement of solute and solvent using dialysis membrane	CO3
7.	**Computations Tools**	To study the thermodynamic properties of DNA sequences using computations tools	CO4

Evaluation Criteria

Components	**Maximum Marks**
Mid Viva (Written exam)	20
Final Viva (Written exam)	20
D2D (Report/Attendance/Experiment)	60
Total	**100**

Project base learning- (**Material Balance**) To study the concept of material balance and chemical changes. To design experiments for Material balance

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Zemansky W and Dittman H.R. "Heat and Thermodynamics" McGraw Hill
2.	Doran P.M. " Bioprocess Engineering Principles"
3.	Himmelblau ,D.M., "Basic Principles and calculations in chemical engineering ," Prentice hall of India, New Delhi
4.	B.G.Kyle, "Chemical and process Thermodynamics" PHI learning Pvt Ltd

Course Code	**15B11BT311**	**Semester** ODD Semester	**Semester:** III **Session : 2022-2023** **Month from:** July to December
Course Name	THERMODYNAMICS & CHEMICAL PROCESSES		
Credits	4	**Contact Hours**	**3+1**
Faculty (Names)	**Coordinator(s)**	Dr. Ashwani Mathur	
	Teacher(s) (Alphabetically)	Dr. Ashwani Mathur	

COURSE OUTCOMES		COGNITIVE LEVELS
CO201.1	Define laws of thermodynamics and their application	Remembering (Level 1)
CO201.2	Explain material and energy balance	Understanding (Level 2)
CO201.3	Demonstrate knowledge of free energy, internal energy, enthalpy, entropy, phase rules for one component and two component systems, Gibb's free energy, fugacity for solutions and vapour-liquid equilibrium,	Understanding (Level 2)
CO201.4	Make use of thermodynamics principles for biomolecular interaction	Applying (Level 3)
CO201.5	Apply knowledge of fluid rheology and heat transfer in biological systems and problems	Applying (Level 3)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	**Thermodynamics**	Introduction and fundamental concept of thermodynamic terms.	1
2.	**First law of thermodynamics**	Concept of open and closed systems, state and path functions, reversible and irreversible processes, equilibrium, phase rule.	6
3.	**Second law of thermodynamic**s	Statement of second law of thermodynamics, concept of entropy, calculation of entropy changes, ideal work and lost work. Applications of 1^{st} and 2^{nd} laws to steady /unsteady processes in closed /open systems. Applications to compression and expansion processes.	7
4.	**Material Balances-I**	Material balances in systems involving physical changes-	5

		Overall and component balances, material balance and problems involving simultaneous equations for simple systems.	
5.	**Material Balances-II**	Material balances in systems involving Chemical changes- Chemical / Biochemical reactions and their stoichiometry, concept of yield and conversion, solving material balance problems involving single and multiple chemical reactions	4
6.	**Energy balance**	Energy balance for closed systems. Mass and energy balance for open systems. Application in Biological systems	**4**
7.	**Fluid flow of mixing**	Classification of fluids, Fluids in motion, Viscosity, momentum transfer ,Non-Newtonian fluids, Viscosity Measurement	**6**
8.	**Heat transfer**	Heat transfer equipments, Mechanism of heat transfer, conduction, Heat transfer between fluids, Design equations for heat transfer systems and applications of design equations.	9

Evaluation Criteria

Components	**Maximum Marks**
T1 Examination	20
T2 Examination	20
End Term Examination	35
TA (MCQ, Class Test / Assignment)	25
Total	**100**

Project Based Learning: The course involves training the students about use of thermodynamic principles in design and operation of instruments including heat exchangers, viscometers and bioreactors in biotech, biopharma and allied sectors. The knowledge of material and energy balance and their role in bimolecular reactions helps students in designing a stoichiometric process

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Basic and Applied Thermodynamics (Second Edition), P.K. Nag, McGraw Hill Education (India) Pvt. Ltd., 2015
2.	Molecular Thermodynamics, Donald A McQuarrie & J.D. Simon, Viva Books, 2018

Course Code	15B17BT271	**Semester** Odd	**Semester** III **Session 2022-2023** Month **Jul-Dec**
Course Name	Biochemical Techniques lab		
Credits	1	**Contact Hours**	2(C-1,C-2,C-3)
Faculty (Names)	**Coordinator(s)**	Dr. Sonam Chawla	
	Teacher(s) (Alphabetically)	1.Dr. Sonam Chawla 2.Dr. Manish Singh 3.Dr. Shalini Maini 4. Prof. Sujata Mohanty.	

Course Description: Synthesis of proteins, lipids, nucleic acids. Use of current biochemical and molecular techniques to plan and carry out experiments related to bio molecules including isolation, purification and kinetics of enzymes.

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO271.1	Demonstrate proficiency in calculations and reagent preparation	Understand level (Level II)
CO271.2	Explain fundamental biochmical principles related to structure and functions of biomolecules	Understand level (Level II)
CO271.3	Identify methods used to study various biomolecules	Apply level (Level III)
CO271.4	Able to examine the enzyme kinetics in biochemical reactions	Analyzing level (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Preparation of reagents	Calculations and reagent preparations	C1
2	Preparation of Buffers and standards	Preparation of buffers, working solutions and standards	C2
3	Total Protein Isolation	Isolation of total cell protein from plant / microbe	C2
4	Separation and Identification of Compounds in a Mixture	Separation and identification of different compounds in a mixture by chromatography methods: • Paper chromatography • Thin layer chromatography(TLC) • Column chromatography	C3

		• Virtual lab demonstration	
5	Separation of Proteins	Analysis of proteins by SDS-polyacrylamide gel electrophoresis (SDS-PAGE)	C3
6	Enzyme Activity	To study amylase activity in total cell protein from plant / microbe	C4
		Total no. of labs-12	

Project based learning: Each student was given insights to understand the concepts of Enzymology and application in wide range of commercially important processes and products. Extraction, purification and identification of biomolecules were also demonstrated to apply the knowledge gathered in drug discovery and for improving food quality

Evaluation Criteria

Components	**Maximum Marks**
Mid-Semester lab-viva/ test	20
End-Semester lab-viva/ test	20
Day to Day performance	45
(Learning laboratory Skills and handling Laboratory Equipments, attendance)	
Laboratory record	15
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Protein Purification Handbook from Amersham Biosciences, 2018
2.	Introduction to Practical Biochemistry, editors: S.K. Sawhney & Randhir Singh, 2005
3.	Understanding Enzymes Function, Design, Engineering, and Analysis, editor: Allan Svendsen; Pan Stanford Publishing Pte. Ltd.. 2016
4.	Protein Sample Preparation Handbook; GE Healthcare Life Sciences

Course Code	15B17EC271	**Semester -:** Odd (specify Odd/Even)	**Semester-:** 3, **Session** 2022-2023 Month- : September- December
Course Name	Electrical Science Lab-2		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Satyendra Kumar, Mr. Ankur Bhardwaj
	Teacher(s)	Dr. Ashish Gupta, Dr. Ajay Kumar, Dr. Alok Joshi, Dr. Amit Goyal, Dr. Archana Pandey, Mr. Atul Kumar Srivastava, Dr. Bajrang Bansal, Dr. Garima Kapoor, Dr. Hemant Kumar, Dr. Jasmine Saini, Dr. Juhi Gupta, Dr. Kapil Dev Tyagi, Dr. Kaushal Nigam, Dr. Kirmender Singh, Dr. Megha Agarwal, Dr. Parul Arora, Mr. Raghvendra Singh, Dr. Satyendra Kumar, Dr. Saurabh Chaturvedi, Mr. Shivaji Tyagi, Mrs. Shradhha Saxena, Dr. Shruti Kalra, Mrs. Smriti Bhatnagar, Dr. Varun Goel, Mr. Vinay Tikkiwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Study and analyze time response of first order and second order passive circuits	Analyzing level (C4)
C204.2	Understand two port resistive network parameters, operational amplifier applications and first order filter.	Understanding level (C2)
C204.3	Understand the characteristics of pn junction diode and its applications	Understanding level (C2)
C204.4	Understand the characteristics of Common emitter and common base configurations of BJT.	Understanding level (C2)

Module No.	**Title of the Module**	**List of Experiments**	**COs**
1.		Study the transient response of a series RC circuit and understand the time	C204.1

	First and Second order passive circuits	constant concept using pulse waveforms.	
		Study of Time Response of R-L-C Network	C204.1
2.	Two port resistive networks	To determine the Z-parameters of a 2-port resistive network.	C204.2
		To determine the h-parameters of a two-port resistive network.	C204.2
3.	Operational amplifier and its applications	To realize inverting and non inverting configurations using Op- Amp IC 741 amplifier.	C204.2
		To realize an adder and substractor circuits using Op-Amp IC 741 amplifier.	C204.2
4.	PN junction and Zener diodes	To study the forward and reverse bias (volt-ampere) characteristics of a simple p-n junction diode. Also determine the forward resistance of the diode.	C204.3
		To study the forward and reverse bias volt-ampere characteristics of a zener diode. Also determine the breakdown voltage, static and dynamic resistances.	C204.3
5.	Diode applications	To observe the output waveform of half/full wave rectifier and calculate its ripple factor and efficiency.	C204.3

		Realization of desired wave shapes using clipper and clamper circuits.	C204.3
		To study Zener voltage regulator and calculate percentage regulation for line regulation and load regulation.	C204.3
6.	Bipolar Junction Transistor	To plot input characteristics of a common emitter npn BJT.	C204.4
		To plot output characteristics of a common emitter npn BJT.	C204.4
		To plot input characteristic of a BJT in Common Base Configuration.	C204.4
		To plot output characteristic of a BJT in Common Base Configuration.	C204.4
7.	First order filters	To plot frequency and phase response of First order low pass and high pass filter.	C204.2

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Attendance, and D2D (15+45)	60
Total	**100**

Project Based Learning: Students will learn about the transient response of first and second order passive circuits. Also, student will learn about Op-amp and its applications like adder and substractor circuits. This course also gives the understanding of semiconductor diodes and Bipolar Junction Transistor. These concepts are the required for Electronic circuit design.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R.C.Dorf, A. Svoboda, "Introduction to Electric Circuits",9th ed, John Wiley & Sons, 2013.

2.	D. Roy Choudhary and Shail B. Jain, " Linear Integrated Circuit," 2nd Edition, NAILP, 2003
3.	A.S .Sedra & K.C.Smith, Microelectronic Circuits Theory and Application, 6th Edition, Oxford University Press, 2015(Text Book)