JAYPEE INSTITUTE OF INFORMATION AND TECHNOLOGY

INTEGRATED M. TECH BIOTECHNOLOGY

7th Semester

Detailed Syllabus
Lecture-wise Breakup
CONTENT AFTER REVISION

Course Code	**17B1NBT737** **NBA CODE C431-2**	**Semester Odd**	**Semester 7th** **Session** 2022 -2023 Month from Aug 21- Dec21
Course Name	**Enzymes in Food Processing**		
Credits	3-0-1	**Contact Hours**	3+1

Faculty (Names)	**Coordinator**	1. Dr. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Dr. Neeraj Wadhwa

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 and purification Increasing yields	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

4

Evaluation Criteria	
Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25 (Assignment)**
Total	**100**
PBL Component : Student will form group of 3- 5 students and submit report on recent and innovative technologies that are applied in the food industry involving enzymes	
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.	**N. Tilak, T.Steve & R. Gerald, *Enzymes in Food Processing* 3rd Edition, USA: Academic Press, 1993.**
2.	J.W. Robert. & V.O.Maarten *Enzymes in Food Technology*: John Wiley and Sons: 2009.
3.	U. Helmut, *Industrial enzymes and their applications* 3rd Edition, John Wiley and Sons: 1998.
4.	W.S. Dominic, *Food enzymes: structure and Mechanism, Chapman* &Hall, USA: 1995.
5.	E. Robert, D.J. Michael ,*Enzyme assays: a practical approach*, Oxford University Press: 2002

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B1NBT832	**Semester** Odd **(specify Odd/Even)**	**Semester** Integrated VII **Session** 2022-2023 **Month** July to December
Course Name	Biostatistics and Its applications		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Shalini Mani
	Teacher(s) (Alphabetically)	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,	**13**
6.	Analysis of data source	Assess data sources and data quality for the purpose of selecting appropriate data for specific research questions	**3**

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**

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.	Pranab Kumar Banerjee, Introduction to Biostatistics (4th Edition), S Chand and Company, 2015.
2.	Veer Bala Rastogi, Biostatistics (3rd Edition), Medtech, 2015
3.	S. Kartikeyan, R. M. Chaturvedi, R. M. Bhosale, Comprehensive textbook of biostatistics and research methodology(1st Edition), Bhalani Publishing House, 2016
4.	B Antonisamy Prasanna Premkumar Solomon Christopher, Principles and Practice of Biostatistics, Elsevier India, 2017
5.	Susan Holmes, Wolfgang Huber, Modern statistics for Modern Biology. Cambridge University Press, 2019

Course Code	16B1NBT734	**Semester Odd**		**Semester VII Session 2022-2023** Month from July to December	
Course Name	Advanced cell biology				
Credits	**3+1**		**Contact Hours**	**4**	
Faculty (Names)	**Coordinator(s)**	Dr. Priyadarshini			
	Teacher(s) (Alphabetically)	Dr. Priyadarshini			

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-3.1	Explain cellular organization, integration, migration and communication	Understanding Level (C2)
C431-3.2	Illustrate membrane trafficking in cell environment	Apply Level (C3)
C431-3.3	Identify the signaling event during biogenesis	Analyze Level (C4)
C431-3.4	Compare regeneration and maintenance of different tissue	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Advance Microscopy	History of microscopy, Electron microscopy, scanning electron microscopy, confocal laser scanning microscopy, fluorescence microscopy, transmission electron microscopy.	3
2.	Organization of cell & tissue	Sub-cellular Fractionation and Characterization of Organelles, Integrating cells into tissue, cell-cell & epithelial-mesenchymal interaction	5
3.	Cell Adhesion, Migration & communication	Cell Adhesion Molecules, Integrins and Mucins and cell migration, Extracellular Matrix and cell communication	4
4.	Nuclear structure & dynamics	a) Nuclear envelop & traffic between the nucleus & cytoplasm b) Internal organization of nucleus c) Nucleolus d) Nucleus during mitosis	5
5.	Membrane trafficking	a) Moving proteins into membrane & organelles b) Vesicular traffic, secretion & endocytosis	5
6.	Tissue maintenance	a) Apoptosis b) Epidermis & its renewal by stem cells, sensory epithelia, airway and the gut c) Blood vessels & endothelial cells, blood cell formation, renewal by pleuripotent cells	8

		d) Genesis, modulation & regulation of skeletal muscle e) Fibroblast & their transformation	
7.	Cytoskeleton dynamics & cellular movement	a) Self assembly & dynamic structure of cytoskeleton filaments b) Molecular motors c) Microtubule based motility	6
8.	Mitochondrial biogenesis	a) Mitochondrial & biogenesis exercise b) Factors regulating mitochondrial biogenesis c) Signalling event during biogenesis	6
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Students in each team researches a particular human disease based on menbrane trafficking, tissue maintenance and cytoskeleton. They will present information about the cellular structure or process affected by the disease, the cellular biology of the disease, and recent research focused on understanding the cellular mechanisms of the disease process. To support effective teamwork and to help students develop collaboration skills useful for their future careers, current research problems will be discussed in small groups.

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.	M. Geoffrey, Cooper & E. Robert Hausman, “The Cell: A Molecular Approach”, ASM Press Publication, 2004
2.	Becker, J. Lewis, Kleinsmith & Jeff Hardin, “The World of the Cell”, Pearson Education publication, 2004
3.	B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts & P. Watter, “Molecular Biology of the Cell”, Garland Science Publication, 2002
4.	H. Lodish, A. Berk, P. Matsudaira, C. A-Kaiser, M. Kreiger, M. P. Scott, S. Lawrence, Zipursky & J. Darnell, “Molecular Cell Biology”, WH Freeman & Company Publication, 1986
5.	Current research paper related to the course

Course Code	**17B1NBT734** ELECTIVE	**Semester Odd**	**Semester VII Semester** **Session** 2022-2023 **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 stemcells	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)

ModuleNo.	**Title of the Module**	**Topics in the Module**	**No. of Lectures forthe module**
1.	Introduction t oStem Cells	Stem cells: the promising field of research, Unique Properties: Self-renewal, Potency andproliferation 2 Asymmetric Cell Division, History ofStem Cells	04
2.	Types and sources of Stem Cells: Embryonic Stem cells; hESCs	Characteristics of ES cells: Sources (IVF & SCNT), Isolationand Culture Techniques, Characterization, Unique features, Genetic Manipulation and Differentiation	06
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 o fStem 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**

PBL: Students after conceptualising the stem cell biology, therapeutic potential of various stem cells and the components of tissue engineering and regenerative medicines, will do projects based on clinical cases where stem cell therapy can be the best option. In individual and in team, they can find the suitable requirements of scaffold material, stem cells and growth molecules and justify their effectiveness and the best strategy for regenerative medicines. They will present their projects in the form of e-posters.

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, OMICSInternational, 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/

Course Code	**17B1NBT739**	**Semester** ODD **(specify Odd)**	**Semester VII Session** 2022 -2023 **Month from: July-Dec.**
Course Name	**Biocomputing and Applications**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Shazia Haider
	Teacher(s) (Alphabetically)	Dr. Shazia haider

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.	Baxevanis A., 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

S.No.		Course Outcome	Cognitive level
1	**Major Project Part-1 (10B19BT791)- 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 2022-2023** Month from **July - December**
Course Name	Summer Training Viva		
Credits	2	**Contact Hours**	**NA**
Faculty (Names)	**Coordinator(s)**	Prof Sujata Mohanty	
	Teacher(s) (Alphabetically)	Prof Sujata Mohanty	

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.

MOLECULAR MODELING AND DRUG DESIGN

Course Code	17M11BT112	**Semester Odd (specify Odd/Even)**	**Semester** I **Session** 2022-2023 **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. SHAZIA HAIDER	
	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-*	6

		intio modeling, CASP, validations, Projects such as ROSETTA, protein folding at home.	
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

Course Code	**18B12HS412**	**Semester** Odd	**Semester** VII **Session 2022-2023** **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 solvingHR 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 managementusing 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 usingappropriate analytical techniques	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectu resfor the modul e**
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.	8
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 forHR data analysis: Correlation, Regression, Factor Analysis, Cluster Analysis,	10

		Structural equation modeling.	
4.	Application of Human Resource Analytics	Workforce Planning Analytics, Diversity Analytics, Talent Sourcing Analytics, Talent Acquisition Analytics, TalentEngagement Analytics, Training and Intervention Analytics, Analytical Performance Management, Retention Analytics.	10
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			**42**

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.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz)
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.	Bhattacharyya, HR Analytics: Understanding Theories and Applications, Sage, 2017
2.	Pease, Byerly and Jac Fitz-enz, Human Capital Analytics: How to Harness the Potential of YourOrganization'sGreatest Asset, Wiley, 2012
3.	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
4.	Guenole, Ferrar and Feinzig, The Power of People: How Successful Organizations Use WorkforceAnalyticsTo Improve Business Performance, First Edition, Pearson, 2017
5.	Sesil, Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing,Incentive and Improving Collaboration, Pearson, 2014

Course Code:	21B12HS411	Semester: ODD	Semester: 7th Session: 2022-2023 Months: August to December
Course Name	Urban Sociology		
Credits	03	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Prof. Alka Sharma
	Teacher(s) (Alphabetically)	Prof. Alka Sharma Dr. Priyanka Chhaparia

COURSE OUTCOMES		COGNITIVE LEVELS
C401-25.1	Understand the concepts and theories of Urban Sociology	C2
C401-25.2	Apply an analytical framework to understand the structural characteristics of cities students are residing in	C3
C401-25.3	Analyze the role of agencies and actor in shaping the process of urbanisation	C4
C401-25.4	Evaluate the importance of good governance and urban planning	C5

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Urban Sociology	Basic Concepts and terminologies of Urban Sociology, Origin of urban societies, Rural-Urban Continuum	4
2.	Theories in Urban Sociology	The Classical Foundations of Simmel, Max Weber, Tonnies, Louis Wirth, Durkhiem and Friedrich Engels	5
3.	The Ecological View	The Chicago School,Concentric zone theory (Burgess), Sector theory (Hoyt), Multiple Nuclei theory (Harris and Ullman)	3
4.	Contemporary Urban Sociology	Political Economy of Cities, Henry Lefebvre, Class Conflict Theories, Accumulation Theory, Neoliberalism, Neo-Weberian, Neo-Marxism, Colonialism	4
5.	Mapping and Organisation	Social Area Analysis, Urban Social Divisions, Concentration and Centralization, Segregation, Cooperatives, Role of Cooperatives in Urban planning and development	4
6.	Urbanisation in India	Development of Urban Sociology in India, Evolution of and from different structures, Spatial Structures and classification of cities	4

7.	Urban Planning	Historical timeline of urban planning, Principles of Urban Planning, Need for planning, Governance, Agencies Involved, Urban local bodies	5
8.	Urban Issues in India	Level, trends, and pattern, Issues (poverty, slum, and environment) and Implications, Lessons from a pandemic	4
9.	Technology and Urbanisation	Digitisation and expansion of cities, Impact of technology on Urbanisation, role of technology in governance	4
10.	Globalisation and Urban Development	Concept of globalisation and its impact on urbanisation, new perspectives on urbanisation, emergence of Mega cities	4
11.	Sustainable Urban Development	Challenges in current model of urbanisation, Need for sustainable urban development, Tenets of sustainable development, Introduction to SDGs and their relevance to urbanisation, sustainable structures	4
		Total number of Lectures	**45**

Evaluation Criteria

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

Project Based Learning: The students would be divided into a group of 4-5. They would be asked to map and discuss the different parts of their cities. The lectures and readings on the process of urbanization and models of urbanization will form the basis for this exercise. Students would be required to critically analyse the urban spaces using sociological perspectives and theories. The students would be needed to make a presentation and also submit a report.

Recommended Reading material:

1.	Gottdiener, M., Budd, L., &Lehtovuori, P. *Key concepts in urban studies*. Sage. (2015)
2.	Lin Jan and Mele Christopher, ed. *The Urban Sociology Reader*. London: Routledge. (2005)
3.	Rao, M. S. A., ed. *Urban Sociology in India: Reader and Source Book*. New Delhi: Orient Longman. (1974)
4.	Savage, M., and Warde, A. *Urban sociology, capitalism and modernity*. Macmillan International Higher Education. (1993)
5.	Sivaramakrishnan, K.C., Kundu, Amitabh & Singh, B.N. *Handbook of Urbanization in India*. Oxford University Press (2007)
6.	Wirth, Louis. *Urbanism as a Way of Life*. American Journal of Sociology. (1938)
7.	Sharma, A.K. and Misra, B.D. *Urbanization in India: Issues &Challenges.*New Delhi: Ane Books Pvt. Ltd.(2018)

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NBT531**	**Semester Odd (specify Odd/Even)**	**Semester** VII **Session** 2022 -2023 Month from June -Dec
Course Name	**Networks of Life**		
Credits	3	**Contact Hours**	**LTP 3 0 0**

Faculty (Names)	**Coordinator(s)**	1. Dr. Shazia Haider
	Teacher(s) (Alphabetically)	1. Dr. Chakresh Jain 2. Dr. Shazia Haider

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-15.1	Explain different type of networks	C2
C401-15.2	Explain models, motifs and network analytics	C2
C401-15.3	Apply networks to solve biological and social problems.	C3
C401-15.4	Case studies on pathogen informatics, metabolic pathways	C4

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	**Network Sciences**	Introduction to network sciences, Graph Theory, Random network, Scale Free Property, Various Models- Erdos Renyi, Barabasi-Albert etc. Centrality and Weighted Networks, Degree, Communities Identification, Robustness, Motifs and Evolving Networks.	18
2.	**Computational Resources**	Hands-on Cytoscape tool, Gephi, etc.	4
3.	**Applications & advanced topics**	Multi-Layered Networks, Spreading phenomenon, Temporal Networks, Networks in epidemics, networks in business, social networks, controlling networks, percolation, rewiring, machine learning in networks	10
4.	**Miscellaneous**	Case studies, projects, hands on workshop on advanced modules on python.	10

Total number of lectures 42

Evaluation Criteria

Components Maximum Marks

T1 20
T2 20
End Semester Examination 35
TA 25 (Assignments, MCQ, PBL)
Total 100

PBL: Students will choose any topic on Biological Network, Python language, Analysis tools and it's application to solve the biological problem linked to a particular disease in a group of 4-5 students.

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. Cohen and S. Havlin, Complex Networks - Structure, Robustness and Function, Cambridge Univ Press, 2010.
2.	M.O. Jackson, Social and Economic Networks, Princeton Univ Press, 2008.
3.	A. Barrat, M. Barthelemy and A. Vespignani, Dynamical Processes on Complex Networks, Cambridge Univ Press, 2008.
4.	E. Kolaczyk, Statistical analysis of network data, Springer, 2009.
5.	S. Wasserman, K. Faust, Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994.
6.	P. Van Mieghem, Graph Spectra for Complex Networks, Cambridge Univ Press, 2011.
7.	R. Diestel, Graph Theory (4th edition), Springer, 2010.
8.	R.K.Ahuja and T.L.Magnanti, Network Flows: Theory, Algorithms, and Application , Pearson, 1993.
9.	Mark Newman, Albert-László Barabási, and Duncan J. Watts, The Structure and Dynamics of Networks, ISBN: 9780691113579, Princeton University press, 2006
10.	Albert-László Barabási, Network Science, Cambridge University Press in 2015.

Course Code	**16B1NHS831**	**Semester: Odd (specify Odd/Even)**	**Semester: VII Session 2022-2023** **Month:** July to December	
Course Name	Gender Studies			
Credits	3	**Contact Hours**	(3-0-0)	
Faculty (Names)	**Coordinator(s)**	Dr Parineeta Singh		
	Teacher(s) (Alphabetically)	Dr Parineeta Singh		

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-19.1	Demonstrate knowledge of the construct of gender and the way itintersectswith other social and cultural identities of race, class, ethnicity and sexuality	Understand(C2)
C401 - 19.2	Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity and masculinity	Apply (C3)
C401-19.3	Analyze the ways in which societal institutions and power structures suchas the family, workplace impact the material and social reality of women's lives	Analyze (C4)
C401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporary settings	Evaluate (C5)
C401-19.5	Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introducing Gender Issues**	● Sex and Gender ● Types of Gender ● Gender Roles and Gender Division of Labor ● Gender Stereotyping and Gender Discrimination ● The Other and Objectification	8
2.	**Gender Perspectives of Body & Language**	● Biological, Phenomenological and Socio-CulturalPerspectives of body ● Body as a Site and Articulation of Power Relations ● Cultural Meaning of Female Body and Women'sLived Experiences ● The Other and Objectification	8

3.	**Social Constructio n of Femininity** & **Feminism**	● Bio-Social Perspective of Gender ● Gender as Attributional Fact ● Feminine & Feminist ● Major Theorists of Feminism Challenging Cultural, Norms of Femininity ● Feminism Today: Radical, Liberal, Socialist,Cultural, Eco feminism & Cyber feminism ● Images of Women in Sports, Arts, Entertainment,Media and Fashion Industry ;Cultural Feminism & Celebrating Womanhood ● Analysis of role women have played across cultures	9
4.	**Social Constructio n of Masculinity**	● Definition and Understanding of Masculinities ● Sociology of Masculinity& its Types ● Social Organization of Masculinity andPrivileged Position of Masculinity ● Politics of Masculinity and Power ● Major Theorists of Masculinity ● Masculine Identities in Literature, Cinema &Media.	9
5.	**Gender Sensitizati on Empower ment &Gender Inclusivity**	● Women , Law & Women Rights In India ● From Women's Studies to Gender Studies: AParadigm Shift ● Gender Studies & Media: Creating NewParadigms in Gender & Culture	8
		Total number of Lectures	**42**

Evaluation Criteria Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Viva)
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.	Davis K., et al, "*Handbook of Gender and Women's Studies*. London: Sage. (2006)
2.	Helgeson, Vicki S., "*The Psychology of Gender",* Pearson(2012)
3.	Friedan B., "*The Feminine Mystique",* Penguin. (1971/1992)
4.	Debeauvoir S. , "*The Second Sex",* Vintage (1953/1997)
5.	Wharton Amy S., "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell(2005)
6.	Pachauri G.," *Gender, School & Society*", R.Lall Publishers(2013)

7.	Connell R.W, "*Masculinities*", Cambridge: Polity. (1985)
8.	MacInnes J., "The *End of Masculinity"*. Buckingham: Open University Press. (1998)
9.	Kaul A.& Singh M., *"New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012)

Project- Divide your life in different age brackets such as 0-5 years, 5-8 years, 8-12 years, 12-15 years, 15-18 years and 18-21 years and write about your experiences with gender. When was the first time you experienced your gender? What was/is the process of gender construction for you? How does different institutions such as family, schools, media, religion etc. has shaped your gender? What kind of differentiations, discriminations (if any) you have faced on the basis of your gender. Also mention the differences you experienced in the second phase when you experienced the bodily changes? How has your gender identity is created during the course of your life? Please explain all these (not limited to these questions only) with the help of any gender theory that we have discussed in the course.

Detailed Syllabus

Lecture-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	17B1NBT732	**Semester** Odd **(specify Odd/Even)**	**Semester 7 Session** 2022-2023 Month from **July**
Course Name	Healthcare Marketplace		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Shweta Dang
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain healthcare market, drugs and devices, role of various stakeholders	Understand Level (C2)
CO2	Apply related intellectual property laws and regulatory approvals for healthcare sector	Apply Level (C3)
CO3	Analyze the various business models/ innovations in the healthcare industry	Analyze Level (C4)
CO4	Compare economic aspects pertaining to the sector	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Healthcare markets**	About the various Regulatory bodies for approval of new medical innovations 2 [CO1] Level 2 Understanding	**02**
2.	**Clinical Pharmacokinetics and Clinical trials for new Drugs**	Biologic sampling techniques, analytical methods for the measurement of drugs and metabolites, and procedures that facilitate data collection and manipulation. Clinical Trials: PhI, II, III and IV [CO2] Level 3 Applying	**05**
3.	**Regulatory approval pathways**	Preclinical studies US and EU filings IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis [CO2] Level 3 Applying	**06**
4.	**Patents of drugs and devices, Entry for generics in health care markets**	Role of patents on new drugs and devices, Ever-greening of patents, Product and Process patents. Hatch Waxman act and Introduction of generics and resulting cost reduction, Orange book (FDA) and related case studies. [CO2] Level 3 Applying	**08**
5.	**Economics of healthcare**	Stakeholders in healthcare- doctors, hospitals and insurers and their roles, technology and human capital [CO1] Level 2 Understanding	**7**

6.	**Medical technology and insurance**	For medical devices, pharmaceuticals, genetic diagnostic tests and their regulations [CO3] Level 4 Analyzing	**4**
7.	**Indian hospital sector**	Various players – government, private, PPP models, strategic perspectives, case studies [CO3] Level 4 Analyzing	**4**
8	**Innovations in the marketplace**	Health to market innovations [CO3] Level 4 Analyzing	**4**
9	**Healthcare informatics**	e-health, collection of health data, data processing, evaluation, health information systems, case studies [CO3] Level 4 Analyzing	**2**
		Total number of Lectures	**42**

Project Based Learning: Students analyze the site https://pmjay.gov.in/about/pmjay, understand the following sections:

- Coverage under PM-JAY
- Implementation Model
- Financing of the Scheme

And represent them in one comprehensive diagram, integrating all the above components. This helps them in understanding recent innovations in healthcare market and integration of healthcare informatics.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (PBL, Assignments 1, 2, 3, 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.	https://www.who.int/nationalpolicies/processes/stakeholders/en/
2.	Conflict of interests. I. Lo, Bernard. II. Field, Marilyn J. (Marilyn Jane) III. Institute of Medicine (U.S.). Committee on Conflict of Interest in Medical Research, Education, and Practice. IV. National Academies Press (U.S.), 2009
3.	Research papers and online resources

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NBT733	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2022 -2023 Month from **Sept-December**
Course Name	Stress: Biology, Behaviour and Management		
Credits	3 (3-0-0)	**Contact Hours**	4 (includes 1 hour /week for discussion)

Faculty (Names)	**Coordinator(s)**	Vibha Gupta
	Teacher(s) (Alphabetically)	Vibha Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-16.1	Explain the biological basis of stress.	**Understand Level (C2)**
C401-16.2	Relate cognitive processes and stress management.	**Understand level (C2)**
C401-16.3	Apply acquired knowledge in understanding and adjusting to different people and situations.	**Apply level (C3)**
C401-16.4	Improve quality of life by reducing stress.	**Create level (C6)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	The concept of Stress - Major stressors vs. routine hassles ; Major types of Stressors - Occupational Stressors; Organization Stress; Environmental Stressors; Happy Interactive Class (HIC)	3
2.	Scientific Foundations of Stress	HIC 1, The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease	5
3.	**Body Systems activated by stressors**	HIC2, Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles	9
4.	Cognitive Psychology	HIC3, Theoretical models: psychodynamic, behavioral, and cognitive; Thoughts, Beliefs and Emotions: Behavioral Patterns; Self-concept and Self-esteem; Stress emotions - Anger and Fear; Personality Traits – Stress prone and Stress resistant	11
5.	Social Psychology	HIC4, Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication; Human Spirituality	3
6.	Stress and the Human Environmental Interactions	HIC4, Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress	3
7.	Happy Interactive Class (HIC) related to Stress	HIC1 - DIY Strategies- Exercise and Health; HIC2 - Journal Writing/Music and Art Therapy; HIC3- Humor and	

	management techniques and therapeutic strategies	Comic Relief; HIC4- Meditation/Mindfulness/Belly Breathing/Visual Imagery/Progressive Muscle Relaxation Psychological interventions; Developing Cognitive Coping Skills; Creative Problem Solving (case studies);	HICs to be delivered in the modules 1-6 4
8.	The adaptive brain	Neuroplasticity – positive adaptation to stress	2
		Total number of Lectures	**40**

Evaluation Criteria

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

Project based learning:
To identify factors responsible for stress in the final year of B.Tech Engineering program and to develop a stress reducing intervention strategy.

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.	George Fink "Stress: Concepts, Cognition, Emotion, and Behavior: Handbook in Stress Series; Volume 1; Academic Press; 2016
2.	Jeanne Ricks "The Biology of Beating Stress"Kindle Edition; 2014
3.	Jerrold S. Greenberg "Comprehensive Stress Management" Tata McGraw-Hill Edition; Tenth Ed., 2009
4.	Brian Luke Seaward "Managing Stress: Principles and Strategies for Health and Well-Being" Sixth Ed., Jones and Bartlett Publishers, 2009
5.	Saundra E. Ciccarelli, and Glenn E. Meyer "Psychology" South Asian Edition; Published by Pearson Education (2008); ISBN 10:8131713873 / ISBN 13: 9788131713877

Course Code	17B1NHS731	**Semester: Odd**	**Semester** VII **Session 2022-2023** **Month from** July to December
Course Name	Customer Relationship Management		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi	
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-17.1	Apply the financial, social and electronic aspects of the Customer Relationship in business situations.	Apply Level (C3)
C401-17.2	Appraise the role of customer share and customer centricity in organizations.	Apply Level (C3)
C401-17.3	Develop the skills to understand customization, innovation and co-creation in organizations and apply them in business contexts.	Analyze Level (C4)
C401-17.4	Analyze the role of interactive technology for customer engagement, customer retention and customer experience management inorganizations.	Analyze Level (C4)
C401-17.5	Evaluate the technological solutions and their applications for effective Customer Relationship Management across different functions in organizations.	Evaluate Level (C5)
C401-17.6	Develop specific models for response modelling and consumer profiling in organizations.	Create Level (C6)

ModuleNo.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	CRM-The Strategic Imperatives	Introduction, CRM in Marketing and IT, CRM for BusinessLeadership, Criticality of customer relationships, Why businesses should adopt CRM, Implementing CRM.	3
2.	Conceptual Foundations ofCRM, Building Customer Relationships	Evolution of CRM, Benefits, Schools of thought on CRM,Defining CRM. Customer Retention and CustomerAcquisition, Customer Profitability is Skewed, ServiceBenefits of CRM, Transaction Marketing vs. RelationshipMarketing, Relationship Building as a process, Bonding for Customer Relationships-Financial, Social, customizationand Structural bonds, Ladder of Loyalty Zero Customer Defection, CRM Framework.	7
3.	Relationship Marketing and Economics of CRM	Internal and external relationships, Electronic Relationships, Operational, Analytical and Collaborative CRM, Market Share vs. Share of Customer, Customer Lifetime Value, andActivity based	6

		costing for CRM	
4.	CRM in B2C, B2B Markets, Customer Experience Manageme nt	CRM in Product and Service Markets, Case Studies, Characteristics of Business Markets, Participants in the business buying process, Key Account Management, Using KAM for Customer Segmentation, Customer Retention Strategy, KAM as a growth and Development Strategy, Customer Value Management in Business Markets, Importance of CRM in B2B Markets, Customer Emotion, Customer Knowledge, Reciprocity, Voice of the Customer, Participation.	7
6.	Components of eCRM solutions (Overview) and Role of Digital Technologies	Data warehousing, Datamining and CRM, Market Basket Analysis and Retail sector, Campaign Management, Sales Force Automation, Customer Service and Support, Corporate Blogs, Online communities, Twitter, Wikis. The Experience ecosystem. CEM, Consumer engagement, segmentation anddifferentiation.	7
7.	Product offerings inthe CRM Marketplace (Overview) and CRM Roadmap	Evaluating Technological solutions for CRM, Comparison ofSiebel, Oracle, MySAP.com and People Soft Enterprisesolutions, Comparison of Talisma, Sales logix, Microsoft andSales notes for small and medium enterprises, Defining aCRM strategy, CRM Implementation Roadmap, Developinga relationship orientation, Customer centric marketing andprocesses, Building organizational capabilities throughinternal marketing, Issues in implementing a technology solution for CRM.	7
8.	Operational issuesin implementing CRM,Social CRM	Process view of CRM, Budgeting for attraction vs. retention,Learning from customer defections, Customer RetentionPlans, Evaluating Retention programs, Social Customer Relationship Management, Social Customer Insights, SocialCRM Strategy, and Social Customer Analytics.	5
		Total number of Lectures	**42**
		Class Presentations	**6**

Project Based Learning: The project is to be done in group size of 4-5 members each. Student groups can choose an organization from one of the industry vertical like banking, IT, hospitality, telecom, airlines, logistics and consulting. Students need to study the CRM processes (internal CRM processes for improving employee productivity and external processes improving the organization-consumer interface) in the vertical/organization chosen. They need to develop a conceptual modelto depict the processes. A questionnaire needs to be developed it can either be an employee-based survey or consumer-based survey. Based on data collection and analysis, CRM strategies have to be formulated, for better consumer segmentation/process improvement/productivity enhancement/ identification of customers with greater Customer Life Time Value/ Customer Retention Program. Strategies can be developed for Key Account Management and Campaign Management. This adds to the employability skills of customer management in an organization.

Evaluation Criteria **Components Maximum Marks**	
T1	20
T2	20
End Semester Examination	35
TA	25 (Presentation, Class Test 1, Class Test 2, 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.	Customer Relationship Management, Ed. Peelan Rob Beltman, 2nd Edition, Pearson, 2014.
2.	Ou, Y. C., Verhoef, P. C., & Wiesel, T. The effects of customer equity drivers on loyalty across services industries and firms. Journal of the Academy of Marketing Science, *45*(3), 336-356, 2017.
3.	Lin, Y. C., Lee, Y. C., & Lin, S. Y. The influence of the personality traits of webcasters on online games. International Journal of Electronic Customer Relationship Management, *11*(1), 94-103, 2017
4.	Menzel, C. M., & Reiners, T.Customer relationship management system a case study on small-medium-sizedcompanies in north Germany. In *Information Systems for Small and Medium-sized Enterprises* pp. 169-197.Springer, Berlin, Heidelberg, 2014.
5.	Customer Relationship Management-A strategic perspective, G. Shainesh, Jagdish Sheth, Reprinted Macmillan Publishers India Limited, 2009.
6.	Mukerjee, K., Customer Relationship Management-A Strategic approach to Marketing, 3rd Edition Prentice Hall of India, 2007.
7.	Customer Relationship Management Concepts and Technologies-Francis Buttle, 3rd Edition Taylor and Francis, 2015.
8.	Berry, Michael, J. A, Linoff, Gordon S., Datamining Techniques for Sales, Marketing and CRM, 2ndEdition, Wiley Publications, 2007.

Course Code	10B1NPH732	**Semester :** Odd	**Semester:** VII **Session: 2022-2023.** **Month from:** July to December	
Course Name	Nanoscience and Technology			
Credits	3	**Contact Hours**	3	
Faculty (Names)	**Coordinator(s)**	Dr. Navendu Goswami and Dr. Sandeep Chhoker		
	Teacher(s) (Alphabetically)	Dr. Navendu Goswami and Dr. Sandeep Chhoker		

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)

ModuleNo.	**Title of the Module**	**Topics in the Module**	**No. of Lecturesfor the module**
1.	Introduction	Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures Magnetic nanomaterials, Chemically assistednanostructures, 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.	Nanomaterial sSynthesis	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 ofNanomaterials	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 T_C nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	10
		Total number of Lectures	**40**

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.

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**

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 collegepress, 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.

Subject Code	18B12HS211	Semester: ODD	Semester VII Session 2022-2023. Months: Aug 2022 to Dec 2022
Subject Name	PSYCHOLOGY OF PERSONALITY		
Credits	3	Contact Hours	(3-0-0)

Faculty (Names)	Coordinator(s)	Dr. Badri Bajaj
	Teacher(s) (Alphabetically)	Dr. Badri Bajaj

COURSE OUTCOMES		COGNITIVE LEVELS
C401-9.1	Demonstrate a basic understanding of concepts of personality	Understanding (Level 2)
C401-9.2	Apply the concepts of personality in day to day life	Applying (Level 3)
C401-9.3	Examine the different theoretical perspectives and approachesofpersonality	Analyzing (Level 4)
C401-9.4	Develop solutions for handling problems and achieving goalsusing personality concepts, theories and approaches	Creating(Level 6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures forthe module
1.	**Introduction to the Psychology of Personality**	Definition and perspectives, Approaches, Research methods	6
2.	**Determinants of Psychologyof Personality**	Motivation and Emotion, Interior selves andinterior worlds, Mentalabilities	6
3.	**Theories**	Psychoanalytical Theory of Personality: Freud, Neo Freudians:Jung, Horney, Erikson	10
4.	**Approaches**	Trait Approach: Allport, Cattell, Biological Approach, Social learning , Humanisticapproach	10
5.	**Assessment of Personality**	Interviews, Projective tests,Behavioralassessment, Personality inventories	10
		Total:	42

Project based learning: Students of Psychology of personality will choose any two theories from the syllabus and study these theories. Make group of 2-3 students. Write everyday applications of some

aspects of these theories. Submit the report of the project through Google Classroom link. Make presentations in the respective tutorial classes.

Evaluation Criteria Components	Maximum Marks20
T 1	20
T 2	35
End Semester ExaminationTA	25 (Assignment, Quiz, Oral Questions)
	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.	Schultz, D. P., and Schultz, S. E., *Theories of personality*. Cengage Learning11th Ed., 2016.
2.	Burger, Jerry M. *Personality: an introduction*. Cengage Learning, 10th Ed.,Cengage Learning, 2019.
3.	Mayer, John D. *Personality: A systems approach*. Rowman & Littlefield, 2017.

Course Code	17B1NMA732	**Semester** - Odd	**Semester** VII **Session** 2022-2023. **Month from** Aug 2022- Dec2022
Course Name	Applied Numerical Methods		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr Yogesh Gupta and Dr Neha Ahlawat	
	Teacher(s) (Alphabetically)	Dr Yogesh Gupta, Dr Neha Ahlawat, Dr. PankajSrivastava	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C401-8.1	solve a single and a system of non-linear equations and analyze the convergence of the methods.	Applying Level(C2)
C401-8.2	explain finite and divided difference formulae for numerical interpolation.	Understanding Level(C3)
C401-8.3	apply numerical differentiation and integration in engineering applications.	Applying Level(C3)
C401-8.4	solve a system of linear equations using direct and iterative methods with their applications in various engineering problems	Applying Level(C3)
C401-8.5	solve eigen-value and corresponding eigen- vector problem fora square matrix	Analyzing Level(C4)
C401-8.6	evaluate the solutions of initial and boundary value problems using various numerical methods.	Evaluating Level(C5)

ModuleNo.	Title of the Module	Topics in the Module	No. of Lectures forthe module
1.	Roots of Non-linear Equations	Concept of round-off and truncation errors. Iterative methods to find roots for one or more nonlinear equations with their convergence	6
2.	Interpolation and Approximation	Interpolating polynomial, Lagrange formula with error, Formulae for equi-spaced points, Divided differences, Spline interpolation, Least square approximation	7
3.	Numerical Differentiation and Integration	Approximation of derivatives, Newton-Cote'sformulae, Gauss-Legendre quadrature formulae, Double integration	7
4.	Numerical Linear Algebra	Gauss-elimination and LU-Decomposition Methods. Iterative methods: Jacobi and Gauss Seidel Methods and their convergence. Power's method for the largest eigen-value, Jacobi and Householder's methods for eigen-values of real symmetric matrices	10
5.	Numerical Solutionsof ODE and PDE	Runge-Kutta and predictor corrector methods for IVPs, Finite difference methodsfor BVPs, Shooting methods, Numerical solutions of parabolic and elliptic partial differential equations by Finite Difference Methods	12
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, 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.	Gerald, C.F. and Wheatley P.O., Applied Numerical Analysis, 7th Ed., Pearson Education,2004.

2.	Conte, S.D. and deBoor, C., Elementary Numerical Analysis, 3rd Ed., McGraw-Hill, 1980.
3.	Gupta, R.S., Elements of Numerical Analysis, 2nd Ed., Cambridge University Press, 2015.
4.	Jain, M.K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International, New Delhi, 2014.
5.	Smith, G.D., Numerical Solution of Partial Differential Equations, 2nd Ed., Oxford, 1978.
Project based learning: Each student in a group of 3-4 will apply the concepts of numerical methods for eigen values. ODE and PDE to solve practical problems.	

Course Code	**14M11BT111**	**Semester** Odd	**Semester** VI Integrated/MTech I **Session** 2022-2023 **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

Course Code	17B1NBT731	**Semester :** ODD	**Semester:** VII **Session: 2022-2023** 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 discussthe 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)