JAYPEE INSTITUTE OF INFORMATION AND TECHNOLOGY

INTEGRATED M.TECH

BIOTECHNOLOGY

SEMESTER VII

Course Code	17B1NBT731	Semester : ODD	Semester: VII Session:2023-2024 Month from: July to December.
Course Name	Food Biotechnology		
Credits	4	Contact Hours	4
Faculty (Names)	Coordinator(s)	Dr. Smriti Gaur	
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Explain fundamental principles of food science and chemistry.	C2
CO2	Outline beneficial and harmful effects of microorganisms related to food	C2
CO3	Utilize microbes for development of functional food	C3
CO4	Examine methods that increase shelf life and quality parameters of food	C4

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Food Science and Food Chemistry	Food Science and Food Chemistry Concepts, Proteins in food, Lipids in food, Carbohydrates in food, Vitamin and minerals, food flavors and colors.	08
2.	Food Fermentations	Microbiology of fermented food products, traditional fermented food items like beverages (cereal and fruit juice based), bakery, fermented Vegetables and dairy products	06
3.	Food Processing and Preservation	Food spoilage and food borne diseases, Principles of food preservation – methods of preservation; irradiation, drying, heat processing(high temperature), chilling and freezing(low temperature),preservation by food additives	10

4.	Functional Foods	Single Cell Protein, Probiotics and prebiotics, Yeast as a food supplement.	06
5.	Processed Food Industry	Enzymes in food industry, Current status of Indian processed food industry, key challenges	06
6.	Food safety and control	Food adulteration, Food safety regulations, Good manufacturing practices – HACCP, Regulations, GMO and GM Foods. International rules and regulations in export and import.	06
		Total number of Lectures	42	

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (presentation and viva)
Total	**10**

Project based learning: Each student in a group of 2 will opt a food industry. They will discuss the various products manufactured by the industry, product processing, manufacturing applications, market information, job prospects etc. This will enhance the student's understanding about various food industries. This would help their employability into the food sector.

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.	Food Science & Food Biotechnology, G.F.G Lopez and GVB Canovas CRC Press, Florida(2003)
2.	Bioprocess and Biotechnology for functional foods and Nutraceuticals, J.R Neeser , J.Bruce German Marcel and Dekker , New York (2004)
3.	Food Microbiology, Frazier W C, Westoff DC, Vanitha NM, Mc Graham Hill Education (2013)
4.	Essentials of food science by. Vaclavik VA and Elizabeth WC., Springer (2008)
5.	Food processing and preservation by Sivasankar B., PHI Private Limited (2008)

Course Code	15B1NBT832	Semester Odd (specify Odd/Even)	Semester VII Session 2023-2024 Month: July to December
Course Name	Biostatistics and its applications		
Credits	4	Contact Hours	4
Faculty (Names)	Coordinator(s)	Dr. Shalini Mani	
	Teacher(s) (Alphabetically)	Dr. Shalini Mani	

COURSE OUTCOMES		COGNITIVE LEVELS
C430-3.1	Explain the various statistical methods to design a biological studies and data representation.	Understanding (Level 2)
C430-3.2	Apply different statistical methods and approaches to study the significance of a study.	Apply (Level 3)
C430-3.3	Examine the relationship between different parameters of a study.	Analyze (Level 4)
C430-3.4	Choose appropriate statistical methods, tools and resources including prediction, validation and evaluation of the biological studies.	Evaluate (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Application and use of Biostatistics as a science, scope.	1
2.	Study design in various fields of research	general principles of study design and its implications for valid inference	1
3.	Sampling theory	Sampling scheme, simple/ systematic/ stratified/ cluster sampling, Sources of data collection	2
4.	Data presentation	Graphical, tabular, Mathematical, finding the central tendency, measure of variations	3
5.	Overview of different statistical methods used in the field of biological sciences.	Hypothesis testing, T-test, Chi square test, ANOVA, Sign Test, Wilcoxon Signed Rank Test, Wilcoxon Rank Sum Test, odds ratio, Binomial/normal/Poisson distribution of probabilities, determination of power of study and sample size calculation, regression analysis, correlation analysis,	12

6.	Analysis of data source	Assess data sources and data quality for the purpose of selecting appropriate data for specific research questions	4
7.	Selection of statistical methods	Identifying the appropriate statistical methods to be applied in a given research setting, applying the selected methods and analysis.	4
8.	Application of Biostatistical analysis.	Designing various studies of medical/ health/ Microbial/Agricultural/Genetics/Pharamaceutical science related studies. Data analysis using different methods Result interpretation	7
9.	Case studies	Based on various research studies and systematic reviews.	4
10.	SPSS, Stats at the bench	Introduction to SPSS, Entering data in SPSS editor. Solving the compatibility issues with different types of files. SPSS and working with descriptive statistics.	4
Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (assignment, class test, quiz)
Total	100

Project Based learning: Students will learn to represent the data of various fields using various statistical methods. Students will also be able to select the appropriate statistical tool for analysis of different data set and interpret the outcome of any study.

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.	Marcello Pagano, Kinberlee Gauvreau, Principle of Biostatistics.
2.	Stephen W Looney, Biostatistical methods, Humana Press
3.	Alan J Cann, Maths from Scratch for Biologist, John Willey and Sons Limited Press.
4.	M Bremer, R W Doerge, Statistics at the Bench, Cold Spring harbor Lab Press.
5.	B K Mahajan, Methods in Biostatistics, VII edition, Jaypee Bothers Medical Publishers, 2010.

Course Code	**17B1NBT734** ELECTIVE	**Semester Odd**	**Semester VII Session** 2023-2024 **Month from** July to December
Course Name	Stem Cells and Health Care		
Credits	4	**Contact Hours**	4
Faculty (Names)	**Coordinator(s)**	Prof. Sujata Mohanty	
	Teacher(s) (Alphabetically)	Prof. Sujata Mohanty	

COURSE OUTCOMES		COGNITIVE LEVELS
C430-1.1	Compare the unique properties of stem cells derived from different sources	Understand Level (C2)
C430-1.2	Select niche and various isolation and reprogramming methods of stem cells	Apply Level (C3)
C430-1.3	Apply the acquired knowledge in Regenerative medicines	Apply Level (C3)
C430-1.4	Analyze the guidelines, political and ethical issues for stem cell research	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Stem Cells	Stem cells: the promising field of research, Unique Properties: Self-renewal, Potency and proliferation Asymmetric Cell Division, History of Stem Cells	04
2.	Types and sources of Stem Cells: Embryonic Stem cells;	Characteristics of ES cells: Sources (IVF & SCNT), Isolation and Culture Techniques, Characterization, Unique features, Genetic Manipulation and Differentiation	06

		hESCs		
3.	Types and sources of Stem Cells: Adult Stem cells; ASCs	Types of Adult Stem Cells: Umbilical Cord Blood, Placental, Hematopoietic, Cardiac, Neural, Pancreatic Stem Cells Adult Stem Cells vs Embryonic stem cells	06
4.	Cloning and Reprogramming of somatic cells: iPSCs	Cloning strategy, Reprogramming of Cells to Stem cells, ipsc, Detail strategy and properties and application of ipsc	06
5.	Therapeutic Applications of Stem Cells	Stem cell Research and application in Healthcare, Tissue Engineering, Regenerative Medicine, Opportunities and Challenges, Case studies	10
6.	Stem cell Banking	Vision, collection and storage procedure, Insurance against life threatening diseases, Existing Centres both in India and abroad	04
7.	Stem cell research: Indian and Global scenario: Ethical and legal issues	Stem cell research Centers in India and abroad and their valuable contribution, National and International guidelines for conducting stem cell research	06
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1 and 2, Class Test, Presentation,)
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.	Robert Lanza et.al., Handbook of Stem Cells, Volume 1-Embryonic Stem Cells; 2006, Academic press

2.	Robert Lanza et.al. Handbook of Stem Cells Volume 2-Adult & Fetal Stem Cells
3.	M.J. Laughlin & H.M. Lazarus Allogeneic Stem cell Transplantation 2003 Humana Press, USA
4.	Mehmet R. TOPCUL and Idil CETIN Stem Cells in Cell Therapy and Regenerative Medicine, OMICS International, ebook, 2018
5.	Robert Paul. Essentials of Stem Cell Biology 2006 Elsevier Academic
6.	Jeanne F. Loring Human Stem Cell Manual: A Laboratory Guide, Elsevier Science& Technology, 2007
7.	Stewart Sell, Stem Cells Handbook 2003 Humana Press, USA
8.	**Recent research articles will be discussed in the class and same will be provided.**
9.	Websites: http, www.isscr.org/, https://stemcells.nih.gov/

S.No.		Course Outcome	Cognitive level
1	**Major Project Part-1 (10B19BT794)- Dr. Chakresh Kumar Jain**		
	C450.1	Interpret the given research problem.	Understanding Level Level II
	C450.2	Organize the existing literature data to formulate the hypothesis	Applying Level Level III
	C450.3	Identify the experimental methods to test for the selected research problem	Applying Level Level III
	C450.4	Prepare and conclude with technical report	Create Level Level VI

Major Project: Students research on topic of their interest and define problem statement, figure out probable solution by reviewing the current literature, Identify the experimental methods, perform all the experiment in lab and communicate their findings orally and by writing. This develops independent working and thinking ability, Experimental skills and other set of skills such as research, problem identification, problem solution, written and oral communication, etc.

Course Code	15B19BT793	Semester ODD	Semester VII Session 2023-2024 Month: from **July -December**
Course Name	Summer Training Viva		
Credits	2	**Contact Hours**	**NA**
Faculty (Names)	**Coordinator(s)**	Dr. Smriti Gaur	
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur	

Course Outcomes:
At the completion of the course, students will be able to

Sl. No.	DESCRIPTION	COGNITIVE LEVEL (BLOOM's TAXONOMY)
C455.1	Extend theoretical knowledge to real time Industry and Institutes	Understanding Level Level II
C455.2	Demonstrate a capacity for critical reasoning and independent learning	Understanding Level Level II
C455.3	Make use of Industrial Training experience to prepare a scientific report	Applying Level Level III
C455.4	Develop greater clarity about academic and career goals	Applying Level Level III

Project Based Learning: Summer Training viva is an absolutely Project Based Learning. Students expose themselves to various working environment of Industry/Academic Institutes/ Health practising centres during the execution of their project work and this interface facilitate themincultivating the entrepreneurial culture, R&D aspect, innovation and also motivate them towards right Employability.

Detailed Syllabus
Lecture-wise
Breakup

Subject Code	17B1NHS733	Semester: ODD	Semester: VII Session 2023-24 Month: July- December
Subject Name	**Human Rights and Social Justice**		
Credits	**3 (3-0-0)**	**Contact Hours**	**(3-0-0)**

Faculty (Names)	Coordinator(s)	**Dr. Namreeta Kumari**
	Teacher	**Dr. Namreeta Kumari**

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C401-18.1	Demonstrate an understanding of the concept and idea of human rights and social justice	Understand (C2)
C401-18.2	Evaluate and interpret information about human rights issues from various sources like print and electronic media, film, documentary and other information technologies	Evaluate(C5)
C401-18.3	Demonstrate an understanding of the International norms and standards of human rights	Understand (C2)
C401-18.4	Analyze the emerging dimensions of human rights and the challenges posed by them	Analyze (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
1.	Conceptual Background of Human Rights and Social Justice	- Meaning and Concept of Human Rights & Social Justice - Notion and Classification of Rights: Natural, Moral and Legal Rights, - Concept of Civil Rights - Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights; Collective/Solidarity Rights), Distinction between CPR & ESCR	6

Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
2.	Evolution of Human Rights	Human Rights in Middle Ages: - Magna Carta Modern Movement for Human Rights: - The United States Declaration of Independence - The French Declaration of the Rights of Man and the Citizen - United States Bill of Rights - Geneva Convention of 1864	9
3.	International Human Rights Standards	- Universal Declaration of Human Rights, 1948. - International Covenant on Civil and Political Rights, 1966 - International Covenant on Economic, Social and Cultural Rights, 1966	8
4.	Human Rights of the specially disadvantaged sections of the society	- Scheduled Castes/Scheduled Tribes and Other Backward Classes: Caste Prejudice and Discrimination - Minorities: Human Rights Issues of Ethnic minorities - Women and Children: Gender Discrimination, Domestic Violence and Offences against Women; Gender Sensitive Laws, Children: Child Abuse, Child Labour, Street Children - Aged and Disabled Persons: Vulnerability and social taboos	8
5.	Human Rights of the Working Class	- Migrant Workers - Bonded Labourers - Agricultural Labourers - Casual Workers	5

6.	Emerging Dimensions Of Human Rights	● National Sovereignty versus 'international enforcement' of human rights ● International politics of human rights and selective application of international sanctions ● Unilateral use of coercion and implementation of human rights ● Human rights, and science and technology	6
Total number of Hours			**42**

Evaluation Criteria

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

Project Based Learning: The students will be required to form groups of 4-5 and review documentaries/movies which are based on the violation/issues of human rights and social justice

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.	Banton, M. (1996). *International Action against Racial Discrimination*. Oxford: Clarendon Press
2.	Cassese, J. (1990). *Human Rights in Changing World.* Philadelphia: Temple University Press
3.	Cruft, R., Liao, S.M.& Renzo. M. (2015). *Philosophical Foundations of Human Rights*. Oxford: Oxford University Press
4.	Dhiman, O.P. (2011). *Understanding Human Rights An Overview*. New Delhi: Kalpaz Publication
5.	Donnelly, J. (2013).*Universal Human Rights and Practices*. Ithaca: Cornell University Press
6.	Easterly, W. (2014). *The tyranny of experts: Economists, dictators, and the forgotten rights of the poor*. New York: Basic Books
7.	Joshi. K.C. (2019). *International Law and Human Rights*. Lucknow: Eastern Book Company
8.	Saksena, K.P. (ed.) (1984). *Human Rights in Asia: Problems and Perspectives*. New Delhi: HURITER
9.	Sen, A. (1999). *Development as Freedom*. Oxford: Oxford University Press
10.	Sinha, M.K, (2000). *Basic Documents on International Human Rights and Refugee Laws*. New Delhi: Manak Publications
11.	Verma, R.S., (2000). *Human Rights: Burning Issues of the World*. Volumes I, II and III. Delhi: Radiant Publishers
12.	U.N. Department of Public Information. (2018). *Universal Declaration of Human Rights*. U.SA.: United Nations

Course Code	1812HS411	Semester Odd	Semester VII Session 2023-2024 Month from July-December
Course Name	HUMAN RESOURCE ANALYTICS		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr Kanupriya Misra Bakhru
	Teacher(s) (Alphabetically)	Dr Kanupriya Misra Bakhru

COURSE OUTCOMES		COGNITIVE LEVELS
C401-20.1	Understand different analytical techniques used for solving HR related problems.	Understand Level (C 2)
C401-20.2	Apply descriptive and predictive analysis techniques to understand trends and indicators in human resource data.	Applying Level (C 3)
C401-20.3	Analyze key issues related to human resource management using analytical techniques.	Analyze Level (C 4)
C401-20.4	Critically asses and evaluate the outputs obtained from analytical tools and recommend HR related decisions.	Evaluate Level (C 5)
C401-20.5	Create hypotheses, propose solutions and validate using appropriate analytical techniques	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Human Resource (HR) Analytics	Understanding the need for mastering and utilizing HR analytic techniques, Human capital data storage and 'big (HR) data' manipulation, Predictors, prediction and predictive modeling, Current state of HR analytic professional and academic training, HR's Contribution to Business Value, the Changing Nature of HR.	8
2.	Human Resource information systems and data	Understanding HR metrics and data, Data collection, tracking, entry, Data availability in the entire Employment Lifecycle, Approaches and costs of collecting HR related data, Analysis software options, Using SPSS, Preparing the data, Using Tableau.	10

3.	Analysis Strategies	From descriptive reports to predictive analytics, Statistical significance, Data integrity, Types of data, Categorical variable types, Continuous variable types, Using group/team-level or individual-level data, Dependent variables and independent variables, Introduction of tools for HR data analysis: Correlation, Regression, Factor Analysis, Cluster Analysis, Structural equation modeling.	10
4.	Application of Human Resource Analytics	Workforce Planning Analytics, Diversity Analytics, Talent Sourcing Analytics, Talent Acquisition Analytics, Talent Engagement Analytics, Training and Intervention Analytics, Analytical Performance Management, Retention Analytics. Data Visualization and Storytelling using Tableau.	12
5.	Future of Human Resource Analytics	Rise of Employee Behavioral Data, Automated Big Data Analytics, Big Data Empowering Employee Development, Quantification of HR, Artificial Intelligence in HR.	6

Total number of Lectures	**44**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz)
Total	**100**

Project Based Learning:

Students, in groups of 5-6, are required to select a contemporary topic of HR. Further students are required to select a sector from where they will collect the data. Data should be collected from at least 50 respondents from the chosen sector. The information can be collected with the help of an interview or some kind of questionnaire pertaining to the HR topic chosen. Analysis of the collected data should be done using SPSS software. Findings should be discussed and recommendations should be suggested.

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.	**Edwards and Edwards, Predictive HR Analytics. Mastering the HR Metric, Kogan Page, Limited, 2019**

2.	Banerjee, Pandey and Gupta, Practical Applications of HR Analytics, Sage, 2019
3.	Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017
4.	Isson, Harriott and Jac Fitz-enz, People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop, and Retain Talent, Wiley, 2016
5.	Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use Workforce Analytics To Improve Business Performance, First Edition, Pearson, 2017
6.	Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing, Incentive and Improving Collaboration, Pearson, 2014

Course Code	17B1NPH732	Semester : Odd	Semester: VII, Session: 2023-2024 Month from: July to December
Course Name	Nanoscience and Technology		
Credits	3	Contact Hours	3
Faculty (Names)	Coordinator(s)	Prof. Navendu Goswami	
	Teacher(s) (Alphabetically)	Prof. Navendu Goswami	

COURSE OUTCOMES		COGNITIVE LEVELS
C401-4.1	Define the Nanoscience and Technology and to know about various other terminologies and developments involved with Nanoscience and Technology	Remembering (C1)
C401-4.2	Classify the nanomaterials depending on the nature of dimensionalities, type of materials classes and explain the basic concepts of nanomaterials	Understanding (C2)
C401-4.3	Apply the concepts of Nanoscience for solving the theoretical and numerical problems	Applying (C3)
C401-4.4	Determine the properties of nanomaterials through suitable characterization tools	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures Magnetic nanomaterials, Chemically assisted nanostructures, Growth in 2-D nanostructures, Carbon nanomaterials	10
2.	Properties of Nanomaterials	Surface to volume ratio, Surface states and energy, Nanoscale oscillators, Confinement in nanostructures, Density of States and number of states of 0-, 1-, 2-, 3-dimensional systems, Change in Band structure and gap, Energy levels, confinement energy and emission in nano, Fluorescence by QDs, Concept of Single electron transistor	5

3.	Nanomaterials Synthesis	Introduction to synthesis techniques, Top down and bottom up approach, Biological methods, Sol-gel method, Nucleation and growth, Ball Milling technique, Chemical vapor deposition, Physical Vapor deposition: Concept of Epitaxy and sputtering, Basics of Photolithography and its limitations, Soft Lithography and Nanolithography	10
4.	Characterization of Nanomaterials	Resolving power (Rayleigh and other criteria) ofmicroscopes and their limitations for nanostructure measurements, Concept of Far and Near field and modification by NSOM, Basic principle, Design of setup, Theory and working, Characterization procedure, result analysis, Merits/demerits of SEM, TEM, STM, AFM	5
5.	Application of Nanomaterials	Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High Tc nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

Project based learning: Students would work on a project of their choice in the field of Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High Tc nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS. In such projects students can apply the basic concepts of Nanoscience for solving theoretical and numerical problems. They can also work on analysis of a nanomaterial to determine its properties through suitable characterization tools such as SEM, TEM, AFM etc. The learning gained through this project would consolidate the understanding and provide skills of analysis and application in Nanoscience and Technology and thereby providing the employability prospects in the organizations and industries involved in the research and development of nanomaterials synthesis and characterizations, nanoelectronics, nanobiotechnology/nanomedicine etc.

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.	*Nanostructures and nanomaterials: synthesis properties and application*, Guozhong Cao, Imperial

	college press, London.
2.	*Introduction to nanotechnology,* Charles Poole *et al* J John Wiley & Sons, Singapore.
3.	*The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation*, A.Lakhtakia, Spie Press USA.
4.	*Springer Handbook of Nanotechnology,* Edited by B. Bhushan, Springer Verlag.

Course Code	18B12CS424	Semester Odd	Semester VII Session 2023-24
			Month from July to December

Course Name	Algorithm Analysis and Artificial Intelligence

Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Alka Singhal
	Teacher(s) (Alphabetically)	Alka Singhal

COURSE OUTCOMES		COGNITIVE LEVELS
C401-12.1	Analyze algorithm's time complexities (Master's method, Recursion tree and substitution method- Sorting and Searching algorithms)	Analyse Level (Level 4)
C401-12.2	Propose solutions for real life computing problems using greedy, divide & conquer, and dynamic programming techniques.	Create Level (Level 6)
C401-12.3	Apply informed and uninformed searching algorithms(A*, Hill Climbing and Simulated Annealing) in AI related problems.	Apply Level (Level 3)
C401-12.4	Solve constraint satisfaction problems and adversarial search algorithms	Create Level (Level 6)
C401-12.5	Apply inference mechanisms(propositional logic , first order predicate logic, and probabilistic reasoning)	Apply Level (Level 3)
C401-12.6	Design and simulate Genetic Algorithms for Optimization.	Create Level (Level 6)

Sr.	Module	Chapters	Lectures
1.	Introduction	Time Complexity analysis: Master's Method. Divide and Conquer methods: Insertion Sort, Merge Sort, Quick Sort	06
2.	Divide and Conquer and Greedy Algorithms	Strassen's Matrix multiplication , Knapsack Problem; Coin change Problem; Huffman Coding; Activity Selection; Minimum Spanning tree, shortest path.	09
3.	Dynamic Programming Algorithms	Knapsack Problem; Coin change Problem; Matrix chain Multiplication, Longest common subsequence etc.	05
4.	Artificial Intelligence : Problem Spaces and Problem Solving by search	State Spaces, Uninformed search strategies (BFS, DFS, DLS, IDS, Bidirectional search),Informed Search & exploration (A*,Heuristic, Local search algorithms, online search agents)	07
5.	Constraint satisfaction problems	Constraint satisfaction problems (backtracking, variable and value ordering, local search), Adversarial Search (games, alpha beta pruning, elements of chance, state of art games)	06
6.	Propositional Logic	Knowledge based agents, PL, FOPL, Syntax and semantics, use, knowledge engineering) , Inference in FOPL(Propositional vs First order inference	06
7.	Uncertainty	Probabilistic reasoning, Bayesian rule, Bayesian network, Inference, Reasoning over time	03
8.	Genetic Algorithms	Travelling Salesman Problem,Knapsack Problem	01
		Total number of Lectures	**43**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance-10Quiz/Assignments/Presentations/Mini-Project- 15)
Total	**100**

Project based learning: Each student understood on the application of Artificial Intelligence for algorithmic optimization. They presented the application by a power-point presentation. It can help improve the efficiency of the real life projects in the real world IT organizations.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.

TEXT BOOKS

1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein , Introduction to Algorithms, MIT Press, 3rd Edition, 2009
2.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
REFERENCE BOOKS Journals, Reports, Websites etc. in the IEEE format	
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Nunes de Castro, Leandro, " Nature-Inspired Computing Design, Development, and Applications" IGI Global, 31-May-2012 - 435 pages
5.	Steven Skiena ,The Algorithm Design Manual, Springer; 2nd edition , 2008
6.	Knuth, The art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional; 3 edition,1997
7.	Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978

Course Code	10B1NBT735	Semester Odd
Course Name		
Credits	3-0-0	Contact Hours
Faculty (Names)	Coordinator(s)	
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES

C431-2.1	Explain role of various enzymes in food processing
C431-2.2	Identify need for Technical enzymes
C431-2.3	Examine recent technology in Food processing Industries
C431-2.4	List quality assurance protocol and economic consideration.

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	General characteristics of Technical Enzymes	Enzyme analysis, technical Enzyme units Enzyme kinetics principles of enzyme assay and kinetic studies; techniques for enzyme extraction; high- throughput screening; statistical analysis of enzyme kinetic data; and relevance of active sites any one example .	4

2.	Description of Enzymes and their substrates	Carbohydrate Hydrolyzing Enzymes – amylases, cellulase, Hemicellulases, Isomerase, Pectin degradation	4
3.	Description of Enzymes and their substrates	Proteases: Plant, animal, microbial, Fat hydrolysis: Lipases , Phospholipases	4
4.	Application of Enzymes Preparation	Enzyme in Starch and Sugar Industry , Enzyme in Brewing Industry , Analytical monitoring of mashing Process, Cold stabilization Enzymatic Alcohol production - continuous process	6
5.	Commercial enzyme production, and the processing	Beverage Industry, Enzymes in Juice and Wine making	4
6.	Flour processing	Enzyme in Flour Processing and Baking – Flour component and enzymes	4
7.	Dairy Industry	Enzymes in Dairy Industry, cheese making and ripening aroma and flavor production, cold sterilization, Enzymes in product modification.	4
8.	Proteolysis	Debittering, Hydrolysis of Soy protein, fish protein, Milk protein, collagen, Blood protein	4
9.	Nutrition	Silage enzymes, Additives in fodder, Chicken feed, Pig husbandry,	4
10.	Legal and economic consideration	Regulatory requirements for enzyme preparation Economic consideration for the use of technical enzymes.	4
		Total number of Lectures	42

Evaluation Criteria

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

Project Based Learning; Students 3 to 4 will form a group and pick up any food processing Industry. They will submit a technical and economic feasibility report which will focus on choice of technology, methodology of converting raw material to finished product, its storage, application .of technical food processing enzyme as well as report the projected sales revenue underlying cost and estimated profit.

Course Code	17B1NBT739		Semester ODD (specify Odd)	Semester VII Session 2023 -2024 Month from: July-Dec.
Course Name	**Biocomputing and Applications**			
Credits	4		**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Nidhi
	Teacher(s) (Alphabetically)	Dr. Nidhi

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand about the biocomputing methods, principles and practices.	Understand Level (C2)
CO2	Outline the advanced genomics, transcriptomics and proteomics, methods	Understand Level (C2)
CO3	Apply web-based methods and tools for simulation of biological problems	Apply Level (C3)
CO4	Analyze vaccine designing and protein-ligand interactions for drug discovery	Analyze Level(C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module

1.	Bio-computing basics	Basics of Biological system, DNA/RNA/Protein, structures, Bioinformatics problems, Mapping, computational methods, limitations Information scope	5
2.	Genomics methods and tools	homology search programs, Psi, Phi-BLAST, Wu Blast, MEGABLAST, T-Coffee, EMBOSS, Gene mapping, Genscript, Bioedit, MEGA, PAML, etc, methods; PSSM/PWM, Entropy, information content etc.	6
3.	Web based tools for complex analysis	Genome annotation and editing methods and tools. Protein, Nucleic Acid sequences and complex, analysis and modelling tools, pipelines. Etc.	5
4.	Trancriptomics methods and tools	Transcriptome profiling, RNA-seq, NGS Data generation and analysis, KEGG, Blast2GO, Validation.	5
5	Proteomics tools	Quantitative proteomics (PANDA), Sub-cellular, localization, nuclease site prediction. Maldi- tof MS data analysis, Open source [Opl analyzer etc.], protein microarray	5
6	Immunoinformatics methods and tools	Immunoinformatics (Case study), antigen/epitopes identification, Prediction of MHC I and MHC binding site, Databases IMGT/LIGM-DB, MHC-Peptide Interaction Database, vaccine design, Peptide designing tool	7

7.	Protein ligand interactions and simulations	Molegro/Autodock software, structure of protein structure (pdb), Genetic algorithm, basics of drug-enzyme and simulations, structure-based designing, target-based designing, high throughput computation of drug molecule, virtual screening, Modules; QSAR, Molegro/ docker/ online free tools etc	9
		Total number of Lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments 1, class test. PBL)
Total	**100**

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

1.	Smith, D.W , "Biocomputing : Informatics and Genome Projects", Academic press Inc.,1994
2.	BaxevanisA., D & Ouellette "Bioinformatics A practical guide to analysis of genes and protein", Wiley-Interscience, 1998.
3.	David Mount "Bioinformatics: Sequence and Genome analysis", Cold Spring Harbor Laboratory Press, 2001.
4	Recent Research papers and online resources

Course Code	14M11BT111	Semester Odd	**Semester** VI Integrated/MTech I **Session** 2023-2024 **Month from** July-December
Course name	**Biomolecules and Cell Communication**		
Credits	3	**Contact hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Reema Gabrani
	Teacher(s) (Alphabetically)	Prof. Reema Gabrani

COURSE OUTCOMES		COGNITIVE LEVELS
C110.1	Explain the signal molecules and major cell signaling pathways	Understand Level (C2)
C110.2	Analyze cell signaling pathways in normal and diseased conditions	Analyze Level (C4)
C110.3	Interpret the mechanisms and regulation of cell cycle and cell death	Understand Level(C2)
C110.4	Analyze the therapeutic drug targets for cancer	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of lectures for the module
1.	Signal molecules	Cytokines and Hormones, Growth factors, neurotransmitters, extracellular matrix components as signaling molecules; autocrine, paracrine, juxtracrine and endocrine signaling	3
2.	G-protein linked signaling pathways	G Protein-Coupled Receptors, Heterotrimeric G Proteins, second messengers, Effector enzymes, Mechanism of transduction, Switching Off and Desensitization of receptors, Visual transduction pathway	8

3.	Signaling mediated by enzyme-linked cell surface receptor	Photoreceptor development in Drosophila, Ras to MAP kinase, Phosphoinositide-3-kinase and signaling through insulin in receptor, JAK-STAT pathway, Signal Transduction via Integrins	8
4.	Nuclear receptor-based signaling	Classification and Structure of Nuclear Receptors, Signaling by steroid hormones, Retinoids, Vitamin D3, and the T3-Hormone, Mechanisms of Transcriptional Regulation by Nuclear Receptors	4
5.	Bacterial Chemotaxis	Two-component signaling pathway, histidine kinase associated receptor, Adaptation, Chemotaxis pathogenicity, symbiotic associations and biofilm	3
6.	Cell cycle Regulation and cell death	Cyclin-CDK variation, Checkpoint signaling, Ubiquitin Proteasome proteolytic system, Intrinsic and Extrinsic Apoptotic pathways	8
7.	Malfunction of Signaling Pathways and Tumorigenesis	Hallmarks of cancer, Developmental pathways, and cancer : Notchsignalingg from Drosophila to humans, Wnt signaling, Hedgehog pathway; Epigenetic changes in cancer, Signalling pathways as therapeutic targets, Analysis of ssignalingevents via case studies	8

Total number of Lectures	42

Evaluation Criteria

Components Maximum Marks

T1   20

T2   20

End Semester Examination   35

TA   25(Presentation, Assignments) PBL:7marks

Total 100

PBL: Students will be given project in groups on "Bench to bedside case study in cell signaling". The project will link the signaling molecule and its cascade to the associated disease and the development a of therapeutic molecule.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks Reference Books, Journals, Reports, Websites in the IEEE format)
1.	B. Gomperts, l. Kramer, P. Tatham "Signal transduction",2ⁿᵈ Ed. Academic Press, 2009
2.	V W Rodwell, D Bender, K M Botham, P J Kennelly, P A Weil, "Harper's Illustrated Biochemistry", 31ˢᵗ Ed. McGraw-Hill Lange 2018
3.	Alberts, Johnson, Lewis, Morgan, Raff, Roberts and Walter, "Molecular Biology of the Cell" Sixth Edition, Garland Science Publication,2014
4.	Refereed papers from scientific journals for case studies

MOLECULAR MODELING AND DRUG DESIGN

Course Code	17M11BT112	**Semester Odd (specify Odd/Even)**	**Semester** I
			Session 2023-2024
			Month from June to Dec
Course Name	**Molecular Modeling and Drug design**		
Credits	3	**Contact Hours**	**LTP 3 0 0**
Faculty (Names)	**Coordinator(s)**	DR CHAKRESH JAIN	
	Teacher(s) (Alphabetically)	DR CHAKRESH JAIN	

COURSE OUTCOMES		COGNITIVE LEVELS
C112.1	Explain macromolecular structures, their Mathematical representation and visualization	**Understanding** (C2)
C112.2	Explain structural modeling, simulation and dynamics	**Understanding** (C2)
C112.3	Apply computational drug designing and simulation approaches for drug discovery	**Applying**(C3)
C112.4	Compare *in-silico* ligand-target interaction methods	**Analyzing** (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module

1.	Introduction to Molecular Modeling	Introduction to structure of DNA, protein and RNA. Structure representation and visualization, Coordinate Systems, Potential Energy Surfaces, Software and Hardware for molecular modeling, Tools such as Swiss pdb viewer, Pymol, VMD etc.	5
2.	Quantum Mechanics and Force Fields	Electron methods and molecular orbital calculations, General Features of Molecular mechanics force field, Bond Stretching. Angle Bending. Introduction to Non-bonded Interactions. Electrostatic Interactions. Van der Waals Mechanics. Force Field Models for the Simulation of Liquid Water.	5
3.	Energy Minimization and computer simulations	Minimization and Related Methods for exploring the Energy Surface. Non-Derivative method, Minimization methods. Computer Simulation Methods. Simple Thermodynamic Properties and Phase Space. Boundaries. Analyzing the Results of a Simulation and Estimating Errors.	5
4.	Molecular Dynamics and simulation	Molecular Dynamics Simulation Methods. Molecular Dynamics Using Simple Models. Metropolis Method. Monte Carlo methods, Web Based Resources, Databases and tools such as GROMACS, AMBER, & CHARMM.	6
5.	Structure Prediction	Principles of structure prediction, comparative modeling and protein folding, Comparative and *ab-intio* modeling, CASP, validations, Projects such as ROSETTA, protein folding at home.	6
6.	Drug designing	Introduction to drug discovery and drug development, Rational approach to drug design, Approaches to lead optimization such as conformation restriction, pharmacophore etc. Designing drugs against enzymes and receptors, Computer Aided Drug Design methods. ADMET, QSAR Tools and databases such as AUTODOCK, MOLEGRO, Drug Bank etc.	16
		Total number of Lectures	**43**

Evaluation Criteria
Components   Maximum Marks
T1   20
T2   20
End Semester Examination   35
TA   25 (Assignment-1, MCQ, Project, Presentation, PBL)
Total   100

PBL: Students will choose any protein linked to a particular disease. How is it commercially used as a therapeutic molecule or as a target to manage the disease and its associated complications

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.	Andrew R leach, V.J Gillet, "An introduction to Chemoinformatic" Springer model of publication, 2007
2.	Gasteiger Johann, "Chemoinformatic A text book" John Wiley, 2008
3.	Andrew R. Leach, "Molecular Modeling principles and applications" Pearson Education, Second edition, 2001