Detailed Syllabus

Course Code	15B11CI513	Semester Even	Semester 6th Session 2023 -2024
			Month: January 2024 to May 2024
Course Name	Software Engineering		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Amit Mishra (62) & Dr. Shruti Jaiswal (128)
	Teacher(s) (Alphabetically)	Dr. Amit Mishra, Ms. Anupama Padha, Mr. Ashish Kumar, Dr. Asmita Yadav, Ms. Lalita Mishra, Dr. Shelendra Pal, Dr. Shruti Jaiswal

COURSE OUTCOMES		COGNITIVE LEVELS
C314.1	Define and choose software engineering principles and software process models for project development.	Remembering (Level 1)
C314.2	Outline the functional and non-functional requirements of a software project and do planning for activities in software development process.	Understand (Level 2)
C314.3	Make use of UML modeling for designing and building the software.	Apply (Level 3)
C314.4	Analyze the performance of software system using different testing methodologies.	Analyze (Level 4)
C314.5	Evaluate the software in terms of general software quality attributes, code structure and try to optimize the overall software system.	Evaluate (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	*Unit-1*	***Introduction to Software Engineering:*** Introduction to software engineering Principles, Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile Models (tools study). Project planning, Project Scheduling: network diagram, Gant Chart, CPM and PERT.	7
2.	*Unit-2*	***Requirement Engineering:*** Types of requirement, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	4
3.	*Unit-3*	***Software Design:*** Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	7
4.	*Unit-4*	***Software Construction:*** Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization. Design pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming.	8

5.	Unit-5	**Software Metrics:** Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric, COCOMO Model.	7
6.	Unit-6	**Software Testing:** White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods.	9
		Total number of Lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments /Tutorial/ Mini Project : 15 Attendance : 10)
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4.

The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, 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)	
Text Book(s):	
1.	Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Fifth Edition-TMH International.
2.	Sommerville, "Software Engineering", Seventh Edition - Addison Wesley.
Reference Book(s):	
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, May 2005
4.	Richard Thayer, "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition, Springer Press

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI514	Semester EVEN	Semester 6th Session 2023 -2024 Month from Jan to June
Course Name	Artificial Intelligence		
Credits	4	Contact Hours	4 (3-1-0)

Faculty (Names)	Coordinator(s)	Varun Srivastava (62), Varsha Garg (128)
	Teacher(s) (Alphabetically)	Varun Srivastava (62), Varsha Garg (128)

COURSE OUTCOMES		COGNITIVE LEVELS
C312.1	Familiarize how computing machine can reason in an incomplete and uncertain environment	Understand (Level 2)
C312.2	Solve real world problems for optimized solutions	Apply (Level 3)
C312.3	Formalize knowledge representation of the real world and draw inference	Analyze (Level 4)
C312.4	Evaluate the performance of learning algorithms.	Evaluate (Level 5)
C312.5	Design and implement the problem-solving agents using AI algorithms	Create (Level 6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	History and foundations of AI	01
2.	Problem solving and intelligent agents	PEAS, Structure of agents, nature of environments, concept of rationality	03
3.	Problem solving-I	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS)	04
4.	Problem solving-II	Informed Search and Exploration (GBFS, Heuristic function, A*, AO*, IDA*, Hill climbing,Simulated Annealing, Genetic Algorithms)	06
5.	Problem solving-III	Constraint satisfaction problems (backtracking search), Adversarial Search (optimal decision in games, alpha beta pruning)	05
6.	Propositional Logic	Knowledge based agents, Propositional Logic, First order Logic, Syntax and Semantics), Inference in FOPL (Unification, forward and backward chaining, resolution)	05
7.	Knowledge representation	Ontology, actions, situations and events, time and event calculus, mental events,	03
8.	Uncertainty	Inference using full joint distribution, Probabilistic reasoning, Bayesian rule,	04

		Bayesian network, Maximum likelihood estimation	
9.	Learning	decision tree, ensemble learning, K- Nearest Neighbor, K-Means algo, Reinforcement Learning	07
10.	Natural Language Processing	Preprocessing, POS tagging using MLE, Parsing using CYK	04

Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks	
T1	20	
T2	20	
End Semester Examination	35	
TA	25	Attendance (10), Assignment/Quiz/Mini-project (15)
Total	**100**	

Project based learning: Students in group of 3 to 4 students are required to develop mini-project based on the concepts taught in this course. Problem statements need to be formulated in various applications domains of AI, proposing the solution approach and implemented using Python.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Books	
1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2020(4th edition) ISBN-0-13-461099-7
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Dash, S. S., Lakshmi, C., Das, S., & Panigrahi, B. K. (Eds.). (2020). Artificial intelligence and evolutionary computations in engineering systems. Springer.
Reference Books:	
4.	Introduction to Artificial Intelligence by Teik Toe Teoh , Zheng Rong, Springer 2022
5.	Understanding Artificial Intelligence: Fundamentals and Applications, by Albert Chun Chen Liu, Oscar Ming Kin Law, Iain Law, Wiley, 2022

Course Code	15B17CI573	Semester: Even	Semester: VI Session:2023 -2024
			Month from Jan to May

Course Name	Software Engineering Lab

Credits	0-0-1		Contact Hours	2

Faculty (Names)	Coordinator(s)	Sarishty Gupta (J62), Prakhar Mishra (J128)
	Teacher(s) (Alphabetically)	J62: Amarjeet Prajapati, Amit Mishra, Anupama Padha, Asmita Yadav, Purtee Kohli, Sonal Saurabh, Sulabh Tyagi, Sumeshwar Singh
		J128: Aditi Sharma , Ashish Kumar, Lalita Mishra, Mukta Goyal, Pankaj Mishra , Shruti Jaiswal

COURSE OUTCOMES		COGNITIVE LEVELS
C374.1	Outline the software process models, framework activities, requirements for a software system.	Understand Level (Level 2)
C374.2	Develop software requirement specification document outlining the specifications for the software, detailing its requirements.	Apply Level (Level 3)
C374.3	Apply design diagrams to represent the structure and functionality of the software system.	Apply Level (Level 3)
C374.4	Examine the errors and performance of software system using different testing techniques.	Analyze (Level 4)
C374.5	Creation of software using software engineering principles.	Create (Level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction to Software Engineering Principles	Introduction to software engineering Principles (evolution, failures, changing nature of software, software myths, product, process, software crisis and need of testing), Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile models – extreme programming and scrum, selection of a life cycle model), PSP, TSP. Types of requirement, Feasibility studies, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	C374.1, C374.2
2.	Software Design andModeling.	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram. Size oriented metrics, LOC, token count, Function Count, cost estimation, data structure metrics, Halstead's Software Metric, Information Flow Metric, Overview of Quality Standards like ISO 9001, SEI-CMM, COCOMO, COCOMO-II, Software risk management	C374.3
3.	Software Optimizing and Refactoring	Coding standards and guidelines, Code checklist, Code Refactoring and Code optimization	C374.4

4.	Software Testing	Black box testing techniques: Equivalence class testing, Boundary value analysis, Decision table testing, Cause effect graphing, White box testing: Path testing, Data flow and mutation testing, Levels of testing- unit testing, integration and system testing, Debugging- techniques, approaches, tools &standards.	C374.4

Evaluation Criteria

Components	Maximum Marks
Lab Test 1	20
Lab Test 2	20
Day-to-Day	60 (Evaluations, Project, Attendance)
Total	**100**

Project based learning: Each student in a group of 3-4 have to work on a mini-project, in which they will create Software Requirements Specification (SRS) document and design the software diagrams. Further, the software implementation should be followed with testing reports. This enhances the understanding of students towards different software engineering concepts and also help them during their employability.

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

Text Books	
1.	Pressman, Roger S. Software engineering: a practitioner's approach. Palgrave Macmillan, 2005.
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley.
3.	KK Aggarwal, Software Engineering.

Reference Books	
4.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, May 2005
5.	Richard Thayer , "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press.
6.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
7.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

Detailed Syllabus

Course Code	15B17CI574	Semester Even	Session: 2023 - 2024
			Month from: Jan 24 to May 24
Course Name	Artificial Intelligence Lab		
Credits	2	Contact Hours	2 hrs

Faculty (Names)	Coordinator(s)	Dr. Ankit Vidyarthi, Dr. Gaurav Kumar Nigam
	Teacher(s) (Alphabetically)	Dr. Varsha garg

COURSE OUTCOMES		COGNITIVE LEVELS
C375.1	Familiarize Python programming framework for solving problems using AI.	Understand Level (L2)
C375.2	Apply knowledge representation formalism to represent world knowledge.	Apply Level (L3)
C375.3	Performance analysis of various AI algorithmic approaches for real world problems.	Analyze Level (L4)
C375.4	Design real world problems using appropriate AI techniques.	Create (L6)

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction to Programming in Python	**Lab Assignment 1 and 2:** Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	1
2.	Problem solving	**Lab Assignment 3:** Uninformed search strategies (BFS, UCS, DFS, IDS), Problem solving agents using uninformed search strategy. **Lab Assignment 4:** Informed Search and Exploration (A*, Hill Climbing, IDA*), Problem solving agents using informed search strategy.	1
3.	Evolutionary Algorithms	**Lab Assignment 5 and 6:** Genetic Algorithms	3
4.	Constraint satisfaction problems	**Lab Assignment 7 and 8:** Formulating Problems as constraint satisfaction problems	3
5	Adversarial Search problems	**Lab Assignment 9 and 10:** Adversarial Search (Optimal decision in games, Alpha-Beta pruning)	4

6	Knowledge representation	**Lab Assignment 11-13:** Inference using Prolog	2

Evaluation Criteria

Components	*Maximum Marks*
Evaluation-1:	10
Lab Test-1:	20
Lab Test-2:	20
Evaluation-2:	10
D2D	10
Project:	15
Attendance:	15
Total	**100**

Project based Learning: In this subject, students work in a team of 3-4 people, to implement a small application/mini-project based on AI. Projects are made by applying the concepts learned in class to real life applications like automated hardware-based application, stock prediction, recommendation system, gaming etc. This helps their employability in the IT 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.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Programming Python by Mark Lutz, 4th Ed, O'Reilly Media, Inc.

Course Code	15B19CI691	Semester Even (specify Odd)	Semester VI Session 2023- 2024 Month from January to June
Course Name	Minor Project-II (CSE)		
Credits	2	Contact Hours	4

Faculty (Names)	Coordinator(s)	ANKIT VIDYARTHI, ANUBHUTI MOHINDRA
	Teacher(s) (Alphabetically)	ALL FACULTY

COURSE OUTCOMES		COGNITIVE LEVELS
C351.1	Compare and Contrast all tools and techniques to generate solution that meet specific need to solve complex problems.	Understand Level (Level-2)
C351.2	Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach	Apply (Level-3)
C351.3	Develop software systems that meet specified design and performance requirements that contributes to global, economic, environmental and social-context	Apply (Level-3)
C351.4	Evaluate & justify the proposed solution using appropriate learning strategies	Evaluate Level (Level-5)
C351.5	Design & develop integrated software models and techniques towards research initiatives	Create Level (Level-6)

Evaluation Criteria	
Components	Maximum Marks
Viva-1	20
Viva-2	20
D2D	60
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a Minor Project based on different engineering concepts. The students can opt any real-world application for the implementation of Minor Project. The students have to implement the real world problem using any open-source programming language. Project development will enhance the knowledge and employability of the students in IT sector.

Course Code	16B1NHS 531	Semester :Even (specify Odd/Even)	Semester : VI Session:2023 -2024 Month from: Jan to June
Course Name	Sociology of Youth		
Credits	3 (3-0-0)	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof Alka Sharma
	Teacher(s) (Alphabetically)	Ms ShikhaKumari

COURSE OUTCOMES		COGNITIVE LEVELS
C303-2.1	Understand Youth and youth culture in sociological perspectives	Understanding(C 2)
C303-2.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C303-2.3	understand youth culture and to interprets the same	Analyzing(C 4)
C303-2.4	Analyze societal problems related to youth in the evolving society.	Evaluating(C 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	**Introduction to Youth**	**Meaning and characteristics of youth, demographic profile of youth in India, Challenges faced by Youth, Youth's roles and responsibilities in society**	4
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	4
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	5
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	8
5.	Socialization of Youth	Concept and processs of socialization, Internalization of norms, types of socialization, conditions of learning, internalized objects, theories of socialization, stages of socialization, adult socialization, agents of socialization, role of culture in socialization, socialization and cultural differences, importance of socialization, Failure of the socialization process	9
6.	Problems of Youth	Role and Value conflicts, Generation Gap, Career decisions and Unemployment, Emotional adjustment, Coping with pressures of living, Unequal Gender norms, Crime (Social Strain theories)	8
7.	Changing perceptive of Youth and Youth Culture in 21st century	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	4
			…
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Presentation, Assignment and attendance)
Total	**100**

Collect data from your classmates through questionnaire and identify the variables shaping their identity and aspirations. In what ways do they do this? (Another way to think about this question: How do these social forces or institution provide you with the chance to pursue your goals? How do they limit your life chances?)

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.	Tyyskä, V. *Youth and Society: The long and winding road*, 2nd Ed., Canadian Scholars' Press, Inc. (2008).
2.	White, Rob, Johanna Wyn and Patrizia Albanese. *Youth & Society: Exploring the Social Dynamics of Youth Experience.* Don Mills, ON: Oxford University Press, 2011.
3.	Bansal, P.*Youth in contemporary India: Images of identity and social change.* Springer Science & Business Media, 2012.
4.	Furlong, Andy. *Youth studies: An introduction.* Routledge, 2012.
5.	Blossfeld, Hans-Peter, et al., eds. *Globalization, uncertainty and youth in society: The losers in a globalizing world.* Routledge, 2006.
6.	Ruhela, Satya Pal, ed. Sociology of the teaching profession in India. National Council of Educational Research and Training, 1970.
7.	Frith, S. "The sociology of youth. Themes and perspectives in sociology." Ormskirk, Lancashire: Causeway Books ,1984.

Course Code	16B1NHS631	Semester Even	Semester 6th Session 2023 -2024
			Month from January to June

Course Name	PROJECT MANAGEMENT		
Credits	3	Contact Hours	2-1-0

Faculty (Names)	Coordinator(s)	Dr. Deepak Verma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma

COURSE OUTCOMES- Revised		COGNITIVE LEVELS
C304-5.1	Understand the basic concepts of project management such as features, objectives, life cycle, model and management.	Understanding Level (C2)
C304-5.2	Apply the understanding of various theoretical frameworks, non-numerical and numerical models to identify project related risks and make correct project selection decisions	Applying Level (C3)
C304-5.3	Analyze the project deliverables and use the planning and scheduling techniques for different stages of project.	Analyze Level (C4)
C304-5.4	Evaluate management approaches for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Project Management: Introduction	Characteristics of project; Life Cycle of Project; Project Model; Project Management as discipline; Contemporary aspects of Project Management	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model, Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-	6

		Resource Leveling and Loading.	
6.	Budgeting, Control and Project Termination	Estimating Project Budgets, Improving the process of cost estimation, Basics, Importance, Purpose of control, Types of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination, Types of termination, typical termination activities.	4

Total number of Lectures	**28**

Project Based Learning: Students are supposed to form a group (Maximum 5 students in each group) and identify a real-life project. They are supposed to do the in-depth study of this project and assess it in terms of project objectives. They are supposed to do the detailed study of project planning and project organization. They must highlight the various tools and techniques of Project planning, which are used in their chosen project. The fundamentals of Project management are very important in today's corporate world and certainly this subject enhances student's employability in every sector.

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25
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)

	Text Book
1.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
	Reference Books:
1.	Timmothy Kloppenborg, Contemporary Project Management, 5tht Edition, Cengage Learning, 2017
2.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12th Edition,Wiley Publications,2017
3.	Wysocki,R.K., Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th Edition, Wiley Publications,2018
4.	Vohra, N. D., Quantitative Techniques in Management, 5thEdition, Tata McGraw Hill Publishing Company, 2017

Detailed syllabus
Lecture-wise Breakup

Subject Code	16B1NHS632	Semester: EVEN	Semester 6th Session 2023-24 Month from Jan to June
Subject Name	COGNITIVE PSYCHOLOGY		
Credits	3	Contact Hours	2-1-0
Faculty (Names)	Coordinator(s)	Dr Yogita Naruka	
	Teacher(s) (Alphabetically)	Dr Yogita Naruka	

COURSE OUTCOMES		COGNITIVE LEVELS
C304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	Applying Level (C3)
C304-4.2	Analyze the different models of various cognitive processes	Analyzing Level (C4)
C304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	Evaluating Level (C5)
C304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	Evaluating Level (C5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Cognitive Psychology	Historical Background: Emergence of modern cognitive Psychology; Approaches: Information Processing and PDP Model; Research Methods	3
3.	Perceptual Processes	Perceptual learning and development; perception of shape, space, and movement.	4
3.	Attention	Selective Attention and Divided Attention: Meaning, Definition, and Theories.	4
4.	Memory	Short Term Memory	3
5.	Imagery	Properties of mental images; Representation of images and cognitive maps.	3
6.	Language	Structure of language and its acquisition, speech perception, factors affecting comprehension.	4
7.	Thinking and Problem Solving	Types of thinking; Classification of problems; Problems solving approaches, Problems space theory by Newell and	4

		Simon, Creativity	
8.	Decision Making	Logical reasoning types and errors in reasoning processes.	**3**
		Concept formation and categorization; Judgment and decision making	
Total number of Hours			**28**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Assignment, Oral Questions)
Total	**100**

Project based learning: Students in a group will choose a research topic from the syllabi of cognitive psychology. Students will cover the following points to prepare project reports: Understanding of concept, related theories and perspectives; Describe the relevance of the chosen concept for personal growth; Discuss the application of chosen topic for your professional life; Elaborate the relevance of the topic at group level and societal level. Discussions on these practical aspects will enhance students' understanding & application of concepts of cognitive psychology in everyday life.

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.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2nd Ed., Sage Publishing, 2012
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013
3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014
4.	Michael W. Eysenck, Mark T. Keane, Cognitive Psychology: A Student's Handbook , 7th Ed, Psychology Press, 2015
5.	Robert Sternberg, Karin Sternberg, Cognitive Psychology, 6th Ed, Wadsworth/Cengage Learning, 2011
6.	Edward E. Smith, Stephen M. Kosslyn, Cognitive Psychology: Mind and Brain, Ist Ed, Pearson Education India; 2015

Course Code	16B1NHS634	Semester Even (specify Odd/Even)	Semester Session 2023 -2024 Month from Jan 2024 to June2024
Course Name	**Theatre and performance (Value added)**		
Credits	**2(Value Added)**	**Contact Hours**	**1-0-2**

Faculty (Names)	Coordinator(s)	Dr Nilu Choudhary& Dr Danish Siddiqui
	Teacher(s) (Alphabetically)	Dr Nilu Choudhary

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-14.1	Demonstrate problem solving ability and effective life skills through theatre performances.	Understanding level(C2)
C304-14.2	Develop awareness of the role of these arts in human life	Understanding level(C2)
C304-14.3	Apply skills of listening, articulation, awareness and collaboration through the creation of performance.	Applying level(C3)
C304-14.4	Design and present an original performance alone or in collaboration with other artists.	Creating level(C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction of Theatre	History of theatre: role of theatre in human culture with special reference to India	2
2.	Characterization	Tips for developing character, thinking about thoughts, Flash –back, Performance	2
3.	Script Writing	Turning a story into a play ,How to write a one Act , setting the scene ,character , stage direction , Dialogues	3
4.	School of Drama	Natya-Shastra, Stanislavsky and Brecht	3
5.	Text and its interpretation	Mother Courage ,Galileo ,AadheAdhure (any one)	3
6.	Back-stage work	Management, planning, execution	1
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Moving in Space.	Students will be moving around the room, filling up the space, changing pace, changing direction, being aware of other people but not touching them. Find new ways of moving, with a different emphasis each time – smooth, jagged, slow, fast, heavy, light, high up, low down and so on. Every now and again Teacher will shout "Freeze! And	**C30**4-**14.1**

		Students need to freeze every muscle in your body. Absolutely NO LAUGH, LOOKING AROUND, OR MOVING. You will be out.	
1.			
2.	Mirror Activity	A great way to get students aware of body movement and working together.	C304-14.1
3.	Characterization	Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable.	C304-14.2
4.	Script Writing	The more passionate you feel about your idea, the more attractive your play will be. Divide the idea into a beginning, middle and end.	C304-14.3
5.	Role Assignment	No acting or movement at this point – just sit together to speak and hear the script carefully. Discuss and clarify any confusing aspects of the script and any apparent challenges in bringing the script to the stage. Division of script into small "units" and rehearsed separately	C304-14.3
6.	Turning story into a play	Read thru each episode or unit separately "on its feet".Actors moving around the stage space. Set blocking for each episode. Use ideas generated from Mini-Episodes, and Staging with Images. Make sure the gestures, movements, and stage pictures tell the story clearly.	C304-14.3
7.	Stage blocking	Practice the blocking and the lines so that everyone knows what happens when and what their performance responsibilities are. Memorize lines. Work on making characters, relationships, and dialogue clear. This is a good place in which to use the Creating the Character lessons. Pay attention to vocal projection and articulation. Generate ideas about any technical elements you want to incorporate using the Transformation of Objects.	C304-14.3
8.	Script to performance	Finalize and run the entire play from beginning to end without stopping to check any additional rehearsal required to get everything running smoothly or not. Finally Perform!!	C304-14.4

Evaluation Criteria

Components	Maximum Marks
Mid Term	30
End Term	40
TA	30 (Script writing, End term stage performance)
Total	**100**

Project Based Learning: Students will be given a project in a group of 5-6 to create own imagination in the form of story and in which students create character, emotions, Vocal projection and articulation, props, background. Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable. With the help of this subject students will understand and experience the importance of these (Human)qualities or arts in human life.

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.   Eric Bentley, ed., The Theory of the Modern Stage: An Introduction to Modern Theatre and Drama,

	Penguin Books, 1968
2.	Mark Fontier, Theory/ Theatre: An Introduction, New York: Routledge, 2002
3.	Michael Holt, Stage Design and Property, Oxford: Phaidon, 1986
4.	Michael Holt, Costume and Make-up, Oxford: Phaidon, 1988
5.	Natyashastra, tr. by AdyaRangacharya, New Delhi: MunshiramManoharlal, 2006,

Course Code	16B1NHS635	Semester Even	Semester VI Session 2023 -2024 Month from Jan to June
Course Name	Organizational Behavior		
Credits	3	Contact Hours	2-1-0
Faculty (Names)	Coordinator(s)	Dr. AnshuBanwari	
	Teacher(s) (Alphabetically)	Dr. AnshuBanwari	

COURSE OUTCOMES		COGNITIVE LEVELS
C304-6.1	Understand the role of individual, groups and structure in achieving organizational goals	Level-2-(Understanding)
C304-6.2	Apply appropriate strategies for meeting the special challenges in the 21st century competitive workplace	Level-3 (Apply)
C304-6.3	Analyze organizational behavioral issues in the context of organizational behavior theories, models, and concepts.	Level-4 (Analyze)
C304-6.4	Assess the potential effects of emerging trends and latest practices on organization's performance	Level-5 (Evaluate)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1	Introduction to OB: Challenges and Opportunities	Interdisciplinary Field, Concepts, Approaches, Responding to Globalization; Improving Quality & Productivity; Improving Customer Service; Improving People Skill; Empowering People; Stimulating Innovation & Change; Coping with Temporariness; Positive Organizational Behavior, Working in Networked Organizations; Balancing Work-Life Conflict	3
2	Managing Workforce Diversity	Major forms of Workplace Diversity, Valuing Diversity, Role of Disabilities, Discrimination, Diversity Initiatives, Diversity Awareness and Affirmative Action, Diversity Management and strategies to implement it Competitive Advantage of Diversity Management Generational Workforce	4
3.	Job Design and Flexible Job Environment	Job Design & its uses; Flexible Job Environment; Job Enrichment Model	2
4.	Leadership: Authentic Leadership	Inspirational Approach to Leadership: Authentic, Ethical & Servant Leadership Defining Authentic Leadership through Intrapersonal, Interpersonal and Developmental Aspects; Basic Model of Authentic Leadership; Practical Approach to Authentic Leadership through the research of Terry and Bill	6

		George; Authentic Leadership: Trust and Ethics, Dimensions of Trust, Counseling & Mentoring	
5.	Power & Politics	Concept of Power; Sources of Power Contingencies of Power; Power Tactics; Measuring Power Bases: Power Authority Obedience Organizational Politics: Types Factors contributing to Political Behavior; Consequences & Ethics of Politics	5
6.	Employee Engagement	Creating a Culture of Engagement, Models of engagement, Benefits of Employee Engagement, Gallup Study, Methods of engaging employees – from entry to exit, Managers Role in Driving Engagement	2
7.	Organizational Culture & Workplace Spirituality	Creating Organizational Culture Approaches to Organizational Culture; How employees learn culture; Measuring Organizational Culture; Spirituality & Organizational Culture	3
8.	Organizational Change & Development	Organizational Change: Meaning & Types; Technology & Change; Resistance to Change v/s Inviting Change; Approaches to Organizational Change; Planning & Implementing Change; Organizational Development; OD Interventions & Change	3
		Total number of Lectures	**28**

Evaluation Criteria

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

Project based learning: To identify the behavioral strategies adopted by a specific corporate/ business leader for his organization to meet the challenges of the 21st century competitive workplace and achieve the tangible outcomes of productivity and employee wellness within his organization.

	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	**S. P. Robbins, T. A. Judge, N. Vohra,** Organizational Behavior, 18th Edition, Pearson, India, 2022
2	**P.Subba Rao,** Organizational Behavior: Text Cases & Games, 2nd Edition, Himalaya Publishing House , 2015
3	**John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt**, Organizational Behavior, 12th Edition, Wiley India Pvt. Ltd, 2012
4	**Debra L.Nelson and James C. Quick,** Organizational Behavior, Cengage Learning, India Edition, 2009
5	Steven L. McShane and Mary Ann Von Glinow, Organizational Behavior Essentials, Tata McGraw Hill Publishing Company Ltd, 2007
6	**J. Marques, and S. Dhiman**, Leadership Today: Practices for Personal and Professional Performance (Springer Texts in Business and Economics), 1st ed., 2017

Course Code	16B1NHS636	Semester: Even	Semester VI Session 2023 -2024 Month: January 2024 to June 2024
Course Name	Literature & Adaption		
Credits	3	Contact Hours	2-1-0

Faculty (Names)	Coordinator(s)	Dr. Monali Bhattacharya(Sector 62) & Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava, Dr Harleen Kaur & Dr. Monali Bhattacharya.

COURSE OUTCOMES		COGNITIVE LEVELS
C304-3.1	Understand and outline the elements and theories of adaption and its various forms.	Understanding Level (C2)
C304-3.2	Utilize visual literacy to identify the language and style adopted in filmed texts through Readers' and Audience' values and perceptions.	Applying Level (C3)
C304-3.3	Analyze texts and their adaptations stylistically beyond the surface level of narrative and audience interpretation.	Analyzing Level (C4)
C304-3.4	Evaluate, interpret and document source texts and adaptations thematically as reflections of value systems, various cultures and times.	Evaluating Level (C5)
C304-3.5	Compose and make an effective presentation of a literary/non literary piece in any genre and design an ethical adaption of any literary/non literary piece in another form individually and in groups.	Creating Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction Literary Devices	Figures of speech, Character, Plotline, Conflict, Point of View	2
2.	Literature & Adaptation	Understanding Cultural Contexts Forms of Adaption Cinematography & Narratology	4
3.	Framework	Adaptation Theories; Reader Response & Audience Response Theories Case study of the Classic Fairy Tale The Sleeping and its contemporary adaptation Maleficent	7
4.	Play & adaptations	The Pygmalion: George Bernard Shaw Hamlet : William Shakespeare	6
5.	Novel &	Pride & Prejudice: Jane Austen	9

	Adaptations	The Giver: Lois Lowry The Godfather: Mario Puzo	
		Total number of Lectures	28

Evaluation Criteria

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

Project Based Learning: The Group Project will consist 2 parts: Part A: creation of a story based on the symbols assigned to different groups in their respective tutorials after T1. The groups will be formed by the teacher based on the marks of T1, with every group having students with lower and higher marks. The students are required to use various literary perspectives to use the symbols in their story and create a narrative with exposition, conflicts, rising and falling action as well as climax and resolution in their respective tutorial classes on the spot. Part B will be a report analyzing the archetypal theory and narrative technique employed.

Recommended Reading material:	
1.	**Linda Hutcheon**, *A Theory of Adaptation*, Routledge, 2006
2.	**Mark William Roche**, *Why Literature matters in the 21st Century*, 1st edition, Yale University Press 2004
3.	**George Bernard Shaw**, *Pygmalion,* Electronic Version, Bartleyby.com, New York, 1999
4.	http://shakespeare.mit.edu/hamlet/full.html
5.	https://www.sparknotes.com/film/sleepingbeauty/
6.	**Jane Austen**, *Pride & Prejudice*, Reprint, Thomas Egerton, 2013
7.	**Mario Puzo,** *The Godfather*, 1stEdition, G. P. Putnam's Sons, USA, 1969
8.	**Lois Lowry,** *The Giver, 1st Edition,* Houghton Mifflin Harcourt Publishing Company, USA, 1993

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	Semester: Even	Semester VI Session 2023-24 Month from Jan 2023 - June 2024	
Course Name	Statistics			
Credits	3		Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr.Anuj Bhardwaj		
	Teacher(s) (Alphabetically)	Dr.Anuj Bhardwaj		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above-mentioned course, the students will be able to:		
C302-1.1	recall measures of central tendency and dispersion for visualizing the data.	Remembering (C1)
C302-1.2	explain skewness, kurtosis, correlation, regression and sampling theory.	Understanding(C2)
C302-1.3	apply skewness, kurtosis, correlation, regression and estimation theory to find the confidence interval.	Applying (C3)
C302-1.4	analyze small and large sample data by using the test of hypothesis.	Analyzing(C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's t distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency, UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	10
5.	Parametric Interval Estimation	definition of confidence interval, pivotal quantity, confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	5

6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7
Total number of Lectures			**42**

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

Project based learning: Students in a group of 4 will collect sample data set and make simple regression models. They will validate the model by hypothesis testing. By this student will be able to make simple linear regression models and validate it.

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.	**S. Biswas, G. L. Sriwastav**, Mathematical Statistics: ATextbook, Alpha Science International, 2011.
2.	**W. Feller**, An Introduction to Probability Theory and its Applications Vol. I, 3rd Edition, 2011.
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj & Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 10th edition, Pearson Education Asia, 2018.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Course Code	16B1NPH631	Semester: Even	Semester: VI Session 2023 -2024 Month from: Jan-June
Course Name	Computational Physics		
Credits	03	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Vikas Malik
	Teacher(s) (Alphabetically)	Vikas Malik

COURSE OUTCOMES		COGNITIVE LEVELS
C302-12.1	Define key concepts used in Monte Carlo Simulation, Random walks, percolation and Numerical methods	Remember Level (C1)
C302-12.2	Explain basics of numerical analysis, statistical mechanics, Monte Carlo simulations, percolation, random walks.	Understand Level (C2)
C302-12.3	Model and simulate magnetic systems, polymers and networks; interpret simulation data	Apply Level (C3)
C302-12.4	Develop advanced Monte Carlo techniques to solve Optimization problems. Simulate percolation of complex networks.	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Numerical Methods	Locating Roots of Equations, Interpolation and Numerical Differentiation, Numerical Integration, Systems of Linear Equations, Ordinary Differential Equations, Fourier Transform Techniques.	10
2.	Simulation Techniques	Random Number Generation and Monte Carlo Methods, Equilibrium Statistical mechanics, Importance sampling, Metropolis algorithm.	10
3.	Applications of Computer Simulations in Physics	Ising Model Simulations of Magnetic Solids and Phase Transitions, Monte Carlo Intergration, Random Walk and its Applications to Polymers, Cluster Identification algorithms, Percolation and Fractal Phenomena, Chaos and Non-Linear Systems.	15
4.	**Advanced Simulation Techniques**	Cluster Algorithms, Variational Methods and Optimization Techniques.	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance (5 M), Class Test/Quizzes (6 M), Internal assessment (04M) Assignments in PBL mode (10 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.	S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India, 2005.
2.	Kerson Huang, Statistical Mechanics, 2nd Edition, John Wiley, 2009.
3.	K. Binder & D. Heermann, Monte Carlo Simulation in Statistical Physics, **2nd Edition,**Springer, 2013.
4.	Newman & Barkema, Monte Carlo Methods in Statistical Physics, Clarendon Press, 1999.
5.	Landau & Binder, A guide to Monte Carlo Simulations in Statistical Physics, Cambridge University Press, 2014.
6.	M. H. Kalos and P. A. Whitlock, *Monte Carlo Methods,* John Wiley and Sons, 2009.

The students will be given small projects (in groups) on various topics like Monte Carlo Simulation, random walks and cluster algorithms. The students will make programs to do simulations on various complex physical systems. This will make the student connect the concepts studied with real world problems.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH632	Semester EVEN	Semester 6th Session 2023-2024 Month from January to May

Course Name	SOLID STATE ELECTRONIC DEVICES

Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Dinesh Tripathi
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Define terminology and concepts of semiconductors with solid state electronic devices.	Remembering (C1)
CO2	Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication.	Understanding (C2)
CO3	Solve numerical problems based on solid state electronic devices.	Applying(C3)
CO4	Examine the impact of various parameters on semiconductor devices and their performances.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Energy band and charges carriers in conductors	Bonding forces and energy bands in solids, charge carriers in semiconductors, carries concentrations, drift of carriers in electric and magnetic fields, Invariance of the Fermi level at equilibrium, optical absorption, Luminescence, Carrier lifetime and photoconductivity, diffusion of carriers	12
2.	Junctions	Fabrication of p-n junctions, equilibrium conditions, steady state conditions, reverse bias breakdown, recombination and generation in the transition region, metal semiconductor junctions, heterojunctions,	10
3.	Transistors	Field effect transistor (FET), Metal-insulator FET, Metal-insulator-semiconductor FET, MOS FET, Bipolar junction transistors	08
4.	Devices	Photodiodes, solar cell, light emitting diodes, semiconductor lasers, Negative conductance Microwave devices: Tunnel diode, IMPATT diode, Gunn diode	10
		Total number of Lectures	40

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [PBL (10), Quizzes (3+3=6), Attn. (5), & Class performance (4)]
Total	**100**

Project based learning: To make a better understanding about the subject, groups of 4-5 students will be formed and a project on semiconductor devices viz. Gauss meter, Photodiode, Light Emitting Diode, Solar cell, Tunnel Diode, FET, MOSFET etc. will be allotted to each of the groups. The students will collect all the information's and understand about the basic principle, fabrication process and current research activities going on in the particular field. The students will also be encouraged to explore the field and create interactive simulations based on these devices.	

	Recommended Reading material:
1.	Donald A Neamen & Dhrubes Biswas, Semiconductor Physics and Devices, McGraw Hill Education
2.	S. M. Sze, Physics of Semiconductor devices, Wiley-Interscience
3.	Streetman and Banerjee, Solid State Electronic devices, PHI
4.	Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design,

Course Code	16B1NPH633	Semester: Even	Semester: VI Session: 2023 -2024 Month: January to June
Course Name	Photovoltaic Techniques		
Credits	3	**Contact Hours**	3

Faculty (Names)	Coordinator(s)	Dr. B. C. Joshi - JIIT 62 Dr. Prashant Chauhan – JIIT 128
	Teacher(s)	Dr. B. C. Joshi Dr. Prashant Chauhan

COURSE OUTCOMES		COGNITIVE LEVELS
C302-8.1	Classify various type of renewable energy sources and explain working of photovoltaic device.	Understand Level (Level 2)
C302-8.2	Demonstrate the use of basic principles to model photovoltaic devices	Understand Level (Level 2)
C302-8.3	Identify challenges and apply strategies to optimize performance of various type of solar cells	Apply Level (Level 3)
C302-8.4	Analyze Solar PV module, mismatch parameter and rating of PV module	Analyze Level (Level 4)
C302-8.5	Evaluate the performance of various stand-alone PV systems with battery and AC and DC load	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Review	Energy issues, conventional energy sources, Renewable energy sources, Solar Energy	02
2.	Solar cell fundamentals	Fundamental of semiconductor, charge carriers and their motion in semiconductors, carriers generation and recombination, p-n junction diode, introduction to solar cell, p-n junction under illumination, Current-Voltage (I-V), open circuit voltage (V_{OC}), short circuit current (I_{SC}) Maximum power, current and voltage and Efficiency, Quantum Efficiency	10
3.	Design of solar cells	Upper limits of cell parameters, loses in solar cell, solar cell design, design for high I_{sc}, V_{oc}, FF, solar simulators	08
4.	Solar cell technologies	Production of Si, Si wafer based solar cell technology, thin film solar cell technologies (CIGS, microcrystalline and polycrystalline Si solar cells, amorphous Si thin film solar cells), multijunction solar cells, Emerging solar cell technologies: organics solar cells, Dye-sensitized solar cell (DSC), GaAs solar cell	12
5.	Photovoltaic system	PV system: Introduction, Stand-alone system, Grid connected system, Hybrid system, Designing of PV system, Balance of system- BOS (Inverters, Controllers, Wiring, Batteries) Photovoltaic Cells, Estimating PV system size and cost, Photovoltaic safety.	08

	Total number of Lectures	40

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (2 Class Tests (6M), Attendance (5M), PBL (10 M), Class performance (4M))
Total	**100**

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

1.	Tom Markvart and Luis Castaner, "Solar Cells: Materials, Manufacture and Operations," Elsevier, 2006
2.	Stuart R. Wenhem, Martin A. Green, M.E. Watt, "Applied Photovoltaics," Earthscan, 2007
3.	Jenny Nelson, "The Physics of Solar Cells" Imperial college press," 003.Aatec publications, 1995.
4.	C S Solanki, Solar Photovoltaics, PHI

PBL: Students are given the task to design a PV system for the water pump and home appliances. This design can help students in understanding the basic knowledge of PV systems, wiring, load calculation, battery sizing, PV panels, etc. This can help students in getting jobs in the renewable energy sector.

Course Code	16B1NPH634	Semester: Even	Semester: VI Session: 2023-24
			From: January 2024 to June 2024

Course Name	Applied Statistical Mechanics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Indrani Chakraborty
	Teacher(s) (Alphabetically)	Dr. Indrani Chakraborty

COURSE OUTCOMES After completion of the course, students will be able to:		COGNITIVE LEVELS
C302-9.1	Define the fundamental parameters of Thermodynamics and Statistical Mechanics.	Remember Level (Level 1)
C302-9.2	Explain the Thermodynamic potentials, Maxwell's equations and Heat equations.	Understand Level (Level 2)
C302-9.3	Apply the concepts of thermodynamics and statistical ensembles to understand the phase space and distribution functions.	Apply Level (Level 3)
C302-9.4	Determine the distribution functions in case of various types of physical and chemical ensembles.	Analyze Level (Level 4)
C302-9.5	Evaluate the ideas of Entropy with respect to Probability and Information Theory; and conclude Liouville's equation.	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Thermodynamics	Overview of basic laws of Thermodynamics; Microscopic and macroscopic parameters, Thermodynamic potentials; Introduction to equilibrium and non-equilibrium systems and related problems; Entropy and probability;	3
2.	Statistical Ensembles	Concept of Statistical ensembles, Density of States; Micro canonical, Canonical, Grand-canonical ensembles	5
3.	Distribution functions	Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac and their applications	6
4.	Non-equilibrium systems	Liouville's equation, von Neumann equation; Random walk, Stochastic methods;	6
5	Modeling and Simulations	Ising model and its applications, Molecular dynamics, Monte-Carlo simulations and Multi-scale modeling for materials properties and engineering applications.	15
6	Applications	Applications of ensemble formalism in dynamics of neural networks, ensemble forecasting of weather, propagation of uncertainty over time, regression analysis of gravitational orbits etc.,	5
		Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [Quiz (06), PBL (10), Attendance (05), Teacher's assessment (04)]
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.		Frederick Reif , *Fundamentals of Statistical and Thermal Physics*, Waveland Pr Inc, 2008.
2.		Kerson Huang , *Statistical Mechanics*, Wiley, 2nd Ed., 1987.
3.		R K Pathria, Paul D. Beale, *Statistical Mechanics*, Academic Press, 3rd Ed., 2011.
4.		Daniel V. Schroeder, *An Introduction to Thermal Physics*, Addison-Wesley, 1st Ed., 1999
5.		L D Landau, *Statistical Physics, Part 1: Volume 5 (Course of Theoretical Physics)*, Butterworth-Heinemann, 3rd Ed., 1980

Project Based earning:	Students will be suggested to choose their PBL topics from the structured syllabus, so that they can have basic knowledge of the subject and they can be familiar with the applications of the subject. Freedom will be given to the students for choosing the PBL topics, which will be approved by the instructor finally.

Course Code	16B1NPH636	Semester: Even	Semester: VI Session 2023 -2024
			Month from: January 2024 to June 2024

Course Name	**Medical & Industrial Applications of Nuclear Radiations**

Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Sandeep Mishra
	Teacher(s) (Alphabetically)	Dr. Sandeep Mishra Dr. Vaibhav Subhash Rawoot

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
CO2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
CO3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
CO4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Nucleus, Radioactivity & Dating	Structure of matter**;** Nucleus: Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect; Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)** Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	17
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of different MRI, Applications of NMR in quantum computation;	09

4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using ⇦+⇨ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

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

Project Bad Learning: Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in medical applications, etc. These problem domains (elemental and content analysis, materials modification, radiation gauging, solid/liquid Interface, and heart imaging) may be also chosen based on their potential interest to students. Students may be given a task of presenting the working of devices like MRI, PET scan, X-rays and other imaging techniques. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

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

1.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Employability: In this course, students learn about the principles and mechanism of working of various medical imaging instruments like MRI, SPECT, PET, PETCT. This course enhances the skill among the students to develop new theories, mechanisms for today's medical industry. By obtaining knowledge in this domain, students may get job opportunity in medical and biomedical industries like nuclear pharmacy, nuclear medicine radiology etc.

Detailed Syllabus

Course Code	16B19PH693	Semester: Even	Semester: 6th Session: 2023-2024 From: January to June
Course Name	Mechatronics		
Credits	2	Contact Hours	2

Faculty (Names)	Coordinator(s)	Dr. Alok P. S. Chauhan
	Teacher(s) (Alphabetically)	Dr. Alok Pratap Singh Chauhan

COURSE OUTCOMES After completion of the course, students will be able to:		COGNITIVE LEVELS
CO1	Define the basic fundamentals of materials and manufacturing as well as electronic and mechanical devices.	Remember Level (Level 1)
CO2	Illustrate the various principles involved in designing controllers and sensors.	Understand Level (Level 2)
CO3	Make use of mechatronics concept in drives, hydraulic and pneumatic systems.	Apply Level (Level 3)
CO4	Discover the problems in designing & fabrication in industrial robotics and mechanized machines.	Analyze Level (Level 4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Mechatronics and Mechatronics Elements	Definition of mechatronics. Mechatronics in manufacturing, products and design. Review of fundamentals of electronics. Data conversion devices, sensors, microsensors, transducers, signal processing devices, relays, contactors and timers.	6
2.	Processors /controllers	Microprocessors, microcontrollers, PID controllers and PLCs.	4
3.	Drives and mechanisms of an automated system	Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.	6
4.	Hydraulic system	Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps. Design of hydraulic circuits.	4
5	Pneumatic system	Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems	4
6.	CNC technology and Robotics	CNC machines and part programming. Industrial Robotics. Use of micro-controllers (Arduino) and microprocessors (Raspberry Pi), etc. and integrate with MATLAB/OCTAVE, etc.	6
		Total number of Lectures	30

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
TA	30 [Attendance (10 M), Class Tests, Quizzes, Internal Assessments, etc (10 M), Internal Assessment and Assignments in PBL Mode (10 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.	**Text 1:** Bolton, W., Mechatronics: Electronic control systems in mechanical and electrical engineering, Pearson, 2019.
2.	**Text 2**: Ramchandran, K. P., Vijayaraghavan G.K, Balasundram, M.S., Mechatronics-Integrated Mechanical Electronic Systems, Wiley, 2019.
3.	**Reference:** De Silva, Clarence W., Mechatronic systems: devices, design, control, operation and monitoring , CRC Press, Taylor & Francis, 2008.
4.	**Reference:** Deb, S. R., Robotics technology and flexible automation, Tata McGraw-Hill, New Delhi, 1994.
5.	**Reference:** Boucher, T. O., Computer automation in manufacturing - an Introduction, Chapman and Hall, 1996.
6.	**Reference:** Alciatore, D. G., Histand, M. B., Introduction to Mechatronics and Measurement Systems, Mc Graw Hill, 2016
7.	**Reference:** Mahalik, N. P., Mechatronics Principles, Concepts and Applications, Mc Graw Hill, 2017

Project Based learning: Different groups of students with 2-3 students in each group may be formed and these groups may be given to complete a task like collecting and classifying the mechatronic applications. The students can consider ideas that include building an autonomous robot, creating an automated control system, developing a smart home automation system, designing a quadcopter drone, developing an exoskeleton robot, and building an automated vehicle. The article advises choosing a project that aligns with one's interests and skills and encourages experimentation and innovation. They can use different commercially available software tools to do designing and prediction. Apart from this different coding languages be used as well along with integrating with Raspberry Pi, Arduino, etc. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

Subject Code	18B11CS311	Semester: Even (specify Odd/Even)	Semester 6th Session Month from Jan-June 2024
Subject Name	Computer Networks and Internet of Things		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Meenal Jain (JIIT 62), Dr. Kedar Nath Singh (JIIT128)
	Teacher(s) (Alphabetically)	**JIIT 62:**1. Amarjeet Kaur 2. Anuja Shukla 3. Jagriti 4. Dr. Kirti Aggarwal 5. Dr. Meenal Jain 6. Shivendrav Singh
		JIIT128: Dr. AnubhutiRodaMohindra, Dr.Charu, Dr. Gaurav Kumar Nigam, Dr. Kedarnath Singh

	COURSE OUTCOMES	COGNITIVE LEVELS
CO1	Defining the basics of networking, components and underlying technologies	Remember (Level 1)
CO2	Illustrate the various key protocols in OSI model and TCP/IP protocol suite and explain various application protocols.	Understand (Level 2)
CO3	Identification and description of various components, architectures and protocols of Internet of Things (IoT) and their reallife problems.	Understand (Level 2)
CO4	Choose the appropriate network layer and data link layer protocols based on the specific requirements of the communication environment.	Apply (Level 3)
CO5	Explain various transport protocols and its performance enhancing mechanisms.	Analyze (Level 4)
CO6	Determine the shortest path for the network using various routing protocols and evaluate it.	Evaluate (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Network terminologies, Network Models, Protocol layers and their services, Connection Oriented and Connectionless services, Physical Media.	4
2.	The Application Layer	Principles of Application-Layer Protocols, HTTP, File Transfer: FTP, DNS, Electronic Mail in the Internet	4
3.	The Transport Layer	Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, UDP and TCP, Connection Establishment, Transport Layer Protocols (go back N, stop and wait, selective repeat), Flow Control, TCP Congestion Control	8
4.	The Network Layer	Introduction and Network Service Model, IP: the Internet IP addressing, Routing Principles,	09

		Protocol, Routing in the Internet,	
5.	The Link Layer and Local Area Networks	The Data Link Layer: Introduction, Services, Error Detection and Correction, Multiple Access Protocols and LANs, LAN Addresses and ARP, IEEE standards and Ethernet	06
6.	Introduction to Internet of Things	Introduction to IoT, IoT reference Model - IoT Reference Architecture,M2M architecture, IOT devices	05
7	IoT protocols	Introduction to IOT protocols: IEEE 802.11, LoRaWAN, 6LoWPAN, RPL and MQTT and CoAP	06
Total number of Lectures			**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = (5), Assignments/Mini-Project= (20))
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, building smart devices, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills towards networking, communication and IoT related issues leading towards employability in IT and hardware 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	James Kurose, Keith Ross," Computer Networking: A Top-Down Approach Featuring the Internet ", Addison Wesley
2	Andrew S. Tanenbaum ,"Computer Networks ", Prentice-Hall Publishers
3	Larry Peterson , Bruce Davie ,"Computer Networks a Systems Approach ", Morgan Kaufmann
4	William Stallings ,"Data and Computer Communications", Prentice Hall
5	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
6	RajkumarBuyya, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Course Code	18B12HS611	Semester EVEN (specify Odd/Even)	Semester VI Session 2023 -2024 Month from :Jan2024 – June2024
Course Name	Marketing Management		
Credits	3(2-1-0)	Contact Hours	42

Faculty (Names)	Coordinator(s)	Dr Aviral Mishra, Dr. Deepak Verma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma

Revised-COURSE OUTCOMES		COGNITIVE LEVELS
C304-7.1	Understand the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	Utilize market opportunities while considering stakeholders interests and business environment.	Applying Level (C3)
C304-7.3	Analyze the emerging marketing trends and social media marketing	Analyze Level (C4)
C-304-7.4	Determine marketing strategies for businesses to gain competitive advantage.	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Understanding New Age Marketing	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	Marketing Environment and Market Research and insights	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment. Company's Micro and Macro Environment Responding to the Marketing Environment	3
3	Strategic Planning and the marketing Process	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	5
4	Consumer and	Consumer Markets and consumer buyer behavior.	5

	Business Buyer Behavior	The buying decision process. Business Markets and business buyer behavior. Discuss the modern ethical standards.	
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behavior in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards. Importance of marketing in CSR and business sustainability.	2
		Total number of Lectures	**28**

Project Based Learning: Students will be assessed on a Project report. The students will present a business plan for a prospective business idea focusing on its marketing strategies applying all the concepts taught in the course

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
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.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 10th Edition, New Delhi, Pearson Education, 2004.
2.	Darymple, Douglas J ., and Leonard J. Parsons, Marketing Management: Text and Cases, 7th Edition, John Wiley & Sons(Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.
4.	Winer, Russell S ., Marketing Management, 2nd Edition, Prentice Hall,2003.
5	Dalrymple, Douglas J ., and Leonard J. Parsons, 2nd Edition, Wiley Publication, 2000.

Operations Research (18B12MA611)

LPP, graphical solutions, simplex method, Big-M method, two phase method, primal-dual relationship, dual simplex method, sensitivity analysis, north west corner rule, least cost method, Vogel's approximation method, resolution on degeneracy, Hungarian method, travelling salesmen problems, pure and mixed integer linear programming problems, cutting plane method, branch and bound method, convex functions, unconstraint problem, extreme points, quadratic programming, Wolfe's method, constrained problems, Lagrange method for equality constraints, Kuhn-Tucker conditions.

Course Description

Course Code	18B12MA611	Semester Even	Semester VI Session 2023-24 Month from Jan - Jun 2024	
Course Name	Operations Research			
Credits	3		Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Ram Surat Chauhan		
	Teacher(s) (Alphabetically)	Dr. Amita Bhagat		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above-mentioned course, the students will be able to:		
C302-3.1	demonstrate understanding ofmathematical models for optimization problems and interpret primal-dual relationship.	Understanding Level (C2)
C302-3.2	applydifferent methods for the solution of linear, non-linear and integer programming problems.	Applying Level (C3)
C302-3.3	solve various transportation and assignment models.	Applying Level (C3)
C302-3.4	examine optimality conditions and perform sensitivity analysis for linear and non-linear programming problems.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear Programming	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and	6

	Problems	Bound Method.	
7.	Non-Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and integer programming problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.

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.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

Detailed Syllabus

Lab-wise Breakup

Subject Code	18B15CS311	Semester: Even	Semester 6th Session 2023-2024 Month from Jan-June 2024
Subject Name	Computer Networks and Internet of Things Lab		
Credits	1	Contact Hours	0-0-2

Faculty (Names)	Coordinator(s)	Dr. ShivendraSingh(J62), Dr.Payal Khurana Batra
	Teacher(s) (Alphabetically)	Anubhuti R Mohindra, Gaurav Nigam, Shariq Murtuza, Prakhar Mishra, Kedar Nath, Astha Singh, Parmeet Kaur, Meenal Jain, Kirti Agarwal, Kavita Pandey, Anuja Shukla, Vikas.

	COURSE OUTCOMES	COGNITIVE LEVELS
C373.1	Interpret and Illustrate various UNIX and LINUX based network commands for various network devices	Understand Level (Level 2)
C373.2	Implement various network protocols using simulation and programming concepts	Apply Level (Level 3)
C373.3	Experiment with various sensors and actuators using Arduino and Raspberry Pi by simulation or hardware.	Apply Level (Level 3)
C373.4	Visualize and analyze the data packets of different TCP/IP layers.	Analyze (Level 4)
C373.5	Design and develop applications for various challenges and problems related to Sustainable Development	Create Level (level 6)

Module No.	Subtitle of the Module	Topics in the module	CO
1.	Introduction	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	C373.1
2.	Socket Programming	Client server programming using TCP and UDP, Implementing a calculator	C373.2

3.	**Network Simulator (NS2)**	Introduction, Implementation of TCP Tahoe and Reno using ns-2, Performance Analysis of TCP Congestion Control Algorithm, Implementation of AQM Algorithm and its performance analysis, and its performance analysis	**C373.2**
4.	**IOT development boards and interfacing with sensors**	Arduino Boards, Raspberry Pi. Temperature Sensor, Humidity Sensor, Pressure Sensor, Proximity Sensor, Accelerometer, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor.	**C373.3**
5.	**Wireshark Simulator**	Practice on WIRESHARK with tcp dump: Application Layer, Transport Layer	**C373.4**
6.	**Application development with LORA kit**	Developing smart applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, smart cities, smart agriculture.	**C373.5**

Evaluation Criteria

Components	Maximum Marks
Lab Test 1	20
Lab Test 2	20
Day-to-Day	60 (Attendance (10), Evaluation (30), Project (20))
Total	**100**

Project based learning: Each student in a group of 4-5 will select an application and analyze the different layers of the network model and how data flows through each in order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major requirements of the communication sector. This enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related 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)
Text Books	
1.	James F. Kurose, Keith W. Ross, " Computer Networking : A Top-Down Approach Featuring the Internet " 3rd Edition Pearson Education.
2.	Andrew S. Tanenbaum,"Computer Networks" 4th Edition
3.	UNIX Network Programming, Volume 1, Third Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
Reference Books/Links	
4.	TeerawatIssariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer.
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

Detailed Syllabus

Lab-wise Breakup

Subject Code	18B15CS371	Semester: Even	Semester 6th Session 2023-2024 Month from Jan-June 2024
Subject Name	Computer Networks and Internet of Things Lab		
Credits	1	Contact Hours	0-0-2

Faculty (Names)	Coordinator(s)	Dr. ShivendraSingh(J62), Dr.Payal Khurana Batra
	Teacher(s) (Alphabetically)	Anubhuti R Mohindra, Gaurav Nigam, Shariq Murtuza, Prakhar Mishra, Kedar Nath, Astha Singh, Parmeet Kaur, Meenal Jain, Kirti Agarwal, Kavita Pandey, Anuja Shukla, Vikas.

	COURSE OUTCOMES	COGNITIVE LEVELS
C373.1	Interpret and Illustrate various UNIX and LINUX based network commands for various network devices	Understand Level (Level 2)
C373.2	Implement various network protocols using simulation and programming concepts	Apply Level (Level 3)
C373.3	Experiment with various sensors and actuators using Arduino and Raspberry Pi by simulation or hardware.	Apply Level (Level 3)
C373.4	Visualize and analyze the data packets of different TCP/IP layers.	Analyze (Level 4)
C373.5	Design and develop applications for various challenges and problems related to Sustainable Development	Create Level (level 6)

Module No.	Subtitle of the Module	Topics in the module	CO
1.	Introduction	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	C373.1
2.	Socket Programming	Client server programming using TCP and UDP, Implementing a calculator	C373.2

3.	**Network Simulator (NS2)**	Introduction, Implementation of TCP Tahoe and Reno using ns-2, Performance Analysis of TCP Congestion Control Algorithm, Implementation of AQM Algorithm and its performance analysis, and its performance analysis	**C373.2**
4.	**IOT development boards and interfacing with sensors**	Arduino Boards, Raspberry Pi. Temperature Sensor, Humidity Sensor, Pressure Sensor, Proximity Sensor, Accelerometer, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor.	**C373.3**
5.	**Wireshark Simulator**	Practice on WIRESHARK with tcp dump: Application Layer, Transport Layer	**C373.4**
6.	**Application development with LORA kit**	Developing smart applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, smart cities, smart agriculture.	**C373.5**

Evaluation Criteria

Components	Maximum Marks
Lab Test 1	20
Lab Test 2	20
Day-to-Day	60 (Attendance (10), Evaluation (30), Project (20))
Total	**100**

Project based learning: Each student in a group of 4-5 will select an application and analyze the different layers of the network model and how data flows through each in order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major requirements of the communication sector. This enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related 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)	
Text Books	
1.	James F. Kurose, Keith W. Ross, " Computer Networking : A Top-Down Approach Featuring the Internet " 3rd Edition Pearson Education.
2.	Andrew S. Tanenbaum,"Computer Networks" 4th Edition
3.	UNIX Network Programming, Volume 1, Third Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
Reference Books/Links	
4.	TeerawatIssariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer.
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

Course Code	19B12HS613	Semester: Even	Semester VI Session 2023-24
			Month from: Jan 2024-June 2024

Course Name	International Trade and Finance

Credits	03	Contact Hours	2-1-0

Faculty (Names)	Coordinator(s)	Dr. Amba Agarwal, Dr. Vandana Sehgal
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal, Dr. Vandana Sehgal

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C304-8.1	Understand the foundations of international trade and finance in the era of globalization.	Understanding Level (C2)
C304-8.2	Apply the major models and theories of international trade.	Applying Level (C3)
C304-8.3	Examine the effects of tariffs, quotas and technical progress on economic growth.	Analyzing Level (C4
C304-8.4	Analyze the equilibrium in the Balance of Payments, exchange rate, monetary policy, foreign trade multiplier and trade policy.	Analyzing Level (C4)
C304-8.5	Evaluate the working of regional blocs and international organizations.	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	International trade and globalization.	2
2.	Theory of International Trade	The pure theory of international trade -Theories of absolute advantage, comparative advantage and opportunity costs, modern theory of international trade; Theorem of factor price equalization; Theory of absolute cost and comparative cost.	5
3.	Economic Growth and International Trade Policy	Terms of trade, Welfare implications (Tariffs, Quotas and non-tariff barriers); Technical progress, Growth and Trade.	4
4.	Balance of Payments	Meaning and components of balance of payments; balance of trade, equilibrium and disequilibrium in the balance of payments; Measuring Deficit or Surplus in BOP, Measures to correct it.	4
5.	Fixed and Flexible Exchange Rate	Fixed exchange rates and flexible exchange rates; Expenditure-reducing and expenditure-switching policies.	4
6.	International Economic Integration	Foreign Trade Multiplier, Devaluation, Theory of Custom Unions, Trade policy.	3
7.	The Theory of Regional Blocs & International organization	Rationale and economic progress of SAARC/SAPTA and ASEAN regions. Regionalism (EU, NAFTA); Functions of GATT/WTO (TRIPS, TRIMS), IMF and World Bank.	6

		Total number of Lectures	**28**

Evaluation Criteria

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

Project Based Learning: The students in a group of 4-5 are required to prepare a project report (selecting two or more countries) to analyze the direction and trade composition between the countries. The students are also required to analyze the areas of potential expansion using different trade indices.

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.	**Krugman, Paul.**, International Economics: Theory and Policy, 10th edition, Pearson, 2017
2.	**Kindleberger, C.P.,** International Economics, 6th edition, R.D. Irwin, Homewood, 1978
3.	**Salvatore, D.**, International Economics, 13th edition , Prentice Hall, Upper Saddle River, N.J., New York, 2016
4.	**Soderston, Bo**, International Economics, 3rd edition, The Macmillan Press Ltd., London, 1999
5.	**Roy Malbika and Sinha, Saket,** International Trade and Finance, 1st edition, Springer, 2017

Detailed Syllabus

Course Code	20B12HS311	Semester Even (specify Odd/Even)	Semester Session 2023-24 Month from Jan– June 2024
Course Name	Global Politics		
Credits	3(2-1-0)	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Gaurika Chugh
	Teacher(s) (Alphabetically)	

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-9.1	Demonstrate an understanding of the meaning and nature of globalization by addressing its political, economic, cultural and technological dimensions	Understanding (C2)
C304-9.2	Analyzing the significance of contemporary global issues such as the proliferation of nuclear weapons, ecological issues, international terrorism, and human security to global governance	Analyze (C4)
C304-9.3	Analyze how the global politics shapes domestic politics	Analyze (C4)
C304-9.4	Demonstrate an understanding of the working of the global economy, its anchors and resistances offered by global social movements	Apply (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Globalization: Conceptions and Perspectives	Political Dimension of globalization Globalization and Culture Technological Dimensions Debates on territoriality and sovereignty	6
2.	Global Economy	Its Significance and Anchors of Global Political Economy:IMF- history and India's benefit from its membership of IMF WTO- History and India's experience with WTO and reform proposals World Bank- history and role of world Bank in India Rise of TNCs and role of TNCs in globalization Global resistances (Global Social Movement and NGOs)- their nature and characteristics, prominent movements and their impact	8
3.	Contemporary Global Issues-I	Ecological Issues: historical overview of international environmental agreements-UNSCD, Paris agreement, climate change- Copenhagen summit to post Copenhagen summit	8

		policies of India, climate change and global initiatives global commons debate Proliferation of Nuclear Weapons-history of nuclear proliferation, threat of proliferation with increase in globalization	
4.	Contemporary Global Issues-II	International Terrorism: globalization and global terrorism, impact of terrorism on globalization, role of non-state actors and state terrorism; the US and war on terrorism Migration and Human Security- globalization, violent extremism and migration; new global regime	6
		Total number of Lectures	**28**

Evaluation Criteria

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

Project Based learning: Each student would form a group of 3-4 students and to make projects on issues such as climate change, terrorism and proliferation of nuclear weapons. This project would help the students in having a better idea about the contemporary global issues and how with the revolution in information and technology as a result of globalization has impacted the world. This would improve their research skills and enhance their knowledge about the impact of globalization on various sectors of the economy.

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.	C. Hay, Ed. *New Directions in Political Science: Responding to the Challenges of an Interdependent World.* New York, USA: Palgrave Macmillan Education, 2010
2.	D.Held& A. McGrew, *Globalization/Anti-globalization: Beyond the Great Divide*. Cambridge, UK: Polity Press, 2007
3.	F. Halliday, "Terrorism in Historical Perspective"., *Open Democracy*. 22 April, 2004 [Online] Avaliable: http://www.opendemocracy.net/conflict/article_1865.jsp
	H.Shukla, *Politics of Globalization*. Indore, India: Mahaveer Publication, 2021
4.	J. Baylis and S. Smith, Ed.*The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2017
5.	L.Gordon and S. Halperin, "Effective Resistance to Corporate Globalisation" in *Contesting Global Governance,* R.O'Brien, A.M. Goetz, J.C. Scholte &M.Williams. Cambridge, UK: Cambridge University Press,2000
	R.Dattagupta, *Global Politics*. Chennai, India: Pearson, 2020

Applicational Aspects of Differential Equations (20B12MA311)

Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem, Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series of orthogonal functions, trigonometric Fourier series, matrix method for homogeneous linear systems with constant coefficients, basic theory of partial differential equations, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.

Lecture-wise Breakup

Course Code	20B12MA311	Semester Even (specify Odd/Even)	Semester VI Session 2023 - 2024 Month from Jan 2024- June2024
Course Name	Applicational Aspects of Differential Equations		
Credits	**3**	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Richa Sharma	
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C302-2.1	recallFourier series, Laplace Transformation and methods for solving ODE.	Remembering(C1)
C302-2.2	explain orthogonality of functions, Sturm - Liouville boundary value problems and formulation of PDE.	Understanding (C2)
C302-2.3	solvepartial differential equationsand system of ordinary differential equations.	Applying (C3)
C302-2.4	simplify differential equations arisingin the field of science and engineering.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Theory of Ordinary Differential Equations	Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem.	10
2.	Sturm-Liouville Boundary Value Problem	Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series of orthogonal functions,	10

			trigonometric Fourier series.	
3.	Matrix Methods to solve ODE's	Matrix Method for Homogeneous Linear systems with Constant Coefficients.	4
4.	Basic Theory of Partial Differential Equations	Solution of first order equations: Lagrange's equation, Charpit's method, higher order linear equations with constant coefficients.	4
5.	Applications of Differential Equations	Fourier integrals, Fourier transforms, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.	14
Total number of Lectures			**42**

Evaluation Criteria

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

Project Based Learning: Students in a group of 4 to 5 students will apply the methods of solving differential equations arising in science and engineering applications.

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.	**Ross, S.L.,** Differential Equations, 3rd Ed., John Wiley & Sons, 2007.
2.	**Jain, R.K. and Iyengar, S.R.K.,** Advanced Engineering Mathematics, 5thEd.,Narosa Publishing House, 2016.
3.	**Chandramouli, P.N.,** Continuum Mechanics, Yes Dee Publishing India, 2014.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10thEdition, John Wieley& Sons, Inc. 2013.

Java Programming (20B16CS322)

Detailed Syllabus

Course Description with CO

Course Code	20B16CS322	Semester: Even	Semester: VI Session 2023 -2024 Month from Jan to Jun
Course Name	Java Programming		
Credits	Audit	Contact Hours	[1- 0 - 2]

Faculty (Names)	Coordinator(s)	Dr. Kirti Aggarwal
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES: At the completion of the course, Students will be able to		COGNITIVE LEVELS
C305-8.1	Apply basic Java programs using Java constructs – loops, switch-case, arrays & strings.	Apply Level (C3)
C305-8.2	Apply all basic concepts of oops using java programming	Apply Level (C3)
C305-8.3	Examine java programs using Exception Handling, Multithreading	Analyze Level (C4)
C305-8.4	Determine the use of Java collection framework	Evaluate Level (C5)
C305-8.5	Create an application based on Java programming constructs	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Overview of OOA (Object Oriented Analysis) and Java basics	Classes, Objects, OOPs concept using JAVA, Packages and Interfaces.	3
2.	JVM Internals	Memory management, Garbage Collection	1
3.	String Handling	Using String and StringBuilder class. String Immutability(toString())	2
4.	Exception Handling in JAVA	Fundamentals, Exception types, Java built-in exceptions, Custom Exceptions, Chained Exceptions.	2

5.	Collections Framework	Collection Overview, List, Map (hashCode & Equals), Set, Queue & other collections	4
6.	Multithreading in Java	Multithreading overview and requirement, Thread state diagram, Java multithreading implementation (Thread/Runnable), Challenges in multithreading/Mutual Exclusion, Java handling of mutual exclusion (synchronization), Communication between threads (wait/notify)	2
		Total number of Lectures	14

Evaluation Criteria

Components	Maximum Marks
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 10, Quizzes = 10, PBL = 10)
Total	**100**

Project based learning: Assignments on different topics are given to each student. They utilize the java concepts and try to solve different problems given as assignments.

The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material:
Text Books
1. Schildt, H. (2021). Java: The Complete Reference, Twelfth Edition. United States: McGraw Hill LLC.
2. Reges, S., Stepp, M. (2020). Building Java Programs: A Back to Basics Approach. United Kingdom: Pearson.
Reference Books
1. Horstmann, C. S. (2021). Core Java: Fundamentals, Volume 1. United Kingdom: Pearson.
2. Curry, C. (2020). Object-Oriented Programming with Java. United States: Addison-Wesley Professional.
3. Loy, M., Niemeyer, P., Leuck, D. (2020). Learning Java: An Introduction to Real-World Programming with Java. United States: O'Reilly Media.

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Department of CS and IT
Problem Solving using C and C++ (20B16CS323)

Subject Code	20B16CS323	Semester Even	Semester VI Session 2023-2024 Month: Jan-June 2024
Subject Name	Problem Solving using C and C++		NBA Code: C305-9
Faculty (Names)	Coordinator(s)	Mr. Amitesh (Sec-62), Ms.Ambalika Sarkar (Sec 128)	
	Teacher(s) (Alphabetically)	Ambalika Sarkar, Amitesh, Ankit Vidyarthi, Deepti Tripathi, Indu Chawla, Kedar Nath Singh, Mohit Singh, Shikha Jain, Sumeshwar Singh	

COURSE OUTCOMES		COGNITIVE LEVELS
C305-9.1	Understand the differences between procedural and object-oriented programming and design patterns.	Understand (C2)
C305-9.2	Apply thorough understanding of modular programming concepts in developing solutions to problems with secure coding practices.	Apply Level (C3)
C305-9.3	Apply the concepts and understanding of various algorithmic techniques, dynamic programming, templates, containers, iterators, and mathematical techniques for solving diverse problems.	Apply Level (C3)
C305-9.4	Evaluate and determine the suitable data structure for a given problem.	Evaluate Level (C5)
C305-9.5	Design a strategic approach for developing an effective solution to various real-world problems.	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. Of Lectures
1	Review and practice problems on Functions in C/C++, STL fundamentals and their advance usage	Functions, Alt function syntax, Function return type deduction, static, const and inline functions, default parameters, overloaded functions- operator and members, friends, overriding functions, STL introduction, vector basics, operations, and complexity. Explores strings for manipulation, sets/maps for usage, and stacks/queues for implementations and use cases.	1
2	Practice problems onPointers and Indirections, Arrays, their relevant algorithms used for problem solving	Smart pointers, pointers and dynamic memory allocation, type inference, array and pointers and their arithmetic and indirections,Algorithms, and Optimization: Covers basic array operations, traversal, and manipulation. Explores Kadane's Algorithm for understanding and implementation, Two Pointer Approach for various applications, and Binary Search with theory, implementation, and optimization techniques.	2

3	Secure Coding practices in C/C++, Practice problems on Arrays and their relevant algorithms used for problem solving	Common String, Integer and dynamic memory allocation Errors, Integer and dynamic memory allocation and String vulnerabilities their mitigation strategies.Arrays, Algorithms, and Optimization: Covers basic array operations, traversal, and manipulation. Explores Kadane's Algorithm for understanding and implementation, Two Pointer Approach for various applications, and Binary Search with theory, implementation, and optimization techniques.	2
4	Practicing Recursion, Backtracking, and Dynamic Programming with Concepts and Examples	Algorithmic Techniques in C++: Includes Recursion with concepts and examples, Backtracking Techniques with understanding and examples, and an introduction to Dynamic Programming (DP) along with basic problems.	1
4.	Tackling Advanced Problems and Optimization Techniques, progressing to Intermediate Problems and their Variations	Dynamic Programming in C++: Explores advanced problems and optimization techniques, followed by intermediate problems and their variations.	1
5.	Unveiling Greedy Algorithms and Graph Algorithms, Delving into Advanced Graph Topics and Unveiling their applications	Algorithmic Concepts in C++: Covers Greedy Algorithms, Graph Algorithms with DFS and BFS traversal, and Shortest Path Algorithms including Dijkstra's Algorithm and Bellman-Ford Algorithm, Minimum Spanning Tree with Prim's and Kruskal's Algorithms, explores advanced topics like Eulerian path/cycle and Topological Sort, and discusses applications of DFS and BFS in various contexts.	2
6.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization of templates, template recursion, variadic templates, Meta-programming	1
7.	Unveiling advanced DS concepts with Real-world Applications	Advanced Data Structures in C++: Covers Heaps and Priority Queues, Segment Trees with construction, queries, and updates, and Fenwick Trees (Binary Indexed Trees) with applications.	1
8.	Problems on catering advanced Mathematical concepts and bit related problems, Usage of advanced string algorithms	Advanced Techniques and Math Concepts in C++: Covers Bit Manipulation, Number Theory (Prime Numbers, Sieve, Modular Arithmetic), and Combinatorics along with Probability.String Algorithms in C++: Covers Pattern Matching and explores Prefix/Suffix Array with its applications.	2
9.	Problems on Concurrency in Programming	Working with dynamic memory, array-pointer duality, low-level memory operations, smart pointers and common memory pitfalls	1
			14
Evaluation Criteria			

Components	Maximum Marks
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 5, Assignments = 15, Internal Assessment = 5, Assignments in PBL mode = 5)
Total	**100**

Project based learning: Project based learning: Each student in a group of 2-4 will choose an industrial application for development. To fulfil the objective of this lab i.e., learning and applying the programming skills in C and C++. Students need to consider a trending industrial requirement for application development using the programming language skills learned. Understanding programming application development helps the students in enhancing knowledge on industry need of software design and development using programming languages.

Recommended Reading material:

Textbooks

1.	Schildt, H. (2003). C++: The complete reference. McGraw-Hill/Osborne.
2.	Lafore, R. (2002). Object-oriented programming in C++. Pearson Education.
3.	Deitel, P., &Deitel, H. (2016). C++ how to Program. Pearson.

Reference Books

1.	Savitch, W. J., Mock, K., Msanjila, S., &Muiche, L. (2015). Problem Solving with C++. Pearson.
2.	Seacord, R. C. (2005). Secure Coding in C and C++. Pearson Education.
3.	Drozdek, A. (2012). Data Structures and algorithms in C++. Cengage Learning.

Detailed Syllabus
Lecture-wise Breakup

Course Code	20B16CS326	Semester EVEN	Semester VI Session 2023 -2024 Month from JAN-JUN
Course Name	Front End Programming		
Credits		Contact Hours	1-0-2

Faculty (Names)	Coordinator(s)	Dr. Shailesh Kumar(J128), Ms. Neha (J62)
	Teacher(s) (Alphabetically)	Dr. Himanshu Agarwal , Mr. Pankaj Mishra,Dr.Shailesh Kumar

COURSE OUTCOMES		COGNITIVE LEVELS
C305-11.1	Familiarity with the fundamental principles of different Front End Tools.	Remembering [Level 1]
C305-11.2	Understand the core principles of Front End Programming	Understanding [Level 2]
C305-11.3	Apply understanding of different programming paradigms.	Apply [Level 3]
C305-11.4	Utilize Front End Technologies in the creation of practical applications for the real world.	Apply[Level 3]
C305-11.5	Create a comprehensive mobile application to address a challenging real-time issue.	Create [Level 6]

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to basic Front End Techniques	HTML 5, CSS 3, JavaScript, jquery, bootstrap	3
2.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
3.	Java Fundamentals	Decision Making, Loop Control, Operators, Array, String, Overloading, Inheritance, Encapsulation, Polymorphism, Abstraction	2
4.	Advanced Front End Programming Concepts	Storing and retrieving data, Python Programming Concepts, Python for developing Android Application.	2
5.	Designing Android Application	Android development lifecycle, Learning UI and layout, controller, component, Directives, Services & views.	3
6.	Android with Database	Data base Application Development	2
7.	Privacy & Security Issues	Security Issues with Android Platform	1
		Total number of Lectures	**14**

Evaluation Criteria

Components	Maximum Marks
Mid Semester Examination	30
End Semester Examination	40
TA	30 (**Attendance-10,Assignments/ Class Test/ Quiz/ LAB Record -05, Project-15**)
Total	**100**

Project based learning: In this subject students will learn the latest front end technology. After completing the subject, each student in a group of 3-4 will be able to create a mobile application.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Reference Books:	
1.	Schildt, H. (2014). Java: The Complete Reference. McGraw-Hill Education Group.
2.	Mughal, K. A., & Rasmussen, R. W. (2016). A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA). Addison-Wesley Professional.
3.	Gaddis, T., Bhattacharjee, A. K., & Mukherjee, S. (2015). Starting out with Java: early objects. Pearson.
Text Books:	
4.	Duckett, J. (2014). Web Design with HTML, CSS, JavaScript and jQuery Set. Wiley Publishing.
5.	Shenoy, A., &Sossou, U. (2014). Learning Bootstrap. Packt Publishing Ltd.
6.	Lee, W. M. (2012). Beginning android for application Development. John Wiley & Sons.
7.	Hardy, B., & Phillips, B. (2013). Android Programming: The Big Nerd Ranch Guide. Addison-Wesley Professional.

Subject Code	21B12CS312	Semester: EVEN SEM	Semester 6th Session 2023-2024 Month from Jan to June 2024
Subject Name	Sensor Technology and Android Programming		
Credits	03	Contact Hours	3 -0 -0

Faculty (Names)	Coordinator(s)	Dr. Vikash
	Teacher(s) (Alphabetically)	Dr. Vikash

After Completion of this course student will able to aquire:

COURSE OUTCOMES After the completion of the course, the students will be able to		COGNITIVE LEVELS
C331-1.1	Understand the diverse sensor & transduce variant , smart sensors and various platform of sensing devices	Understanding (C2)
C331-1.2	Understand Anatomy of an android development environment (IDE) for sensing application and instrument for various Android applications.	Understanding (C2)
C331-1.3	Apply the various physical sensors of the Android device and its programming in the development of various Android applications.	Applying (C3)
C331-1.4	Evaluating physical sensor for various services/app using Android.	Evaluating (C5)
C331-1.5	Development of the various real-life applications using design, development , and testing.	Creating (C6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Fundamentals of Sensors	**Sensing and Sensor Fundamentals:** Sensing Modalities, Mechanical Sensors, MEMS Sensors, Optical Sensors, Semiconductor Sensors, Electrochemical Sensors, Biosensors **Key Sensor Technology Components-Hardware and Software Overview:** Smart Sensors, Sensor Systems, Sensor Platforms, Microcontrollers for Smart Sensors, Microcontroller Software and Debugging	9
2.	Introduction to Android Programming	**Overview of the Android Platform:** Introducing Android, Setting Up Your Android Development Environment. **Android Application Basics:** Anatomy of an Android Application, Android Manifest File, Managing Application Resources. **Android User Interface Design Essentials:** Exploring User Interface Building Blocks, Designing with Layouts, Partitioning the User Interface with Fragments, Displaying Dialogs.	9

3.	Inferring Information from Physical Sensors	**Overview of Physical Sensors,**Android Sensor API, Sensing the Environment, Sensing Device Orientation and Movement. **Detecting Movement:** Acceleration Data. **Sensing the Environment:** Barometer vs. GPS for Altitude Data **Android Open Accessory (AOA):** AOA Sensors versus Native Device Sensors, AOA Beyond Sensors, AOA Limitations, AOA and Sensing Temperature	8
4.	Sensing the Augmented, Pattern-Rich External World	RFID, Near field communication (NFC), Inventory Tracking System using NFC, Camera Activity, Barcode Reader, ImageProcessing using AOA, Android Clapper and Media Recorder.	8
5.	Development of user Services using Android and Sensors	Development of android services such as motion detection, Air Monitoring, Screen Brightness Monitoring, Acceleration, Position, Air Pressure Monitoring, and Monitor of Temperature	8
		Total number of Lectures	**42**

Evaluation Criteria Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 {(Quiz + Project Assignment +Class Test)15+ Attendance10}
Total	**100**

Project based learning: Learning smart sensors of android devices, student can write, read, and analyze graphical data of any connected android device from anywhere in the world. Students will get employment in sensor-based and android app firms. Group project will be given to the students to design custom based android application/services which access the various sensors of the android devices remotely. Depending on the services and its popularity, one can even have a start-up company for the same.

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

Text Books (s):

1.	Greg Milette, Adam Stroud, "Professional Android Sensor Programming", ISBN: 978-1-118-18348-9, Wiley June 2012
2.	McGrath, Michael J., Cliodhna Ni Scanaill, and Dawn Nafus. "*Sensor technologies: healthcare, wellness, and environmental applications".* Springer Nature, 2013.
3.	Annuzzi, Joseph, Lauren Darcey, and Shane Conder. *Introduction to Android application development: Android essentials.* Pearson Education, 2014.
4.	Fraden, Jacob. Handbook of Modern Sensors: Physics, Designs, and Applications. Germany, Springer International Publishing, 2015.
5.	Advances in Modern Sensors: Physics, design, simulation and applications (IOP Series in Sensors and Sensor Systems) Hardcover – Import, 16 November 2020 by G R Sinha
6.	Horton, John. Android Programming for Beginners. United Kingdom, Packt Publishing, 2015.
7.	Kurniawan, Budi. *Introduction to Android Application Development.* Brainy Software Inc, 2014.

Reference book (s):

8.	*Nagpal, V. (2016). Android Sensor Programming By Example. Packt Publishing Ltd.*

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS313	Semester Even 2024	Semester VI Session 2023 - 2024
			Month from January to June 2024
Subject Name	Fundamentals of Distributed and Cloud Computing		
Credits	3	Contact Hours	3 Lectures

Faculty (Names)	Coordinator(s)	Dr. Prakash Kumar (Sec 62) and Dr. Pulkit Mehndiratta (Sec 128)
	Teacher(s) (Alphabetically)	1. Prakash Kumar 2. Pulkit Mehndiratta

COURSE OUTCOMES		COGNITIVE LEVELS
C331-2.1	Compare Distributed Mutual exclusion and deadlock handling techniques in distributed environments.	Understand (Level 2)
C331-2.2	Understand various Deployment Models, Cloud Service Models, Essential Characteristics, Foundational Elements and Enablers, Architecture of Cloud Computing.	Understand (Level 2)
C331-2.3	Identify and solve event ordering related problems occurring due to various synchronization related issues in distributed systems.	Apply (Level 3)
C331-2.4	Analyze various Virtualization Techniques, Virtual Machine Provisioning, Migration techniques, containerization and their performances in cloud environments.	Analyze (Level 4)
C331-2.5	Evaluate data consistency, replication and fault related issues for various distributed scenarios.	Evaluate (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Review of operating systems principles, Theoretical foundations to Distributed Systems.	Review of Operating Systems Principles, Introduction to Distributed Systems concepts.	3
2.	Synchronization Mechanisms in Distributed Systems	Resource models. Clock synchronization. Event ordering. Timestamps recording. Global state collection mechanisms.	3
3.	Election Algorithms and Termination Detections	Election Algorithms: Ring and Bully Algorithms, Termination Detection,	2
4.	Distributed Mutual Exclusion (DME) Algorithms	Distributed mutual exclusion. Token and non-token based algorithms. Comparative performance analysis.	4

5.	Distributed Deadlock Detection Algorithms	Process deadlocks in DS. Deadlock handling techniques.	3
6.	Agreement Protocols	System Model, Classification, Byzantine Problems and solutions.	2
7.	Consistency and Replication Issues	Data-centric consistencies, Client-centric consistencies. Epidemic Protocols.	5
8.	Fault Tolerance and Reliability	Fault Tolerance, Reliability in Distributed Systems, group communications, and Distributed commit. Failure Recovery.	5
9.	Introduction to Cloud Computing	Introduction to cloud computing, Correlation between Distributed and Cloud Models.	2
10.	Cloud services and models	Deployment Models, Service models, SaaS, PaaS, IaaS. Essential Characteristics, Foundational Elements, Enabling Technologies for Cloud.	3
11.	Virtualization Technology, Virtual Machines (VMs) and Containerization	Virtualization Technology, Virtualization Techniques, Virtual Machines, Virtual Machine Monitors, Live Migrations, Virtual Clusters, Containers and overview of Dockers	8
12.	Cloud Security	Data and Network security in cloud, Access control and authentication in cloud computing.	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project Based Learning:5, Assignments:10, Attendance:10)
Total	**100**

Project-Based Learning: A group of a maximum of 4 students is to be formed. Each group shall choose a Distributed Systems and/or Cloud based project. The project shall be designed and/or modeled either based on Distributed Systems algorithms and scheduling techniques, and/or any Cloud Platform like AWS, Google Cloud, Eucalyptus, CloudSim, iFogSim, or any simulation tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

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

Textbooks

1. Tanenbaum, A.S, Marten, V. Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Prentice Hall. Reprint 2015.

2. M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw-Hill. 2012.

3. K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel

Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier. 2014.

4. R. K. Buyya, J Broberg, AdnrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley Publisher. 2014

5 Barrie Sosinsky, "Cloud Computing Bible" Wiley India Publishers, 2013.

Reference books/papers

1. Tanenbaum, A. S Distributed Operating Systems, 1st Ed., Prentice-Hall, Englewood Cliffs, NJ.

2. "Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.

3. Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.

4. Rich Uhlig, et. al., "Intel Virtualization Technology" IEEE Journal, 2005.

5. "Implementing Virtualization" White paper, Intel virtualization Technology, 2008

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS314	Semester Even (specify Odd/Even)	Semester VI Session 2023 - 2024 Month from Jan 2024 to June 2024
Course Name	Introduction to Large Scale Database Systems		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Devpriya Soni & Dr. Parmeet Kaur
	Teacher(s) (Alphabetically)	Dr. Devpriya Soni, Dr. Parmeet Kaur

COURSE OUTCOMES		COGNITIVE LEVELS
C331-3.1	Explain the concept and challenges of large scale data storage and management	Understand level (Level 2)
C331-3.2	Interpret the impact of background processes involved in queries on database operations and design	Apply Level (Level3)
C331-3.3	Apply techniques of data fragmentation and replication to design a distributed or parallel database system for large scale data	Apply Level (Level3)
C331-3.4	Compare the suitability of various database systems to manage, store, query, and analyze large scale data	Analyze level (Level4)
C331-3.5	Evaluate relational with nonrelational database systems for large scale data applications	Evaluate level (Level5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C331-3.1	2	2	1	2	1	1			1	1		2	1	1
C331-3.2	2	3	3	1	1	1			1	1	1	2	2	3
C331-3.3	3	1	2	1	1	1			1	1	1	2	2	2
C331-3.4	2	2	3	1	2	2			1	2	1	2	1	3
C331-3.5	2	2	2	2	2	1			1	1	1	2	2	2
NBA Code: C331-3	2	2	2	1	1	1			1	1	1	2	2	2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C331 -3.1	2	2	1	2	1	1			1	1		2	1	1
	Moderately mapped as applying knowledge of mathematics in concepts of large scale data management and storage	Moderately mapped as analysing problems associated with large scale data storage and management	Slightly mapped asDesign solutions of large scale data storage and management are discussed	Moderately mapped to research-based knowledge of large scale data storage and management	Slightly mapped to apply appropriate techniques in large scale data storage and management	Slightly mapped to research-based knowledge of large scale data storage and management			Slightly mapped to Individual and team work for applied in large scale data storage and management	Slightly mapped to complex engineering activities related to large scale data storage and management			Slightly mapped as identifying suitable data structures for large scale data storage and management	Slightly mapped to technological challenges associated with large scale data storage and management
C331 -3.2	2	3	3	1	1	1			1	1	1	2	2	3
	Moderately mapped as applying knowledge of mathematics in background processes involved in queries on database operations and design	Strongly mapped as analysing problems associated to background processes involved in queries on database operations and design	Strongly mapped as Design solutions of background processes involved in queries on database operations and design are discussed	Slightly mapped to research-based knowledge of background processes involved in queries on database operations and design	Slightly mapped to apply appropriate techniques in background processes involved in queries on database operations and design	Slightly mapped to research-based knowledge of background processes involved in database operations			Slightly mapped to Individual and team work for applying background processes involved in queries	Slightly mapped to complex engineering activities related to background processes involved in queries on database operations and design	Slightly mapped to Project management using background processes involved in queries on database operations and design are discussed	Moderately mapped to learning background processes involved in queries for future	Moderately mapped as identifying suitable algorithms associated to background processes involved in queries	Strongly mapped to technological challenges associated to background processes involved in queries are discussed
C331 -3.3	3	1	2	1	1	1			1	1	1	2	2	2
	Strongly mapped as applying knowledge of mathematics in data fragmentation and replication of data in distributed or parallel database system	Slightly mapped as analysing problems associated to data fragmentation and replication of data in distributed or parallel database system	Moderately mapped to Design solutions of data fragmentation and replication of data in distributed or parallel database system	Slightly mapped to research-based knowledge of data fragmentation and replication of data in distributed or parallel database system	Slightly mapped to apply appropriate techniques in data fragmentation and replication of data in distributed or parallel database system	Slightly mapped to research-based knowledge of data fragmentation and replication of data in distributed or parallel database syste			Slightly mapped to Individual and team work for applying data fragmentation and replication of data in distributed or parallel datab	Slightly mapped to complex engineering activities related to data fragmentation and replication of data in distributed or parallel database system	Slightly mapped to Project management using data fragmentation and replication of data in distributed or parallel database system	Moderately mapped to life learning of data fragmentation and replication of data in distributed or parallel database system	Moderately mapped as identifying suitable algorithms associated to data fragmentation and replication	Moderately mapped to technological challenges associated to data fragmentation and replication of data in distributed or parallel database system

						m			ase system				
C331 -3.4	2	2	3	1	2	2		1	2	1	2	1	3
	Moderately mapped as applying knowledge of mathematics in comparing the suitability of various database systems	Moderately mapped as analysing problems associated to various operations of large scale data	Strongly mapped to design solutions of various operations of large scale data	Slightly mapped to research-based knowledge of various operations of large scale data	Moderately mapped to apply appropriate techniques in various operations of large scale data	Moderately mapped to research-based knowledge of various database systems		Slightly mapped to Individual and team work for applying various operations of large scale data	Moderately mapped to complex engineering activities related to various database systems	Slightly mapped to project management for various database systems	Moderately mapped to life learning of various operations of large scale data	Slightly mapped as identifying suitable algorithms associated in various database systems	Strongly mapped to technological challenges associated to various database systems
C331 -3.5	2	2	2	2	2	1		1	1	1	2	2	2
	Moderately mapped as applying knowledge of mathematics for evaluating relational with nonrelational database systems	Moderately mapped as analysing problems associated with relational and nonrelational database systems	Moderately mapped to design solutions for evaluating relational with nonrelational database systems	Moderately mapped to research-based knowledge for evaluating relational with nonrelational database systems	Moderately mapped to apply appropriate techniques for evaluating relational with nonrelational database systems	Slightly mapped to research-based knowledge for evaluating relational with nonrelational database systems		Slightly mapped to Individual and team work for evaluating relational with nonrelational database systems	Slightly mapped to complex engineering activities related to evaluation of relational with nonrelational database systems	Slightly mapped to project management in evaluating relational with nonrelational database systems	Moderately mapped to life learning of relational and nonrelational database systems	Moderately mapped as identifying suitable algorithms for evaluating relational with nonrelational database systems	Moderately mapped to technological challenges associated with evaluation of relational to nonrelational database systems
NBA Code : C331 -3	2	2	2	1	1	1		1	1	1	2	2	2

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to large scale Databases	Review of database systems, Data sources and join processing, modelling and query languages	2
2.	Transaction management	Transaction processing concepts, Concurrency control techniques and protocols	4
3.	Data Storage and	Data storage and indexing of massive databases in databases and data warehouses. Introduction to technologies	7

	Indexing	for handling big data	
4.	Query processing and Optimization	<mark>Measures of query cost, Evaluation of expressions, Query planning, evaluation and optimization</mark>	5
5.	Big data Tools and Technologies	<mark>Review of Big data, CAP Theorem (consistency, availability, partition tolerance), Using big data in businesses, Data visualization for data analysis, NoSQL databases</mark>	7
6.	Hadoop and its Ecosystem	Hadoop core components, Hadoop Ecosystem components, Data storage and processing in Hadoop framework	5
7.	Application-driven databases	<mark>Parallel and Distributed databases, Distributed Database Design, Architecture of Distributed DBMS</mark>	8
8.	Advanced databases	Graph databases, spatial and temporal databases	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 Attendance (10 Marks), Assignment/Quiz/Mini-project (15 Marks)
Total	**100**

Project based Learning: Each student in a group of two or three student will explore a large database from the domain of their choice. For real time applicability of subject, they will explore and choose one visualization tool available. The chosen visualization tool will be used for analyzing the database. Understanding the data visualization process, will help in their employability in big data analysis organizations.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)		
Text Books		
1.	AviSilberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw-Hill, March 2019.	
2.	RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems (7th Edition) 7th Edition, Pearson Education (June 18, 2015), ISBN-10: 0133970779, ISBN-13: 978-0133970777.	
3.	Sadalage, P.J. &Foowlwer, M. 2013. NoSQL distilled: a brief guide to the emerging world of polygot persistence. Addison-Wesley	
4.	White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.	
5.	Zikopoulos, Paul, and Chris Eaton. Understanding big data: Analytics for enterprise class hadoop and streaming data. McGraw-Hill Osborne Media, 2011.	
6.	Shashank Tiwari, Professional NoSQL, Wiley, 2011	
Reference Books		
1.	Rick, Smolan, and Jennifer Erwitt. "The human face of big data." Against All Odds Production (2012).	
2.	Prajapati, Vignesh. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2013.	

3.	Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking. " O'Reilly Media, Inc.", 2013.
4.	DeRoos, Dirk. Hadoop for dummies. John Wiley & Sons, 2014.
5.	Mayer-Schönberger, Viktor, and Kenneth Cukier. Big data: A revolution that will transform how we live, work, and think. Houghton Mifflin Harcourt, 2013.

Course Code	21B12CS315	Semester:Even	Semester VI Session 2023 -2024
			Month from: Jan to May 2024
Course Name	Web Technology and Cyber Security		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Arpita Jadhav Bhatt (J62), Lalita Mishra(J128)
	Teacher(s) (Alphabetically)	Arpita Jadhav Bhatt (J62), Aastha Maheshwari (J62), Lalita Mishra (J128), VartikaPuri (J128)

COURSE OUTCOMES		COGNITIVE LEVELS
C331-4.1	Understand Advanced Java Scripting language and related web development concepts	Understand (level 2)
C331-4.2	Understand event-driven programming concepts and open-source web development frameworks	Understand (level 2)
C331-4.3	Examine defense mechanisms for cyber security	Apply (Level 3)
C331-4.4	Develop web pages using fundamental building blocks of web development.	Apply (Level 3)
C331-4.5	Analyze hacking techniques to attack websites and describe their countermeasures	Analyze (Level 4)

Module No.	Subtitle of the Module	Topics in the Module	CO Mapping	No. of Lectures for the module
1.	Review of Essential topics in Web Development	HTML, CSS, JavaScript Basics, Primitives, Functions, Objects, Event - Driven Programming, Callbacks	CO1, CO4	3
2.	Programming in React JS	Understanding SPA, React Overview, React vs Angular, React Deep-Dive, Composition over Inheritance, Declarative code with JSX, Unidirectional Data Flow, Components, Lists and Keys, Form Handling, Hooks, Life Cycle, React Router	CO2	9
3.	Programming in Node JS	Introduction to Node JS, EventLoop, REPL, Modules, REST, Scaling	CO2	5
4.	Web Development Frameworks	Types of web applications, Front-end vs. Back-end frameworks, Developing web applications using popular frameworks Django, Bootstrap, JQuery	CO2	4
5.	Securing Web Applications	Cybersecurity overview,Principles of Cyber Security and SecureApplication Architecture	CO3	3
6.	Hacking Web Applications and Countermeasures	Cross Site Scripting, Cross Site Request Forgery, XML External Entity (XXE) attacks and their countermeasures	CO5	5

7.	Injection Attacks and Their Defenses	SQL injection, code injection and Command injection Attacks and their Defenses	**CO5**	4
8.	Denial of Service Attacks	Denial of Service and Distributed Denial of Service Attacks on Web Applications and Defenses	**CO5**	2
9.	Secure Network Protocols	DNS Attacks and DNSSec, VPNs, and IPSec	**CO5,CO3**	7
		Total number of Lectures		**42**

	Evaluation Criteria
	Components **Maximum Marks**
	T1 20
	T2 20
	End Semester Examination 35
	TA 25 (Attendance (10), Quiz/ Assignment (5), Mini-Project (10))
	Total **100**

Project based learning:A group of 3-4 students will make a web application using any of the web technologies (either single or in combination) covered as part of this course. Students will build a secure web application (using the fundamentals of cyber security) using advanced JS scripting technologies and/ or web frameworks. This will give students a hands-on experience of the used web technologies, thereby enhancing their employability in the IT 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)
	Text Books
1.	Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th, Pearson, 2015.
2.	Matt Bishop, Computer Security: Art and Science, Addison-Wesley Educational Publishers Inc, 2003.
3.	Brad Dayley , Brendan Dayley et al., Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications (Developer's Library), 2nd, Addison-Wesley Educational Publishers Inc, 2018.
4	Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Apress, 2018.
	Reference Books
1	Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd, Apress, 2019.
2.	William Stallings, Lawrie Brown, Computer Security, Principles and Practice, 4th, Pearson Education, 2018.
3	Dr. David Basin, Applied Information Security, Springer, 2011.
4	Douglas R. Stinson, Cryptography Theory and Practice, 3rd, CRC Press, 2005.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS317	Semester Even (specify Odd/Even)	Semester VI Session 2023 -2024 Month:January 2024
Course Name	Introduction to Blockchain Technologies		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Mr. Sumeshar Singh (J62), Dr. Mukta Goyal (J128)
	Teacher(s) (Alphabetically)	Mr. Sumeshwar Singh (J62), Dr. Mukta Goyal (J128)

COURSE OUTCOMES		COGNITIVE LEVELS
C332-1.1	Define the basic blockchain terminologies and its related application areas	Remember Level (Level 1)
C332-1.2	Understand the basic building blocks of blockchain such as decentralized networks, cryptography, consensus, and data structure.	Understand Level (Level 2)
C332-1.3	Understand functionality of Bitcoin in view of building blocks of blockchain.	Understand Level (Level 2)
C332-1.4	Use solidity programming language to develop smart contracts	Apply Level (Level 3)
C332-1.5	Analyze the Blockchain decentralization and its applications.	Analyze Level (Level 4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	**Overview:** Digital Age, Internet of Information, Concept of Trust, Trust protocol, What is blockchain, how blockchain works, steps in Blockchain transaction, Main components of Blockchain. **Blockchain design principles:** Network integrity, Distributed Power, Value as Incentives, Security, Privacy, Rights Preservation, and Inclusion **Blockchain Implementation Challenges:** 1) The Technology challenges, 2) The Energy Consumption, 3) Governments role, 4) Impact of Old Paradigms 5) Challenges with the Incentives, 6) Blockchain as Job Killer, 7) Governing the Protocols, 8) Distributed Autonomous Agents, 9) Privacy, 10) Malicious usage	6
2.	Components of Blockchain	**Basic building blocks**: 1) Networking – distributed networking, peer-to-peer, Bit-torrent, IPFS, 2) Cryptography, 3) Data structure – Merkle Tree, DAG and 4) Consensus - Byzantine Generals Problem, and Consensus as a distributed coordination problem, Consensus algorithms, RAFT, Paxos, Byzantine fault Tolerance, PBFT, PoS.	9
3.	Blockchain Applications and Case studies	**Cryptocurrencies**: Introduction to digital currency, Crypto currency, Explanation of Bitcoin with concepts covered in Module 1 and 2. Cryptographic methods in Bitcoin, Hashing in Bitcoin, Overview of Hash puzzle in Bitcoin, The real need for mining – Consensus in Bitcoin (PoW), Mining difficulty,Bitcoin-NG, Bitcoin block structure. Comparison of Consensus protocols. Importance of public key cryptosystems, distributed consensus, Hashing, Hash Puzzles, private vs public blockchain, blockchain versions and use cases, Example case studies, Application areas.	9
4.	Introduction to Smart Contracts	Bitcoin vs. Ethereum, Introduction to smart contracts, advantage of smart contracts, examples of smart contracts, Guidelines for choosing blockchian projects, Solidity programming language,	9

		Introduction to REMIX IDE, Introduction to Solidity smart contracts, Solidity structure and language syntax, Deploying and interacting with smart contracts via Remix IDE.	
5.	Developing Blockchain Applications	Getting started with Node js, Front end, Back end development in Node JS, Best practices, Testing and deploying smart contracts, Currency wallets – Metamask, Application development with Solidity smart contracts and Node JS, case study.	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance(10) , Assignment/Quiz (5), PBLmode(10))
Total	**100**

Project based learning: Each student in a group of 4-5 will opt a domain in which blockchain can be implemented. The highlighted content can be used to choose project topics that help students evaluate and apply the knowledge gained in blockchain application development. The goal for each project is to work on case studies similar to those that a professional blockchain application developer comes across.

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

Text Books:

1.	EladElrom. "The Blockchain Developer."Apress, 2018.
2.	Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. (Chapters 2, 3, and 5)
3.	AmbadasTulajadasChoudhari, Arshad SarfarzAriff, Sham M R, "Blockchain for Enterprise Application Developers", Wiley, 2020.
3.	Reusch, Nicolas. "Solidity Programming Essentials: A beginner's guide to building smart contracts for Ethereum and blockchain."Packt Publishing, 2018.
4.	Don Tapscott and Alex Tapscott. "Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World." Penguin, 2016.
5.	A. Lewis, The Basics of Bitcoins and Blockchains, Springer, 2017.
6.	Dorjee Sun. "Blockchain Basics: A Non-Technical Introduction in 25 Steps."Apress, 2017.

References :

1	Ye, Tao, Min Luo, Yi Yang, Kim-Kwang Raymond Choo, and Debiao He. "A Survey on Redactable Blockchain: Challenges and Opportunities." IEEE Transactions on Network Science and Engineering (2023).
2.	Praveen, Gajala, Piyush Kumar Singh, and Prabhat Ranjan. "A comprehensive blockchain technology survey: architecture, applications and challenges." International Journal of Internet Technology and Secured Transactions 13, no. 1 (2023): 26-63.
3.	Xu, Jie, Cong Wang, and Xiaohua Jia. "A Survey of Blockchain Consensus Protocols." ACM Computing Surveys (2023).
4.	Munir, Sundas, and Walid Taha. "Pre-deployment Analysis of Smart Contracts--A Survey."arXiv preprint arXiv:2301.06079 (2023).
5.	Tschorsch, Florian, and Björn Scheuermann. "Bitcoin and beyond: A technical survey on decentralized digital currencies." IEEE Communications Surveys & Tutorials 18, no. 3 (2016): 2084-2123.
6.	Nakamoto, Satoshi. Bitcoin: A peer-to-peer electronic cash system. Manubot, 2019.

Course Code	21B12CS318	Semester : Even	Semester 6th Session 2023-2024
			Month from Jan 2023 to June 2023

Course Name	Big Data Ingestion		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Shikha Mehta (128), Sonal Surabh(62)
	Teacher(s) (Alphabetically)	Shikha Mehta Sonal Surabh

COURSE OUTCOMES		COGNITIVE LEVELS
C332-2.1	Explain the fundamental concepts and building blocks of Big Data Ingestion	Understand (Level 2)
C332-2.2	Apply modern tools for ingestion and storage of big data in varied formats.	Apply (Level 3)
C332-2.3	Analyze the tools and technologies for big data ingestion and storage.	Analyze (Level 4)
C332-2.4	Evaluate the usability of data ingestion and storage tools for real world applications.	Evaluate (Level 5)
C332-2.5	Implement big data applications using different data ingestion and storage tools	Create (Level 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Big Data, Architecture and Patterns	Review of Big Data landscape, Big Data: Why and Where, Characteristics of Big Data (V's of Big Data) and Dimensions of Scalability, Data Ingestion, Data Collection, Data processing, Data Storage Layer, Data Querying and Data Visualization Layer, Concepts of Data Ingestion, Data Storage, Data Quality, Data Operations.	6
2.	Big Data Sources and Formats	Structured vs. Semi-structured vs. Unstructured, Batch vs. Streams, Understanding Data Lakes, Exploring the Relational Data Model of CSV Files, Exploring the Semi-structured Data Model of JSON data, Exploring the RC and ORC File Formats, Exploring Streaming Sensor Data, Exploring Streaming Twitter Data.	6
3.	Big Data Storage Technologies	NoSQL and NewSQL, Using Hadoop to Store Data (HDFS, HBASE), From DBMS to BDMS, Introduction to Hadoop, Hadoop Ecosystem, HDFS, Mapreduce, Data Analysis using Hadoop	6
4.	Big Data Storage Technologies	Redis: An Enhanced Key-Value Store, Semi-structured Data – AsterixDB, Solr: Managing Text, Relational Data – Vertica.	5
5.	Using Sqoop for Big Data Ingestion	Sqoop Import, Import Data from MySql to HDFS, Other Variations of Sqoop Import Command, Sqoop Export Command, Sqoop Jobs.	8

6.	Using Flume for Big Data Ingestion	What is Flume, and where it is used, Difference between Flume and Sqoop, How Flume Works, What is Flume Agent, What are the Components of Flume Agent, How Data Flows between Various Components of the Flume.	7
7.	Overview of popular BDI tools	Apache Kafka, Apache Storm, Amazon Kinesis, DataTorrent etc.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks	
T1	20	
T2	20	
End Term	35	
TA	25	Attendance (10), Assignment/Quiz/Mini-Project (15)
Total	100	

Project based learning: Each student in a group of 2-3 will apply big data storage technologies to store data from DBMS to BDMS. To make subject application based, the student applies big data ingestion tools to ingest data into a Big Data system. Applicability of Hadoop, Sqoop, Flume, Kafka for big data ingestion enhance the student's knowledge and helps their employability into big data application domains.

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

Text Book(s):	
1.	Dey, N., Hassanien, A. E., Bhatt, C., Ashour, A., & Satapathy, S. C. (Eds.). (2018). Internet of Things and Big Data Analytics Toward Next-Generation Intelligence (pp. 3-549). Berlin: Springer.
2.	Covington, D. (2016). Analytics: Data Science, Data Analysis, and Predictive Analytics for Business. CreateSpace Independent Publishing Platform.
3.	Grover, M., Malaska, T., Seidman, J., & Shapira, G. (2015). Hadoop Application Architectures: Designing Real-World Big Data Applications. " O'Reilly Media, Inc.".
4.	Marz, N., & Warren, J. (2015). Big Data: Principles and Best Practices of Scalable Real Time Data Systems. Manning Publications Co.

Reference Book(s):	
5.	Sedkaoui, S. (2018). Data Analytics and Big Data. John Wiley & Sons.
6.	Dasgupta, N. (2018). Practical Big Data Analytics: Hands-on Techniques To Implement Enterprise Analytics and Machine Learning using Hadoop, Spark, NoSQL and R. Packt Publishing Ltd.
7.	Kumar, V. N., & Shindgikar, P. (2018). Modern Big Data Processing with Hadoop: Expert Techniques For Architecting End-to-End Big Data Solutions To Get Valuable Insights. Packt Publishing Ltd.

Course Code	21B12CS319	Semester EVEN	Semester VI Session 2023 -2024 Month from JAN-JUN
Course Name	Fundamentals of Soft Computing		
Credits	3	**Contact Hours**	3 –0 - 0

Faculty (Names)	**Coordinator(s)**	Parul Agarwal, Arti Jain
	Teacher(s) (Alphabetically)	Arti Jain, Dharmveer Singh Rajpoot, Parul Agarwal

COURSE OUTCOMES		COGNITIVE LEVELS
C332-3.1	Understand vagueness, ambiguity, and uncertainty in different types of real-world problems.	Understand (Level 2)
C332-3.2	Apply fuzzy logic principles to model and solve real-world problems involving uncertainty and imprecision.	Apply (Level 3)
C332-3.3	Apply neural network architectures and deep learning techniques to solve problems in various domains such as image recognition, natural language processing, and time-series prediction.	Apply (Level 3)
C332-3.4	Analyze the performance of different neural network architectures and optimization techniques through experimentation and comparative studies.	Analyze (Level 4)
C332-3.5	Critically assess the limitations and strengths of deep learning in handling complex data and compare it with traditional neural network in terms of scalability and performance.	Evaluate (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction, Knowledge representation	Concept of computing systems, Soft computing vs. Hard computing, characteristics and applications of soft computing, methods of Knowledge representation.	5
2.	Fuzzy Inference System with applications	Fuzzy sets, operations of fuzzy sets, membership functions,Fuzzy relations, rules and fuzzy inferences, Defuzzification techniques, Fuzzy expert systems. Application of fuzzy logic.	8
3.	Introduction to Artificial Neural Network	Fundamentals, Evolution of neural network, Basic models of Neural networks, Terminologies of ANNs, McCulloh – Pitts Neuron, Single Layer Perceptron, Multi-Layer Perceptron Activation Functions (Linear, Sigmoid, Tanh, Relu, Leaky ReLu), Loss Functions, optimization techniques (Gradient Descent, Stochastic Gradient Descent, Mini Batch Gradient Descent, ADAM, RMSProp, AdaGrad, Nadam).	12
4.	Supervised Learning Models	Feedforward, Back Propagation Network, batch normalization, one hot, dropout, embedding, CNN, word to vec conversion (continuous bag of words, skip gram), evaluating word representation, LSTM.	9
5.	Unsupervised Learning Models	Boltzmann machines, autoencoders, encoder-decoder, variational autoencoder, convolutional autoencoder, Generative Adversial model	8
Total number of Lectures			**42**

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = 10, Class Test/Quizzes/Internal Assessment/Mini Project=15)
Total	**100**

Project Based Learning: Each student in a group of 3-4 will develop one intelligent application using some real time dataset and explaining the real time usage of the developed application. Also the application to be assessed based on the performance metrics and optimization techniques.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text Books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Books	
1.	S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd, 2007.
2.	Simon Haykin, Neural Network: A comprehensive foundation, Pearson Education Asia (Adisson Wesley), 2003.
3.	David E. Goldberg, Genetic Algorithm in Search Optimization and Machine learning, Pearson Education Asia (Adisson Wesley), 2000.
4.	Mohamad H. Hassoun, Fundamentals of Artificial Neural Networks, The MIT Press, 1995.
5.	George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, PHI 1995.
6.	B. Yegnanarayana, Artificial Neural Networks, PHI, 2009.
7.	Timothy J. Ross, Fuzzy logic with engineering applications. John Wiley & Sons, 2009.
Reference Books, Journals, Reports, Websites etc. in the IEEE format	
8.	IEEE Transactions on Evolutionary Computation
9.	IEEE Transactions on Fuzzy Systems
10.	IEEE Transactions on Neural Networks
11.	IEEE Transactions on Pattern Analysis and Machine Intelligence
12.	ACM Transactions on Intelligent Systems and Technology

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS320	Semester Even (specify Odd/Even)	Semester VI Session 2023 -2024 Month from: Jan to June 2024
Subject Name	Open source software development		
Credits	4	**Contact Hours**	3-0-0

Faculty (Names)	Coordinator(s)	Prashant Kaushik(J62), Shariq Murtuza(J128)
	Teacher(s) (Alphabetically)	J62 – Prashant Kaushik J128 – Shariq Murtuza

COURSE OUTCOMES		COGNITIVE LEVELS
C332-4.1	Understand the benefits of using Open Source Software and key concepts.	Understand Level (Level 2)
C332-4.2	Understand the application of open source repository for collaborative development and version control.	Understand Level (Level 2)
C332-4.3	Understand the Linux Architecture, and its utilities used in Open Source Software Development.	Understand Level (Level 2)
C332-4.4	Understand the concept of Virtualization and cloud computing using open source tools.	Understand Level (Level 2)
C332-4.5	Develop applications using the open source language and tools.	Create Level (Level 6)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Open Source Software	What is Open Source Software, What Is Proprietary Software, Pragmatism vs Idealism, History of Open Source Software, Open Source Governance Models, Advantages of OSS, Contributing to OSS Projects, Tips for Successful Contributions, Continuous Integration, OSS Licenses and Legal Issues, Patents and Licenses, Leadership vs. Control, Diversity in OSS	2
2.	Linux tools for a developer	Introduction to Linux, its Kernel and Other System Components, Linux File System, Editing Tools – gedit, vi, emacs, Manual Pages, Linux Commands – cat, ps, top; File and Directory Management commands, grep, wc, sort, ls, head, tail, env, netstat, ip, pwd, chmodetc.,AWK,SED, SHELL Scripting, GCC, JVM, ECLIPSE, NETBEANS	10
3.	Git for distributed development	Introduction to GIT, its installation and usage, Working with GIT, Common GIT Commands, Creating Repositories, Creating a Commit, GIT Fork, Merge, Pull, Push, Clone; Merge Conflicts, Version Control	2
4.	Python and its libraries	Introduction to python, Python programming, Python libraries: NumPy, SciPy, Ipython, Pandas, matplotlib, Dash,Scikit-Learn, keras/tensorflow,PyTorch,OpenCV python	10
5.	Open Source Tools for Web Development	Open Source Web Development Tools, Web Development Framewroks and their Configurations, Web Servers.	5

6.	Virtualization and Cloud Computing	Introduction to Virtualization – OS Network and Memory, Dockers and Containers, Introduction to Hypervisors, working of hypervisors, Types of Virtual Machine, Creating a Virtual Machine. Cloud Computing overview and history, OpenStack Overview & History, High Level Overview of OpenStack Architecture, Architecting & Implementing OpenStack Deployment, Horizon dashboard.	10
7.	Case Studies: Popular Open Source Software	Study Popular Open Source Software, their Architecture, Development Time-Line, Challenges, Communities	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Mini Project(5),Tutorial(5),Assignments(5))
Total	**100**

Project based learning: The students will work in a group of 3 members. In the mini-project, students will be able to develop applications in either domain - General Purpose Applications, Web-applications, and Cloud using OpenStack. Further they will be able to explore various open source tools and techniques. used in different domains like data-science, cloud computing, machine learning and AI 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)
	Text Book(s):
1.	Fogel, Karl. *Producing open source software: How to run a successful free software project.* " O'Reilly Media, Inc.", 2005.
2.	Brown, Amy, and Greg Wilson. *The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks.* Vol. 1. Lulu. com, 2011.
3.	Greg DeKoenigsberg, Chris Tyler, Karsten Wade, Max Spevack, Mel Chua, and Jeff Sheltren*, Practical Open Source Software Exploration.* Edition 0.8
	Reference Book(s) and Other Reading Material:
4.	Chacon, Scott, and Ben Straub. *Pro git.* Springer Nature, 2014.
5.	Peterson, Kevin. *The github open source development process.* url: http://kevinp. me/github-process-research/github-processresearch. pdf
6.	Shotts, William. *The Linux command line: a complete introduction.* No Starch Press, 2019.
7.	William "Bo" Rothwell .*Linux for Developers: Jumpstart Your Linux Programming Skills*, Publisher(s): Addison-Wesley Professional
8.	Portnoy, Matthew. *Virtualization essentials.* Vol. 19. John Wiley & Sons, 2012.
9.	Chisnall, David. *The definitive guide to the xen hypervisor.* Pearson Education, 2008.
10.	Pepple, Ken. *Deploying openstack.* " O'Reilly Media, Inc.", 2011.
11.	Jackson, Kevin. *OpenStack cloud computing cookbook.* Packt Publishing Ltd, 2012.
12.	Lutz, Mark. *Programming python.* " O'Reilly Media, Inc.", 2001.
13.	McKinney, Wes. "pandas: a foundational Python library for data analysis and statistics."*Python for High Performance and Scientific Computing* 14, no. 9 (2011).
14.	Oliphant, Travis E. *A guide to NumPy.* Vol. 1. USA: Trelgol Publishing, 2006.
15.	Tosi, Sandro. *Matplotlib for Python developers.* Packt Publishing Ltd, 2009.
16.	Naramore, Elizabeth, et al. *Beginning PHP5, Apache, and MySQL web development.* John Wiley & Sons, 2005.
17.	Lee, James, and Brent Ware. *Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP.* Addison-Wesley Professional, 2003.
18.	Swain, Nathan R., et al. "A review of open source software solutions for developing water resources web applications."*Environmental Modelling & Software*67 (2015): 108-117.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS321	Semester: Even (specify Odd/Even)	Semester VI Session 2023-24 Month from **January** to **June 2024**
Course Name	Concepts of Graph Theory		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	Coordinator(s)	Dr.DhanalekshmiGopinathan (J62),Dr.Shruti Gupta(J128)
	Teacher(s) (Alphabetically)	Dr.DhanalekshmiGopinathan (J62),Dr.Shruti Gupta(J128)

COURSE OUTCOMES		COGNITIVE LEVELS
C332-5.1	Describe the fundamental concepts in graph theory	Understand Level(Level 2)
C332-5.2	Explain the procedure to store graphs and way to access them	Understand Level (Level 2)
C332-5.3	To apply graph theory based tools in solving practical problems	Apply Level (Level 3)
C332-5.4	Analyze various graph theories based on distinct mathematical principles.	Analyze Level (Level 4)
C332-5.5	Evaluate or synthesize any real world applications using graph theory.	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Fundamental Concepts, Graph representations, Graph Isomorphisms, Subgraphs, Complement of a Graph	3
2.	Graph Traversing	DFS, BFS, Shortest paths, Optimal tours, Cycle detection, Euler's Cycle, Hamiltonian Cycle, TSP, etc.	5
3.	Applications of Trees	Trees and concepts, Spanning Tree, Minimum spanning Tree, Prims and Kruskal, Applications	4
4.	Connectivity and Traversability	Connectivity Properties and Structure, de Bruijn Graphs and Sequences, Chinese Postman Problems, Further Topics in Connectivity	5
5.	Dual and Graph Planarity	Combinatorial vs. Geometric Graphs, Planar Graphs, Kuratowski's Graph, Planarity detection, Geometric duality, Thickness and crossing	5
6.	Coloring & Applications	Chromatic number, portioning, polynomial, Edge Coloring, Vertex coloring, Four color problem, Algorithms for Graph Coloring, Applications in Storage management, Timetable schedules	7

7.	Matching and Covering	Graph Matching, Matching algorithms, Applications; Covering properties, procedure, applications	4
8.	Extended Graph Theory	Algebraic Graph Theory, Spectral Graph Theory, Topological Graph Theory, Analytic Graph Theory	5
9.	Network Flow Graph	Flows in transportation networks, max-flow min-cut theorem, Maximum flow algorithm, Revisiting theorems	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Assignments and Mini Project)
Total	**100**

Project Based Learning: Students in a group of 3-4 will take some real-world problem and apply Graph logics to solve the problem in a meaning way. Students can able to understand the core logic about data sharing and retrieval using Graph centric approach.

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.	Koh Khee Meng, Dong Fengming, Tay Eng Guan, Introduction to Graph Theory, World Scientific Press, 2014
2.	Jonathan L Gross, Jay Yellen, Ping Zhang, Handbook of Graph Theory, Second Edition, CRC Press 2013
3.	Krishnaiyan "KT" Thulasiraman, Handbook of Graph Theory, Combinatorial Optimization, and Algorithms, CRC Press 2016
4.	Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, Reprint 2016
5.	Jean-Claude Fournier, Graph Theory With Applications, Wiley 2013

DETAILED SYLLABUS AND EVALUATION SCHEME

CourseCode	21B12HS311	Semester:EVEN (specify Odd/Even)	Semester:VI Session:2023-24 Month from: Jan-June
CourseName	Development Issues and Rural Engineering		
Credits	03	ContactHours	2-1-0

Faculty(Names)	Coordinator(s)	Dr.Amandeep Kaur
	Teacher(s) (Alphabetically)	Dr. Amandeep Kaur amandeep.kaur@mail.jiit.ac.in

COURSE OUTCOMES		COGNITIVE LEVELS
C304-10.1	Understand the concept, philosophy and determinants of rural development	Understanding Level- (C2)
C304-10.2	Explain the role of local self-governance in planning and development of rural areas.	Understanding Level- (C2)
C304-10.3	Examine the role of public policies related to rural development	Analyze Level –(C4)
C304-10.4	Analyze the impact of recent policy changes and schemes on rural development.	Analyze Level –(C4)
C304-10.5	Evaluate the issue and challenges through possible determinants of rural development.	Evaluation Level- (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Rural Development: An Introduction	Rural Development Philosophy, Concepts, Principles, Traditional and Modern Concept of Development, Trends and Pattern of micro as well as macro indicators of Rural Development.	4
2.	Public Policies and Rural Development	Policies related to Employment Generation, Poverty Reduction, Skill Development and Infrastructure such as MGNGEGA, DDUGKY, AtamNirbhar Bharat rojgaryojna and schemes related to MSMEs etc.	6

3.	Rural Development Administration and Panchayat Raj Institutions	Rural Development administration: Panchayat Raj System (73rd Amendment Act), functions of Panchayat Raj System, Financial Distribution of Resources in Rural India through Panchayat Raj System, merits and demerits of Panchayat system, Ways to strengthen the existing system by overcoming the flaws.	6
4.	Rural Development Issues and Challenges	Issues and challenges of Rural development: Employment in line with sectoral distribution (GDP and Employment), Poverty and Migration Issue, Rural and Urban Consumption and Production Linkages.	7
5.	Recent Advancements and changes	Recent packages and schemes implemented in Rural India, Budget Allocation for Rural Development -2022-23 and 2023-24: For Employment Generation, poverty reduction, infrastructure and MSMEs.	5
Total number of Lectures			**28**

Evaluation Criteria

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

Project-based Learning: Students are required to collect the data related to different indicators of rural development (related to agriculture, health and education infrastructure, literacy levels, population density, poverty, employment etc.). They also need to check the compatibility of data (data mining and data refining process) and then analyse the contribution of these indicators in rural development of particular state/country as whole. Moreover, they are required to analyse the extent of progress and failure of programmes/schemes implemented in rural areas for poverty reduction, employment generation and MSMEs. Collecting information and analysing the data related to development indicators and policies will upgrade students' knowledge regarding the development issues and strengthen their skills to tackle multiple data handling and measuring issues.

Recommended Reading material:	
1.	**Singh, Katar.** Rural Development: Principles, Policies and Management *(3e)*.2009
2.	**Coke, P., Marsden, T. and Mooney, P.** Handbook of Rural Studies. Sage Publications, 2006
3.	**Todaro, M.P.**, **Stephen C. Smith,** Economic Development, Pearson Education, 2017
3.	**Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4.	**Musgrave, R. A., Musgrave, P. B.,** Public Finance in Theory and Practice, McGraw Hill Education,2017

Detailed Syllabus
Lecture-wise Breakup

Course Code	23B18HS311	Semester Even (specify Odd/Even)	Semester Session 2022-2023 Month from February to July
Course Name	Introduction to Workplace Communication (Value added)		
Credits	0	Contact Hours	1-0-2

Faculty (Names)	Coordinator(s)	Dr. Ekta Singh
	Teacher(s) (Alphabetically)	Dr. Ekta Singh

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
CO1	Describe different types of communication and how they are used in the workplace	Understanding level(C2)
CO2	Understand the impact that communication can have on how people are perceived by others	Applying level (C3)
CO3	Recognize the skills required for effective communication	Analyzing level(C4)
CO4	Identify how effective communication can overcome challenges in the workplace	Evaluating level(C5)
CO5	Reflect on current interpersonal communication skills and how these can be developed and used more successfully.	Creating (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures
1.	Introduction to Work Place Communication	Concept and mechanism of communication, understanding of effective communication at work place, understanding corporate communication and its importance, Different levels of communication at workplace, Different kinds of communication employed inworkplace	3
2.	Written Communication Skills	Effective and appropriate use of email, email etiquettes, report writing, memo writing, proposals and questionnaire, preparation of PowerPoint presentation slides, common grammatical errors, outlining before writing and document design	4
3.	Oral Communication Skills	Non-Verbal Communication and Cultural Competence, Public speaking vs. Small group communication, Interpersonal Communication, Interview etiquette	2
4.	Team Work	Contribution to Teams, Communication with peers, managers, clients and customers, Active participation in meetings, Professional conduct	2
5.	Visual and Electronic Communication Skills	Introduction to Visual and electronic communication, Producing Visual aids, writing effective text messages, Usage of Multimedia, Video calls etiquettes, various tools and software used	3
Total number of hours			**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1	**Introduction to Work Place Communication**	Introduction in an Interview Spread the Word Exercise	**CO3** **CO2**
2	**Written Communication Skills**	Effective Email Writing Listen and Write	**CO3** **CO5**
3	**Oral Communication Skills**	Mock Interview Customer – Service Provider Interaction	**CO5** **CO4**
4	**Team Work**	Heard, Seen, Respected Conflict Resolution	**CO1** **CO4**
5	**Visual and Electronic Communication Skills**	Online Briefing Session Online Meeting Etiquette	**CO1** **CO3**

Evaluation Criteria

Components	**MaximumMarks**
Midtermexamination	30
EndSemesterExamination	40
TA	30 (Technical presentation, class participation,Project)
Total	**100**

Project Based Learning: Students form a group of 4-5 students. Each group is required to choose an internal communication case study of corporate organizations which shows and describes the cost of poor communication. Students are required to:

1- Present the case and reflect on the related communicationbarriers
2- Submit a report on the same

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.	P. M. &. R. A. Luecke, Interpersonal Communication Skills in the Workplace, United States of America: American Management Association, 2008.
2.	D. L. Lewis, Effective Communication in the Workplace: A Practical Guide to Improve Interpersonal Communication in the Workplace for Better Environment, Client Relationships, and Employee Engagement, Independently Published, 2019.
3.	D. L. Lewis, Effective Communication in the Workplace: A Practical Guide to Improve Interpersonal Communication in the Workplace for Better Environment, Client Relationships, and Employee Engagement, Independently Published, 2019.
4.	Barun K. Mitra, Personality Development & Soft Skills, Oxford University Press, New Delhi, 2012.
5.	L. M. &. M. Valo, in *Workplace Communication*, vol. 1, New York, Routledge, 2019.
6.	M. S. &. A. Aira, "Technology-Mediated Communication in the Workplace," in *Workplace Communication*, New York, Routledge, 2019. [5]
7.	J. Mizrahi, Writing for the Workplace: Business Communication for Professionals, Business Expert Press, 2015.
8.	Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
9.	S. Kumar and PushpLata, Communication Skills, Oxford University Press,1st, Ed. 2011
10.	Raman M. and S. Sharma, Technical Communication: Principles & Practices, 29th Impression, Oxford University Press, New Delhi, 2009

Course Code	**24B12HS311**	Semester: Even (specify Odd/Even)	Semester: 5th Session: 2023 -2024 Month from: January-June
Course Name	**Investment management**		
Credits	03	Contact Hours	2-1-0

Faculty (Names)	Coordinator(s)	Dr.Purwa Srivastava
	Teacher(s) (Alphabetically)	DrPurwa Srivastava

COURSE OUTCOMES		COGNITIVE LEVELS
C206-11.1	To Understand and getting acquainted with the securities market and its investment instruments.	Understand (C2)
C206-11.2	To Apply the concept of fundamental analysis of company and Investment Planning	Apply (C3)
C206-11.3	To Analyze the relationship between risk and return by applying various models	Analyze (C4)
C206-11.4	To Evaluate the value of financial assets, equities and bonds.	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	**Introduction to Financial Investments**	Concept and Definition of Investment – Investment Decision and Process – Types – Investment Vs Speculation-Role of Speculator – Source of Investment Information –Opening Demat account -Securities Market-Primary and Secondary Market –Stock Exchanges – Investment Planning and investment avenues	6
2.	**Fundamental Analysis**	**Economic analysis** -Factors in Domestic and International economy – **Industry Analysis**: Industry classification schemes –Classification by product and according to business cycle – Key characteristics in industry analysis – Industry life cycle – Sources of information for industry analysis.**Company Analysis**: Sources of information for company analysis (Internal, External) – Factors in company analysis – Operating analysis – Management analysis – Financial analysis – Earnings quality.	5
3.	Basic Concepts and Methods	Capital Asset Pricing Model - Assumptions – Inputs Required for Applying CAPM, The Capital Market Line - Security Market Line, Pricing of Securities with CAPM. Arbitrage pricing theory (APT).	5
4.	Equity Valuation	Equity Valuation: Balance Sheet Techniques- Book value, Liquidation value, Replacement cost. Discounted Cash Flow Techniques: Dividend discount model, Free cash flow model. Relative Valuation Techniques: Price-earnings ratio, Price-book value ratio, Price-sales ratio.	5
5.	Bond Valuation	Overview of fixed-income securities – Risk factors in fixed-income securities (Systematic and unsystematic) – Bond analysis – Types of bonds – Major factors in bond rating process – Bond returns – Holding period return - Concept of yield – Current yield – Yield-to-Maturity – Price-yield relationship – Convexity - Term structure of interest rates and yield curve – Duration - Valuation of preference shares.	7
Total number of Lectures			**28**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (assignments, class test, project)
Total	**100**

Project-based learning- The student will be given a group project to do the fundamental analysis of one Industry. They will perform economic analysis, Industry analysis and company analysis. Basis this analysis they will shortlist top five companies fit for investing in that particular sector. They will prepare a rating chart for the companies for the top companies selected for investing.

	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.	Luenberger, D. G. (2017), Investment Science,Oxford University Press.
2.	Bodie, Kane, and Marcus (2019), Investments,McGraw Hill.
3.	Damodaran, A.(2014), Applied Corporate Finance, Wiley India
4.	ZviBodie, Alex Kane, Alan J Marcus, Pitabas Mohanty (2014) Investments, (10th Edition), Tata McGraw Hill.
5.	Punithavathy Pandian, Security Analysis and Portfolio Management, Vikas Publishing House Pvt. Ltd.
6.	Jordan, R. J, and Fisher, D. E: (1995), Security Analysis and portfolio, (6th Edition), Pearson.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**24B12HS312**	Semester Even	Semester: VI
			Session: 2023-2024
			Month from Jan 2024 to June2024

Course Name	**FILM STUDIES**		
Credits	**3**	**Contact Hours**	**2-1-0**

Faculty (Names)	**Coordinator(s)**	Dr Mohammed Danish Siddiqui
	Teacher(s) (Alphabetically)	Dr Mohammed Danish Siddiqui

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
CO1	Label with knowledge and reflect upon the articulation of a film's content, form and structure and genre	Remembering level(C1)
CO2	Demonstrate the formal and stylistic elements of film and extend an understanding of film language and terminology, and analyze the ways in which that this language constructs meaning and ideology	Understanding level(C2)
CO3	Applying Critical film theories to be able to identify significant movements and articulate key concepts.	Applying level (C3
C04	Discover the familiarity with diverse forms of the moving image, including, for example, the feature film, experimental and avant-garde cinema, video art and moving image installation, television, and digital media	Analyzing level(C4)
C05	Evaluate film forms and its historical and cultural contexts. Explain how a film offers a set of social, political, and cultural ideas and questions through form and content	Evaluating Level (C5)
CO6	Develop a competency in discussing the ways in which film is influenced and shaped by individuals, movements, institutions, and technologies with local, national, transnational, and global dimensions	Creating level(C6)

Modul e No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction of Film and Film Theorists	History of Film: role of Film in human culture, elements of film, Film Theories and Theorist, Language of Film, Camera, and its Language.	5
2.	Components of Cinema	Color meaning in Cinema, Film Genre, Editing, Intertextuality, History of Cinema: German Expressionism, Aesthetics of Neo -Realism, French new wave, Concept of Third Cinema, Film Noir, Indian cinema, OTT Platforms: NETFLIX, Amazon Prime Video, Disney Hot Star, EROS	5
3.	Critical Film Theory	An Introduction to Critical Film Theories, Apparatus theory, Screen theory, Queer Theory, Cognition, Auteur theory, Mise En Scene, Male Gaze	5
4.	Reception of Film	Film and reception theory, Spectatorship as bridge,	2
5.	Film Reading	Bride and Prejudice, Gone with the Wind, Avatar: The way of Water	6
6	Essays on Film	Andrea Bazin: The Evolution of the Language of Cinema Gilbert Harman: Semiotics and the cinema Laura Mulvey: Visual Pleasure and the Narrative Cinema Bill Nicholas: The Voice of the Documentary	5
		Total number of Lectures	**28**

PBL Component: The Project is to be done in a group of 3-4 Students. Students will be asked to write a Proposal with a well-researched technical report on the nature and critical appraisal of film by identifying the themes and purpose of film and its elements and its application in the real world**.**

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.	Vallejo, Amy, Film Studies: The Basics, Routledge London, and New York 2005.
2.	Joret Blandine: Studying Film with Andre Bazin, Amsterdam university Press
3.	Nelmes, Jill: An Introduction to Film Studies, Routledge London 1998.
4.	Doughty Ruth and Deborah Shaw: FILM ---The Essential Study Guide, Routledge London and New York 2009.

Evaluation Criteria

Components	Maximum Marks
Test 1	20
Test 2	20
End Term	35
TA	25
Total	100

Detailed Syllabus
Lecture-wise Breakup

Course Code	24B16HS311		Semester: Even, VI	Semester: VI Session: Even, 2023-24 Month: January- June 2024
Subject Name	**Basics of Creative Writing (Value Added Course)**			**NBA Code: C305-16**
Credits	**2**		**Contact Hours**	**L-T-P (1-0-2)**
Faculty (Names)	**Coordinator(s)**		Dr Harleen Kaur	
	Teacher(s) (Alphabetically)		Dr Harleen Kaur	

COURSE OUTCOMES: The students will be able to:		COGNITIVE LEVELS
C305-16.1	Explore the creative process through writing in different genres	Understand (C2)
C305-16.2	Develop an ability to critique constructively	Apply (C3)
C305-16.3	Synthesize the coherent and cohesive devices by using transition markers	Analyze (C4)
C305-16.4	Evaluate different forms of creative writing	Evaluate (C5)
C305-16.5	Employ to write clearly, effectively, and creatively by using appropriate style as per content and context	Create (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	General Principles of Writing	● Introduction to writing ● Understanding creativity in writing ● Discovering the joy of writing ● Essentials of creative writing	3
2.	Essentials of Language Usage	● Language, Syntax and Figures of Speech ● Imagery, Motifs and Symbols ● Punctuation and Spellings	3
3.	Developing Ideas into texts	● Plot, Character and Dialogue ● From creative thoughts to expression ● Editing and Rewriting	3
4.	Structure of Creative Writing	● Coherence ● Cohesion ● Ways to attain unity	3
5.	Modern forms of Creative Writing	● Writing for mainline media ● Book Reviews ● Writing for the web	2
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	No of Lab Sessions (in hours)	CO
1.	Hands on process of Pre-writing	Students will be divided into groups. The students will be given a current topic after discussion with them and they will be assigned the following devices to write on the given topic: ● Freewriting ● Listing ● Cluster ● Mindmapping After completion of above-mentioned processes, the group will present their ideas in front of everyone.	6	CO1
2.	Idea Generation/ Brainstorming	The teacher will ask students to bring a few excerpts of their favourite fiction /Non-Fiction and they will be asked to use the following devices in the chosen text to create a new plot: **S** – Substitute **C** – Combine **A** – Adapt **M** – Modify **P** – Put to another use **E** – Eliminate **R** – Reverse	6	CO2
3.	Structuring Ideas and Writing	The students will be asked to structure their ideas in a coherent way and reproduce the same in following forms: ● Twitterature ● Flash Fiction The twitterature will allure them reproduce the ideas in very precise form of 160 words whereas Flash fiction will allow them to write within 1000 words.	6	CO3
4.	Developing a story	The students will be asked to write a story on the same topic by using the following different devices: ● Developing a story ● Inductive to Deductive ● Deductive to Inductive ● Spatial to Chronological ● Chronological to Spatial	4	CO4
5.	Experimental pieces	The students will be asked to write profiles, book review and blogs and travelogues to share their experience.	6	CO5
Total number of Lab Hours				28

Evaluation Criteria

Components	Maximum Marks
Mid Term	30
End Term	40
TA	30 (PBL, Script writing, End term stage performance)

Project Based Learning:
Students, in groups of 4-5, are required to re-write a novella using the SCAMPER Technique.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
Text Book(s):	
1.	Steele, Alexander Ed.: Writing Fiction: the Practical Guide from New York's Acclaimed Creative Writing School, Gotham Writers' Workshop, 2003.
2.	King, Stephen: On Writing: A Memoir of the Craft, Pocket Books, 2002.
Reference Book(s):	
3.	Lamott, Anne: Bird by Bird: Some Instructions on Writing and Life, Goodreads Author,1995
4.	Goldberg, Natalie: Writing Down the Bones: Freeing the Writer Within, Shambala, 2006.
5.	Browne, Rennie: Self-Editing for Fiction Writers: How to Edit Yourself Into Print ,William Morrow Paperbacks, 2004.
6.	Atwan, Robert and Forer, Bruce: Why we Write: a thematic reader, Harper and Row, 1986.
7.	DiYanni, Robert: Twenty-five great essays, Longman, 2001.
8.	Daniels, David I.,Goldstein, Janet M.,Hayes, Christopher G.:A Basic Reader for College Writers, 1989
9.	McQuade, Donald, Atwan, Robert: Thinking in Writing: Structures for Composition, Knopf, 1998.

Course Code	15B1NHS831	Semester Even (specify Odd/Even)	Semester VI Session 2023-2024Month fromJan-June	
Course Name	Effective tools for Career Management and Development			
Credits	3		Contact Hours	2-1-0

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

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand one's personal priorities, skills, interests, strengths, and valuesusing a variety of contemporary assessment tools and reflection activities.	Understand Level (C 2)
CO2	Apply knowledge of all the Career Stages in managing career effectively.	Apply Level (C 3)
CO3	Examine and maximize one's potential for achieving the desired career option.	Analyze Level (C4)
CO4	Develop the competencies required by the job market	Create Level (C 6)

Module No.	Title of the Module	Topics in the Module	No. of Lecturesand Tutorial for themodule
1.	Introduction to Career Development	Introduction to Professional Career Development-Role and importance of human resource in an organization, Introduction to Career Planning: Self-Concept.	4 (CO1)
2.	Self-Assessment and strategies for Recruitment and Selection	Introduction to complete cycle of Recruitment and Selection, various tools used for assessment and testing candidates-aptitude test, personality test etc. Introduction to Workforce planning, Job Analysis, Job Description and Job Specification.	6 (CO3)
3.	Self-Branding, Social Media and Personnel Development	Pitch your Brand (Elevator pitches and their use), Personal Branding, creating a Positive Professional Image (Business etiquette) – Social Media and your online image, Using Social Media to Find Job. Introduction to various techniques used for learning and development, training effectiveness, Transactional Analysis-Parent, Adult and Child Ego States.	6 (CO3)
4.	Managing Career -Performance Review and Compensation	Transitioning from college to work Strategies to thrive at work- Performance Management: Key Result Areas, Key Performance Indicators, Different Performance Review Methods. Compensation Strategy and trends- Compensation package, ESOPs, Performance based pay, Recognition, and Rewards.	6 (CO2)

5.	Individuals and Job Markets	The New Employment Reality and Job Market Trends, Developing Competencies and Abilities, Human Resource Management Practices in India, Internationalization of Human Resource Management Commonly UsedJargons.	6 (CO4)
		Total number of Lectures	**28**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Term TA	35
Total	25(Class Mock Activities, Project, Assignment, Quiz)
	100

Project Based Learning:

Students, in groups of 3-4, are required to select a company that has come for Campus placement at JIIT, Noida. Students have to study the Recruitment and Selection process of the Company selected. The information can be collected with the help of an interview or some kind of questionnaire pertaining to the Recruitment and Selection process from seniors who have been placed in the givencompany.

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.	Joshi, Campus to Corporate, Your Roadmap to Employability, Sage Publications India Pvt. Ltd., 2015
2.	Mathur, Mastering interviews and group discussions, CBS Publishers& Distributors Pvt. Ltd., New Delhi, 2018
3.	Mitra, Personality Development and soft skills, Oxford University Press, New Delhi, 2011
4.	Pareek and Purohit, Training Instruments in HRD and OD, Sage Publications India Pvt. Ltd., 2018
5.	Pande and Basak, Human Resource Management- Text and Cases, Pearson, 2012
6.	Dessler and Varkkey, Human Resource Management, Pearson, 2011