Detailed Syllabus

Course Code	15B11CI513	**Semester**Even	**Semester** 6th **Session** 2020 -2021 **Month from** January21 to June21
Course Name	**Software Engineering**		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. ShulabhTyagi (62), Dr. Shruti Jaiswal (128)
	Teacher(s) (Alphabetically)	Ms. Sonal, Ms. Sakshi Gupta, Ms. Sarishty Gupta (62) Dr. Chetna Gupta, Dr. Himanshu Mittal (128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C314.1	Explain software engineering principles and software process models for project development.	Remembering(Level 1)
C314.2	Identify functional and non-functional requirements of a software project and design document software requirements specification.	Understand (Level 2)
C314.3	Design, represent and document software requirements specification. Plan and execute activities for a software project.	Create (Level 6)
C314.4	Apply UML modeling for software design from software requirements specification.	Apply(Level 3)
C314.5	Analyze code checklist. Perform code Reviews, Code Refactoring, and Code optimization, design pattern	Analyze(Level 4)
C314.6	Apply testing principles, develop and implement various manual and automated testing procedures, formal methods	Apply(Level 3)
C314.7	Evaluate software in terms of general software quality attributes and possible trade-offs presented within the given problem.	Evaluate(Level 5)

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

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

Evaluation Criteria

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

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

The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

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

Text Book(s):	
1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Fifth Edition-TMH International .
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley.
Reference Book(s):	
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, May 2005
4.	Richard Thayer , "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

Detailed Syllabus

Subject Code	15B11CI514	**Semester: EVEN (specify Odd/Even)**	**Semester** EVEN **Session** 2020-2021 **Month from** January 21 **to** June 21
Subject Name	ARTIFICIAL INTELLIGENCE		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Ambalika Sarkar/ Dr. Shikha Jain
	Teacher(s) (Alphabetically)	AmbalikaSarkar,Dr. Shikha Jain.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C312.1	Design, implement and analyze the problem solving agents using various informed, uninformed search strategies.	Analyzing [Level 4]
C312.2	Analyze and apply algorithms to solve problems requiring evolutionary search strategies, constraint satisfaction and game theory.	Analyzing [Level 4]
C312.3	Represent knowledge and Apply inference mechanisms using propositional logic (PL) and first order predicate logic (FOPL).	Apply [Level 3]
C312.4	Apply model of probabilistic reasoning in incomplete and uncertain environment.	Apply [Level 3]
C312.5	Develop the agents with natural language processing and learning capabilities.	Apply [Level 3]

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

9.	Learning	decision tree, ensemble learning, K-Nearest Neighbor, K-Means algo, Reinforcement Learning	07
10.	Natural Language Processing	Preprocessing, POS tagging using MLE, Parsing using CYK	04
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning component- Students made project in a group of 3-4 members. Projects are made by applying the concepts learned in class to real life applications like stock prediction, customer recommendation, gamming etc. This helps their employability 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)

1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5.	IEEE Intelligent Systems

Software Engineering LAB(15B17CI573)
Detailed Syllabus

Course Description with CO

Course Code	**15B17CI573**	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 **Month from January to Mayx**
Course Name	**Software Engineering LAB**		
Credits	0-0-1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Ms. Sakshi Gupta & Ms. Sarishty Gupta (J62) Mr. Himanshu Mittal (J128)
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati, Dr. Indu Chawla, Ms. Purti Kohli, Ms. Sakshi Gupta, Ms. Sarishty Gupta, Ms. Sonal, Dr. Sulabh Dr. Chetna Gupta, Dr. Himanshu Mittal, Dr. Shruti Jaiswal, Ms. VartikaPuri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C371.1	Explain software engineering principles and software process models for project development, software requirements specification for a software project	Understand Level (Level II)
C371.2	Apply Software Design and modeling.	Apply Level (Level III)
C371.3	Apply Software Optimizing and Refactoring	Apply Level (Level III)
C371.4	Apply testing principles and implement various testing procedures	Apply Level (Level III)
C371.5	Creation of software using software engineering principals	Create (level VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Software Engineering Principals	Introduction to software engineering Principles (evolution, failures, changing nature of software, software myths, product, process, software crisis and need of testing), Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile models – extreme programming and scrum, selection of a life cycle model), PSP, TSP. Types of requirement, Feasibility studies, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	1
2.	Software Design and modeling.	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram. Size oriented metrics, LOC, token count, Function Count, cost estimation, data structure metrics, Halstead's Software Metric, Information Flow Metric,	2

		Overview of Quality Standards like ISO 9001, SEI-CMM, COCOMO, COCOMO-II, Software risk management	
3.	Software Optimizing and Refactoring	Coding standards and guidelines, Code checklist, Code Refactoring and Code optimization	3
4.	Software Testing	Black box testing techniques: Equivalence class testing, Boundary value analysis, Decision table testing, Cause effect graphing, White box testing: Path testing, Data flow and mutation testing, Levels of testing- unit testing, integration and system testing, Debugging-techniques, approaches, tools & standards.	4

Evaluation Criteria

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

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

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

1.	Pressman, Roger S. Software engineering: a practitioner's approach. Palgrave Macmillan, 2005.
2.	Jalote, Pankaj. An integrated approach to software engineering. Springer Science & Business Media, 2012.
3.	KK Aggarwal, Software Engineering, 2001.
4.	David Solomon and Mark Russinovich ," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
5.	https://www.tutorialspoint.com/software_engineering/
6.	ACM/IEEE transactions on Software Engineering
7.	ACM Transactions on Software Engineering Methodology
8.	Springer Journal of Empirical Software Engineering
9.	Springer Journal of Software and Systems Modeling

Detailed Syllabus

Course Code	15B17CI574	**Semester** EVEN	**Semester 6th Session** 2020 -2021

		(specify Odd/Even)	**Month from January 21 to June 21**
Course Name	Artificial Intelligence Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Ankita Verma\ Ambalika Sarkar
	Teacher(s) (Alphabetically)	Ambalika Sarkar, Ankita Verma, Mukta Goel, Shikha Jain, NFS1

COURSE OUTCOMES		**COGNITIVE LEVELS**
C372.1	Construct problem solving agent using various Informed and uninformed search strategies	Apply Level (C3)
C372.2	Utilize evolutionary search algorithms to solve the real world complex problems	Apply Level (C3)
C372.3	Analyze and apply algorithms to solve problems requiring constraint satisfaction and game theory	Analyze Level (C4)
C372.4	Demonstrate and understand the inference mechanisms using prepositional and first order logic	Understand(C2)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Lab hours for the module**	**CO**
1	*Introduction to Programming in Python*	➢ Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	2	C2
2	Problem solving	➢ Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS) ➢ Informed Search and Exploration (BFS, A*, IDA*, SMA*,IDA*)	4	C3
3	Evolutionary Algorithms	➢ Genetic Algorithms	2	C3
4	Constraint satisfaction problems	➢ Formulating Problems as constraint satisfaction problems	2	C4
5	Adversial Search problems	➢ Adversarial Search (optimal decision in games, alpha beta pruning)	3	C3
6	Knowledge representation	➢ Inference using Prolog	2	C2

Evaluation Criteria

Components	**Maximum Marks**
Evaluation 1	10
Lab Test 1	20
Quiz	20
Lab Test 2	20
Mini-project	20
Evaluation 2	10
Total	**100**

Project Based learning: In this subject, students work in the team of 3-4 people, to implement a small application/mini-project based on AI. Projects are made by applying the concepts learned in class to real life applications like automated hardware based application, stock prediction, recommendation system, gaming etc. This helps their employability in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5.	IEEE Intelligent Systems

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B19CI691	**Semester** Even **(specify Odd)**	**Semester** VI **Session** 2020 -2021 **Month from** January to June
Course Name	Minor Project-2		
Credits	2	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	MUKESH SARASWAT, 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 (Attendance (15), Quality of Minor Project (30), Laboratory record (15)
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

Subject Code	15B22CI521	**Semester Even (specify Odd/Even)**	**Semester** Even **Session** 2020 - 21 **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**
C314.1	Differentiate between Public, Private, and Hybrid Clouds	Understand Level (Level 2)
C314.2	Develop Enterprise applications based on XML, JavaScript, Java Servlets, Java Server Pages, etc.	Apply Level(Level 3)
C314.3	Develop web service based solutions by using REST, JSON, SOAP, etc.	Apply Level(Level 3)
C314.4	Examine emerging technologies in cloud environment.	Analyse Level(Level 4)
C314.5	Evaluate the performance of different Public Cloud Platforms e.g., GAE, AWS and Azure.	Evaluate Level(Level 5)
C314.6	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	CO
1	XML Programming	XML, DTD, XML schema, XPath, XQuery	6	CO2
2	Web services	REST, JSON,SOAP	6	C03
3	JavaScript	Basic constructs, Conditional statements, Loop, External linking with .js, Browser related events	6	CO2
4.	Server Side programming	Java servlet, Java server pages	8	CO2
5.	Introduction to Cloud Computing	Public, private, and Hybrid clouds; Features of cloud platforms	4	CO1
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	CO5, CO6
7.	Apache Hadoop	Introduction to distributed computing, Map Reduce	3	C04
8.	Virtualization	Virtualization structures/tools and mechanism, Virtualization of CPU, Memory and I/O devices	2	CO4
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**

Project-Based Learning: Each student (individually) will design, build and deploy an application for a real life problem in Amazon AWS cloud.

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)

Detailed Syllabus

Lecture-wise Breakup

Course Code	**15B22CI621**	**Semester : Even**	**Semester** 6th **Session** 2020 -2021 **Month from Jan 21 to June 21**
Course Name	**Data Mining And Web Algorithms**		
Credits	4	**Contact Hours**	4(3+1)

Faculty (Names)	**Coordinator(s)**	Archana Purwar
	Teacher(s) (Alphabetically)	Archana Purwar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C313.1	Understand the basics of data mining and pre-processing of data.	Understand Level (Level 2)
C313.2	Analyze the transactional data for finding frequent and interesting patterns using association rule mining techniques like Apriori and FP-Growth.	Analyse Level (Level 4)
C313.3	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)
C313.4	Cluster the similar/dissimilar objects using different methods like partitioning, hierarchical and density based clustering.	Create Level (Level 6)
C313.5	Analyze the link structure of web using page rank and HITS algorithms.	Analyse Level (Level 4)
C313.6	Develop recommendation system using collaborative filtering techniques	Create Level (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
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	**10**

		Partitioning Algorithm, subspace clustering techniques, ,Applications of clustering.	
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

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

1.	**Text Books**
2.	Han, Jiawei, Jian Pei, and Micheline Kamber. Data mining: concepts and techniques. Elsevier, 3rd edition ,2012
3.	Kimball R. and Ross M ,The Data Warehouse Toolkit", Wiley, 3rd edition,2013
4.	Pujari, Arun K, Data mining techniques , Universities press, 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
7.	Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier,2002
8.	Berson, Alex, and Stephen J. Smith. Data warehousing, data mining, and OLAP. McGraw-Hill, Inc., 2004
9.	Inmon W.H.,Building the Data Warehouse ,4th Edition, Wiley,2005
10.	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.
11.	Dunham, Margaret H. Data mining: Introductory and advanced topics. Pearson Education India, 2006.

12.	Mattison, Rob, and Brigitte Kilger-Mattison. Web warehousing and knowledge management. McGraw-Hill School Education Group, 1999.
13.	Hand, David, Heikki Mannila, and Padhraic Smyth. Principles of data mining.PHI, 2005
14.	C.D. Manning, P. Raghavan, H. Schütze., Introduction to Information Retrieval, Cambridge Press,1st edition, 2008.

Detailed Syllabus

Lab-wise Breakup

Course Code	15B28CI581	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 **Month:January 2021**
Course Name	Cloud based enterprise systems lab		
Credits	2	**Contact Hours**	0-0-2
Faculty (Names)	**Coordinator(s)**	VikasHassija	
	Teacher(s) (Alphabetically)	Mr. VikasHassija(J62) Mr. Prashant Kaushik (J62)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C581.1	Create Server app and its modules	Create Level (Level 6)
C581.2	Develop multi core server apps	Apply Level (Level 4)
C581.3	Use nodejs for multi core apps	Apply Level (Level 4)
C581.4	Design Auto Scale apps for server	Apply Level (Level 4)
C581.5	Analyse the VMs for the cloud deployment	Evaluate Level (Level 6)
C581.6	Understand the cloud concept for App dev.	Understand Level (Level 2)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Hypervisior Virtual machine (PAAS, IAAS, VAAS)	Use hypervisor scripts to create VMs	4
2.	Types of virtual machine (compute, storage, etc) AWS EC2	Create Storage and compute virtual machines	2
3.	Private Clouds and Public clouds software virtualization. Lambda	Install openstack on personal PC	1
4.	S3cloud orchestration Python scripts for load balancing.DynamoDB	Use S3to host files	2
5.	VPC - cloud networking Backup and recovery	Create a VPC of two node cluster in AWS	3

6.	Billing and Alerts OpenStack using dev stack and more python scripts	Install billing policy in Open stack	5

Evaluation Criteria	
Components	**Maximum Marks**
Lab Test -1	**20**
Lab Test -2	**20**
Lab Evaluations	**30**
Project	**20**
Attendance	**10**
Total	**100**

Project based learning: Each student in a group of 4-5 will develop a basic website or mobile application with No SQL data base connectivity using mongo DB. The created website or app will be hosted on one of the cloud service providers such as amazon AWS or Microsoft Azure. Various features of the service provider will be tested to increase the app performance, scalability or to reduce the cost. This enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related sector.

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

1.	Cloud Computing for Complete Beginners: Building and Scaling High-Performance Web Servers on the Amazon Cloud by Ikram Hawaramani, 2016.
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

Lab-wise Breakup

Course Code	15B28CI681	**Semester : Even** (specify Odd/Even)	**Semester 1st Session** 2020-2021 **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)	Aditi Sharma, Dr.Archana Purwar

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-Growthto 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 andranking 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	DevelopApriori algorithm to mine frequent item-sets. ImplementFP-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 (45) +Attendance (15))	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 thedata mining techniques in any programming languageof 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 2-4 willchoose a real-worlddata 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,StephenJ.Smith, Data Warehousing, data mining and OLAP , McGraw-Hill,2001

8.	InmonW.H.,Building the Data Warehouse ,4th Edition, Wiley(2005).
9.	Mattison R. ,Web Warehousing and Knowledge Management", Tata McGraw-Hill. (2007)
10.	David Hand, HeikkiMannila 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:2020 -2021 Month from: Jan- June 2021**
Course Name	**Sociology of Youth**		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Ms Shikha Kumari**
	Teacher(s) (Alphabetically)	**Ms Shikha Kumari**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-13.1	Demonstrate an understanding ofYouth and youth culture in sociological perspectives	Understanding(C 2)
C304-13.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C304-13.3	Examine the relative importance of structure and agency in shaping young people's experiences and life opportunities	Analyzing(C 4)
C304-13.4	Evaluate youth experience in a context of social change	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	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	2

	in 21st century		
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignment, attendance, Quiz and Participation in Tutorial)
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.	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.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2020 -2021 **Month from January 2021to June 2021**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

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

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	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model,Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-Resource Leveling and Loading.	6
6.	Budgeting, Control and Project Termination	Estimating Project Budgets, Improving the process of cost estimation, Basics, Importance, Purpose of control, Types of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination,	4

		Types of termination, typical termination activities.	
Total number of Lectures			**28**

Evaluation Criteria

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

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 and Time, cost, performance and client satisfaction. They are supposed to do the detailed study of project planning, organizing, scheduling, leading and controlling. They must highlight the various tools and techniques which are used in their chosen project. The project provides understanding to students that how organizations are managing their projects and what is the relevance and appropriate usage of the concepts, tools and techniques that they are studying in this subject. The fundamentals of Project management are very important in today's corporate world and certainly this subject enhances student's employability in every sector.

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

1.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
2.	Timmothy Kloppenborg, Contemporary Project Management, 5th[t] Edition, Cengage Learning, 2017
3.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12th Edition,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

Subject Code	**16B1NHS632**	**Semester: EVEN**	**Semester 6th Session 2020-21 Month from Jan to June**
Subject Name	**COGNITIVE PSYCHOLOGY**		
Credits	**3**	**Contact Hours**	**2-1-0**
Faculty (Names)	**Coordinator(s)**	**Dr. Badri Bajaj**	
	Teacher(s) (Alphabetically)	**Dr. Badri Bajaj**	

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

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

		reasoning processes. Concept formation and categorization; Judgment and decision making	
Total number of Hours			**28**

Evaluation Criteria

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

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

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2nd Ed., Sage Publishing, 2012
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013
3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014
4.	Michael W. Eysenck, Mark T. Keane, Cognitive Psychology: A Student's Handbook , 7th Ed, Psychology Press, 2015
5.	Robert Sternberg, Karin Sternberg, Cognitive Psychology, 6th Ed, Wadsworth/Cengage Learning, 2011
6.	Edward E. Smith, Stephen M. Kosslyn, Cognitive Psychology: Mind and Brain, Ist Ed, Pearson Education India; 2015

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS635**	**Semester: Even**	**Semester: VI Session: 2020 -2021** **Month: Jan 2021 to June 2021**
Course Name	**Organizational Behavior**		
Credits	**3**	**Contact Hours**	**3(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Dr Anshu Banwari**
	Teacher(s) (Alphabetically)	**Dr Anshu Banwari**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-6.1	Identify dynamic human behavior through an insight into relationships between individuals, groups and organizations	Apply (C3)
C304-6.2	Analyze individual management style as it relates to influencing and managing behavior in the organization.	Analyze (C4)
C304-6.3	Decide and justify set of strategies for meeting the special challenges in the 21st century competitive workplace	Evaluate (C5)
C304-6.4	Assess the potential effects of important developments in the external environment on behavior in organizations	Evaluate (C5)

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

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

Evaluation Criteria

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

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

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

1.

2.
3.
4.
5.
6.

S. Robbins, T. Judge, S. Sanghi, *Organizational Behavior*, 13th Ed, Prentice-Hall India, 2001

P.Subba Rao*, Organizational Behavior: Text Cases & Games*, 2nd Edition, Himalaya Publishing House , 2015

John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt, *Organizational Behavior*, 12th Edition, Wiley India Pvt. Ltd, 2012

Debra L.Nelson and James C. Quick, *Organizational Behavior*, Cengage Learning, India Edition, 2009

Steven L. McShane and Mary Ann Von Glinow, *Organizational Behavior Essentials*, Tata McGraw Hill Publishing Company Ltd, 2007

Jerald Greenberg, *Behavior in Organizations*, 10th Ed, PHI Learning Pvt Ltd

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B1NHS636**	**Semester : Even**	**Semester VI Session** 2020 -2021 **Month: January 2021 to June 2021**
Course Name	**Literature & Adaption**		
Credits	**3**	**Contact Hours**	**2-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-3.1	Understand and outline the elements and theories of adaptation and its various forms, and relate with the texts reflecting the cultural, moral and linguistic changes in the contemporary society.	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 in the context of myriad cultures and multidisciplinary settings individually and in groups.	Applying Level (C3)
C304-3.3	Analyze texts and their adaptations beyond the surface level of narrative or character as reflections of value systems of various cultures and times individually and in a team.	Analysing Level (C4)
C304-3.4	Evaluate, interpret and document source texts and adaptations thematically and stylistically to learn the nuances of language, culture and values of the society.	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 adaptation 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, Quiz, Attendance)
Total	**100**

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.	**Stanley Wills & Gary Taylor**, *The Complete Works. The Oxford Shakespeare* (Compact ed.). Oxford: Clarendon Press. , 1988.
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

Subject Code	18B11CS311	**Semester: Even (specify Odd/Even)**	**Semester 6th Session Month from Jan-June 2021**
Subject Name	Computer Networks and Internet of Things		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	1. Somya Jain (JIIT 62) 2. Dr. Payal Khurana Batra (JIIT 128)
	Teacher(s) (Alphabetically)	**JIIT 62:**1. Amarjeet Kaur 2. Dr. Parul Agarwal 3. Dr.Sangeeta Mittal 4. Somya Jain 5. Vivek Kr. Singh 6. NF3 8. **JIIT 128**: 1. AnubhutiRodaMohindra 2. Mr. Bansidhar Joshi 3. Dr. Payal Batra4. Rupesh K Koshariya

COURSE OUTCOMES		**COGNITIVE LEVELS**
C313.1	Defining the basics of networking, components and underlying technologies	Remembering (Level 1)
C313.2	Illustrate the various key protocols in OSI model and TCP/IP protocol suite and explain various application protocols.	Understanding (Level 2)
C313.3	Examine various transport protocols and its performance enhancing mechanisms.	Analysing (Level 4)
C313.4	Determine the shortest path for the network using various routing protocols and evaluate it.	Evaluating (Level 5)
C313.5	Choose IP & MAC addressing mechanisms and data link layer protocols to solve communication, error detection and correction problems.	Applying (Level 3)
C313.6	Identification and description of various components, architectures and protocols of Internet of Things (IoT) and their real life problems.	Understand (Level 2)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Network terminologies,Network Models, Protocol layers and their services, Connection Oriented and Connectionlessservices,Physical Media.	04
2.	The Application Layer	Principles of Application-Layer Protocols, HTTP, File Transfer: FTP, DNS, Electronic Mail in the Internet	4
3.	The Transport Layer	Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, UDP and TCP, Connection Establishment, Transport Layer Protocols (go back N, stop and wait, selective repeat), Flow Control, TCP Congestion Control	8
4.	The Network Layer	Introduction and Network Service Model, IP: the Internet IP addressing, Routing Principles, Protocol, Routing in the Internet,	09
5.	The Link Layer and Local Area Networks	The Data Link Layer: Introduction, Services, Error Detection and Correction, Multiple Access Protocols and LANs, LAN Addresses and ARP, IEEE standards and Ethernet	06
6.	Introduction to Internet of Things	Introduction to IoT, IoT reference Model - IoT Reference Architecture,M2M architecture, IOT devices	05
7	IoT protocols	Introduction to IOT protocols:IEEE 802.11, LoRaWAN, 6LoWPAN, RPL and MQTT and CoAP	06

Total number of Lectures		**42**
Evaluation Criteria **Components**	**Maximum Marks**	
T1	20	
T2	20	
End Semester Examination	35	
TA	25 (Attendance = (10), Assignments/Mini-Project/Tutorial/Quiz = (15))	
Total	**100**	

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, building smart devices, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills towards networking, communication and IoT related issues leading towards employability in IT and hardware sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1	James Kurose, Keith Ross," Computer Networking: A Top-Down Approach Featuring the Internet ", Addison Wesley
2	Andrew S. Tanenbaum ,"Computer Networks ", Prentice-Hall Publishers
3	Larry Peterson , Bruce Davie ,"Computer Networks a Systems Approach ", Morgan Kaufmann
4	William Stallings ,"Data and Computer Communications", Prentice Hall
5	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
6	RajkumarBuyya, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Detailed Syllabus
Lab-wise Breakup

Subject Code	**18B15CS311**	**Semester** **EVEN 2021**	**Semester _V Session 2020-21** **Month Jan 2021 to July 2021**
Subject Name	**Computer Networks and Internet of Things Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**

Faculty (Names)	**Coordinator(s)**	**Dr. P. Raghu Vamsi**
	Teacher(s)	**Dr.P. Raghu Vamsi, Dr.Vivek K Singh, Amarjeet Kaur Dr.Gagandeep Kaur, Dr.Kavita Pandey, Dr.Parul**

S. No.	DESCRIPTION	COGNITIVE LEVEL(BLOOMS TEXONOMY)
C373.1	Classify all the wired/wireless technologies and the basic network building blocks	Understand Level (Level 2)
C373.2	Visualize and analyze the data packets of different TCP/IP layers. Store the data packets as *.pcap files.	Apply Level (Level 3)
C373.3	Create client and server applications using the "Sockets" and the implementation of various protocols at Data link and TCP layer	Analyze Level (Level 4)
C373.4	Implement the working of various sensors and actuators using Arduino and Raspberry Pi.	Apply Level (Level
C373.5	Design and develop applications for various challenges and problems related to Sustainable Development	Create (level 6)

Module No.	Subtitle of the Module	Topics in the module	CO
1.	**Introduction**	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	CO1
2.	**Wireshark Simulator**	Practice on WIRESHARK with tcpdump : Application Layer, Transport Layer	CO2
3.	**Socket Programming**	Client server programming using TCP and UDP, Implementing a calculator	CO3
4.	**Network Simulator (NS2)**	Introduction, Implementation of TCP Tahoe and Reno using ns-2, Performance Analysis of TCP Congestion Control Algorithm, Implementation of AQM Algorithm and its performance analysis, and its performance analysis	CO4
5.	**IOT development boards and interfacing with sensors**	Arduino Boards, Raspberry Pi. Temperature Sensor, Humidity Sensor, Pressure Sensor, Proximity Sensor, Accelerometer, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor.	CO4
6	**Application development with LORA kit**	Developing smart applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, smart cities, smart agriculture.	CO5
Evaluation Criteria			

Components	Maximum Marks
Lab Test -1	**20**
Lab Test -2	**20**
Lab Evaluations	**30 (15 + 15)**
Project	**20**
Attendance	**10**
Total	**100**

Project based learning: Each student in a group of 4-5 will select an application and analyze the different layers of the network model and how data flows through each in order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major requirements of the communication sector. This enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related sector.

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

1.	James F. Kurose, Keith W. Ross, " Computer Networking : A Top-Down Approach Featuring the Internet " 3rd Edition Pearson Education.
2.	Andrew S. Tanenbaum,"Computer Networks" 4th Edition
3.	UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	TeerawatIssariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer.
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

SYLLABUS AND EVALUATION SCHEME

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester:** VI **Session** 2020-21 **Month from:** January- June
Course Name	Econometric Analysis		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	ManasRanjanBehera
	Teacher(s) (Alphabetically)	ManasRanjanBehera

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

Course Code	20B12HS311	**Semester** Even **(specify Odd/Even)**	**Semester Session** 2020-21 **Month from** Jan - July
Course Name	Global Politics		
Credits	3(2-1-0)	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri

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 Proliferation of Nuclear Weapons-history of nuclear proliferation, threat of proliferation with increase in globalization	8

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

Java Programming (20B16CS322)

Detailed Syllabus

Course Description with CO

Course Code	**20B16CS322**	**Semester** Even	**Semester** VI **Session** 2020 -2021 **Month from Jan to Jun**
Course Name	**Java Programming**		
Credits	Audit	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Mr. Mahendra Kumar Gurve
	Teacher(s) (Alphabetically)	Mr. Mahendra Kumar Gurve

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

Course Code	**20B16CS323**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 **Month from January to June**
Course Name	Problem Solving using C and C++		
Credits	0	**Contact Hours**	[0- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Ms. Anuradha Gupta, Ms. Mradula Sharma
	Teacher(s) (Alphabetically)	Dr. Alka Singhal, Dr. Ashish Mishra, Ms. Anuradha Gupta and Mr. Rupesh kumar

COURSE OUTCOMES [NBA Code: C305-9] At the completion of the course, Students will be able to		**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**	**No. of Lectures for the module**
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.	**1**
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	**2**
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.	**2**
4.	String Localization and Regular Expression	Localization and working with regular expression, Programming with Regex library	**1**
5.	Practice problems on Exception Handing and Assertions	Errors and Exceptions, Exception Mechanisms, Exceptions and Polymorphism, Stack unwinding and Cleanup, Common error handling issues	**1**
6.	Applications with Disk Files and other I/O	Using streams, Input and Output with Streams, String Streams, File Streams and Bidirectional I/O	**1**
7.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization of templates, template recursion, variadic templates, Meta-programming	**2**
8.	Working with Standard Template Library	Understanding and working with containers, container adapters and iterators, Lambda expressions, Function objects, STL algorithms, Customize and extend STL	**2**

9.	Programming using Dynamic Memory Allocation Model	Working with dynamic memory, array-pointer duality, low level memory operations, smart pointers and common memory pitfalls	**1**
10.	Problems on Concurrency in Programming	Introduction, Threads, Atomic operations library, Mutual Exclusion, Conditional variables	**1**
			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** 2020 -2021 **Month from Jan 2021 to Jun 2021**
Course Name	**Non-linear Data Structures& problem solving**		
Credits	2	**Contact Hours**	1- 0 - 2

Faculty (Names)	**Coordinator(s)**	Dr. Manju
	Teacher(s) (Alphabetically)	Dr. Aparajita Nanda, Dr. Manish Ku. Thakur, Dr. Manju

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 SartajSahni, 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** 2020 -2021 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits	0	**Contact Hours**	0-0-2 (2 hrs per week)

Faculty (Names)	**Coordinator(s)**	Dr. Shailesh Kumar
	Teacher(s) (Alphabetically)	Ms. Kritika Rani, 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

Course Code	21B12CS311	**Semester odd (specify Odd/Even)**	**Semester VI Session** 2020 -2021 **Month from** Jan21 to May21
Course Name	Software Development Principles and Practices		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Aparajita Nanda
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-13.1	Explain software engineering principles and software process models for project development.	Understand Level (Level 1)
C302-13.2	Analyze software requirements and document software requirements specification.	Analyze Level (Level 4)
C302-13.3	Design and develop the system models for software development.	Apply Level (Level 3)
C302-13.4	Apply risk management principles and processes to determine risk and its mitigation plans.	Apply Level (Level 3)
C302-13.5	Assess software quality using various metrics	Evaluate Level Level 5

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Software Engineering**	Introduction to software engineering principles, Software process models(build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models. Introduction to Agile Methodologies , Project planning, and Project Scheduling.	7
2.	**Requirement Engineering**	Balancing Development Needs with Organizational Expectations, Writing Requirements and Requirements Specifications, Quality Assurance of Requirements, Types of requirement, Prioritizing Requirements, SRS.	7
3.	**Software Design**	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	8
4.	**Risk Assessment and management**	Task Analysis, Accident Theory, Accident Investigation and Reporting, Accident Statistics, Safety Inspection Procedures, Disaster Planning, Risk Management Systems, Analysis of risk at various stages of SDLC, Tools and techniques	5
5.	**Software Metrics**	Size-Oriented Metric, Functional Point metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Objectoriented Metric, Class-Oriented Metric, COCOMO Model.	6

6.	**Software Testing and Debugging**	White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing. Debugging and its types.	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (**Attendance-05, Assignments/Quiz/Mini Project-20**)
Total	**100**

Project based learning: Each student in a group of 4-5 will choose an application or problem Software Development Principles to understand the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment. To make subject application based, the students demonstrate an understanding of current theories, models, and techniques that provide a basis for the software lifecycle. Expose students to current technologies and issues that provide ability to use the techniques and tools necessary for engineering practice and employability into software industries.

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.	Roger S. Pressman and Bruce R Maxim, "Software Engineering: A practitioner approach", 8th Edition- McGraw-Hill - ISBN: 978-0-07-802212-8
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley
Other Reference books	
3.	GRADYBOOCH, JAMES RUMBAUGH, IVAR JACOBSON, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts.
4.	Richard Thayer , "Software Engineering Project Management", Second Edition - Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

Detailed Syllabus
Lecture-wise Breakup

New Elective:

Subject Code	21B12CS312	**Semester:EVEN SEM**	**Semester 6th Session** 2020-2021 **Month from** Jan- May 2021
Subject Name	**Sensor Technology and Android Programming**		
Credits	**03**	**Contact Hours**	**3- 1 -0**

Faculty (Names)	**Coordinator(s)**	Hema N, Gaurav Kumar Nigam
	Teacher(s) (Alphabetically)	Hema N, Gaurav Kumar Nigam

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.	**Fundamental 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 DevelopmentEnvironment. **Android Application Basics:**Anatomy of an AndroidApplication, 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 ExternalWorld**	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, Reference Books, Journals, Reports, Websites etc)

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 2020by 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.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS313	**Semester (Even)**	**Semester** Even **Session** 2020 - 21 **Month from** January to june 2021
Subject Name	Fundamentals of Distributed and Cloud Computing		
Credits	**3**	**Contact Hours**	**3 Lectures**

Faculty (Names)	**Coordinator(s)**	Dr. Prakash Kumar
	Teacher(s) (Alphabetically)	1. Dr. Charu 2. Dr. Prakash Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Identify and solve event ordering related problems occurring due to various synchronization related issues in distributed systems.	Apply (Level 3)
CO2	Compare analysis for Distributed Mutual exclusions and deadlock handling techniques in distributed environments.	Understand (Level 2)
CO3	Evaluate data consistency, replication and fault related issues for various distributed scenarios.	Evaluate (Level 5)
CO4	Understand various Deployment Models, Cloud Service Models, Essential Characteristics, Foundational Elements and Enablers, Cloud Architecture.	Understand (Level 2)
CO5	Analyze various Virtualization Techniques, Virtual Machine Provisioning, Migration techniques 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 Virtual Machine Monitors(VMMs)	Virtualization Technology, Virtualization Techniques, Virtual Machines, Virtual Machine Monitors, Live Migrations, Virtual Clusters. Intel Virtualization Technology: Challenges, Addressing the challenges in IVT.	8
12.	Cloud Security	Data and Network security in cloud, Access control and authentication in cloud computing.	2
			42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project Based Learning:15, Assignments:5, Attendance:5)
Total	**100**

Project Based Learning: A group of maximum 4 students are 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)

Text books

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.

References

6.	Tanenbaum, A. S Distributed Operating Systems, 1st Ed., Prentice-Hall, Englewood Cliffs, NJ.
7.	"Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.
8.	Dan C. Marinescu, "Cloud Computing: Theory and Practice", Morgan Kauffman Publishers, Elsevier.
9.	Rich Uhlig, et. al., "Intel Virtualization Technology" IEEE Journal, 2005.
10.	"Implementing Virtualization" White paper, Intel virtualization Technology, 2008

Detailed Syllabus

Lecture-wise Breakup

Course Code	21B12CS314	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2020 - 2021 **Month from** Jan 2021 to June 2021
Course Name	Introduction to Large Scale Database Systems		
Credits	**3**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Dr.DevpriyaSoni&Dr.Indu Chawla
	Teacher(s) (Alphabetically)	Dr.DevpriyaSoni, Dr.Indu Chawla

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

Subject Code	21B12CS315	**Semester Odd (specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 **Month from:** Jan to Jun 2021
Subject Name	Web Technology andCyber Security (NBA Code: C331-4)		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Bhawna Saxena (J62), VartikaPuri (J128)
	Teacher(s) (Alphabetically)	Bhawna Saxena, P. Raghu Vamsi, VartikaPuri

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**	**CO Mapping**
1.	Review of Essential topics in Web Development	HTML, CSS, JavaScript Basics, Primitives , Functions, Objects , Event - Driven Programming ,Callbacks	4	C331-4.1
2.	Programming in React JS	Understanding SPA, React Overview, React vsAngular,React Deep-Dive, Composition over Inheritance, Declarative code with JSX, Unidirectional Data Flow, Components, Life Cycle, React Router	8	C331-4.2
3.	Programming in Node JS	Introduction to Node JS, Event Loop, REPL, Modules , REST, Scaling	4	C331-4.2
4.	Web Development Frameworks	Developing web applications using Django, Drupal, Bootstrap, Flask, JQuery	5	C331-4.3
5.	Hacking Web Applications and Countermeasures	Cross Site Scripting, Cross Site Request Forgery, XML External Entity (XXE) attacks and their countermeasures	5	C331-4.4
6.	Injection Attacks and Their Defenses	SQL injection, code injection and Command injection Attacks and their Defenses	4	C331-4.4
7.	Denial of Service Attacks	Denial of Service and Distributed Denial of Service Attacks on Web Applications and Defenses	2	C331-4.4
8.	Securing Web Applications	Principles of Cyber Security and Secure Application Architecture	2	C331-4.5
9.	Secure Network Protocols	DNS Attacks and DNSSec , SSL/TLS. VPNs , HTTPs and IPSec	8	C331-4.5

Total number of Lectures	**42**	
Evaluation Criteria **Components** **Maximum Marks** T1 20 T2 20 End Semester Examination 35 TA 25 (Attendance (10), Assignment/ Mini-Project/ Tutorial/ Quiz(15)) **Total** **100**		

Project based learning:A group of 4-5 students will develop a web application using any of the web technologies (either single or in combination) covered as part of this course.Students will be required to develop a secure web application having countermeasures implemented against web hacks like XSS, CSRF, injection attacks, DOS attacks etc. Building a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of cyber security will give students a hands on experience of working in the area of web technology and cyber security.The knowledge gained will enhance 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** 2020 -2021 **Month:January 2021**
Course Name	Introduction to Blockchain Technologies		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr.Mukta Goyal/Vikas Hassija
	Teacher(s) (Alphabetically)	Dr. Mukta Goyal(J128) Mr. Vikas Hassija(J62)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-1.1	Define the basic blockchain terminologies and its related applicationareas.	Remember Level (Level 1)
C332-1.2	Understand the security components in decentralized networks such as cryptography and digital signatures.	Understand Level (Level 2)
C332-1.3	Verify the feasibility of applying different consensus algorithms in blockchain to support low latency and more number of nodes.	Apply Level (Level 3)
C332-1.4	Analyze various consensus algorithms like PoW, PoS, PoB, Raft consensus, Paxos consensus, BFT.	Analyze Level (Level 4)
C332-1.5	Evaluate the performance improvements in block time and throughout by using different consensus algorithms namely PBFT, PoW.	Evaluate Level (Level 5)

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.	4
2.	Components of Blockchain	Importance of distributed consensus, Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles.	3
3.	Blockchain design principles	Network integrity, Distributed Power, Value as Incentives, Security, Privacy, Rights Preservation, Inclusion, and Guidelines for choosing Blockchain project. Example case studies, Application areas.	4
4.	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	3
5.	Blockchain Transactions and consensus	The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination problem, Consensus algorithms, RAFT, Paxos, Byzantine fault Tolerance, PBFT, PoW, PoS.	8
6.	Introduction to Bitcoin Blockchain	Introduction to digital currency, Crypto currency, Explanation of Bitcoin with concepts covered in Module 1, 2, and 3.	4

		Cryptographic methods in Bitcoin, Hashing in Bitcoin, Overview of Hash puzzle in Bitcoin, Consensus in Bitcoin, Bitcoin block structure, block creation and storage, and Bitcoin wallets.	
7.	Metrics for Crypto currencies	Metrics to be considered for designing crypto currency blockchain.	2
8.	Introduction to Smart Contracts	Role of Bitcoin scripts, advantage of smart contracts, Introduction to REMIX IDE, Introduction to Solidity smart contracts, Solidity structure and language syntax, Deploying and interacting with smart contracts via Remix IDE.	8
9.	Developing Blockchain	Getting started with Node js, Role of Node js in crypto currency development, Front end development in Node JS, Back end development in Node JS, Best practices, case study.	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance(10) , Assignment(5), PBLmode(7) and Quiz(3))
Total	**100**

Project based learning: Each student in a group of 4-5 will opt a company that builds tools to help financial institutions and governments monitor the exchange of crypto currencies. The company's due diligence software monitors and detects fraudulent trading, laundering and compliance violations, and builds trust in blockchain.

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.	Nakamoto, Satoshi. Bitcoin: A peer-to-peer electronic cash system. Manubot, 2019.
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)

References :

1	Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World
2.	Blockchain: Blueprint for a New Economy
3.	The Truth Machine: The Blockchain and the Future of Everything
4.	IEEE Transactions on vehicular technology
5	ACM Transactions on Blockchain

Detailed Syllabus

Lecture-wise Breakup

Course Code	21B12CS318	**Semester** : Even	**Semester** 6th **Session** 2020-2021 Month from Jan 2021 to June 2021
Course Name	Big Data Ingestion		
Credits	3	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Arti Jain
	Teacher(s) (Alphabetically)	Dr. Arti Jain

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-2.1	Explain the fundamental concepts of Big Data and Data Analytics.	Understand (Level 2)
C332-2.2	Understand the various formats of Big Data and their sources.	Understand (Level 2)
C332-2.3	Infer the need and challenges of Big Data Ingestion.	Understand (Level 2)
C332-2.4	Apply various types of storage for Big Data such as Hadoop Distributed File Systems, NoSQL and NewSQL.	Apply (Level 3)
C332-2.5	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 Agent, What are the Components of Flume Agent, How Data Flows between Various Components of the Flume.	7

7.	Overview of popular BDI tools	Apache Kafka, Apache Storm, Amazon Kinesis, DataTorrent etc.	4
		Total number of Lectures	**42**

Evaluation Criteria

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

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

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

Text Book(s):

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

Reference Book(s):

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

Course Description

Course Code	21B12CS319	**Semester EVEN**	**Semester** VI **Session** 2020 -2021 **Month from JAN-JUN**
Course Name	Fundamentals of Soft Computing		
Credits	4	**Contact Hours**	3 –1 - 0

Faculty (Names)	**J62**	Sherry Garg
	J128	Varsha Garg

COURSE OUTCOMES		**COGNITIVE LEVELS**
C-332-3.1	Understand vagueness, ambiguity and uncertainty in different type of real world problems	Understanding (Level 2)
C-332-3.2	Analyze the fuzzy inference system and their applications in different set of problems	Analyze(Level 4)
C-332-3.3	Assess different optimization techniques through error /loss functions	Evaluate (Level 5)
C-332-3.4	Integrate and develop standalone and hybrid Intelligent techniques for real time engineering application.	Create (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Knowledge representation and Evolutionary Algorithm	Concept of computing systems, Soft computing vs. Hard computing, Characterstics and applications of soft computing, methods of Knowledge representation, Introduction to Genetic Algorithm.	05
2.	Fuzzy Inference System with applications	Fuzzy sets, operations of fuzzy sets, membership functions, Fuzzy realtions, rules and fuzzy inferences, Defuzzification techniques, Fuzzy expert systems. Application of fuzzy logic.	08
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, MultiLayer PerceptronActivation Functions (Linear, Sigmoid, Tanh, Relu, Leaky Relu), Loss Functions, optimization techniques (Gradient Descent, Stochastic Gradient Descent, Mini Batch Gradient Descent, ADAM, RMSProp, AdaGrad, Nadam)	09
4.	Supervised Learning Models	Feed forward, Back Propagation Network, batch normalization, one hot, dropout, embedding, LSTM, GRU, CNN + RNN, Bi-Directional RNN	12
5.	Unsupervised Learning Models	Boltzmann machines, autoencoders, encoder-decoder, variational autoencoder, stack, convolutional autoencoder	08
		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 assessedbased 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
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

Detailed Syllabus

Lecture-wise Breakup

Subject Code	21B12CS320	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 **Month from:** Jan **to** June 2021
Subject Name	Open source software development		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Kashav Ajmera (J62), Nitin Shukla (J128)
	Teacher(s) (Alphabetically)	J62 – Kashav Ajmera J128 – Nitin Shukla

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, chmod etc.,AWK,SED, SHELL Scripting, GCC, JVM, ECLIPSE, NETBEANS	10
3.	Git for distributed development	Introduction to GIT, its installation and usage, Working with GIT, Common GIT Commands, Creating Repositories, Creating a Commit, GIT Fork, Merge, Pull, Push, Clone; Merge Conflicts, Version Control	2
4.	Python and its libraries	Introduction to python, Python programming, Python libraries: NumPy, SciPy, Ipython, Pandas, matplotlib, Dash,Scikit-Learn, keras/tensorflow,PyTorch,OpenCV python	10
5.	Open Source Tools for Web Development	Open Source Web Development Tools, Web Development Framewroks and their Configurations, Web Servers.	5
6.	Virtualization and Cloud Computing	Introduction to Virtualization – OS Network and Memory, Dockers and Containers, Introduction to Hypervisors, working of hypervisors, Types of Virtual Machine, Creating a Virtual Machine. Cloud Computing overview and history, OpenStack Overview & History, High Level Overview of OpenStack Architecture, Architecting & Implementing OpenStack Deployment, Horizon dashboard.	10
7.	Case Studies: Popular Open Source Software	Study Popular Open Source Software, their Architecture, Development Time-Line, Challenges, Communities	3
Total number of Lectures			**42**

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

Project based learning: The students will work in a group of 3 members. In the mini-project, students will be able to develop applications in either domain - General Purpose Applications, Web-applications, and Cloud using OpenStack. Further they will be able to explore various open source tools and techniques.
used in different domains like data-science, cloud computing, machine learning and AI etc.

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

Detailed Syllabus

Lecture-wise Breakup

Course Code	21B12CS321	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2020-21 **Month from** January **to** June 2021
Course Name	Concepts of Graph Theory		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr Ankit Vidyarthi
	Teacher(s) (Alphabetically)	Dr Ankit Vidyarthi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-5.1	Understand the fundamental concepts in graph theory	Understand Level (Level 2)
C332-5.2	Understand the procedure to store graphs and way to access them	Understand Level (Level 2)
C332-5.3	Apply graph theory logics to solve real world problems using planarity and coloring	Apply Level (Level 3)
C332-5.4	Analyze problems related to spectral and analytical domain that can be solved using special graphs	Analyzing Level (Level 4)
C332-5.5	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:2020-21** Month from: Jan-June
CourseName	Development Issues and Rural Engineering		
Credits	03	ContactHours	2-1-0

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

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

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectu the modu**
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), Povertyand 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 agric health and education infrastructure, literacy levels, population density, poverty, employment etc.). They also need to check the compa of data (data mining and data refining process) and then analyse the contribution of these indicators in rural development of par state/country as whole. Moreover, they are required to analyse the extent of progress and failure of programmes/schemes impleme rural areas for poverty reduction, employment generation and MSMEs. Collecting information and analysing the data rela development indicators and policies will upgrade students'knowledge regarding the development issues and strengthen their skills to 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	18B12HS611	**Semester EVEN** (specify Odd/Even)	**Semester VI Session**2020-2021 **Month from: Jan - June**
Course Name	Marketing Management		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Praveen Sharma, 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. Discuss the modern ethical standards.	5
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**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Viva, Oral 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.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 10th Edition, New Delhi, Pearson Education, 2004.
2.	Darymple, Douglas J., and Leonard J. Parsons, Marketing Management: Text and Cases, 7thEdition, 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.	Hollensen, S. (2019). Marketing management: A relationship approach. Pearson Education.

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B12HS612	Semester:Even	**Semester VI Session** 2020 -2021

			Month from Jan2021 to June 2021
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 Behavioural Internet, 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	4

		Marketing.	
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,Viva and Attendance)
Total	**100**

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

1.	Digital Marketing, Chaffey, D., & Ellis-Chadwick, F, Seventh Edition, Pearson (U.K) 2019.
2.	Digital Marketing, Seema Gupta, First Edition, Mc Graw Hill Education (India) Private Limited ,2018
3.	Social Media Marketing A Strategic Approach, Melissa Barker, Donald Barker, Second Edition Cengage Learning ,2017.
4.	Internet Marketing: A Practical Approach in the Indian Context, Maity, Moutusy, First Edition Oxford University Press,2017.
5.	Fundamentals of Digital Marketing, Puneet Singh Bhatia, Second Edition, Pearson,2017.
6.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
7.	Social Media Marketing, Liana "Li" Evans, First Edition, Pearson, 2011.

Detailed Syllabus Lecture-wise Breakup

Course Code	**18B13HS612**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2020-2021 Month fromJan-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 Lecturesand Tutorial for themodule**
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 UsedJargons.	2
Total number of Lectures			**14**

Module No.	**Title of the Module**	**List of Experiments/Activities**	**CO**
1.	Introduction to Career Lifecycle	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 andAssertiveness.	CO3, CO4
3.	Personnel Development and yourcareer	Practical Sessions on Johari Window-Knowing Thyself, Transaction Analysis-Parent, Child, Adult Ego State for effective interpersonal communication.	CO1, CO3
4.	Human Resource Evaluation and 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 givencompany.

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

1.	Joshi, Campus to Corporate, Your Roadmap to Employability, Sage Publications India Pvt. Ltd., 2015
2.	Mathur, Mastering interviews and group discussions, CBS Publishers& Distributors Pvt. Ltd., New Delhi, 2018
3.	Mitra, Personality Development and soft skills, Oxford University Press, New Delhi, 2011

4.	Pareek and Purohit, Training Instruments in HRD and OD, Sage Publications India Pvt. Ltd., 2018
5.	Pande and Basak, Human Resource Management- Text and Cases, Pearson, 2012
6.	Dessler and Varkkey, Human Resource Management, Pearson, 2011

Detailed Syllabus

Lecture-wise Breakup

Course Code	**21B13HS311**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2020 -2021 Month from Jan 2021-June 2021**
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 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 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

Evaluation Criteria **Components**	**Maximum Marks**

Mid Term	30 (Project)
End Term	40 (Written)
TA	30 (Class Mock Activities, 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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS634**	**Semester E**ven **(specify Odd/Even)**	**Semester Session** 2020 -2021 **Month from** Jan 2021 to June2021
Course Name	**Theatre and performance(Value added)**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Nilu Choudhary
	Teacher(s) (Alphabetically)	Dr Nilu Choudhary

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

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

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Moving in Space.	Students will be moving around the room, filling up the space, changing pace, changing direction, being aware of other people but not touching them. Find new ways of moving, with a different emphasis each time – smooth, jagged, slow, fast, heavy, light, high up, low down and so on. Every now and again Teacher will shout "Freeze! And Students need to freeze every muscle in your body. Absolutely NO LAUGH, LOOKING AROUND, OR MOVING. You will be out.	**C30**4-14**.1**
2.	Mirror Activity	• A great way to get students aware of body movement and working together.	**C30**4-14**.1**
3.	Characterization	Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable.	**C304-14.2**
4.	Script Writing	The more passionate you feel about your idea, the more attractive your play will be. Divide the idea into a beginning, middle and end.	**C304-14.3**
5.	Role Assignment	No acting or movement at this point – just sit together to speak and hear the script carefully. Discuss and clarify any confusing aspects of the script and any apparent challenges in bringing the	**C304-14.3**

		script to the stage. Division of script into small "units" and rehearsed separately	
6.	Turning story into a play	Read thru each episode or unit separately "on its feet".Actors moving around the stage space. Set blocking for each episode. Use ideas generated from Mini-Episodes, and Staging with Images. Make sure the gestures, movements, and stage pictures tell the story clearly.	**C304-14.3**
7.	Stage blocking	Practice the blocking and the lines so that everyone knows what happens when and what their performance responsibilities are. Memorize lines. Work on making characters, relationships, and dialogue clear. This is a good place in which to use the Creating the Character lessons. Pay attention to vocal projection and articulation. Generate ideas about any technical elements you want to incorporate using the Transformation of Objects.	**C304-14.3**
8.	Script to performance	Finalize and run the entire play from beginning to end without stopping to check any additional rehearsal required to get everything running smoothly or not. Finally Perform!!	**C304-14.4**

Evaluation Criteria

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

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

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

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH632	**Semester** EVEN	**Semester 6th Session** 2020 -2021 **Month from January to May**
Course Name	SOLID STATE ELECTRONIC DEVICES		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh Tripathi	
	Teacher(s) (Alphabetically)	NA	

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

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

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (7), Attend. (7), PBL (6) and 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:**2019 -2020 **Month: January to June**
Course Name	Photovoltaic Techniques		
Credits	3	**Contact Hours**	3+1

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Classify various type of renewable energy sources and explain working of photovoltaic device.	Understand Level (Level 2)
CO2	Demonstrate the use of basic principles to model photovoltaic devices	Understand Level (Level 2)
CO3	Identify challenges and apply strategies to optimize performance of various type of solar cells	Apply Level (Level 3)
CO4	Analyze Solar PV module, mismatch parameter and rating of PV module	Analyze Level (Level 4)
CO5	Evaluate the performance of various stand-alone PV systems with battery and AC and DC load	Evaluate Level (Level 5)

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

Total number of Lectures	**40**

Evaluation Criteria

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

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.

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

Detailed Syllabus

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2020 -2021 **Month from: January to June**
Course Name	**Medical & industrial applications of nuclear radiation**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi
	Teacher(s) (Alphabetically)	Dr. Manoj Tripathi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-11.1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
C302-11.2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
C302-11.3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
C302-11.4	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,	09

		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;	
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 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

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

1.	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

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B19BT692	**Semester Even (specify Odd/Even)**	**Semester VI Session Month from** Jan - May
Course Name	**Applied Mushroom Biology**		
Credits	2	**Contact Hours**	**2**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO692.1	Define mushroom biology	Remembering Level (C1)
CO692.2	Experiment with mushroom cultivation	Applying Level (C3)
CO692.3	Explain environmental and medicinal aspects of mushroom	Understanding Level (C2)
CO692.4	Analyze economics of mushroom cultivation	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Principles of Mushroom Biology	Introduction, concepts, types, uses of mushrooms, Edible and poisonous mushrooms	2
2.	Global production	Agribusiness involving mushrooms, global status, opportunities, and constraints	2
3.	Mushroom cultivation	Cultivation: Culturing, preservation methods, spawn production, quality attributes, storage, transport of commercially important mushrooms Lab: Bed preparation, use of different types of substrates (straw, cotton mill waste, water hyacinth etc.) for cultivation of oyster, white button, shiitake, and caterpillar mushrooms	8
4.	Mushroom biotechnology	Constraints in transformation, production of new varieties, genomic and proteomic approaches	4
5.	Environmental & Medicinal aspects	Bioremediation using mushrooms, Production of nutraceuticals & value-added products. Lab: Quality checks in cultivation process, processing, and preservation	8
6.	Economics	Economics of setting up a commercial mushroom production unit.	4

		Lab: Report on economics of production	
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
TA	30
Total	**100**

Project Based Learning:

The course is designed and aimed to train the students about mushroom production for Self or industrial - employment and they succeed in acquiring knowledge after exposure to training on mushroom production and its varied use in different sectors. The students get to know the in-depth concept for utilising modern technologies in mushroom cultivation to ensure high yield, low cost of production and round the year production. Many mushroom culture industries have been setup in India where good employment opportunities exists for persons trained in mushroom culture and employment can be created for self and other persons by establishing mushroom cultivation units, cottage / small scale industry with limited resources. Hence, equips the students to venture in this industry that has remarkably high employment generation and foreign exchange earning potential.

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.	SHU-TING CHANG , PHILIP G. MILES: MUSHROOMS: *Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact,* SECOND EDITION, CRC Press, 2011
2.	R. Gogoi, Y. Rathaiah, T.R. Borah, Mushroom Cultivation Technology, Scientific Publishers, 2019
3.	T.R Borah et al, Spawn Production and Mushroom Cultivation Technology, ICAR manual, 2018, India

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	**Semester :**Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Himanshu Agarwal	
	Teacher(s) (Alphabetically)	Dr. Himanshu Agarwal, Dr. Anuj Bhardwaj, 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.

Applicational Aspects of Differential Equations (20B12MA311)

Course Description

Course Code	20B12MA311	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Applicational Aspects of Differential Equations		
Credits	**3**	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Lakhveer Kaur	
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur	

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 linear equations with constant coefficients.	4
5.	Applications of Differential Equations	Fourier integrals, Fourier transforms, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.	14
Total number of Lectures			**42**

Evaluation Criteria

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

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.

Operations Research (18B12MA611)

Course Description

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Operations Research		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Neha Singhal	
	Teacher(s) (Alphabetically)	Dr. Neha Singhal, Dr. Pato Kumari, 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 inequality constraints, Quadratic Programming -Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and integer programming problem to solve some practical problems. To make the subject application based, the

students analyze the optimized way to deal with afore mentioned topics.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

Mathematical Modelling in Biotechnology (21B12MA311)
Couse Description

Course Code	21B12MA311	**Semester** - Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	**Mathematical Modelling in Biotechnology**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Lakhveer Kaur	
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur, Dr. Amit Srivastava	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-12.1	explain basic concepts of mathematical modelling in Biotechnology.	Understanding Level (C2)
C302-12.2	apply difference equations in mathematical modelling.	Applying Level (C3)
C302-12.3	make use of ordinary differential equations in mathematical modelling.	Applying Level (C3)
C302-12.4	construct and solve mathematical models using system of differential equations.	Applying Level (C3)
C302-12.5	apply partial differential equations and numerical methods to solve various models.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Mathematical Modelling	Classification of mathematical models. Procedure, merits and challenges of mathematical modelling. Applications of algebra, geometry, calculus etc. in mathematical modelling.	6
2.	Mathematical Modelling through Difference Equations	Basic theory and methods for difference equations, Homogeneous and non-homogeneous difference equations, Difference equations in discrete models of population dynamics and genetics, Discrete Prey-Predator models.	8
3.	Mathematical Modelling through Ordinary Differential Equations	Formation of differential equations, Methods of ordinary differential equations, First order and higher order ODEs, Eigen values and eigen vectors, Stability and bifurcation, Applications in continuous models such as Growth models, Decay models, Newton's Law of Cooling, Population dynamics, Continuous Prey-Predator models and other models.	11
4.	Applications of System of Differential Equations	Methods for system of simultaneous ordinary differential equations, Applications in Mathematical models of infectious diseases, The Kermack-McKendrick model, Epidemic models- SI, SIR, SIRS, SIRD etc.	8
5.	Applications of Partial Differential Equations and Numerical Methods in Mathematical	Basic concepts, methods and applications of partial differential equations, Numerical methods in modelling, Euler method, Runge-Kutta method, some applications in Biotechnological processes.	9

	Modelling		
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz , Assignments, PBL etc.)
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.	**J. N. Kapur,**Mathematical Modeling, New Age International 2005.
2.	**L. Edsberg,** Introduction to Computation and Modeling for Differential Equations, John Wiley and Sons 2008.
3.	**D. S. Jones**, Differential Equations and Mathematical Biology, Chapman & Hall/CRC Mathematical Biology and Medicine Series 2005.
4.	**S. Banerjee,** Mathematical Modeling: Models, Analysis and Applications, CRC Press 2014.
5.	**Ching-Shan Chou, Avner_Friedman,** Introduction to Mathematical Biology, Springer International Publishing Switzerland 2016.

Numerical Aptitude (16B19MA691)
Course Description

Course Code	16B19MA691	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Numerical Aptitude		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Trapti Neer	
	Teacher(s) (Alphabetically)	Dr. Trapti Neer, Dr. Neha Ahlawat, Dr. Sarfaraz	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C305-5.1	explain basics of mathematical aptitude.	Understanding Level (C2)
C305-5.2	explain set, functions and representation of numbers.	Understanding Level (C2)
C305-5.3	solve problem on probability theory, quadratic equations and complex numbers.	Applying Level (C3)
C305-5.4	explain inequalities, mensuration, data interpretation and errors.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Mathematical Aptitude	Fractions, simplification, HCF and LCM, ratio and proportion, percentage, partnership, age, average, profit and losses, simple interest and compound interest, time and work, time and distance.	10
2.	Set Theory and Representation of Numbers	Basics, identities, Venn diagram, addition principle, Pigeon hole principle, Functions-types of functions, some special functions, hashing function, characteristics function, Ackermann's function, Representation of numbers in binary, octal, hexadecimal, floating point representation of numbers.	08
3.	Probability	Probability, binomial theorem, linear equations, quadratic equations, complex numbers, logarithms.	06
4.	Geometry and Data Interpretation	Surds and indices, inequalities, mensuration, geometry, data interpretation, errors- types of errors, error propagation, errors in series approximation.	06
Total number of Lectures			**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
TA	30 (Assignments)
Total	**100**

Project based learning: Students are divided in a group of 4-5 to do a survey on the questions that are available in the GMAT or GATE exams. The student can recognize the problems that appear in competitions and do good practice to the said problems as learned in this course.

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.	**Aggarwal, R.S.**, Quantitative Aptitude, S. Chand & Co., 2008
2.	**Praveen, R. V.**, Quantitative Aptitude and Reasoning, 3rd Edition, Prentice Hall India, 2016.
3.	**Prakasa Rao, B.L.S.,**A First Course in Probability and Statistics, World Scientific, 2009.
4.	**Rosen & Kenneth H,** Discrete Mathematics and Its Applications, Tata Mc-Graw Hill, New Delhi, 2007.