Detailed Syllabus
Lecture-wise Breakup

Subject Code	15B22CI521	**Semester Even (specify Odd/Even)**	**Semester** Even **Session** 2022 - 23 **Month from** January to June
Subject Name	Cloud based Enterprise Systems		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Bharat Gupta	
	Teacher(s)	Bharat Gupta	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Differentiate between Public, Private, and Hybrid Clouds	Understand Level (Level 2)
CO2	Develop Enterprise applications based on XML, JavaScript, Java Servlets, Java Server Pages, etc.	Apply Level(Level 3)
CO3	Develop web service based solutions by using REST, JSON, SOAP, etc.	Apply Level(Level 3)
CO4	Examine emerging technologies in cloud environment.	Analyse Level(Level 4)
CO5	Evaluate the performance of different Public Cloud Platforms e.g., GAE, AWS and Azure.	Evalute Level(Level 5)
CO6	Design and deploy Enterprise applications on one of the Cloud Service Providers, i.e., Amazon AWS or Microsoft Azure.	Create Level(Level 6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1	XML Programming	XML, DTD, XML schema, XPath, XQuery	6
2	Web services	REST, JSON,SOAP	6
3	JavaScript	Basic constructs, Conditional statements, Loop, External linking with .js, Browser related events	6
4.	Server Side programming	Java servlet, Java server pages	8
5.	Introduction to Cloud Computing	Public, private, and Hybrid clouds; Features of cloud platforms	4
6.	Public Cloud Platforms	Introduction to GAE, AWS and Azure; Programming support of Google App Engines, Amazon AWS, and Microsoft Azure; Emerging cloud software environments	7
7.	Apache Hadoop	Introduction to distributed computing, Map Reduce	3
8.	Virtualization	Virtualization structures/tools and mechanism, Virtualization of CPU, Memory and I/O devices	2
Total number of Lectures			42

Evaluation Criteria

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

- **Attendance/Tutorial Assessment/Quiz:10**
- **Mini-project in PBL mode:15**

Total	**100**

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

Text Book	
1.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing:A Hands-on Approach", Universities Press, 2014

References	
1.	David Clinton, "Learn Amazon Web Services in a Month of Lunches", MANNING, 2017
2.	https://www.w3.org/XML/
3.	https://aws.amazon.com/
4.	https://azure.microsoft.com/en-in/
5.	https://cloud.google.com/appengine/docs/
6.	John Pollock, JavaScript, 3rd Edition, Mc Graw Hill, 2011
7.	https://docs.oracle.com/javase/tutorial/jaxp/
8.	Elliotte Harold, W. Means,XML in a Nutshell, 3rd Edition, O'Reilly Media, 2009
9.	http://www.oracle.com/technetwork/java/javaee/jsp/index.html (JSP)
10.	https://docs.oracle.com/javaee/6/tutorial/doc/bnafd.html (Java Servlet Technology)
11.	https://www.heroku.com/

Detailed Syllabus
Lab-wise Breakup

Course Code	15B28CI581	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2022 -2023 **Month:** Jan- Jun 2023
Course Name	Cloud based enterprise systems lab		
Credits	1	**Contact Hours**	0-0-2
Faculty (Names)	**Coordinator(s)**	Mr. Kashav Ajmera	
	Teacher(s) (Alphabetically)	Ms. Deepti singh (J62), Mr. Kashav Ajmera (J62)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Create Server app and its modules	Create Level (Level 6)
C374.2	Develop multi core server apps	Apply Level (Level 4)
C374.3	Use nodejs for multi core apps	Apply Level (Level 4)
C374.4	Analyse the VMs for the cloud deployment	Understand Level (Level 2)
C374.5	Understand the cloud concept for App dev.	Evaluate Level (Level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	XML	Introduction to basic of XML: XML attributes XML tree and XML validation.	2
2.	Java Script	Introduction of JavaScript: JavaScript Variables, Control Statement and Loops in JavaScript JavaScript Functions, JavaScript Object.	2
3.	Java Servlet and JSP	Introduction to Java Servlet and JSP: servlet request. session tracking, event handling and listener.	2
4.	NodeJs	Introduction to NodeJs: File system, NPM, Events, upload files and email.	2
5.	AWS	Introduction to AWS cloud platform: S3, EC2, DynamoDB, RDS, VPC, and IAM.	4
6.	Virtual Machine	Introduction to virtual machine: Hypervisor, create VM, VM groups, networking, migration, and monitoring.	2

Evaluation Criteria	
Components	**Maximum Marks**
Eval 1	10
Lab test 1	20
Eval 2	10
Lab test 2	20
Day 2 Day	40 (Attendance, Assignments, Mini Project)
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 an application in either domain - General Purpose Applications or Web-applications and deploy it on the Cloud platform.

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.	Cloud Computing for Complete Beginners: Building and Scaling High-Performance Web Servers on the Amazon Cloud by Ikram Hawaramani
2.	AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud by Mike Rayan , 2018
3.	AWS Scripted: How to Automate the Deployment of Secure and Resilient Websites with Amazon Web Services VPC, ELB, EC2, RDS, IAM, SES and SNS by Christian cerri, 2014

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B19CI691	**Semester** Even **(specify Odd)**	**Semester** VI **Session** 2022-23 **Month from** January to June
Course Name	Minor Project-2		
Credits	2	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	HIMANI BANSAL, ANKIT VIDYARTHI
	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.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**18B13HS612**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2022-2023 Month from Jan-June**
Course Name	**Effective tools for Career Management and Development**		
Credits	**2**	**Contact Hours**	**1-0-2**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-2.1	Assess ones personal priorities, skills, interests, strengths, and values using a variety of contemporary assessment tools and reflection activities.	Evaluate Level (C 5)
C305-2.2	Apply knowledge of all the Career Stages in making informed career decisions.	Apply Level (C 3)
C305-2.3	Develop and maximize ones potential for achieving the desired career option.	Create Level (C6)
C305-2.4	Analyze the processes involved in securing and managing career by employees of different organizations.	Analyze Level (C 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures and Tutorial for the module**
1.	Introduction to Career Life cycle	Introduction to Career Life Cycle of an individual-Role and importance of human resource in an organization, Evolution of Strategic Human Resource Management.	3
2.	Self Branding and strategies to do well in Recruitment and Selection	Introduction to complete cycle of Recruitment and Selection, Introduction to various tools used for assessment and testing candidates-aptitude test, personality test, graphology test etc. Introduction to Workforce planning, Importance and practical application of Job Analysis, Job Description and Job Specification.	3
3.	Personnel Development and your career	Introduction to various learning and development, Introduction to various techniques used for learning and development, measure of training effectiveness, Training techniques / delivery, Kirkpatrick Model, Introduction to Succession Planning, Transactional Analysis.	3
4.	Human Resource Evaluation and Compensation	Performance Management: Measurement Approach, Developing Job Descriptions, Key Result Areas, Key Performance Indicators, Assessment Centre, 360 Degree feedback, Balanced Scorecard, Effective Performance Metrics. Compensation Strategy and trends- Compensation package, ESOPs, Performance based pay, Recognition, Retrial benefits, Reward management, Team rewards.	3

5.	Human Resource Control and special topics	Human Resources Audit, The Human Resource Information System (HRIS), Human Resources Accounting, Competency Management, Human Resource Management Practices in India, Internationalization of Human Resource Management Commonly Used Jargons.	2
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Introduction to Career Life cycle	Practical Sessions on Resume and Cover Letter Writing	CO1, CO2
2.	Self Branding and strategies to do well in Recruitment and Selection	Practical Sessions on Job Description, Job Specification and Self-Branding, Psychometric self-reflection tools on Personal Orientation and behavior-Personal Efficacy, Personal effectiveness, Locus of Control, Emotional Intelligence and Assertiveness.	CO3, CO4
3.	Personnel Development and your career	Practical Sessions on Johari Window-Knowing Thyself, Transaction Analysis-Parent, Child, Adult Ego State for effective interpersonal communication.	CO1, CO3
4.	Human Resource Evaluationand Compensation	Practical Sessions on HR Interview and Mock HR Interview	CO2, CO4
5.	Human Resource Control and special topics	Practical Sessions on Group Discussions and Mock Group Discussions	CO2, CO4

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30 (Project)
End Term	40 (Written)
TA	30 (Class Mock Activities, Assignment, Quiz)
Total	**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 given company.

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

Detailed Syllabus
Lecture-wise Breakup

Subject Code	15B22CI622	Semester (specify Odd/Even)	Semester 6th Session EVEN Month from Jan'23- Jun'23
Subject Name	MOBILE APPLICATION AND INTERNET OF THINGS		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. K. Rajalakshmi
	Teacher(s) (Alphabetically)	Dr. Arpita Jadhav Bhatt Dr. K. Rajalakshmi

COURSE OUTCOMES		COGNITIVE LEVELS
C315.1	Understand the basics of Mobile Technology, Mobile Operating Systems, Android OS and Android Studio	Understanding (Level 2)
C315.2	Demonstrate the android application elements, life cycle user interface of Android Applications.	Apply (Level 3)
C315.3	Analyze different Android application development concepts like UI design, views, data passing and intents , fragments etc.,	Analyze (Level 4)
C315.4	Analyze various data handling techniques using SQLite, data parsing and location based services	Analyze (Level 4)
C315.5	Analyze the integration of Android applications with IoT devices	Analyse (level 4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction of Mobile Technology ,Android, Android OS	Introduction of Mobile Technology: History of mobile phones, Evolution of Mobile Technology. **Introduction to Java Enabled Mobiles**: Micro Edition, J2ME. Introduction to Android: History, Danger, Android Inc, HTC Sooner, T-Mobile G1. **Introduction to Mobile OS:** Android, iOS, Windows Mobile OS, Blackberry **Introduction to Software's and Tools:** Android Studio. **Introduction to Android Building Tools:** Java, JDK, JRE, Android SDK,	6

		Android Developer Tools. Setting up Android Environment, **Android Architecture.:** Overview of the Stack , Linux Kernel , Native Libraries , Dalvik Virtual Machine, Android Virtual Machine (ADT), Dalvik Debug Monitor Server (DDMS), LogCat, Application Framework, Application Licensing, Gradle.	
2.	Introduction to Android Development, Android Life Cycle, User Interface,	**Introduction to Android Development:** Android Core Building Blocks, Android Emulator, AndroidManifest.xml, R.java file, uses-permission, Project Structure, Layout resource. **Android Life Cycle**: Activity, Intent, Android Menus, Layout Manger. **Hello World User Interface:** Working with Button, Toast, Button, Toggle Button, Switch Button, Image Button, Check Box, Alert Dialog,	6
3.	Event handling, View, Grid view, List view, Spinner	**Event handling:** Button handling, action listener, Spinner **View:** Grid View, Web View, Scroll View, Search View, Tab Host, Customization of Viewers (Grid, List, Spinner), **Adaptor:** Array Adaptor, **Services:** Overview of services in Android, Implementing a Service, Service lifecycle, Recycler View	6
4	Data Passing using Intents, objects, Fragments, Picker View	**Intents and objects:** Multiple activities switching **Fragment:** Fragment Lifecycle, Fragment Example **Picker:** Date and Time picker using Dialog Fragment	6
5.	Database handling in Android	**SQLite:** Create databases in android using SQLite , Handling database with content provider Creating Database and Data model, **Loader:** Implementing a Loader, Sqlite Database and Cursor Loader	6
6	Data Parsing, Location based Services	JSON Parsing, JSON objects, parsing JSON Array, Location based Services,	6

		integrating Google maps in Android app	
7.	Introduction to Internet of Things	Introduction to Internet of Things, Layers in IoT, IoT Communication Protocols at different layers, Design steps for IoT, IoT Enabling Technologies, IoT Levels.	4
8.	Internet Connecting Principles	Introduction to Arduino and Raspberry Pi, Connectivity with other components, internet connectivity, IP addressing in IoT, Media Access Control, and Application Layer Protocols: MQTT, CoAP, XMPP.	4
		Total number of Lectures	44

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments/Quiz(8), Attendance(10) ,PBL(7))
Total	**100**

Project based learning: Students form group of size 2-3 members. Each group will identify several real life issues in various thrust areas like healthcare, industrial, education, smart city, logistics, environment, governance and etc. Once problem has been identified, the group will analyze the problem and synthesize Mobile Application and IoT based solutions to the identified problem. Each group will apply different mobile device based approaches such as IOT smart sensor and heterogeneous devices. This approach will enhance skills of each student and increase the understanding of mobile application development in distributed applications. Moreover, candidate will gain the enough knowledge to provide the mobile based IoT solution to enhance the quality of life in human/organization. After this course, a student will able to undertake any work in this area in the industry or research.

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.	Hagos T. Android Studio IDE Quick Reference: A Pocket Guide to Android Studio Development. Apress; 2019 Jul 31.
2.	Micheal Burton, Android App Development for Dummies, 3/e, John Wiley & Sons, 2015, ISBN-13:978-1118387108. .
3.	Meier R, Lake I. Professional Android. John Wiley & Sons; 2018 Aug 23.
4.	Griffiths D. Head First Android Development: a brain-friendly guide. " O' Reilly Media, Inc."; 2017 Aug 9.
5.	Lauren Dracy, Shane Conder, Android Wireless Application Development-Advanced Topics, Volume II, Addison-Wesley Professional, 2012, ISBN-13:978-0321813848
6.	Joseph Annuzzi Jr, Advanced Android Application Development, Addison-Wesley

	Professional, 2014, ISBN-13:978-9332552012
7.	Erik Hellman, Android Programming: Pushing the Limits, John Wiley & Sons, 2014, ISBN-13:978-8126547197.
8.	5. Mark Wickham., Practical Android: 14 Complete Projects on Advanced Techniques and Approaches,1st edn, Apress, Jan 2018, ISBN-13: 978-1-4842-3333-7
9.	Internet of Things: A Hands-on Approach. United Kingdom: ArshdeepBahga& Vijay Madisetti, 2014.
10.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. United Kingdom: Pearson Education, 2017.
11.	The Internet of Things: Key Applications and Protocols. United Kingdom: Wiley, 2012.

Detailed Syllabus
Lab-wise Breakup

Subject Code	15B28CI682	**Semester:** Even	**Semester:** VI **Session :** 2022-2023 **Month from:** Jan to May 2023
Subject Name	Mobile Application And Internet Of Things Lab		
Credits	**1**	**Contact Hours**	**0-0-2**

Faculty (Names)	**Coordinator(s)**	Dr. Arpita Jadhav Bhatt
	Teacher(s) (Alphabetically)	Arpita Jadhav Bhatt, K. Rajalakshmi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C375.1	Understand the Android OS and fundamental concepts in Android Programming	Understanding (Level 2)
C375.2	Demonstrate various components, apply layouts and views in Android applications	Apply (Level 3)
C375.3	Develop Android applications to save and store data in SQL lite, sharing data, using services	Apply (Level 3)
C375.4	Design application using Android and Raspberry pi hardware and software tool kits.	Create (Level 6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Weeks (2 Labs per Week)**
1.	Introduction to Android app development and Android studio	Introduction to app development process and its platforms and development tools, Android Architecture, Versions Android operating systems, setting up the environment, SDK, Architectural components, creating simple Android applications, Activities, Intents and manifest files, Life cycles of an activity, working with intents, using intent object to link activities and types of intent, passing data using intents. Create Your First Android App: Overview of the development process - Java, Android Studio, Project layout in Android Studio, Target and minimum SDKs, Android Virtual Device (AVD) Monitor, Viewing	2 Weeks

		logs in logcat and AVD, Android manifest file, App Architecture.	
2.	Basic UI design, Views and View Groups, Adapters	Form widgets, Text Fields, Layouts, Types of Layouts, Views and View Groups, Textview, EditText, XML layouts, Image View, List View, Grid View, Spinners Navigation bar, tab bar, user inputs like swipes, pinch, zoom etc. Adapters, ArrayAdapters, BaseAdapters, ListView and ListActivity, Custom listview, GridView using adapters	2 Weeks
3.	Event Handling	Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Handling buttons and action listener methods and events, performing simple operations with button	2 Weeks
4.	Data passing between activities using intents, Picker View (Date and time)	Intent types, working with intents, using intent object to link activities and types of intent, passing data using intents, Develop an app for demonstrating the communication between Intents, Picker views	2 Weeks
5.	Data base handling using SQLite	Sqlite introduction, database Create, Retrive, Update, delete operations, backup of DB's, SQLiteOpenHelper ,SQLiteDatabase	2 Weeks
6.	XML parsing , implementing location based services	XML Parsing, JSON Parsing, JSON objects, parsing JSON Array, Location based Services, integrating Google maps in Android app	2 Weeks
7.	Internet Connecting Principles	Introduction to Arduino and Raspberry Pi, Application Layer Protocols: MQTT, CoAP, XMPP.	2 Weeks
Total			**14 Weeks**

Evaluation Criteria

Components	**Maximum Marks**
Lab Test# 1	20
Lab Test# 2	20
Day to Day (break up for 60 marks)	
Attendance	15
Eval-1	15
Eval-2	15
Project	15
Total	**100**

Project based learning: Students form group of size 2-3 members. Each group will identify several real life

issues in various thrust areas like healthcare, industrial, education, smart city, logistics, environment, governance and etc. Once problem has been identified, the group will analyze the problem and synthesize Mobile Application and IoT based solutions to the identified problem. Each group will apply different mobile device based approaches such as IOT smart sensor and heterogeneous devices. This approach will enhance skills of each student and increase the understanding of mobile application development in distributed applications. Moreover, candidate will gain the enough knowledge to provide the mobile based IoT solution to enhance the quality of life in human/organization. After this course, a student will able to undertake any work in this area in the industry or research.	
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.	Hagos T. Android Studio IDE Quick Reference: A Pocket Guide to Android Studio Development. Apress; 2019 Jul 31.
2.	Meier R, Lake I. Professional Android. John Wiley & Sons; 2018 Aug 23.
3.	Griffiths D. Head First Android Development: a brain-friendly guide. " O' Reilly Media, Inc."; 2017 Aug 9.
4.	Darwin IF. Android Cookbook: Problems and Solutions for Android Developers. " O'Reilly Media, Inc."; 2017 May 10.
5.	Internet of Things: A Hands-on Approach. United Kingdom: Arshdeep Bahga & Vijay Madisetti, 2014.
6.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. United Kingdom: Pearson Education, 2017.
7.	The Internet of Things: Key Applications and Protocols. United Kingdom: Wiley, 2012.
Reference books	
8.	Raj Kamal, “Mobile Computing”, first edition, Oxford University Press, 2007.
9.	Asoke K Talukder, and Roopa R. Yavagal, “Mobile Computing: Technology, Application and Service Creation”, Tata McGraw-Hill Professional, 2005
10.	Stojmenovic, and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002.
11.	Reza Behravanfar, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, Cambridge University Press, 2004.
12.	J.F. DiMarzio “Android: A Programmers Guide”.
13.	IEEE Transaction on Broadcasting
14.	IEEE Transaction on Communication
15.	IEEE Transaction on Computers
16.	IEEE Communication Letters

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B22CI621	**Semester : Even**	**Semester** VI **Session** 2022 -2023 **Month from Jan'2023 to June'2023**
Course Name	Data Mining And Web Algorithms		
Credits	**4**	**Contact Hours**	**4(3+1)**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-12.1	Understand the basics of data mining and pre-processing of data.	Understand Level (Level 2)
C401-12.2	Analyze the transactional data for finding frequent and interesting patterns using association rule mining techniques like Apriori and FP-Growth.	Analyse Level (Level 4)
C401-12.3	Apply a wide range of classification techniques like Naïve-bayes, decision tree, and KNN for the numerous application including fraud detection, target marketing, medical diagnosis, etc.	Apply Level (Level 3)
C401-12.4	Cluster the similar/dissimilar objects using different methods like partitioning, hierarchical and density based clustering.	Create Level (Level 6)
C401-12.5	Analyze the link structure of web using page rank and HITS algorithms.	Analyse Level (Level 4)
C401-12.6	Develop recommendation system using collaborative filtering techniques	Create Level (Level 6)

Sr.	**Module**	**Chapters**	**Lectures**
1.	Course overview	What Motivated Data Mining? Why Is It Important? What Is Data Mining? Data Mining—On What Kind of Data? Data Mining Functionalities—What Kinds of Patterns Can Be Mined? Are All of the Patterns Interesting? Data mining process, Types of datasets and attributes, Major Issues in Data Mining.	03
2.	Data Preprocessing	Getting To know your data, Data extraction, Data cleaning, Data Integration and transformation, Data reduction	06
3.	Association Rule mining	Usability and Complexity Analysis of Apriori Algorithm, Sampling Algorithm, Partitioning, Using multiple minimum supports	05
4.	Classification Algorithms	Issues Regarding Classification and Prediction, Bayesian Classification, Usability and Complexity Analysis of Bayesian algorithm, Nearest Neighbor algorithm, Decision Tree based algorithm.	07
5.	Clustering Algorithms	Clustering Algorithms: Types of Data in Cluster Analysis, Similarity Measures, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Usability and Complexity Analysis of Agglomerative Hierarchical Algorithm, K-means and K-Mediod Partitioning Algorithm, subspace clustering techniques, , Applications of clustering.	10
6.	Web algorithms	Web algorithms: Link Based Search Algorithm, Web Crawling, Indexing, Searching, Zone Indexing, Term-Frequency, Link Analysis Algorithm.	03

7.	Ranking Algorithms	Ranking Algorithms: Page rank, Hits ranking algorithms	03
8.	Web caching Algorithm	Web caching Algorithm : LRV, FIFO, LRU, Random, OPT	02
9.	Recommendation Algorithms:	Recommendation Algorithms: Collaborative Filtering, Item-to-Item recommendation, Memory Based Recommendation,	03
		Total number of Lectures	**42**

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

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on association mining approaches, classification methods, page rank as well as HITS algorithm and recommendation algorithm. The students can choose any real-world application that requires some decision-making. The students have to implement the mini-project using any open-source programming language. Project development will enhance the knowledge and employability of the students in 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	Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 3rd edition ,2012
2	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley, 3rd edition,2013
3	Pujari, Arun K, Data mining techniques , Universities press, 3rd edition , 2013
4	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley, 3rd edition,2013
5	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, second edition, 2019
6	Langville, Amy N., and Carl D. Meyer. Google's PageRank and beyond: The science of search engine rankings. Princeton University Press, 2012.
Reference Books	
8	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier,2002
9	Berson, Alex, and Stephen J. Smith. Data warehousing, data mining, and OLAP. McGraw-Hill, Inc., 2004
10	Inmon W.H.,Building the Data Warehouse ,4th Edition, Wiley,2005
11	Anahory, Sam, and Dennis Murray. Data warehousing in the real world: a practical guide for building decision support systems. Addison-Wesley Longman Publishing Co., Inc., 1997.
12	Dunham, Margaret H. Data mining: Introductory and advanced topics. Pearson Education India, 2006.
13	Mattison, Rob, and Brigitte Kilger-Mattison. Web warehousing and knowledge management. McGraw-Hill School Education Group, 1999.
14	Hand, David, Heikki Mannila, and Padhraic Smyth. Principles of data mining.PHI, 2005
15	C.D. Manning, P. Raghavan, H. Schütze., Introduction to Information Retrieval, Cambridge Press,1st edition, 2008.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B28CI681	**Semester: Even** (specify Odd/Even)	**Semester 1st Session** 2022-2023 **Month from** Jan to May
Course Name	DATA MINING AND WEB ALGORITHMS LAB (15B28CI681)		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Aditi Sharma
	Teacher(s) (Alphabetically)	Dr. Alka Singhal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C375.1	Apply the data pre-processing techniques on the dataset and implement association rule mining techniques like Apriori and FP-Growth to analyze frequent and interesting patterns in the transactional data.	Apply (Level III)
C375.2	Apply a wide range of classification techniques like Naïve-Bayes, decision tree, and KNN for the numerous data mining applications.	Apply (Level III)
C375.3	Implement and validate the Clustering methods and outcomes of different methods like partitioning, hierarchical and density-based clustering.	Evaluate (Level V)
C375.4	Analyze the link structure of web using different Web caching and ranking algorithms.	Analyze (Level IV)
C375.5	Creation of project using data mining technique to solve the real-world problems like fraud detection, hand writing recognition, stock prediction etc.	Create (Level VI)

Module No.	**Title of the Module**	**List of Experiments**
1.	Data Preprocessing	Explore the various data mining tools. Apply Data pre-processing i.e. Data extraction, Data cleaning, Data Integration and transformation, Data reduction. Perform Data Similarity Measure (Euclidean, Manhattan Distance). Implement Jaccard coefficient for documents similarity.
2.	Association Rule Mining	Develop Apriori algorithm to mine frequent item-sets. Implement FP-growth algorithm to identify the frequent item sets. Implement ECLAT algorithm for rule mining.
3.	Classification	Analysis of Bayesian algorithm, Nearest Neighbor algorithm, Decision Tree based algorithm for classification. Implement ID3, C4.5 and Naïve Bayes.

4.	Clustering	Develop different clustering algorithms like K-Means, K-Medoids Algorithm, Partitioning Algorithm and Hierarchical Approach to generate clusters.
5.	Validity Measures	Implement Validity Measures to evaluate the quality of Data Mining Algorithms.
6.	Web Application	Analyze the link structure of web using page rank algorithms. Analyze the link structure of web using HITS algorithms. Analyze different Web caching Algorithm: LRV, FIFO, LRU etc.

Evaluation Scheme	**Components**	**Maximum Marks**
	Lab Test 1	20
	Lab Test 2	20
	Day-to-Day (Evaluations/ Mini Project/Lab Records /Attendance)	60
	Total	**100**

Project based learning: Data mining is widely used by customer-oriented companies like - retail, healthcare, banking, e-commerce, etc. After the completion of this lab, students would learn to apply the data mining techniques in any programming language of their choice (C, C++, java, python) and would be familiar with different data mining tools like Weka, rapid miner etc. To fulfill this objective, each student in a group of 3-4 will choose a real-world data mining problem for development. Introducing data mining application development to students can help them to gain knowledge and enhance their skills on industry need of data prediction, clustering and classification.

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	Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers,Elsevier (2012).
2	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of Massive Datasets, Cambridge Universities press(2014).
3	Pujari, Arun K,Data mining and statistical analysis using SQL, Universities press(2016)
4.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, second edition, 2019
5.	Langville, Amy N., and Carl D. Meyer. Google's PageRank and beyond: The science of search engine rankings. Princeton University Press, 2012.

REFERENCES

1.	Transactions on Database Systems (ACM)
2.	IEEE Transactions on Knowledge & Data Engineering
3.	The VLDB Journal The International Journal on Very Large Data Bases
4	Thuraisingham, B. Data Mining. Boca Raton: CRC Press, https://doi.org/10.1201/b16553.(2014)
5.	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley (2011)
6.	Soumen Chakrabarti, Mining the Web:Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier (2009)

7.	Alex, Berson,Stephen J.Smith, Data Warehousing, data mining and OLAP , McGraw-Hill,2001
8.	Inmon W.H.,Building the Data Warehouse ,4th Edition, Wiley(2005).
9.	Mattison R. ,Web Warehousing and Knowledge Management", Tata McGraw-Hill. (2007)
10.	David Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining, PHI (2001).

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS 531**	**Semester :Even (specify Odd/Even)**	**Semester : VI Session:2022 -2023 Month from: Jan to June**
Course Name	**Sociology of Youth**		
Credits	**3 (2-1-0)**	**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**	2
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	2
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	3
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	6
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	7
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)	6
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	2
			…

Total number of Lectures	**28**

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.

SYLLABUS AND EVALUATION SCHEME

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester:** VI **Session** 2022-23 **Month from:** Feb-July
Course Name	Econometric Analysis		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Manas Ranjan Behera
	Teacher(s) (Alphabetically)	Manas Ranjan Behera

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	*Demonstrate* the key concepts from basic statistics to understand the properties of a set of data.	Understanding Level - C2
CO2	*Apply* Ordinary Least Square method to undertake econometric studies.	Apply Level - C3
CO3	*Examine* whether the residuals from an OLS regression are well-behaved.	Analyze Level - C4
CO4	*Evaluate* different model selection criteria for forecasting.	Evaluation Level - C5
CO5	*Create* models for prediction from a given set of data.	Creation Level - C6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Statistical Inference	Point and interval estimation; ;The Z distribution ;The Null and Alternate hypotheses ;The chi-square distribution; The F distribution; The t distribution	3

2.	Regression Analysis	Two variable regression model; The concept of the PRF; Classical assumptions of regression; Derivation of the OLS estimators and their variance; Properties of OLS estimators under classical assumptions; Gauss-Markov Theorem; Tests of Hypothesis, confidence intervals for OLS estimators; Measures of goodness of fit: R square and its limitations; Adjusted R square and its limitations	7
3.	Econometric Model Specification	Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias	5
4.	Failure of Classical Assumptions	Multi-collinearity and its implications; Auto-correlation: Consequences and Durbin-Watson test ;Heteroskedasticity: Consequences and the Goldfeld - Quandt test	2
5.	Forecasting	Forecasting with a)moving averages b) linear trend c) exponential trend CAGR; Forecasting with linear regression; Classical time series decomposition; Measures of forecast performance: Mean square error and root mean square error; Limitations of econometric forecasts	5
6.	Time Series Analysis	Univariate Time Series Models: Lag Operator, ARMA , ARIMA models, Autoregressive Distributed Lag Relationship	3
7.	Linear Programming	Linear programming; Dual of a linear programming problem; Simplex method Transportation	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20

End Semester Examination	35
TA	25 (Quiz+Project+Viva -Voce)
Total	**100**

Project based Learning: Students have to form a group (maximum 5 students in each group) and have to do an econometric analysis on the topic assigned. Students will use the different statistical methods using quantitative data to develop theories or test existing hypothesis. Students will also be encouraged to forecast future economic trends.

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.	Gujarati, D.N. (2002), Basic Econometric (4^{th} ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2^{nd} ed.), New York: Macmillan.
4.	Wooldridge,J (2010),Econometric Analysis of Cross Section and Panel Data(2nd ed.), Cambridge, The MIT Press.
5.	Stock, J. H., and M. W. Watson. (2015). Introduction to Econometrics, (Third Update), Global Edition. Pearson Education Limited.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN (specify Odd/Even)**	**Semester** VI **Session**2022-2023 **Month from : Jan – June 2023**
Course Name	Marketing Management		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma, Dr. Deepak Verma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C304-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-304-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

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 Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour.	5

		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 (Project & Viva)
Total	**100**

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

1.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 16thGlobal Edition, New Delhi, Pearson Education, 20015.
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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2022 -2023 **Month from January 2023to June 2023**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Deepak Verma, Dr. Swati Sharma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr. Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
C304-5.2	Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions	Analyze Level (C4)
C304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
C304-5.4	Evaluate management processes for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate Level (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	6
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	8
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.	6
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.	6
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-Resource Leveling and Loading.	8
6.	Budgeting, Control	Estimating Project Budgets, Improving the process of cost	8

	and Project Termination	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.	
Total number of Lectures			**42**

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 (Assignment, Project, Oral Questions)
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.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
2.	TimmothyKloppenborg, Contemporary Project Management, 5th‘ Edition, Cengage Learning, 2017
3.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12thEdition,Wiley Publications,2017
4.	Wysocki,R.K., Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th Edition, Wiley Publications,2018
5.	Vohra, N. D., Quantitative Techniques in Management, 5thEdition, Tata McGraw Hill Publishing Company, 2017

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS636**	**Semester : Even**	**Semester VI Session** 2022 -2023 **Month: January 2023 to June 2023**
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. 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 analyze the language and style adopted in filmed texts and examine them as reflections of 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.	Analysing 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 & Adaptations	Pride & Prejudice: Jane Austen The Giver: Lois Lowry The Godfather: Mario Puzo	9
		Total number of Lectures	28

Evaluation Criteria

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

Project Based Learning: The Group Project consists of 3 components: A Digital Narrative Poster, Ethical Adaptation and a Report. The students pick a text (Novel /Play) of their choice which has not been covered in the syllabus. The students need to take 1 adaptation of the text in each of the following category: a) Faithful b) Acculturated/Loose and analyze all the adaptations as per the given points: a)Narrative Plot b) Conflicts c) Character development d) Thematic differences when using Literary & adaption theories. e) Narrative art and Mise-en-scene. This comparative analysis is to be submitted in the form of a Narrative Digital Poster. The students also create a brief ethical adaptation of the source text in the form of a short story/script/poem. The project includes a brief 2-3 pages report which should highlight the following: a) Objectives of the Project b) Rationale for Choosing the Text & its adaptations c) Literature Review/ Background study Method & Theories applied e) Discussion & Analysis/ Findings f) Conclusion (with reference to Objectives) g) Significance of the Findings for the Society/ Relevance in enhancing our learning for life h) Limitations i) Individual Contribution of each of the Team Member in the Whole Project j) References/Works Cited

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*, 1st Edition, G. P. Putnam's Sons, USA, 1969
8.	**Lois Lowry,** *The Giver, 1st Edition*, Houghton Mifflin Harcourt Publishing Company, USA, 1993

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH632	**Semester** EVEN	**Semester 6th Session** 2022-2023 **Month from January to May**
Course Name	SOLID STATE ELECTRONIC DEVICES		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh Tripathi and Dr. Anuj Kumar	
	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 (5)]
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,

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH633	**Semester: Even**	**Semester:** VI **Session:** 2022 -2023 **Month: January to June**
Course Name	Photovoltaic Techniques		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Manoj Kumar-JIIT 62 Dr. Prashant Chauhan – JIIT 128
	Teacher(s)	Dr. Manoj Kumar 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)	08

		Photovoltaic Cells, Estimating PV system size and cost, Photovoltaic safety.	
		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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH634	**Semester:** Even	**Semester** VI **Session** 2022 -2023 **Month:** from January 2023 to June 2023
Course Name	Applied Statistical Mechanics		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Navendu Goswami
	Teacher(s) (Alphabetically)	Prof. Navendu Goswami

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-9.1	Define the fundamental parameters of Thermodynamics and Statistical Mechanics.	Remembering (C1)
C302-9.2	Explain the Thermodynamic potentials, Maxwell's equations and Heat equations.	Understanding (C2)
C302-9.3	Apply the concepts of thermodynamics and statistical ensembles to understand the phase space and distribution functions.	Applying (C3)
C302-9.4	Determine the distribution functions in case of various types of physical and chemical ensembles.	Evaluating (C5)
C302-9.5	Evaluate the ideas of Entropy with respect to Probability and Information Theory; and conclude Liouville's equation.	Evaluating (C5)

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 emsembles	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 [2 Quiz (6 M), Project Based Learning (PBL) (10 M), Attendance (5 M) and Internal assessment (4 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.	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 learning: Students would work on a project of their choice in any of the following fields: materials science processing, property determination and application; neural network-based ensemble, any ensemble formalism in economics, weather etc. In such projects students can not only apply the basic concepts of thermodynamics but also apply the ideas of suitable ensemble, Monte-Carlo simulation, Molecular dynamics, Ising Model etc. to determine the properties, predict its behaviour with time evolution and assess application potential. The learning obtained through this project would not only provide deeper understanding of the pertinent concepts learnt in this course but also develop the skills of applying the statistical mechanics to solve the related problems and thereby proving the employability potential in materials research-based industries, economics and meteorological departments.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2022 -2023 **Month from:** January 2023 to June 2023
Course Name	Medical & Industrial Applications of Nuclear Radiations		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Vaibhav Subhash Rawoot	
	Teacher(s) (Alphabetically)	Dr. Sandeep Mishra Dr. Vaibhav Subash 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 differen 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 $\beta+\gamma$ 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:** 2022-2023 **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.

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C305-15.1	3	2	1	1								2		
C305-15.2	3	3	2	3								1		
C305-15.3	2	2	3	2	2							2		
C305-15.4	1	2	2	2	2							1		
Average	2	2	2	2	2							2		

Course Description

Course Code	21B12CS319	**Semester EVEN**	**Semester** VI **Session** 2022 -2023 **Month from JAN-JUN**
Course Name	Fundamentals of Soft Computing		
Credits	3	**Contact Hours**	3 –0 - 0

Faculty (Names)	**Coordinator(s)**	Parul Agarwal (J62), Arti Jain (J128)
	Teacher(s) (Alphabetically)	Arti Jain Parul Agarwal Sherry Garg

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-3.1	Understand vagueness, ambiguity, and uncertainty in different types of real-world problems	Understanding (Level 2)
C332-3.2	Analyze the fuzzy inference system and its applications in different sets of problems	Analyze (Level 4)
C332-3.3	Assess different optimization techniques through error/loss functions	Evaluate (Level 5)
C332-3.4	Integrate and develop standalone and hybrid Intelligent techniques for real-time engineering applications	Create (Level 6)

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, MultiLayerPerceptronActivation 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	
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, Foundamentals of Artificial Neural Networks, The MIT Press, 1995
5	George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, PHI
6	B. Yegnanarayana, Artificial Neural Networks, PHI
7	Timothy J. Ross, Fuzzy logic with engineering applications. John Wiley & Sons, 2009.
REFERENCE BOOKS Journals, Reports, Websites etc. in the IEEE format	
7	IEEE Transactions on Evolutionary Computation
8	IEEE Transactions on Fuzzy Systems
9	IEEE Transactions on Neural Networks
10	IEEE Transactions on Pattern Analysis and Machine Intelligence
11	ACM Transactions on Intelligent Systems and Technology

Operations Research (18B12MA611)

Course Description

Course Code	18B12MA611	**Semester Even**	**Semester VI** **Session** 2022-23 **Month from** Jan - Jun 2023		
Course Name	Operations Research				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Pato Kumari			
	Teacher(s) (Alphabetically)	Dr. Mohd. Sarfaraz, Dr. Amita Bhagat			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C302-3.1	construct mathematical models for optimization problems and solve linear programming problems (LPP) using graphical and simplex method.	Applying Level (C3)
C302-3.2	apply two-phase, Big-M and dual simplex method for linear programming problems.	Applying Level (C3)
C302-3.3	make use of sensitivity analysis to linear programming problems.	Applying Level (C3)
C302-3.4	solve transportation, assignment and travelling salesman problems.	Applying Level (C3)
C302-3.5	apply cutting plane and branch & bound techniques to integer programming problems.	Applying Level (C3)
C302-3.6	examine optimality conditions and solve multivariable nonlinear 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 Problems	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method.	6
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	8

		inequality constraints, Quadratic Programming - Wolfe's Method	
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
Lecture-wise Breakup

Course Code	19B12HS612	Semester:Even	**Semester VI Session** 2022 -2023 **Month from** Jan 2023 to June 2023
Course Name	Social Media and Society		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Infer the implications of digital change, and the concept of social media and e-marketing in the context of the changing marketing landscape	Apply Level(C3)
C304-1.2	Elaborate the implications of cyber branding and digitization on online marketing mix decisions	Create Level (C6)
C304-1.3	Develop specific models related to social media and social media analytics	Create Level (C6)
C304-1.4	Evaluate concepts related to Search Engine Marketing, Customer Centric Web Business models and Web Chain Analysis	Evaluate Level(C5)
C304-1.5	Illustrate the new age marketing practices	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Individuals Online and Rules for engagement for social media	What is social media marketing, the importance of social media for influencing target audience, Patterns of internet usage, Internet user demographics, The BehaviouralInternet, E-Marketing, The Virtual world, the changing Marketing Landscape, E -Marketing-Strengths and Applications, Online Marketing Domains, Digital Marketing Optimization, The Need for Digital Engagement	4
2.	The Online Marketing Mix	The Online Marketing Mix, Consumer Segmentation, Consumer Traits, Consumers and Online Shopping Issues, E-Product, E-Place, E-Price, E-Promotion, Website Characteristics affecting online purchase decision.	3
3.	The Online Consumer and Social Media	The Digital Ecosystem, Online Consumer Behavior, Cultural Implications of key web characteristics, Models of website visits, Web 2.0 and Marketing, The collaborative web, Network evolution, Network science, Marketing with networks, Metcalfe's law, Netnography, Social Media Model by McKinsey, social media Tools-Blogs, Wikis, Online Communities, Facebook, Twitter, You Tube, Flickr, Microblogging.	4

4.	Online Branding and Traffic Building	Cyberbranding, Online brand presence and enhancement, The Digital Brand Ecosystem, Brand Experience, Brand Customer Centricity, Brands and Emotions, The Diamond Water paradox, Internet Traffic Plan, Search Marketing Methods, Internet Cookies and Traffic Building, Traffic Volume and quality, Traffic Building Goals, Search Engine Marketing, Keyword Advertising, Keyword value, Internet Marketing Metrics, Websites and Internet Marketing.	4
5.	Web Business Models ,Social Media Strategy ,Social Media Marketing Plan	The value of a Customer Contact, Customer Centric Business Management, Web Chain of Events, Customer Value Analysis and the Internet, Business Models, Revenue Benefits, Value Uncertainty, Purchase Importance,Define a social media plan, explain the social Media marketing planning cycle, list the 8C's of strategy development.	4
6.	Market Influence analytics in a Digital Ecosystem	Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem, The Digital Ecosystem, Knowledge as a value proposition, CGM and Consumer behavior, The value of the power of influence, Amplifying Social Media Campaigns.	4
7.	The Contemporary Digital Revolution and its impact on society	Online Communities and Co-creation, The fundamentals of online community management strategies, The World of Facebook, The Future of Social media Marketing—Gamification and Apps, Game based marketing The world of Apps, Apps and the Indian Diaspora	3
8.	Integrating Mobile into Social Media Marketing	Types of Mobile Marketing, Progression of the mobile as a Marketing channel, some Indian mobile marketing campaigns, Impact of social media on government, the economy, development, and education	2
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project-Report and Viva)
Total	**100**

Project Based Learning: The project is to be done in a group size of 4 -5 members. Students were asked to identify one brand/company on social media. Read the information available on social media and browse through campaigns. Study the consumer engagement and comments. Write their opinion about it. Analyze the same with a social media tool and compare the results. Also identify and elucidate the strategies used by the brand in the context of online branding. This helped the students to understand concepts of cyber branding and social media analytics and enhanced their employability skills in an 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.	Digital Marketing, Seema Gupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018
2.	Social Media Marketing A Strategic Approach, Melissa Barker, Donald Barker,Second Edition Cengage Learning ,2017.
3.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
4.	Social Media Marketing, Liana “Li” Evans, First Edition, Pearson, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS613	**Semester:** Even	**Semester** VI **Session** 2022-23 **Month from:** Jan 2023-June 2023
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	Explain the foundations of international trade and finance in the era of globalization.	Understanding Level (C2)
C304-8.2	Analyze the major models and theories of international trade.	Analyzing Level (C4)
C304-8.3	Identify the effects of tariffs, quotas and technical progress on economic growth.	Applying Level (C3)
C304-8.4	Examine the equilibrium in the Balance of Payments (BOP) and measures to correct disequilibrium.	Analyzing Level (C4)
C304-8.5	Compare the fixed and flexible exchange rate, monetary policy, foreign trade multiplier & trade policy.	Analyzing Level (C4)
C304-8.6	Analyze the working of regional blocks & international organizations.	Analyzing Level (C4)

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** - July
Course Name	Global Politics		
Credits	3(2-1-0)	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Ila Joshi/Dr Gaurika Chugh
	Teacher(s) (Alphabetically)	Dr. Gaurika Chugh/ Ila Joshi

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	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	Understanding (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 policies of India, climate change and global initiatives global commons debate	8

		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 (Attendance, Quiz, Project)
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.	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] Available: http://www.opendemocracy.net/conflict/article_1865.jsp
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 Globalization" in *Contesting Global Governance*, R.O'Brien, A.M. Goetz, J.C. Scholte & M.Williams. Cambridge, UK: Cambridge University Press,2000

Detailed Syllabus
Lecture-wise Breakup

Course Code	23B18HS311	**Semester E**ven **(specify Odd/Even)**	**Semester Session** 2022-2023 **Month from** January to July
Course Name	**Workplace Communication (Value added)**		
Credits	**0**	**Contact Hours**	**3(1-0-2)**

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

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C305-14.1	Describe different types of communication and how they are used in the workplace	Understanding level(C2)
C305-14.2	Applying the understanding of professional writing and design various professional documents	Applying level (C3)
C305-14.3	Assess the interaction of verbal communication with non – verbal cues and communicate efficiently with the target audience	Analyzing level(C4)
C305-14.4	Understand the dynamics of team communication and learn to communicate effectively with their peers, superiors and other colleagues	Applying Level (C3)
C303-14.5	Recognize the kinds of virtual communication at workplaces and interpret its significant impact on overall communication at workplace	Understanding level (C2)

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 in workplace	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	**Maximum Marks**
Midterm examination	30
End Semester Examination	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 communication barriers

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.	Barun K. Mitra, Personality Development & Soft Skills, Oxford University Press, New Delhi, 2012.
4.	L. M. &. M. Valo, in *Workplace Communication*, vol. 1, New York, Routledge, 2019.
5.	M. S. &. A. Aira, "Technology-Mediated Communication in the Workplace," in *Workplace Communication*, New York, Routledge, 2019. [5]
6.	J. Mizrahi, Writing for the Workplace: Business Communication for Professionals, Business Expert Press, 2015.
7.	Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
8.	S. Kumar and PushpLata, Communication Skills, Oxford University Press,1st, Ed. 2011
9.	Raman M. and S. Sharma, Technical Communication: Principles & Practices, 29th Impression, Oxford University Press, New Delhi, 2009

Applicational Aspects of Differential Equations (20B12MA311)

Course Description

Course Code	20B12MA311	**Semester** Even	**Semester** VI **Session** 2022-23 **Month from** Jan 2023 - June 2023
Course Name	Applicational Aspects of Differential Equations		
Credits	**3**	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr Richa Sharma	
	Teacher(s) (Alphabetically)	Dr Richa Sharma	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-2.1	solve ordinary differential equations in LCR and mass spring problems.	Applying Level (C3)
C302-2.2	explain orthogonality of functions and apply it to solve Sturm-Liouville boundary value problems.	Applying Level (C3)
C302-2.3	apply matrix algebra to find the solution of system of linear differential equations.	Applying Level (C3)
C302-2.4	formulate and solve first and second order partial differential equations.	Applying Level (C3)
C302-2.5	evaluate solution of differential equations arising in engineering applications.	Evaluating Level (C5)

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, trigonometric Fourier series.	10
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	4

		linear equations with constant coefficients.	
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: Each student in a group of 3-4 will apply the concepts of differential equations arising in 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, 2004.
2.	**Jain, R.K. and Iyengar, S.R.K.,** Advanced Engineering Mathematics, 3rd Ed., Narosa Publishing House, 2012
3.	**Chandramouli, P.N.,** Continuum Mechanics, Yes Dee Publishing India, 2014.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10th Edition, John Wieley & Sons, Inc. 2013.

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	**Semester:** Even	**Semester** VI **Session** 2022-23 **Month from** Jan 2023 - June 2023
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shikha Pandey	
	Teacher(s) (Alphabetically)	Dr. Shikha Pandey, Dr. Pinkey Chauhan	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-1.1	make use of measures of central tendency, dispersion, skewness and, kurtosis for description and visualization of population data.	Applying Level (C3)
C302-1.2	apply correlation and regression in statistical analysis of data.	Applying Level (C3)
C302-1.3	explain sampling theory and its distributions.	Understanding Level (C2)
C302-1.4	explain the concepts and properties of estimation theory.	Understanding Level (C2)
C302-1.5	apply sampling and estimation theory to find the confidence interval.	Applying Level (C3)
C302-1.6	analyze small and large sample data by using the test of hypothesis.	Analyzing Level (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 students 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.	**Biswas and Srivastava**, A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing House, New Delhi.
2.	**W. Feller**, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern-Ltd, 1971
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.

Java Programming (20B16CS322)

Detailed Syllabus

Course Description with CO

Course Code	**20B16CS322**	**Semester** Even	**Semester** VI **Session** 2022 -2023 Month from Jan to Jun
Course Name	**Java Programming**		
Credits	Audit	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Mr. Janardan Kumar Verma , Shariq Murtuza
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-8.1	Write basic Java programs using Java constructs – loops, switch-case and arrays.	Understand Level (C2)
C305-8.2	Define all basic concepts related to OOP concepts	Remember Level (C1)
C305-8.3	Develop java programs using Java collection framework	Apply Level (C3)
C305-8.4	Create or design 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 = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
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 studentsin 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. (2014). *Java: the complete reference*. McGraw-Hill Education Group.
2.	Bloch, J. (2016). *Effective java*. Pearson Education India.

Referenc Books

1.	Sierra, K., & Bates, B. (2005). Head First Java: A Brain-Friendly Guide. " O'Reilly Media, Inc.".
2.	Mughal, K. A., & Rasmussen, R. W. (2003). A programmer's guide to Java certification: a comprehensive primer. Addison-Wesley Professional.

Detailed Syllabus

Subject Code	20B16CS323	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2022-2023 **Month: Jan-June 2023**
Subject Name	Problem Solving using C and C++		NBA Code: C305-9
Faculty (Names)	**Coordinator(s)**	Dr. Sonal (Sec-62) & Dr. Neeraj Jain (Sec 128)	
	Teacher(s) (Alphabetically)	Dr. Neeraj Jain, Dr. Sonal	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-9.1	Apply and use library functions, pointer arithmetic, arrays, and regular expressions and secure coding practices in programs.	Apply Level (C3)
C305-9.2	Use critical thinking skills and creativity to choose the appropriate containers, iterators and algorithms for a given problem.	Apply Level (C3)
C305-9.3	Demonstrate the use of concurrency principles, input and output streams and defensive techniques in programs.	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**Assigned COs**
1.	Review and practice problems on Functions in C/C++	Functions, Alt function syntax, Function return type deduction, static, const and inline functions, default parameters, overloaded functions- operator and members, friends, overriding functions.	**CO1**
2.	Practice problems on Arrays and Pointers and Indirections	Smart pointers, pointers and dynamic memory allocation, type inference, array and pointers and their arithmetic and indirections	**CO1**
3.	Secure Coding practices in C/C++	Common String, Integer and dynamic memory allocation Errors, Integer and dynamic memory allocation and String vulnerabilities their mitigation strategies.	**CO1**
4.	String Localization and Regular Expression	Localization and working with regular expression, Programming with Regex library	**CO2**
5.	Practice problems on Exception Handing and Assertions	Errors and Exceptions, Exception Mechanisms, Exceptions and Polymorphism, Stack unwinding and Cleanup, Common error handling issues	**CO2**
6.	Applications with Disk Files and other I/O	Using streams, Input and Output with Streams, String Streams, File Streams and Bidirectional I/O	**CO2**
7.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization of templates, template recursion, variadic templates, Meta-programming	**CO3**
8.	Working with Standard Template Library	Understanding and working with containers, container adapters and iterators, Lambda expressions, Function objects, STL algorithms, Customize and	**CO3**

		extend STL	
9.	Programming using Dynamic Memory Allocation Model	Working with dynamic memory, array-pointer duality, low level memory operations, smart pointers and common memory pitfalls	**CO3**
10.	Problems on Concurrency in Programming	Introduction, Threads, Atomic operations library, Mutual Exclusion, Conditional variables	**CO3**
			14

Evaluation Criteria

Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
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:

Text Books

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

Course Code	20B16CS324	**Semester** Even	**Semester** VI **Session** 2022 -2023 **Month from** Jan 2023 to Jun 2023
Course Name	Non-linear Data Structures & Problem Solving		
Credits		**Contact Hours**	1- 0 - 2

Faculty (Names)	**Coordinator(s)**	Sarishty Gupta
	Teacher(s) (Alphabetically)	Deepika Varshney, Sarishty Gupta, Vivek Kumar Singh

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-10.1	Demonstrate operations on different data structures.	Understand Level (C2)
C305-10.2	Use critical thinking skills and creativity to choose the appropriate data structure and solve the given problem.	Apply Level (C3)
C305-10.3	Identify the correctness and efficiency of the solution by constructing different test cases.	Apply Level (C3)
C305-10.4	Develop solutions to real world problems by incorporating the knowledge of data structures	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Problem Solving and Data Structures	Concepts of Problem Solving, Performance metrics for Algorithm Analysis, Why study Data structures and Abstract Data Types. Practice problems on Sparse Matrix	**1**
2.	Practice problems on advanced list structures	Multi-list, skip list, XOR linked list, self organizing list, unrolled linked list	**2**
3.	Practice problems on point and range queries using tree structures	Suffix array and suffix tree, Trie and persistent trie, Segment tree and persistent segment tree, Interval tree, K dimensional tree, Binary indexed tree, Splay tree, Treap (randomized BST), Order statistics tree	**4**
4.	Practice problems on optimization problems using tree structures.	Tournament tree, Decision tree, Cartesian tree	**2**

5.	Practice problems on heaps and sets	Sparse set, Disjoint set, Leftist heap, K-aryheap	**2**
6.	Problem solving using graphs	Social graphs, Transportation system graphs, Resource allocation graphs	**3**
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance – 10, Quizes/Mini Project – 20)
Total	**100**

Project based Learning: Each student in a group of 3-4 will develop a simulator with the help of various advanced data structures. Students will be able to understand and apply algorithms and advanced data structures properly; know how to evaluate, choose appropriate algorithms or data structures; know how to design and implement algorithms or data structures to serve the purpose of designing solution.Selecting t**heappropriate** data **structure** is an integral part of the programming and problem-solving process. The project typically incorporates various advanced data structure concepts to enable the synthesis of knowledge from real-life experiences.

Recommended Reading material:	
Text Books	
1.	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Fourth Edition.
2.	Handbook of Data Structures and Applications, 2nd Edition by Sartaj Sahni, Dinesh P. Mehta, CRC Press
References	
3.	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
4.	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
5.	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
6.	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
7.	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education

Detailed Syllabus
Lecture-wise Breakup

Course Code	**20B16CS326**	**Semester EVEN**	**Semester VI Session** 2022 -2023 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits		**Contact Hours**	1-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Amanpreet Kaur (J62), Dr. Shailesh Kumar(J128)
	Teacher(s) (Alphabetically)	Dr. Amanpreet Kaur, Dr. Bhawna Saxena, Dr. Lakshmi,Dr. Megha Rathi, Dr. Niyati Aggrawal, Dr.Shailesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-11.1	Demonstrate new technologies by applying foundation paradigms	Understanding [Level 2]
C305-11.2	Build strong foundations for basic front end tools & technologies thereby making them understand the application development lifecycle.	Apply [Level 3]
C305-11.3	Develop elegant and responsive Front-end by leveraging latest technologies	Apply [Level 3]
C305-11.4	Explain activity creation and Android UI designing	Understanding [Level 2]
C305-11.5	Develop an integrated mobile application to solve any complex real time problem	Create [Level 6]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
2.	Introduction to basic front end techniques	HTML 5, CSS 3, Javascript, jquery, bootstrap	3
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.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS312	**Semester: EVEN SEM**	**Semester 6th Session** 2022-2022 **Month from** Jan to June 2023
Subject Name	**Sensor Technology and Android Programming**		
Credits	**03**	**Contact Hours**	**3 -0 -0**

Faculty (Names)	**Coordinator(s)**	Dr. Vikash , Mr. Shariq_Murtuza
	Teacher(s) (Alphabetically)	Dr. Hema N, Dr. Vikash , Mr. Shariq_Murtuza

COURSE OUTCOMES **After the completion of the course, the students will be able to**		**COGNITIVE LEVELS**
C331-1.1	Understand the sensor, smart sensors and various platform of sensing devices	Level-1 (Remembering)
C331-1.2	Understand Anatomy of an android development environment (IDE) for sensing application	Level-2 (Understanding)
C331-1.3	Accessing various physical sensors of the Android device and its programming	Level-3 (Applying)
C331-1.4	Develop various user services/app using Android and sensors	Level-6 (Create)

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, Image-Processing 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+ Attendance□10}
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

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

Detailed Syllabus
Lecture-wise Breakup

Branch: B.TECH(IT), VI SEM, EVEN, 2023

Subject Code	21B12CS313	**Semester** Even	**Semester** VI **Session** 2022 - 2023 **Month from** January to June 2023
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. Bansidhar Joshi (Sec 128)
	Teacher(s) (Alphabetically)	Dr. Prakash Kumar and Dr. Bansidhar Joshi

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

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, Adnrzej Goscinski, "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** 2022 - 2023 **Month from** Jan 2023 to June 2023
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 (J128), Dr. Parmeet Kaur (J62)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-3.1	Infer the background processes involved in queries and transactions, and explain how these impact on database operation and design	Understand level (Level 2)
C331-3.2	Choose appropriate ways of storing data and optimize queries.	Analyze level (Level4)
C331-3.3	Explain the concept and challenge of big data and demonstrate the comparison of relational database systems with NoSQL databases	Understand level (Level 2)
C331-3.4	Compare and discover the suitability of appropriate large databases to manage, store, query, and analyze various form of big data	Analyze level (Level4)
C331-3.5	Apply techniques for data fragmentation, replication, and allocation to design a distributed or parallel database system	Apply Level (Level3)

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 processingconcepts, Concurrency control techniques and protocols	4
3.	Data Storage and Indexing	Data storage and indexing of massive databases in databases and data warehouses. Introduction to technologies for handling big data	7
4.	Query processing and Optimization	Measures of query cost, Evaluation of expressions, Query planning, evaluation and optimization	5
5.	Big data Tools and Technologies	Review of Big data, CAP Theorem (consistency, availability, partition tolerance), Using big data in businesses, Data visualization for data analysis, NoSQL databases	7

6.	Hadoop and its Ecosystem	Hadoop core components, Hadoop Ecosystem components, Data storage and processing in Hadoop framework	5
7.	Application-driven databases	Parallel and Distributed databases, Distributed Database Design, Architecture of Distributed DBMS	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	25Attendance (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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS315	**Semester:** Even	**Semester** VI **Session** 2022 -20223 **Month from:** Jan to May 2023
Course Name	Web Technology and Cyber Security		
Credits	3-0-0	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Bhawna Saxena (J62), Vartika Puri (J128)
	Teacher(s) (Alphabetically)	Arpita Jadhav Bhatt, Bhawna Saxena, Vartika Puri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-4.1	Apply the fundamental elements of Web development in design of web pages	Apply (level 3)
C331-4.2	Understand the web development concepts built on Advanced Java Scripting	Understand (level 2)
C331-4.3	Use the popular web development frameworks to build web applications	Apply (level 3)
C331-4.4	Apply hacking techniques to attack websites and describe their countermeasures	Apply (level 3)
C331-4.5	Understand defense mechanisms for cyber security	Understand (level 2)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**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	3
2.	Programming in React JS	Understanding SPA, React Overview, React Deep-Dive, Composition over Inheritance, Unidirectional Data Flow, Lists and Keys, Form Handling, Hooks, Life Cycle, React Router	9
3.	Programming in Node JS	Introduction to Node JS, Event Loop, REPL, Modules, REST, Scaling	5
4.	Web Development Frameworks	Types of web applications, Front-end vs. Back-end frameworks, Developing web applications using popular frameworks Django, Bootstrap, JQuery	4
5.	Securing Web Applications	Cybersecurity overview, Principles of Cyber Security and Secure Application Architecture	3
6.	Hacking Web Applications and Countermeasures	Cross Site Scripting, Cross Site Request Forgery, XML External Entity (XXE) attacks and their countermeasures	5
7.	Injection Attacks and Their Defenses	SQL injection, code injection and Command injection Attacks and their Defenses	4
8.	Denial of Service Attacks	Denial of Service and Distributed Denial of Service Attacks on Web Applications and Defenses	2
9.	Secure Network Protocols	DNS Attacks and DNSSec, VPNs, and IPSec	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** 2022 -2023 **Month: January 2023**
Course Name	**Introduction to Blockchain Technologies**		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr P. Raghu Vamsi (J62), Dr. Mukta Goyal (J128)
	Teacher(s) (Alphabetically)	Dr P. Raghu Vamsi

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	Apply Web3 API to interact front end application with smart contracts	Apply Level (Level 3)

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), PBL mode (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.	Elad Elrom. “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.	Ambadas Tulajadas Choudhari, Arshad Sarfarz Ariff, 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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS318	**Semester** : Even	**Semester** 6th **Session** 2022-2023 Month from Jan 2023 to June 2023
Course Name	Big Data Ingestion		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Bharat Gupta (62), Shikha Mehta (128)
	Teacher(s) (Alphabetically)	Bharat Gupta , Shikha Mehta

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain the fundamental concepts of Big Data and Data Analytics.	Understand (Level 2)
CO2	Understand the various formats of Big Data and their sources.	Understand (Level 2)
CO3	Infer the need and challenges of Big Data Ingestion.	Understand (Level 2)
CO4	Apply various types of storage for Big Data such as Hadoop Distributed File Systems, NoSQL and NewSQL.	Apply (Level 3)
CO5	Apply BDI tools as Sqoop and Flume to ingest data into a Big Data system.	Apply (Level 3)

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 Ingestion	Need, Parameters, Challenges, Key Functions, Big Data Ingestion Tools: Common Features, Objectives, Benefits, Examples.	3
4.	Big Data Storage Technologies	Big Data Technologies: Hadoop, NoSQL and NewSQL, Using Hadoop to Store Data (HDFS, HBASE), From DBMS to BDMS, Redis: An Enhanced Key-Value Store, Semi-structured Data – AsterixDB, Solr: Managing Text, Relational Data – Vertica.	8
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	7

		Agent, What are the Components of Flume Agent, How Data Flows between Various Components of the Flume.	
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.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS320	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2022 -2023 **Month from:** Jan **to** June 2023
Subject Name	Open source software development		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Mr. Kashav Ajmera (62), Dr. Pulkit Mehndiratta (128)
	Teacher(s) (Alphabetically)	Mr. Janardan Kumar Verma(62), Mr. Kashav Ajmera (62), Dr. Pulkit Mehndiratta (128)

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 3)
C332-4.5	Develop applications using the open source language and tools.	Apply Level (Level 3)

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 as a Language, Installing Python and Writing A Program, Expression,Python programming continued: Conditional statements, functions, strings, File processing , python lists,Dictionaries, Counting with Dictionaries,Tuples and dictionaries	10

		Python libraries: NumPy, Pandas, matplotlib,	
5.	Open Source Tools for App Development	Introduction to App Development and process using Android Studio, Android Architecture, Setting up the environment, SDK, Description of Architectural components, Creating simple Android applications, Activities, Intents and manifest files, Life cycles of an activity, Handling buttons and action listener, working with intents, Passing intent object to link activities and types of intent, Passing data using intents, bundle, working with multiple activities	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(10),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.	Cannon, Jason. Linux for Beginners. United Kingdom: Createspace Independent Pub, 2014.
2.	Bresnahan, Christine., Blum, Richard. Linux Command Line and Shell Scripting Bible. United Kingdom: Wiley, 2021.
3.	Petersen, Richard. Linux: The Complete Reference, Sixth Edition. United Kingdom: McGraw-Hill Education, 2008.
4.	Brown, Amy, and Greg Wilson. *The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks*. Vol. 1. Lulu. com, 2011.
5.	Fogel, Karl. Producing Open Source Software: How to Run a Successful Free Software Project. United States: O'Reilly Media, 2009.
6.	Hagos T. Android Studio IDE Quick Reference: A Pocket Guide to Android Studio Development. Apress; 2019 Jul 31.
7.	Griffiths D. Head First Android Development: a brain-friendly guide. " O' Reilly Media, Inc."; 2017 Aug 9.
Reference Book(s) and Other Reading Material:	
8.	Chacon, Scott, and Ben Straub. *Pro git*. Springer Nature, 2014.
9.	Peterson, Kevin. *The github open source development process*. url: http://kevinp. me/github-process-research/github-processresearch. pdf
10.	Shotts, William. *The Linux command line: a complete introduction*. No Starch Press, 2019.
11.	William “Bo” Rothwell .*Linux for Developers: Jumpstart Your Linux Programming Skills*, Publisher(s): Addison-Wesley Professional
12.	Portnoy, Matthew. *Virtualization essentials*. Vol. 19. John Wiley & Sons, 2012.
13.	Chisnall, David. *The definitive guide to the xen hypervisor*. Pearson Education, 2008.
14.	Pepple, Ken. *Deploying openstack*. " O'Reilly Media, Inc.", 2011.
15.	Jackson, Kevin. *OpenStack cloud computing cookbook*. Packt Publishing Ltd, 2012.
16.	Lutz, Mark. *Programming python*. " O'Reilly Media, Inc.", 2001.
17.	McKinney, Wes. "pandas: a foundational Python library for data analysis and statistics."*Python for High Performance and Scientific Computing* 14, no. 9 (2011).
18.	Oliphant, Travis E. *A guide to NumPy*. Vol. 1. USA: Trelgol Publishing, 2006.
19.	Tosi, Sandro. *Matplotlib for Python developers*. Packt Publishing Ltd, 2009.
20.	Naramore, Elizabeth, et al. *Beginning PHP5, Apache, and MySQL web development*. John Wiley & Sons, 2005.
21.	Lee, James, and Brent Ware. *Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP*. Addison-Wesley Professional, 2003.
22.	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** 2022-23 **Month from** January **to** June 2023
Course Name	Concepts of Graph Theory		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr Ankita (J62), Dr. Laxmi Chaudhary (J128)
	Teacher(s) (Alphabetically)	Dr Ankita (J62), Dr. Laxmi Chaudhary (J128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand the fundamental concepts in graph theory	Understand Level(Level 2)
CO2	Understand the procedure to store graphs and way to access them	Understand Level (Level 2)
CO3	Apply graph theory logics to solve real world problems using planarity and coloring	Apply Level (Level 3)
CO4	Analyze problems related to spectral and analytical domain that can be solved using special graphs	Analyzing Level (Level 4)
CO5	Evaluate the concept of Flow mechanism to solve domain specific problems	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	Minimum Spanning Tree, Depth First Search, Spanning Tree, Breadth First Search Spanning Tree	4
4.	Connectivity and Traversability	Connectivity Properties and Structure, de Bruijn Graphs and Sequences, Chinese Postman Problems, Traveling Salesman 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	Chromatic number, portioning, polynomial, Edge Coloring, Vertex coloring, Four color problem	4
7.	Applications of Coloring	Algorithms for Graph Coloring, Applications in Storage management, Timetable schedules	3
8.	Matching and Covering	Graph Matching, Matching algorithms, Applications; Covering properties, procedure, applications	4
9.	Extended Graph Theory	Algebraic Graph Theory, Spectral Graph Theory, Topological Graph Theory, Analytic Graph Theory	5
10.	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(10), Tutorial/Quiz/Class Test/Mini Project (15))
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:2022-23** Month from: Feb-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	Assess public policies related to rural development	Analyze Level –(C4)
C304-10.3	Explain the role of local self-governance in planning and development of rural areas.	Understanding Level- (C2)
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 of 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 -2019-20 and 2020-21: 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	**21B13HS311**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2022 -2023 Month from Jan-June**
Course Name	**Poverty, Inequality and Human Development**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Akarsh Arora
	Teacher(s) (Alphabetically)	Dr Akarsh Arora

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-13.1	Understand the concepts and dimensions of Poverty, Inequality and Human Development	Understand (Level 2)
C305-13.2	Evaluate different approaches to measure Poverty, Inequality and Human Development	Evaluate (Level 5)
C305-13.3	Apply an analytical framework to understand the factual or proximate causes or determinants of Poverty and Inequality	Apply (Level 3)
C305-13.4	Analyze the role of public policy and affirmative action to tackle Poverty and Inequality and strengthen Human Development.	Analyze (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Concepts and Dimensions	Concepts and Dimensions of Poverty, Inequality and Human Development	3
2.	Measurement	Measurement of Poverty and Inequality: Steps and Axioms. Steps to calculate Human Development	4
3.	Data Sources	Census Data, Unit level Household Data, Geospatial Data, Satellite Image Data	2
4.	Determinants	Determinants/ Factors: Demographics, Household, Individual, and Macroeconomic variables Introduction to Stata, Regression- Linear and Binary models	3
5.	Public Policies and Affirmative Actions	Review of different public policies of GOI to eradicate poverty. Role of education and health care policies to strengthen human development	2
		Total number of Lectures	**14**

Module No.	**Title of the Module**	**List of Experiments/Activities**	**CO**
1.	Concepts and Dimensions	Practical sessions on different dimensions of poverty and inequality.	CO1, CO2
2.	Measurement	Practical sessions on STATA/Python software to measure poverty, inequality, and human development.	CO1, CO2
3.	Data Sources	Practical sessions on key survey issues and problems while collecting data on poverty, inequality and human development.	CO2, CO3

4.	Determinants	Practical sessions on STATA/ Python software to find and interpret the determinants of poverty using regression analysis.	CO2, CO3
5.	Public Policies and Affirmative Actions	Practical sessions on the impact of different Government of India policies and programmes on poverty, inequality and human development.	CO3, CO4

Project based Learning: Students, in groups of 2-3, are required to submit a detailed report on the measurement of poverty and inequality for the selected Indian state. Students are expected to follow official poverty estimation reports in India and measure poverty in a genuine sense based on the existing poverty methodology. They also need to check the data's compatibility, process the data after cleaning for various issues and analyse poverty and inequality at aggregated and disaggregated levels. Furthermore, they need to support findings/ arguments based on previous research studies. Measurement, interpretation and empirical-based argumentation in this sense will upgrade students' knowledge regarding economic development issues and strengthen their skills to tackle extensive and multiple data sets and develop their core competencies in respect of social data science.

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Project)
End Term	40 (Written)
TA	30 (Project Assignment, Quiz)
Total	**100**

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

1.	A. V. Banerjee and E. Duflo, *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. New York: Public Affairs, 2011
2.	J. Haughton and S. R. Khandker, *Handbook on Poverty and Inequality*. Washington, DC: The World Bank, 2009.
3.	A. Tarozzi and A. Deaton, "*Using census and survey data to estimate poverty and inequality for small areas*," The review of economics and statistics, vol. 91, no. 4, pp. 773-792, 2009.
4.	D. Ray, *Development Economics*, 19 ed. New Delhi, India: Oxford University Press, 2012
5.	A. Sen, *On Economic Inequality*. Oxford: Clarenson Press, 1997.
6.	S. Alkire and M. E. Santos, "*Acute Multidimensional Poverty: A New Index for Developing Countries*," OPHI Working Paper. 2017.
7.	A. V. Banerjee and E. Duflo, *Good Economics for Hard Times*. New Delhi: Juggernaut, 2019.