THE NATIONAL INSTITUTE OF ENGINEERING
MYSORE – 8

(Autonomous Institution under VTU)

Bachelor of Engineering

Scheme of Teaching and Detailed Syllabus – III Year

5th & 6th Semester

(Batch: 2021-2025 – NEP)

B.E (Computer Science and Engineering)

Department of Computer Science and Engineering

V SEMESTER

SCHEME OF TEACHING AND EXAMINATION
V Semester

Sl. No	Course Code	Course Title	Category	Teaching Department	Theory Lecture L	Tutorial T	Practical/ Drawing P	CIE Marks	SEE Marks	Credits
1	21CS5C01	Operating Systems	PC	CSE	3	0	0	50	100	3
2	21CS5C02	Microprocessor and Interfacing	PC	CSE	3	0	2	50	100	4
3	21CS5C03	Database Management System	PC	CSE	3	0	0	50	100	3
4	21CS5C04	Software Project Management and Entrepreneurship	PC	CSE	3	2	0	50	100	4
5	21CS5C05	Introduction to Data Science	PC	CSE	2	0	0	50	50	2
6	21CS5L01	Database Laboratory	PC	CSE	0	0	2	25	25	1
7	21CS5OXX	Open Elective 1	OE	Other Dept.	3	0	0	50	100	3
8	21CS5A01	Research Methodology and IPR	AEC	CSE	2	0	0	50	50	2
9	21HS5C01	Physical Education/Yoga & NSS	HSC	Physical Education	-	-	-	50	0	0
TOTAL										**22**

		OPEN ELECTIVE 1			
Sl. No.	**Course Code**	**Course Title**	**Theory Lecture**	**Tutorial**	**Practical/ Drawing**
1	21CS5O11	Data Structures	3	0	0
2	21CS5O12	Data Mining	3	0	0
3	21CS5O13	Python Programming	3	0	0
4	21CS5O14	Database Management System	3	0	0
5	21CS5O15	Software Engineering	3	0	0
6	21CS5O16	Object Oriented Programming with C++	3	0	0

Code: 21CS5C01   **Course: Operating Systems**
Credits: 3   **L:T:P - 3:0:0**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks:100**

Prerequisites if any	NIL
Learning objectives	1. To understand the roles and responsibilities of Operating Systems. 2. Familiarize about the concepts of Process, Scheduling, Memory management and Deadlocks.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the process management policies and process scheduling. Illustrate the concepts of VProcess synchronization	Understanding
CO2	Illustrate various strategies of Memory Management especially Paging and Segmentation.	Apply
CO3	Apply various Page Replacement Techniques and identify the design issues in paging.	Apply
CO4	Illustrate the various mechanisms to handle deadlock.	Apply

Mapping with POs and PSOs:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO 1	PSO 2
CO1	3	2	2	-	2	-	-	-	-	-	-	2		2	2
CO2	2	2	2	-	1	-	-	-	-	-	-	2		2	2
CO3	2	2	2	-	2	-	-	-	-	-	-	2		2	2
CO4	2	2	2	–	1	-	-	-	-	-	-	2		2	2

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Processes, Threads and Scheduling			
1.1	**Introduction:** What is an operating system?	1	-	-
1.2	The Operating system as an extended machine, The Operating system as a resource manager.	1	-	-
1.3	**Processes**: The process model, Process creation, Process termination	1	-	-
1.4	Process hierarchies, Process states.	1	-	-
1.5	**Threads**: The Thread model, Thread usage, implementing threads in user space, implementing threads in the kernel	1	-	-
1.6	Hybrid implementations, Scheduler activations	1	-	-
1.7	**Scheduling**: Introduction to scheduling, Scheduling in batch Systems	1	-	-
1.8	Scheduling in interactive systems, Priority based Scheduling	1	-	-
1.9	Round robin Scheduling	1	-	-

Module – 2: Interprocess Communication			
2.1	**Interprocess communication:** Race conditions, Critical regions	1	-	-
2.2	Mutual exclusion with busy waiting,	1	-	-
2.3	Sleep and wakeup	1	-	-
2.4	Semaphores	1	-	-
2.5	Message Passing,	1	-	-
2.6	Barriers	1	-	-
2.7	**Classical IPC problems:** The dining philosophers' problem	1	-	-
2.8	The Readers and Writers problem.	1	-	-
Module – 3: Memory Management			
3.1	**Memory Management:** Background	1	-	-
3.2	Swapping	1	-	-
3.3	Contiguous Memory Allocation	1	-	-
3.4	Paging	1	-	-
3.5	Structure of the page Table	1	-	-
3.6	Segmentation.	1	-	-
3.7	**Virtual Memory**: Background; Demand Paging	1	-	-
3.8	Thrashing	1	-	-
Module – 4: Page replacement Algorithms and Design Issues			
4.1	**Page Replacement Algorithms**: The optimal page replacement algorithm	1	-	-
4.2	The not recently used page replacement algorithm	1	-	-
4.3	The first-in first-out	1	-	-
4.4	The second chance page replacement algorithm	1	-	-
4.5	The clock page replacement algorithm	1	-	-
4.6	The least recently used.	1	-	-
4.7	**Design issues for paging systems**: Local versus Global allocation policies, Load control, Page size	1	-	-
4.8	Separate instruction and data spaces, Shared pages, Shared libraries.	1	-	-
Module – 5: Deadlocks			
5.1	**Deadlocks**: **Introduction to deadlocks**: Conditions for deadlock	1	-	-
5.2	Deadlock modeling.	1	-	-
5.3	**Deadlock detection and recovery**: Deadlock detection with one resource of each type	1	-	-
5.4	Deadlock detection with multiple resource of each type, Recovery from deadlock.	1	-	-
5.5	**Deadlock avoidance**: Resource trajectories, Safe and Unsafe States, The Banker's algorithm for a single resource, The banker's algorithm for multiple resources.	1	-	-
5.6	**Deadlock prevention**: Attacking the Mutual-Exclusion Condition, Attacking the Hold-and-Wait condition, Attacking the No-Preemption condition, Attacking the Circular Wait condition	1	-	-
5.7	Two-Phase Locking, Starvation.	1		
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**	-
	Total No. of Practical Hours	**00**

Textbooks:

1. **Modern Operating systems, 4th** Edition, Andrew S.Tanenbaum, Herbert Bos Pearson Education Limited; Global Edition. **(MODULE1, MODULE 2, MODULE 4, MODULE 5)**

2. **Operating System Principles –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley-India, 7th edition, 2006. **(MODULE 3)**

Reference Book:

1. Operating Systems, William Stallings, PHI, Fourth Edition
2. Operating Systems, Milan Kovic, Tata McGraw Hill, 2001.
3. Operating System Design: v. 1: The Xinu Approach (Prentice-hall Software) Douglas Comer.
4. TUNIX Operating Systems: A Practical Approach, Robert Switzer, Prentice-Hall, 1993.

Online Resources:

1. https://nptel.ac.in/courses/106108101

Code: 21CS5C02   **Course: Microprocessor & Interfacing**
Credits: 3   **L:T:P - 3:0:2**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks: 100**

Prerequisites if any	Computer Organization
Learning objectives	1. To Describe the Architecture of 8086 Data transfer Instructions,
	2. To gain knowledge on Arithmetic and Logic Instructions, Control Instructions, Hardware configuration of 8086 processor and ARM Microcontroller Architecture

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe 8086 Architecture and its addressing modes.	Understanding
CO2	Illustrate the use of data transfer instructions.	Apply
CO3	Illustrate Arithmetic, Logical, Shift and Control Instructions.	Apply
CO4	Describe the Hardware configurations of 8086 processor, Pentium processor and ARM microcontroller Architecture	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	1	-	-	-	-	-	-	-	-	-	-	-	2	2
CO3	1	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	1	-	3	-	2	3	3	-	-	-	-	-	2	2

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: The Microprocessor and its Architecture				
1.1	Internal Microprocessor Architecture, Real Mode Memory Addressing,	2	-	-
1.2	**Addressing Modes, Addressing modes:** Data Addressing Modes	6	-	-
Module – 2: Assembler Language programming – I				
2.1	**Data Movement Instructions**: MOV, PUSH/POP, Load-Effective Address	4	-	-
2.2	String Data Transfers, Miscellaneous Data Transfer, The Jump Group, Procedures instructions.	4	-	-
Module – 3: Assembler Language programming – II				
3.1	**Arithmetic and Logic Instructions:** Addition, Subtraction and Comparison, Multiplication and Division	2	-	-
3.2	Basic Logic Instructions, Shift and Rotate	3	-	-
3.3	**Program Control Instructions,** The Jump Group, Procedures.	3	-	-
Module – 4: Interrupts				
4.1	**Interrupts:** Introduction to Interrupts, System Bus Structure	1	-	-
4.2	Minimum mode 8086 pin configurations, Maximum Mode	2	-	-
4.3	8255 Interfacing: mode 0, Interfacing example	2	-	-
4.4	LED, Stepper motor, Display, keypad	3	-	-

	Module – 5: Introduction to Pentium Microprocessor			
5.1	Introduction to Pentium Microprocessor, Special Pentium Registers, New Pentium instructions	3	-	-
5.2	**ARM-32 bit Microcontroller:** Architecture of ARM Cortex M3, General Purpose Registers, Special Registers, exceptions, interrupts. Assembly basics	5	-	-
	List of Experiments			
1	8086 Assembly Language Programs on programs on Data Movement Instructions	-	-	1
2	8086 Assembly Language Programs on String, procedure, jump instructions	-	-	1
3	8086 Assembly Language Programs on Arithmetic and Logic Instructions	-	-	1
4	8086 Assembly Language Programs on o Arithmetic and Logic Instructions	-	-	1
5	8086 Assembly Language Programs on Logic Instructions	-	-	1
6	8086 Assembly Language Programs on Logic Instructions	-	-	1
7	Read the status of eight input bits from the Logic Controller Interface and display 'FF' if it is the parity of the input read is even; otherwise display 00.	-	-	1
8	Scan a 8 x 3 keypad for key closure and to store the code of the key pressed in a memory location or display on screen. Also display row and column numbers of the key pressed.	-	-	1
9	Drive a stepper motor interface to rotate the motor in Clockwise and anticlockwise direction by N steps. Introduce suitable delay between successive steps.	-	-	1
10	Write an assembly level program to display messages FIRE and HELP alternately with flickering effects on a 7-segment display interface.	-	-	1
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**	-	
	Total No. of Practical Hours		**10**	

Textbook:

1. The Intel Microprocessors, Barry.B.Brey, PHI Publication, 8th edition, 2009.
2. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, 2nd Edition, Newnes, (Elsevier), 2010

Reference Book:

1. Microprocessor and Interfacing, Douglas V.Hall, TMH, 2nd edition 2006
2. Microprocessor Systems: The 8086/8088 Family, Glenn A.Gibson, Prentice-Hall of India, 2nd Edition, 1986.
3. The Intel Microprocessor Family: Hardware and Software Principles and Applications, James L. Antonakos, Thomson, 2007

Online Resources:

- Online Resource 1:https://userpages.umbc.edu/~squire/intel_book.pdf
- Online Resource 2:https://www.tutorialspoint.com/microprocessor/microprocessor_8086_overview.htm

Code: 21CS5C03   **Course: Database Management Systems**
Credits: 3   **L:T:P - 3:0:0**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks:100**

Prerequisites if any	Basic Set Theory
Learning objectives	1. Design databases using the Entity Relationship model and normalization, ensuring efficient data organization and minimizing redundancy. 2. Apply SQL queries to interact with the database, manipulate data effectively, and demonstrate an understanding of transaction concepts.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Infer different database models and creation of MySQL database.	Understanding
CO2	Design the database using Entity-Relationship model and Normalization.	Apply
CO3	Apply SQL query to interact with the database and illustrate transaction concepts.	Apply
CO4	Use triggers, constraints indexes, views and understand database recovery techniques.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	2	-	2	-	2	-	-	-	-	-	-	-		3	1
CO2	2	2	2	-	2	-	-	-	-	-	-	-		3	2
CO3	3	2	2	1	3	-	-	1	1	-	-	-		2	-
CO4	1	-	1	-	1	-	-	-	-	-	-	-		1	-

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction and Relational Database				
1.1	Introduction: Advantages of using a DBMS approaches, Definition of schema, data model and instances	2	-	-
1.2	Three-schema architecture and data independence	1	-	-
1.3	Different Database Models, Interfacing with a Database, The Mechanics, Disk versus Main-Memory, Steps in Designing a Database.	2	-	-
1.4	An Example Database: The Everest Books Database	1	-	-
1.5	**Relational Databases (with a MySQL Flavor):** MySQL Database System, Database Organization, Creating and using the Database.	2	-	-
Module – 2: Database Design				
2.1	**Manipulating the Database:** Example Tables, Relational Algebra, Modeling The Everest Books' Database, Ad Hoc Database Design	2	-	-
2.2	**Database Design 1:** The Entity-Relationship Model- Entity, Entity Sets, Attributes, Relationships, Constraints on Relationship types, Weak entity type, Notations for ER Diagrams	3	-	-
2.3	**Database Design 2:** Definition of Functional Dependencies, Normal Forms Based on Primary Keys - 1NF, 2NF, 3NF, BCNF	3	-	-

Module – 3: SQL and Transactions			
3.1	**SQL:** Basics, Data Definition Language, Data Manipulation Language, Stored Routines.	4	-	-
3.2	**Transactions:** Informally Speaking, Transactions in SQL, Transaction Semantics, Serializability, Locks, SQL Isolation Levels, Transactions in MySQL	4	-	-
Module – 4:Constraints, Triggers, and Indexes			
4.1	**Constraints:** Constraints in SQL, Constraint Check Time	1	-	-
4.2	**Triggers:** Triggers in SQL	2	-	-
4.3	**Indexes:** How does an Index Work?, Types of Indexes, Different Types of Indexes, Hash Indexes, Indexes in MySQL, Some Thoughts on Indexing	5	-	-
Module – 5: Views and Logs & Recovery			
5.1	**Views:** Two Implementations of Views, Views in MySQL, Examples	3	-	-
5.2	**Logs and Recovery:** Failure Types, Logs, Log Details, Some Log Characteristics, Database Recovery, MySQL, Database Recovery Example	5	-	-
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**00**	-
Total No. of Practical Hours				**00**

Textbooks:

1. The Database Book: Principles and Practice using MySQL, Narain Gehani, Universities Press(India) Private Limited 2008.
2. Fundamentals of Database Systems, Elmasri and Navathe, Addison-Wesley, 7[th]Edition, 2016.

Reference Books:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill, 3rd Edition, 2003.
2. Silberschatz, Korth and Sudharshan: Database System Concepts, 6th Edition, McGrawHill, 2010.

Online Resources:

1. https://dev.mysql.com/doc/refman/8.0/en/sql-statements.html
2. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Code: 21CS5C04   **Course: Software Project Management and Entrepreneurship**
Credits: 4   **L:T:P - 3:2:0**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	Apply all the concepts of Project Management and Entrepreneurship

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe the roles and responsibilities by the PM process group (initiating, planning, and executing controlling, closing).	Understanding
CO2	Articulate the purpose and benefits of project management (PM).	Apply
CO3	Apply quality management and process improvement in the context of software development projects.	Apply
CO4	Describe who is an Entrepreneur and clear understanding of Entrepreneurship Process.	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	2	2	3	3	-	3	3
CO2	-	-	-	-	-	-	-	-	-	2	2	-	2	2
CO3	-	1	-	1	2	-	-	-	-	-	-	-	3	2
CO4	3	-	3	-	3	-	2	2	2	3	3	-	2	3

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction to Software Project Management				
1.1	**Introduction to Software Project Management:** Introduction, Why is Software Project Management Important?	2	-	-
1.2	What is a Project? Software Projects versus Other Types of Project	2	2	-
1.3	Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans,	2	-	-
1.4	Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Evaluation and Programme Management, Overview of Project Planning, Some ways of categorizing Software Projects	2	-	-

Module – 2: Software Development Methodologies			
2.1	**Software Development Methodologies:** The old way and the new: The principles of conventional software engineering, principles of modern software management	4	2	-
2.2	Transitioning to an iterative process. Life cycle phases. Software Effort Estimation, introduction, Where are the Estimates Done?	2	-	-
2.3	Problems with Over- and Under-Estimates, the Basis for Software Estimating, Software Effort Estimation Techniques.	2	-	-
Module – 3: Activity Planning			
3.1	**Activity Planning:** Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities	3	-	-
3.2	Risk Assessment - Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management,	3	2	-
3.3	Resource Allocation - Nature of Resources, Identifying Resource Requirements, Scheduling Resources	2	-	-
Module – 4: Introduction to Entrepreneurship			
4.1	What is Entrepreneurship?, Theories on Entrepreneurship, Categories, Influencers, Myths, Challenges, Ethics, Impact	4	-	-
4.2	Entrepreneurship ecosystem, Context, Players, Ecosystem and Entrepreneurial Mobility	4	2	-
Module – 5: Entrepreneurship Process			
5.1	Entrepreneurship Process, Why a Process for Entrepreneurship?	3	-	-
5.2	The Unorthodox Iterative Process, Assessing the Opportunity	3	-	-
5.3	An Overview of the Entrepreneurship Process, Ideation and Coming up with the idea	2	2	-
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**10**	**-**
Total No. of Practical Hours				**00**

Textbook:

1. Bob Hughes, Mike Cotterel, Rajib Mall: Software Project Management, Sixth Edition; McGraw Hill, 2016.

2. Entrepreneurship: Theory and Practice, Raj Shankar, Tata McGraw Hill, 2012

Reference Book:

1. Walker Royce: Software Project Management, Pearson Education, 2015.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs70
2. https://slideplayer.com/slide/8780931/
3. https://slideplayer.com/slide/5770105/
4. https://www.youtube.com/watch?v=b6mcMkQONic
5. https://www.youtube.com/watch?v=4SWEX4L2dOc

Code: 21CS5C05	Course: Introduction to Data Science
Credits: 2	L:T:P - 2:0:0
SEE: 50%	CIE: 50%
SEE Hours: 2	Max. Marks: 50

Prerequisites if any	Linear Algebra, Probability and Statistics
Learning objectives	1. To understand the significance of Data Science in Industry and Academia. 2. Learn basics of R language

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe the importance of Data Science and learn Statistical modelling, probability distributions, fitting a model, Overfitting	Understanding
CO2	Understand EDA and illustrate few machine learning algorithms and implement using R language.	Apply
CO3	Apply Bayesian law and Use Machine learning algorithms as spam filters	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	1	-	-	-	-	-	-	1	2	1
CO2	2	2	2	-	2	-	-	-	-	-	-	1	2	1
CO3	2	3	2	-	1	-	-	-	-	-	-	1	2	1

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction				
1.1	**Introduction**: What is Data Science?	1	-	-
1.2	Big Data and Data Science hype – and getting past the hype,	1	-	-
1.3	Why now? – Datafication, Current landscape of perspectives, Skill sets.	1	-	-
1.4	Needed Statistical Inference: Populations and samples	1	-	-
1.5	Statistical modelling	1	-	-
1.6	Probability distributions	1	-	-
1.7	Fitting a model	1	-	-
1.8	Introduction to R	1	-	-
Module – 2: Exploratory Data Analysis and Data Science Process				
2.1	**Exploratory Data Analysis and the Data Science Process:** Basic tools (plots, graphs and summary statistics) of EDA	1	-	-
2.2	Philosophy of EDA	1	-	-
2.3	The Data Science Process,	1	-	-
2.4	Case Study: RealDirect (online real estate firm).	1	-	-
2.5	Three Basic Machine Learning Algorithms: Linear Regression	1	-	-
2.6	k-Nearest Neighbours (kNN)	1	-	-
2.7	k-means Clustering	1	-	-
2.8	Comparison of these three algorithms	1	-	-

	Module – 3: Machine Learning Algorithm and Usage in Applications			
3.1	**Machine Learning Algorithm and Usage in Applications:** Motivating application: Filtering Spam,	1	-	-
3.2	Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam,	1	-	-
3.3	Data Wrangling: APIs and other tools for scrapping the Web	1	-	-
3.4	**Extracting Meaning from Data:** The Kaggle Model	1	-	-
3.5	Example: User (customer) retention.	1	-	-
3.6	Feature Generation (brainstorming, role of domain expertise, and place for imagination)	1	-	-
3.7	Feature Selection algorithms: Filters; Wrappers	1	-	-
3.8	Decision Trees;	1	-	-
3.9	Random Forests	1	-	-
	Total No. of Lecture Hours	**25**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Doing Data Science, Cathy O'Neil and Rachel Schutt, Straight Talk from The Frontline O'Reilly, 2014

Reference Book:

1. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Morgan Kauffman, Third Edition, 2012
2. Mining of Massive DatasetsV2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Cambridge University Press, 2nd Edition, 2014

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs69
2. https://www.coursera.org/programs/projects/getting-started-with-kaggle?
3. https://www.coursera.org/learn/r-programming?

Code: 21CS5L01	Course: Database Laboratory
Credits: 1	L:T:P - 0:0:2
SET: 50%	CIE: 50%
SET Hours: 2	

Prerequisites if any	NIL
Learning objectives	Develop proficiency in designing, implementing, and interacting with databases using the Entity-Relationship Model and SQL, enabling students to independently create robust and efficient database applications.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Design a database for applications using Entity-Relationship Model.	Analyze
CO2	Develop Structured Query Language (SQL) queries to interact with the database.	Apply
CO3	Design and implement database applications on their own.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	3	-	-	-	2	3	2	1	3	3
CO2	2	-	2	-	3	-	-	-	-	3	-	1	3	3
CO3	2	-	1	-	3	-	-	-	3	3	3	3	3	3

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

List of Exercises

1. SQL Queries 1
2. SQL Queries 2
3. Entity-Relationship Diagrams
4. Mini-Project

Reference Book:

1. The Database Book: Principles and Practice using MySQL, NarainGehani, Universities Press (India) Private Limited 2008.
2. Fundamentals of Database Systems, Elmasri and Navathe, Addison-Wesley, 5th Edition, 2007.

Online Resources:

1. https://dev.mysql.com/doc/refman/8.0/en/sql-statements.html
2. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Code: 21CS5O01	**Course: Data Structures**
Credits: 3	**L:T:P - 3:0:0**
SEE: 50%	**CIE: 50%**
SEE Hours: 3	**Max. Marks: 100**

Prerequisites if any	Problem Solving through Programming
Learning objectives	1. To provide the knowledge to explain the fundamentals of data structures and their applications essential for problem solving.
	2. To acquire the knowledge on applying the concepts of Stack, Queue, Linked lists, trees and sorting algorithms for solving the real-world problems.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the concepts of pointers and structures in problem solving.	Understand
CO2	Use different types of linked lists to solve problems.	Apply
CO3	Demonstrate stack and queue data structures to solve problems.	Apply
CO4	Illustrate the operations performed on tree data structure and different sorting methods.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	2	1	1
CO2	3	2	3	-	-	-	-	-	-	-	-	2	3	3
CO3	3	2	3	-	-	-	-	-	-	-	-	2	3	3
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	3

Mapping Strength: **Strong– 3** **Medium – 2** **Low – 1**

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1:			
1.1	Pointers: Introduction	1	-	-
1.2	Structures, Nested Structures, Arrays of Structures	2	-	-
1.3	Structures and Functions, Self-Referential Structures	2	-	-
1.4	Introduction to Data Structures, Classification of data structures, Operations on data structures, Abstract data type	1	-	-
	Module – 2:			
2.1	Linked Lists - Singly linked lists	3	-	-
2.2	Circular linked lists	2	-	-
2.3	Doubly linked lists	2	-	-
2.4	Circular doubly linked lists	2	-	-
	Module – 3:			
3.1	Stacks: Introduction, Array Representation of Stacks	1	-	-
3.2	Operations on a Stack, Linked Representation of Stacks	1	-	-
3.3	Applications of Stacks: Conversion of an infix expression into a postfix expression, Evaluation of a postfix expression, Recursion.	3	-	-
3.4	Queues: Introduction, Array Representation of Queues, Linked Representation of Queues	2	-	-
3.5	Types Of Queues: Circular Queue, Priority Queues	2	-	-

	Module – 4:			
4.1	Trees: Introduction, Types of Trees	1	-	-
4.2	Traversing A Binary Tree,	1	-	-
4.3	Binary Search Trees, Operations on Binary Search Trees	3	-	-
4.4	Threaded Binary Trees: One-way Threading,	1	-	-
4.5	AVL Tree,Binary Heaps operations	3	-	-
	Module – 5:			
5.1	Sorting: Introduction to Sorting , Radix Sort , Heap Sort	2	-	-
5.2	Hashing and Collision: Introduction, Hash Tables, Different Hash Functions	2	-	-
5.3	Collisions	2	-	-
5.4	Pros and Cons of Hashing, Applications of Hashing	1	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	-
	Total No. of Practical Hours			**00**

Text Books:

1. ReemaThareja, "Data Structures using C", 2nd Edition, 2018, Oxford University Press.

Reference Books:

1. Aaron M Tenenbaum, YedidyahLangsam and Moshe J Augenstein, "Data Structuresusing C", 2014, low price edition, Pearson education,.
2. Richar F Gilberg and Behronz A Forouzan, "Data Structures, A Pseudocode Approach with C", 2nd Edition, 2012, Thomson.
3. Horowitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, 2011, Universities Press.

Online Resources:

1. NPTEL: Programming and Data structures- https://nptel.ac.in/courses/106/105/106105085/
2. Coursera: Data Structures - https://www.coursera.org/learn/data-structures
3. Programming & Data structures: http://nptel.ac.in/courses/106106130/

Code: 21CS5O02

Credits: 3

SEE: 50%

SEE Hours: 3 hrs

Course: Introduction to Data Mining

L:T:P - 3:0:0

CIE: 50%

Max. Marks:100

Prerequisites if any	NIL
Learning objectives	1. Understanding of Data Mining Concepts and Applications 2. Analysis of various Data Preprocessing Techniques and Data Warehouse Implementation. 3. Mining Frequent Patterns, Associations, and Correlations and Classification and prediction

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand Data Mining concepts and applications of Data Mining Applications.	Understanding
CO2	Discuss Data Preprocessing Techniques.	Analyze
CO3	Understand Data Warehouse Implementation.	Analyze
CO4	Acquire the knowledge of Data Cube Computation and Data Generalization, Mining Frequent Patterns, Associations, and Correlations and Classification and prediction	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	2	-	-	-	-	-	-	3	3
CO2	3	2	-	2	-	-	-	-	-	-	-	-	3	2
CO3	3	-	3	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	-	2

Mapping Strength: **Strong– 3** **Medium – 2** **Low – 1**

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Data Mining Concepts and Applications				
1.1	Motivation and importance, What is Data Mining, Relational Databases	2	-	-
1.2	Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications	3	-	-
1.3	Data Mining Functionalities	2	-	-
1.4	Interestingness of a pattern Classification of Data Mining Systems.	1	-	-
Module – 2: Data Preprocessing Techniques				
2.1	Data Preprocessing Why Pre-process the Data?	1	-	-
2.2	Data Cleaning	2	-	-
2.3	Data Integration and Transformation	2	-	-
2.4	Data Reduction	2	-	-
2.5	Data Discretization.	1	-	-
Module – 3: Data Warehouse Implementation				
3.1	Data Warehouse and OLAP Technology for Data Mining	1	-	-
3.2	What is a Data Warehouse? Multi-Dimensional Data Model	2	-	-
3.3	Data Warehouse Architecture	2	-	-
3.4	Data Warehouse Implementation	2	-	-
3.5	Development of Data Cube Technology	1	-	-

	Module – 4: Data Cube Computation and Data Generalization			
4.1	Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation	3	-	-
4.2	Further Development of Data Cube and OLAP Technology	2	-	-
4.3	Attribute-Oriented Induction—An Alternative Method for Data Generalization and Concept Description	3	-	-
	Module – 5: Association and Classification			
5.1	Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map	1	-	-
5.2	Efficient and Scalable Frequent Itemset Mining Methods	2	-	-
5.3	Mining Various Kinds of Association Rules	2	-	-
5.4	Classification and Prediction: What Is Classification? What Is Prediction?	2	-	-
5.5	Issues Regarding Classification and Prediction	1	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, MorganKaufman Publications. 3rd Edition, July 2011.

Reference Book:

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

Online Resources:

1. https://hanj.cs.illinois.edu/bk3/bk3_slidesindex.htm
2. https://www.ibm.com/topics/data-mining

Code: 21CS5O03	Course: Python Programming
Credits: 3	L:T:P - 3:0:0
SEE: 50%	CIE: 50%
SEE Hours: 3	Max. Marks:100

Prerequisites if any	Fundamentals of computer & programming
Learning objectives	1. To store and process data using various Python data structures.
	2. To manage files using python programs.
	3. To implement the object-oriented programming concepts in Python.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the fundamentals of programming using Python	Understanding
CO2	Identify the methods to create and manipulate lists, tuples and dictionaries.	Apply
CO3	Develop programs for string processing and file organization.	Apply
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	1	2	-	-	-	-	-	-	1	3	1
CO2	1	-	2	1	2	-	-	-	-	-	-	1	3	1
CO3	1	-	2	1	2	-	-	-	-	-	-	1	3	1
CO4	1	-	2	1	2	-	-	-	-	-	-	1	3	1

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1:				
1.1	**Python Basics:** Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program.	3	-	-
1.2	**Flow control:** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().	3	-	-
1.3	**Functions:** def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number.	3	-	-
Module – 2:				
2.1	**Lists:** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References.	3	-	-
2.2	**Dictionaries and Structuring Data:** The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.	3	-	-
Module – 3:				
3.1	**Manipulating Strings:** Working with Strings, Useful String Methods, Project: Adding Bullets to Wiki Markup	3	-	-

3.2	**Reading and Writing Files:** Files and File Paths,	3	-	-
3.3	The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, **Project:** Generating Random Quiz Files.	3	-	-
Module – 4:				
4.1	**Organizing Files:** The shutil Module,	2	-	-
4.2	Walking a Directory Tree	1	-	-
4.3	Compressing Files with the zipfile Module	2	-	-
4.4	**Project:** Renaming Files with American-Style Dates to European-Style Dates	1	-	-
4.5	**Project:** Backing Up a Folder into a ZIP File.	1	-	-
Module – 5:				
5.1	**Classes and objects:** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying	3	-	-
5.2	**Classes and functions:** Time, Pure functions, Modifiers, Prototyping versus planning	3	-	-
5.3	**Classes and methods:** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation	3	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Al Sweigart, "Automate the Boring Stuff with Python", 1stEdition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)

Reference Book:

1. Learning Python, Mark Lutz, O'Reilly Media, 5th Ed.
2. Introducing Python – Modern Computing in Simple Packages, Bill Lubanovic, O'ReillyMedia, First Edition.

Online Resources:

1. https://www.learnbyexample.org/python/
2. https://www.learnpython.org/
3. https://pythontutor.com/visualize.html#mode=edit

Code: 21CS5O04	Course: Database Management System
Credits: 3	L:T:P - 3:0:0
SEE: 100 Marks	CIE: 100 Marks
SEE Hours: 3	Max. Marks:100

Prerequisites if any	NIL
Learning objectives	To learn the fundamentals of Database Management Systems, its design, interacting with database and other related concepts.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the fundamentals of database management systems.	Understand
CO2	Design relational database using Entity Relationship model and Normalization.	Analyze
CO3	Use relational operations & expressions and write SQL queries and SQL queries to interact with the database.	Apply
CO4	Explain the concepts of database transactions and create triggers, indexes, and views in SQL.	Understand

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	2	-	2	-	2	-	-	-	-	-	-	-		-	-
CO2	3	-	2	-	2	-	-	-	-	-	-	1		3	3
CO3	3	2	2	-	3	-	-	-	-	-	-	2		3	3
CO4	2	-	1	-	2	-	-	-	-	-	-	-		3	3

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1				
1.1	**Introduction:** Introduction, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach	4	-	-
1.2	Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence	4	-	-
Module – 2				
2.1	Database Design: Entity, Entity Sets, Attributes, Relationships, Constraints on Relationship types, Weak entity type	3	-	-
2.2	Notations for ER Diagrams, Sample ER Notations.	2	-	-
2.3	Definition of Functional Dependencies, Normal Forms Based on Primary Keys - 1NF, 2NF, 3NF, BCNF.	3	-	-
Module – 3				
3.1	Relational Algebra Operations and Expressions	2	-	-
3.2	SQL: Basics, Data Definition Language	2	-	-
3.3	Data Manipulation Language	2	-	-
3.4	Stored Routines	2	-	-
Module – 4				
4.1	Transactions: Informally Speaking, Transactions in SQL, Transaction Semantics, Serializability, Locks, Transactions in MySQL	4	-	-

4.2	Constraints: Constraints in SQL, Constraint Check Time	2	-	-
4.3	Triggers: Triggers in SQL	2	-	-
Module – 5				
5.1	Indexes: How does an Index Work?, Types of Indexes, Different Types of Indexes, Hash Indexes, Indexes in MySQL	5	-	-
5.2	Views: Two Implementations of Views, Views in MySQL, Examples	3	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**-**	**-**
	Total No. of Practical Hours			**-**

Textbooks:

1. The Database Book: Principles and Practice using MySQL, NarainGehani, Universities Press (India) Private Limited, 2008.
2. Fundamentals of Database Systems, Elmasri and Navathe, Addison-Wesley, 7th Edition, 2016.

Reference Books:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill, 3rd Edition, 2003.
2. Database System Concepts, Silberschatz, Korth and Sudharshan, 6th Edition, McGrawHill, 2010.

Online Resources:

1. https://nptel.ac.in/courses/106105175
2. https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/

Course Code: 21CS5O05   **Course: Software Engineering**
Credits: 3   **L:T:P   3:0:0**
CIE: 50%   **SEE: 50%**
SEE Hours: 3   **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	1. Learn the fundamentals of software engineering process and process models for building a software systems. 2. Learn to validate the software systems using testing strategies 3. Use suitable software project estimation model for developing software

Course Outcomes:

On successful completion of the course, the student will be able to:

COs	Course Outcomes	Bloom's level
CO1	Describe the fundamentals of Software Engineering Process and Process Models	Understand
CO2	Prepare quality software system using design principles.	Apply
CO3	Use software testing techniques to perform system validations.	Apply
CO4	Apply an effective software project estimation model for developing software product.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	-	-	-	2	2	2	2	2	-
CO2	-	-	3	-	2	-	-	-	2	2	-	2	3	-
CO3	3	-	-	2	-	-	-	-	-	-	-	2	-	2
CO4	3	3	3	2	-	2		2	2	2	2	2	-	3

Mapping strength : 3 – Strong   2 – Medium   1 – Low

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Introduction** to Software engineering	2	-	-
1.2	**The Software Process**: Software Engineering, A Layered Technology, A Process Frame Work, Capability Maturity Model Integration	3	-	-
1.3	**Process Models**: Incremental Process Models, Evolutionary Process Models	3	-	-
	Module – 2			
2.1	**Agile View of Process**: Agility, Agile Process, Agile Process Model	3	-	-
2.2	**Requirement Engineering:** Requirement Engineering Tasks, Initiating Requirement Engineering Process, Developing USE-CASE	4	-	-

	Module – 3			
3.1	**Building The Analysis Model**: Requirement Analysis, Analysis Modeling Approach, Data Modeling concept, Scenario Based Modeling, Flow Based Modeling, and Behavioral Modeling	4	-	-
3.2	**Design Engineering:** Design Process and Design Quality, Design Concepts	4	-	-
3.3	**Creating an Architectural Design**: Software Architecture, Data Design, Architectural Styles and Patterns	3	-	-
	Module – 4			
4.1	**Testing Strategies**: A Strategic Approach to Software Testing, Test Strategies for Conventional Software, validation testing	3	-	-
4.2	**Testing Tactics**: Software Testing Fundamentals, Black Box & White Box Testing, Basis Path Testing, Black Box Testing	4	-	-
	Module – 5			
5.1	**Project Management**: Project Management Spectrum, People, Product, Process, Project	3	-	-
5.2	**Software Project Estimation**: Decomposition Techniques, Empirical Estimation Models	3	-	-
5.3	**Report writing**	1	-	-
	Total No. of Lecture Hours	**40**		
	Total No. of Tutorial Hours		**00**	**00**

Text Books:

1. Software Engineering: A Practitioners Approach – Roger S. Pressman, 7th Edition, McGraw-Hill 2010

Reference Books:

1. Software Engineering: Ian Somerville, 10th Edition, Pearson Education, 2016.

2. Software Engineering Theory and Practice: Shari Lawrence P fleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.

3. Software Engineering Principles and Practice: Waman S Jawadekar, Tata McGraw Hill, 2004

Online Resources:

1. https://www.digimat.in/nptel/courses/video/106101061/L01.html

2. https://www.digimat.in/nptel/courses/video/106105182/L01.html

3. https://www.coursera.org/learn/software-processes-and-agile-practices

Code: 21CS5O06   **Course: Object Oriented Programming with C++**
Credits: 3   **L:T:P - 3:0:0**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks: 100**

Prerequisites if any	Familiarity with basic programming concepts such as variables, data types, control structures, functions and basic input/output operations.
Learning objectives	1. Understand and implement the fundamental concepts of object-oriented programming. 2. Gain proficiency in using access specifiers (public, private, protected) to control the visibility and accessibility of class members. 3. Learning the concepts of virtual functions and abstract classes, facilitating runtime polymorphism and creating interfaces. 4. Explore the concept of templates and generic programming, enabling the creation of reusable code that can work with different data types.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain principles of Object Oriented Programming using class and objects.	Understanding
CO2	Design and implement classes, objects, and member functions in C++ and Create and use constructors and destructors to initialize and clean up objects.	Apply
CO3	Use operator overloading and Design reusable and extensible classes using inheritance and virtual functions.	Apply
CO4	Analyze templates and generic programming techniques to create reusable code that works with different data types and Use advanced C++ features such as STL	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	-	1	3	-	-	-	2	-	2	-	-	-		2	3
CO2	2	-	2	1	3	1	-	-	-	2	1	1		2	3
CO3	2	-	2	1	3	1	-	-	-	2	1	1		2	3
CO4	2	-	2	1	3	1	-	-	-	2	1	1		2	3

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

No s	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: Introduction to Object-Oriented Programming			
1.1	**Introduction:** Generation of Programming Languages, Features of Object-Oriented Programming, Merits and Demerits of Object-Oriented Programming Language, Applications of Object-Oriented Programming.	2	-	-
1.2	**Basics of C++ Programming:** History of C++, Structure of C++ Program, Writing the First C++ Program, Compiling and Executing C++ Programs, Input and Output Statements in C++.	3	-	-

1.3	**Functions, Arrays, pointers:** Inline Functions, Memory Allocation in C++ Programs, C++ Extension to Structures, Dynamic Memory Allocation, Copying and Comparing Structures, Structures and Functions, C++ Extension to Structures.	3	-	-
Module – 2: Classes and Objects				
2.1	**Introduction:** Specifying a Class, Creating Objects, Accessing Object Members, Nested Member Functions, making a Member Function Inline, Memory Allocation for Class and Objects, Array of Objects, Dynamic Memory Allocation for Array of Objects, Returning Objects, This Pointer, Constant Parameters and Members, Pointers within a Class, Local Classes, Nested Classes in C++, Empty Classes, Friend Function, Friend Class, Pointers and Class Members.	4	-	-
2.2	**Constructors and Destructors:** Introduction, Constructor, Types of Constructors, Constructor with Default Arguments, Constructor Overloading, Destructors, Object Copy, Constant Objects, Anonymous Objects, Anonymous Classes.	4	-	-
Module – 3: Operator Overloading and Type Conversions				
3.1	**Introduction:** Scope of Operator Overloading, Syntax for Operator Overloading, Operators that can and cannot be Overloaded, Implementing Operator Overloading.	3	-	-
3.2	Overloading Unary Operators, Returning Object, Using a Friend Function to Overload a Unary Operator, Overloading the Prefix Increment and Decrement Operators, Overloading the Post-Fix Increment and Post-Fix Decrement Operators, Overloading Binary Operators, Overloading Special Operators.	3	-	-
3.3	Type Conversions.	2	-	-
Module – 4:Inheritance and Run-Time Polymorphism				
4.1	**Introduction:** Defining Derived Classes, Access Specifiers, Types of Inheritance, Single Inheritance, Constructors and Destructors in Derived Classes, Multi-Level Inheritance, Constructor in Multi-Level Inheritance, Multiple Inheritance, Constructors and Destructors in Multiple Inheritance, Ambiguity in Multiple Inheritance, Hierarchical Inheritance, Constructors and Destructors in Hierarchical Inheritance, Hybrid Inheritance.	3	-	-
4.2	Virtual Base Classes, Object Slicing, Pointers to Derived Class, Run-Time Polymorphism.	3	-	-
4.3	Virtual Functions, Pure Virtual Functions, Abstract Base Classes, Virtual Constructor and Destructors, Pros and Cons of Inheritance.	3	-	-
Module – 5: Templates, STL and New Features in C++				
5.1	**Introduction:** Use of Templates, Function Templates, Class Template, Class Templates and Friend Function, Templates and Static Variables in C++, Class Templates and Inheritance, Class Template with Operator Overloading, Pros and Cons of Templates.	4	-	-
5.2	**STL and New Features in C++:** Containers, Algorithms, Iterators, Using Containers, Run-Time Type Information, Explicit Keyword, Mutable Keyword.	3	-	-
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**00**	-
Total No. of Practical Hours				**00**

Textbook:

1. Reema Thereja, "Object Oriented Programming with C++", First Edition, Oxford University Press, 2015.

Reference Book:

1. **C++ The Complete Reference,** Herbert Schildt, TMH, McGraw-Hill, 4th Edition, 2017.
2. Let Us C: BalaGuruswamy, TATA McGraw Hill.
3. **C++ Primer**, Stanley B.Lippman and JoseeLajore, Addison Wesley, 3rd Edition, 2014.

Online Resources:

1. http://www.cplusplus.com/

Code: 21CS5A01   **Course: Research Methodology and IPR**
Credits: 2   **L: T: P - 2:0:0**
SEE: 50%   **CIE: 50%**
SEE Hours: 2   **Max. Marks: 50**

Prerequisites if any	NIL
Learning objectives	1. To gain knowledge on research methodology and explain the technique of formulating a research problem. 2. To understand various research designs and different types of data collections. 3. To acquire the knowledge on report writing and various concepts of IPR.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Discuss different objectives of research and formulating Research Problem	Understanding
CO2	Analyze various research design and methods of data collection	Analyze
CO3	Acquire the knowledge on Report Writing and IPR	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	3	3	-	-	-	3	-	-	-	-	-		3	2
CO2	3	2	3	-	-	-	-	-	-	-	-	-		3	-
CO3	-	3	-	-	-	-	3	-	-	-	-	-		2	1

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Research Methodology: An Introduction, Defining the research problem			
1.1	Meaning of Research, Objectives of Research Motivation in Research	1	-	-
1.2	Types of Research, Research Approaches, Research Methods versus Methodology, Research and Scientific Method.	2	-	-
1.3	Research Process.	3	-	-
1.4	Criteria of good research, what is a Research Problem?	1	-	-
1.5	Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.	2	-	-
Module – 2: Research Design, Methods of data collection			
2.1	Meaning of Research, Design, Need for Research Design	1	-	-
2.2	Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs.	2	-	-
2.3	Collection of Primary Data, Observation Method, Interview Method Collection of Data through Questionnaires.	3	-	-
2.4	Collection of Data through Schedules, Difference between Questionnaires and Schedules Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection	3	-	-

Module – 3: Interpretation and Report Writing and Introduction to Intellectual Property				
3.1	Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Precautions for Writing Research Reports.	1	-	-
3.2	Role of IP in the Economic and Cultural Development of the Society, IP Governance, Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention, Rights Associated with Patents, Enforcement of Patent Rights, Inventions Eligible for Patenting, Process of Patenting	4	-	-
3.3	Classes of Copyrights, Criteria for Copyright Ownership of Copyright, Copyrights of the Author, Copyright Infringements, Copyright Registration, Copyright Symbol Validity of Copyright.	2	-	-
	Total No. of Lecture Hours	**25**	-	-
	Total No. of Tutorial Hours		**00**	-
	Total No. of Practical Hours			**00**

Textbook:

1. Kothari, C.R., (2014), Research Methodology, New Age International second revised edition
2. Prof. Rupinder Tewari, Ms. Mamta Bhardwaj (2021) Intellectual Property A Primer for Academia.

Reference Book:

1. Ranjit Kumar, (2011). Research Methodology a step by step guide for beginners, Sage Publications

2. Chawla, Deepak &Sondhi, Neena (2011). Research methodology: Concepts and Cases, Vikas Publishing House Pvt. Ltd. Delhi.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec23_ge07/preview
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview

VI SEMESTER

SCHEME OF TEACHING AND EXAMINATION
VI Semester

Sl. No	Course Code	Course Title	Category	Teaching Department	Teaching Hours / Week			Examination		Credits
					Theory Lecture	Tutorial	Practical/ Drawing			
					L	T	P	CIE Marks	SEE Marks	
1	21CS6C01	Artificial Intelligence and Machine Learning	PC	CSE	3	0	0	50	100	3
2	21CS6C02	Computer Networks	PC	CSE	3	0	0	50	100	3
3	21CS6C03	Fundamentals of DevOps	PC	CSE	3	0	0	50	100	3
4	21CS6C04	Full Stack Development	PC	CSE	3	0	2	50	100	4
5	21CS6L01	Computer Networking Laboratory	PC	CSE	0	0	2	25	25	1
6	21CS60XX	Open Elective 2	OE	Other Dept.	3	0	0	50	100	3
7	21CS6C05	Minor Project	PC	CSE	0	0	4	50	50	2
8	21CS6AXX	AEC 6	AEC	CSE	1	0	0	50	0	1
9	21HS6C01	Environment Studies	HSC	Civil				50	0	0
10	21HS6C02	Physical Education/Yoga & NSS	HSC	Physical Education	-	-	-	50	0	0
11	21XX6I01	Summer Internship 2	PI	Completed during IV Sem Vacation				50	50	2
TOTAL										**22**

OPEN ELECTIVE 2					
Sl. No.	Course Code	Course Title	Theory Lecture	Tutorial	Practical/ Drawing
1	21CS6O01	Big Data Analytics	3	0	0
2	21CS6O02	Cyber Security	3	0	0
3	21CS6O03	C# Programming and .Net Concepts	3	0	0
4	21CS6O04	Block chain Technology	3	0	0
5	21CS6O05	Machine Learning	3	0	0
6	21CS6O06	Programming in JAVA	3	0	0

Code: CS6C01	Course: Artificial Intelligence and Machine learning
Credits: 3	L:T:P - 3:0:0
SEE: 50%	CIE: 50%
SEE Hours: 3	Max. Marks: 100

Prerequisites if any	NIL
Learning objectives	Understand the basics of Machine Learning and Artificial Intelligence.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the theoretical concepts of Machine learning models	Understanding
CO2	Apply the concepts of Bayeian rule in Decision making	Apply
CO3	Apply the various dimensionality reduction techniques	Apply
CO4	Understand the fundamentals of Intelligent agents, basic concepts of knowledge representation and logic agents	Understanding

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	3	3	3	-	-	-	-	-	-	-	2	1
CO2	-	3	3	3	3	-	-	-	-	-	-	-	2	1
CO3	-	3	3	3	3	-	-	-	-	-	-	-	2	1
CO4	-	2	2	2	2	-	-	-	-	-	-	-	2	1

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos.	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction to Machine Learning				
1.1	What Is Machine Learning?	1		
1.2	Examples of Machine Learning Applications	2		
1.3	Learning a Class from Examples	1		
1.4	Vapnik-Chervonenkis Dimension	1		
1.5	Probably Approximately Correct Learning	1		
1.6	Noise	1		
1.7	Regression	1		
1.8	Model Selection and Generalization	1		
Module – 2: Bayesian Decision Theory				
2.1	Classification	1		
2.2	Losses and Risks	1		
2.3	Discriminant Functions	1		
2.4	Maximum Likelihood Estimation	2		
2.5	Evaluating an Estimator: Bias and Variance	1		
2.6	The Bayes' Estimator	1		
2.7	Regression	1		
2.8	Model Selection Procedures	1		

Module – 3: Dimensionality Reduction			
3.1	Subset Selection	2		
3.2	Principal Component Analysis	2		
3.3	Singular Value Decomposition and Matrix Factorization	1		
3.4	k-Means Clustering	1		
Module – 4: Introduction to AI				
4.1	Intelligent agent	1		
4.2	Agents and environments, behavior	1		
4.3	The concept of rationality	1		
4.4	The nature of environments	1		
4.5	The structure of agents	1		
4.6	Problem solving agents	1		
4.7	Informed (heuristic) search strategies	2		
Module – 5: Logical Agents & Knowledge Representation				
5.1	Knowledge-Based Agents	1		
5.2	The Wumpus World	1		
5.3	Logic	1		
5.4	Propositional Logic	1		
5.5	Agents Based on Propositional logic	1		
5.6	Ontological Engineering	1		
5.7	Categories and Objects	1		
5.8	Reasoning Systems for Categories	1		
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**00**	-
Total No. of Practical Hours				**00**

Textbook:

1. Introduction to Machine Learning, Alpaydin Ethem, 2015.
2. Artificial Intelligence: A modern Approach Stuart Russell, Peter Norvig Third edition, Pearson publication, 2015.

Reference Book:

1. Mehryar Mohri, Afsin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, 2nd Edition, 2018

Online Resource:

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Prerequisites if any	Data Communications and Networking
Learning objectives	1. To understand the services of network layer, functioning of unicast and multicast routing protocols 2. To learn the IPv4 , IPv6 and subnetting concepts 3. To learn the transport and application layer protocols

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Discuss the network layer services, concepts of IP, auxiliary protocol in IPV4 and working of different Unicast Routing algorithms and protocols.	Understand Apply
CO2	Discuss IPV6, its features and various Multicast routing protocols.	Understand Apply
CO3	Identify the functions of the Transport layer, analyze the performances of UDP and TCP protocols.	Understand Apply
CO4	Explain the working of various application layer protocols.	Understand

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	-	-	-	-		2	1
CO2	3	2	-	-	1	-	-	-	-	-	-	-		2	1
CO3	3	2	-	-	1	-	-	-	-	-	-	-		2	1
CO4	2	1	-	-	2	-	-	-	-	-	-	-		3	2

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos.	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Network Layer-I				
1.1	Network layer services: Packetizing ,Routing and forwarding other services	1	-	-
1.2	Packet switching: Datagram approach, Virtual circuit approach,	1	-	-
1.3	Network layer performance,	1	-	-
1.4	IPv4 addresses: Address space, Classful addressing	1	-	-
1.5	Classless addressing	1	-	-
1.6	DHCP, Network Address Resolution (NAT)	1	-	-
1.7	Forwarding IP packets: based on Destination Address and longest matching	1	-	-
1.8	Network Layer Protocols: Internet Protocol (IP): Datagram format	1	-	-
1.9	Fragmentation and options.	1	-	-

	Module – 2: Network Layer-II			
2.1	ICMPv4: Messages, debugging tools, ICMP Checksum	1	-	-
2.2	Mobile IP: Addressing, Agents, Three phases	1	-	-
2.3	Unicast Routing: Introduction, General Idea, Least cost routing	1	-	-
2.4	Routing Algorithms: Distance Vector Routing	1	-	-
2.5	Link State routing	1	-	-
2.6	Unicast Routing Protocols: Internet Structure, Routing Information Protocol(RIP)	1	-	-
2.7	Border Gateway Protocol(BGP): operation of External BGP(eBGP),Operation of Internal BGP(eBGP)	1	-	-
	Module – 3: Network Layer-III			
3.1	Multicast Routing: Introduction, Unicasting, Multicasting, broadcasting, Intra-domain Multicast Protocols: DVMRP	1	-	-
3.2	PIM (DM), PIM (SM)	1	-	-
3.3	IGMP: Messages, Propagation of Membership Information and Encapsulation,	1	-	-
3.4	IPv6 Addressing: Representation, Address space, Address space allocation	1	-	-
3.5	Auto configuration	1	-	-
3.6	The IPv6 Protocol: Packet Format, Extension Header	1	-	-
3.7	The ICMPv6 Protocol: Error Reporting Messages, Information Messages, Neighbor Discovery Messages and Group Membership Messages.	1	-	-
	Module – 4: Transport Layer			
4.1	Introduction, Transport layer services: Process-to-process communication, Addressing: port numbers, ICANN ranges, Encapsulation and Decapsulation, Multiplexing and Demultiplexing , Flow Control and Error Control.	1	-	-
4.2	Transport layer protocols: Introduction: Services, Port Numbers	1	-	-
4.3	User Datagram Protocol: User Datagram, UDP Services	1	-	-
4.4	Transmission Control Protocol: TCP services, TCP Features	1	-	-
4.5	Segment, A TCP Connection	1	-	-
4.6	Windows in TCP, Flow Control	1	-	-
4.7	Error control: checksum, acknowledgment, generating acknowledgement, RTO, retransmission after 3 duplicates ACK segment, out of order segment.	1	-	-
4.8	TCP congestion control: Congestion Window, Congestion detection	1	-	-
4.9	Congestion policies, Fast Recovery and TCP timers	1	-	-
	Module – 5: Application Layer			
5.1	Introduction: Providing Services, Application layer Paradigms. Client Server Programming: API	1	-	-
5.2	standard client server protocols: WWW & HTTP	1	-	-
5.3	FTP, Electronic Mail: Architecture, User Agent, Message Transfer Agent.	1	-	-
5.4	POP3, IMAP	1	-	-
5.5	Telnet: Local versus Remote Logging	1	-	-
5.6	Domain Name System: Name Space, Flat Name Space, DNS in the Internet	1	-	-
5.7	Resolution, Caching, Resource Records.	1	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Textbook 1: **Data Communications and Networking,** BehrouzA. Forouzan, Tata McGraw-Hill, 5th Edition, 2013.

Reference Book:

1. **Computer Networks,** Andrew S. Tanenbaum, Pearson Education, 4th Edition, 2002.
2. **Data and Computer Communication,** William Stallings, Pearson Education, 8th Edition, 2007

Online Resource

1. https://archive.nptel.ac.in/courses/106/105/106105183/

Code: 21CS6C03	Course: Fundamentals of DevOps
Credits: 3	L:T:P - 3:0:0
SEE: 50%	CIE: 50%
SEE Hours: 3	Max. Marks: 100

Prerequisites if any	NIL
Learning objectives	By the end of the course, students should have a solid understanding of DevOps principles, tools, and practices. They should be able to effectively collaborate in a DevOps environment, automate processes, manage infrastructure as code, and deploy applications using modern DevOps techniques.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Ability to explain the core concepts, principles, and benefits of DevOps.	Understanding
CO2	Proficiency in using version control systems and implementing collaborative development workflows	Apply
CO3	Skill in provisioning and managing infrastructure using Infrastructure as Code (IaC) tools.	Apply
CO4	Ability to analyze and learn from real-world case studies of successful DevOps implementations.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	1		1	-
CO2	-	-	3	-	-	-	-	-	-	-	1	-		-	1
CO3	-	3	-	-	-	-	1	2	-	-	-	1		-	-
CO4	-	-	-	3	2	-	-	-	1	1	-	-		1	-

Mapping Strength:　　　**Strong– 3**　　　**Medium – 2**　　　**Low – 1**

Course Structure

Nos.	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: Introduction to DevOps and its Principles			
1.1	Introduction to DevOps and its Principles: Understanding DevOps: Definition, goals, and benefits	1	-	-
1.2	Key principles of DevOps: Continuous integration, continuous delivery, automation, and collaboration	1	-	-
1.3	DevOps culture and mindset	1	-	-
1.4	Case studies of successful DevOps implementations	1	-	-

1.5	Version Control and Collaboration Tools: Introduction to version control systems (e.g., Git)	1	-	-
1.6	Branching and merging strategies	1	-	-
1.7	Collaborative development workflows	1	-	-
1.8	Introduction to code review processes and tools (e.g., GitHub, Bitbucket)	1	-	-
Module – 2: Continuous Integration and Build Automation				
2.1	Continuous integration (CI) concepts and benefits	1	-	-
2.2	Introduction to build automation tools (e.g., Jenkins, Travis CI)	1	-	-
2.3	Configuring and managing CI pipelines	1	-	-
2.4	Running automated tests and generating reports	1	-	-
2.5	Infrastructure as Code (IaC): Introduction to Infrastructure as Code (IaC) and its benefits	1	-	-
2.6	Infrastructure provisioning tools (e.g., Terraform, CloudFormation)	1	-	-
2.7	Building and managing infrastructure using IaC	1	-	-
2.8	Managing infrastructure changes and versioning	1	-	-
Module – 3: Configuration Management				
3.1	Introduction to configuration management tools (e.g., Ansible, Puppet)	1	-	-
3.2	Managing system configurations and deployments	1	-	-
3.3	Configuration drift and remediation	1	-	-
3.4	Automating software deployments	1	-	-
3.5	Continuous Delivery and Deployment: Introduction to continuous delivery and deployment concepts	1	-	-
3.6	Release management and versioning	1	-	-
3.7	Automating deployment pipelines	1	-	-
3.8	Canary deployments and blue-green deployments	1	-	-
Module – 4: Monitoring and Logging				
4.1	Introduction to monitoring and logging in DevOps	1	-	-
4.2	Metrics, logging, and alerting systems (e.g., Prometheus, ELK Stack)	1	-	-
4.3	Application performance monitoring	1	-	-
4.4	Log analysis and troubleshooting	1	-	-
4.5	Containerization and Orchestration: Introduction to containerization with Docker	1	-	-
4.6	Container orchestration tools (e.g., Kubernetes, Docker Swarm)	1	-	-
4.7	Deploying and scaling containers	1	-	-
4.8	Monitoring and managing containerized applications	1	-	-
Module – 5: Cloud Platforms and Services				
5.1	Introduction to cloud computing platforms (e.g., AWS, Azure, GCP)	1	-	-
5.2	Cloud service models (IaaS, PaaS, SaaS)	1	-	-
5.3	Leveraging cloud services for DevOps	1	-	-
5.4	Cloud security and compliance considerations	1	-	-
5.5	DevOps Best Practices and Case Studies: Advanced DevOps practices and techniques	1	-	-
5.6	Scaling DevOps in large organizations	1	-	-
5.7	Real-world case studies of successful DevOps implementations	1	-	-
5.8	Industry trends and future directions in DevOps	1	-	-
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**00**	-
Total No. of Practical Hours				**00**

Textbook:

1. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley.
2. "DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" by Gene Kim, Jez Humble, Patrick Debois, and John Willis.

Reference Book:

1. "Site Reliability Engineering: How Google Runs Production Systems" edited by Betsy Beyer, Chris Jones, Jennifer Petoff, and Niall Richard Murphy.
2. "Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations" by Nicole Forsgren, Jez Humble, and Gene Kim.

Online Resource

1. **https://nptel.ac.in/courses/128106012**

Code: 21CS6C04   **Course: Full stack development**
Credits: 4   **L:T:P - 3:0:2**
SEE: 50%   **CIE: 50%**
SEE Hours: 3   **Max. Marks: 100**

Prerequisites if any	Computer networks
Learning objectives	1. Create web page using HTML & CSS
	2. Develop familiarity with the JavaScript language; realize concepts commonly used in dynamic language programming, such as introspection, higher-order functions, closures, familiar with common libraries and tools that are used in web application development.
	3. Create React Components, perform some simple tests, think in React., Add state and props to an application.
	4. To create dynamic content and interact with databases using php.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Prepare web pages using XHTML and CSS.	Apply
CO2	Apply core constructs and event handling mechanisms of JavaScript to develop web pages	Apply
CO3	Build interactive web applications using ReactJS	Analyze
CO4	Demonstrate the creation of dynamic web pages using XHTML, PHP, MYSQL/MongoDB	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	3	-	2	-	-	-	-	-	1	3	3	3
CO2	1	-	2	-	2	-	-	-	-	-	1	2	3	3
CO3	1	-	3	-	3	-	-	-	-	-	2	2	3	3
CO4	1	-	3	-	3	-	-	-	-	-	2	2	3	3

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

Nos.	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: XHTML and CSS			
1.1	Introduction to XHTML , Basic syntax,	1	-	-
1.2	Standard XHTMl Document Structure, Paragraphs, Line Breaks, Heading Tags	1	-	-
1.3	Font Styles, Sizes, Color, Character Entity	1	-	-
1.4	Images, links, Lists, tables, form tags	1	-	-
1.5	Introduction CSS, Applying CSS to HTML, Selectors, Properties and Values	2	-	-
1.6	Font properties, text decoration, List property, CSS Colors and Backgrounds, CSS Box Model, CSS Margins, Padding, and Borders, background images, span and div tags	2	-	-

	Module – 2: JavaScript			
2.1	Introduction to JavaScript, General syntactic characteristics	1		
2.2	Primitives, operations, expressions	1	-	-
2.3	Screen output and keyboard input, Control statements,	2	-	-
2.4	Object creation &modification, arrays, array methods, Functions,	1	-	-
2.5	JavaScript and XHTML Documents: The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling,	3	-	-
2.6	Handling events from the Body elements, Button elements, Text box and Password elements.	3	-	-
	Module – 3: ReactJS			
3.1	Introduction, Templating using JSX	2	-	-
3.2	Components, State and Props	2	-	-
3.3	Lifecycle of Components	1	-	-
3.4	Rendering List and Portals	1	-	-
3.5	Error Handling, Routers	2	-	-
3.6	Redux and Redux Saga	2	-	-
	Module – 4: PHP			
4.1	PHP Introduction, Embedding PHP into HTML, Configuration, Quick examples, **Language Syntax**	1	-	-
4.2	Built-in PHP Functions	1	-	-
4.3	PHP and MySQL: Connecting PHP to Mysql/mongoDB with examples	3	-	-
	Module – 5: MongoDB			
5.1	MongoDB basics	2	-	-
5.2	Documents, collections ,database query language, mongo shell	1	-	-
5.3	Mongo DB CRUD operations, create , read, projection, update, delete aggregate	1	-	-
5.4	scheme initialization , reading from Mongo DB, writing from Mongo DB	1	-	-
	Lab experiments			
1	Create a html page as shown below. Book Information Author: [ ] Title: [ ] Price: [ ] [Submit] [Reset]	-	-	1

2	Create the below registration form using forms in HTML	-	-	
	Contact Form Example A complete **HTML Form** with all inputs, select dropdown, radio buttons, checkbox, textarea, submit and reset buttons. Name Email [Check] Age Country India Password Resume Choose File No file chosen Hobbies ☑ Cricket ☐ Football Gender ○ Female ○ Male City --Choose City-- ▾ Address Submit Reset			
3	Create an Indian tri-color flag using frames in CSS (one portion orange, middle portion white, third portion green and a rotating wheel in the middle. Divide the frames horizontally)	-	-	
4	Demonstrate the different types of selectors in CSS. • CSS Element Selector • CSS Id Selector • CSS Class Selector • CSS Universal Selector • CSS Group Selector	-	-	1
5	Design the below CSS Box model using HTML and CSS properties **CSS Box-Model Property** Love to design Enjoy learning	-	-	1
6	Demonstrate the three different types of HTML lists: • Ordered List or Numbered List (ol) • Unordered List or Bulleted List (ul) • Description List or Definition List (dl)	-	-	
7	Write a JavaScript program to display the current day and time in the following format.	-	-	
8	Write a JavaScript program to find the area of a triangle where three sides are 5, 6, 7.	-	-	
9	Write a JavaScript program where the program takes a random integer between 1 and 10, and the user is then prompted to input a guess number. The program displays a message "Good Work" if the input matches the guess number otherwise "Not matched".	-	-	
10	Write a JavaScript program to calculate multiplication and division of two numbers (input from the user).	-	-	
11	Write a JavaScript program to create another string by adding "Py" in front of a given string. If the given string begins with "Py" return the original string.	-	-	1

12	Write a JavaScript program to create a new string from a given string by changing the position of the first and last characters. The string length must be broader than or equal to 1.	-	-	
13	Write a JavaScript program to check whether a given positive number is a multiple of 3 or 7.	-	-	
14	Write a JavaScript program to concatenate two strings and return the result. If the length of the strings does not match, then remove the characters from the longer string.	-	-	
15	Write a JavaScript program to sort a list of elements using Bubble sort	-	-	
16	Write a JavaScript program to set paragraph background color.	-	-	
17	Write a JavaScript program to calculate sphere volume by accepting values through HTML form	-	-	
18	Write a JavaScript program to find the name, value, type, text on a button	-	-	
19	Write a JavaScript to find the method for sending form data	-	-	1
20	Write a JavaScript to get the number of options in dropdown list	-	-	
21	Write a JavaScript to find the value of href attribute of a link	-	-	
22	Write a JavaScript to find the height of an image	-	-	1
23	When the input field gets focus, a function is triggered which changes the background-color using a javaScript	-	-	
24	Click the button to trigger a function using javaScript	-	-	
25	Demonstrate onload event using javaScript	-	-	
26	Demonstrate image slider using React	-	-	1
	Display a list in React	-	-	
23	**Simple Login form in React**	-	-	
24	Factorial program in PHP using recursive function	-	-	2
25	Write a PHP script to create enumerated array and associative array using user defined function and display the contents using for each loop.	-	-	
26	Demonstrate how to post data from HTML to PHP using php code.	-	-	
27	Write a PHP script to display the contents of an employee table (empno, ename, esal) based on empno accepted through html document.	-	-	
28	Write a PHP script to accept employee number, name and salary from HTML document and display them. Also insert the same into employee table.	-	-	
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**	-	
	Total No. of Practical Hours	**10**		

Textbook:

1. Programming the World Wide Web, Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
2. Open Source Web Development with Lamp, James Lee and Brent Ware, Pearson Education, 2009

Reference Book:

1. Internet and World Wide Web: How to Program -Harvey M. Deitel, Paul J. Deitel, 4thedition, Pearson, 2009.
2. The Web Programming Building Internet Applications- Chris Bates, 3rd Edition, Wiley India, 2006.

Online Resources:

1. MongoDB Notes for Professionals book Tutorial for Beginners in PDF by GoalKicker.com
2. https://docs.google.com/viewer?url=https://www.computer-pdf.com/pdf/0840-mongodb-notes-for-professionals-book.pdf
3. https://www.javatpoint.com/reactjs-tutorial

Code: 21CS6L01	Course: Computer Networking Laboratory
Credits: 1	L:T:P - 0:0:2
SET: 50%	CIE: 50 %
SET Hours: 2	Max. Marks:25

Prerequisites if any	Data Communications and Computer Networks
Learning objectives	1. To learn the use of simulator to configure networking devices and protocols 2. To implement error detection and congestion control techniques.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Simulate operations of Networking protocols and devices	Apply
CO2	Demonstrate error detection and congestion control techniques	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	-	-	-	-		3	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-		2	2

Mapping Strength: Strong– 3   Medium – 2   Low – 1

List of Experiments

Part- A

1. Perform a detailed study of the following:
    a. Types of Network cables.
    b. Network Devices.
    c. Network IP.
    d. Basic network command and Network configuration commands.
2. Configure and implement DHCP service in a Local Area Network.
3. Configure and implement DNS service.
4. Performing an Initial Switch and Initial Router Configuration.
   (Host name, Console password, vty password, Privileged EXEC mode password, Privileged EXEC mode secret, Configure banner messages,

5. Configure port security and Secure unused ports.

6. Implement the following types of routing:
    a. Static Routing.
    b. Dynamic Routing.
7. Configuring WEP on a Wireless Router.

8. Demonstrating Inter-VLAN Routing in Switch.
9. Demonstrating Static Network Address Translation (NAT).
10 .Configuring a Cisco Router as a DHCP Server.

Part B

1. Write a program to implement Single Parity Check Error detection technique.
2. Write a program to implement Cyclic Redundancy Check (CRC) Error detection technique
3. Write a program to implement Checksum Error detection technique
4. Write a program for congestion control using leaky bucket Algorithm

Text Books:

1. Introduction to Networks v6 Companion Guide, By Cisco Networking Academy Published Nov 22, 2016, Cisco Press.

2. Data Communications and Networking, BehrouzA. Forouzan, Tata McGraw-Hill, 5th Edition, 2013.

Reference Book:

1. Computer Networking: A Top-Down Approach (6th Edition) 6th Edition by James F. Kurose (Author), Keith W. Ross (Author)Reference book 2

Online Resource

1. https://learningnetwork.cisco.com/s/packet-tracer-alternative-lab-solutions

Code: 21CS6O01	Course: Big Data Analytics
Credits: 3	L:T:P – 3:0:0
SEE: 100 Marks	CIE: 50 Marks
SEE Hours: 3	Max. Marks: 100

Prerequisites if any	NIL
Learning objectives	Big Data and Related Technologies for Handling Big Data and Hadoop Ecosystem

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Overview of Big Data and Related Technologies for Handling Big Data and Hadoop Ecosystem	Understanding
CO2	Acquire clear understanding of MapReduce Fundamentals	Understanding
CO3	Acquire clear understanding of Virtualizing and Processing Data using MapReduce	Understanding
CO4	Demonstrate Hadoop YARN configuration and commands and describe Hive services data types and built-in-functions.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	1	-	-	-	-	3	2
CO2	3	-	-	3	-	-	-	-	1	-	1	1	3	1
CO3	3	1	3	1	-	-	-	-	-	1	-	-	3	3
CO4	3	2	1	2	-	-	-	-	1	-	-	-	2	1

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: Getting an Overview of Big Data			
1.1	What is Big Data? History of Data Management – Evolution of Big Data, Structuring Big Data	2		
1.2	Types of Data, Elements of Big Data, Volume, Velocity, Variety, Veracity	2		
1.3	Advantages of Big Data Analytics	2		
1.4	Introducing Technologies for Handling Big Data and Hadoop Ecosystem	2		
1.5	Distributed and Parallel Computing for Big Data, Introducing Hadoop, How does Hadoop Function?	2		
	Module – 2: Understanding MapReduce Fundamentals			
2.1	MapReduce, Features of MapReduce, Combining HBase and HDFS	2		
2.2	Hadoop YARN, Introducing HBase	2		
2.3	The MapReduce Framework, Exploring the Features of MapReduce, Working of MapReduce,	2		
2.4	Exploring Map and Reduce Functions, Techniques to Optimize MapReduce Jobs	2		
2.5	Hardware/Network Topology, Synchronization, File System, Uses of MapReduce	2		
	Module – 3: Big Data Technology Foundations			
3.1	Understanding Big Data Technology Foundations and Processing your Data with MapReduce	2		
3.2	Exploring the Big Data Stack, Virtualization and Big Data, Virtualization Approaches	2		
3.3	Points to Consider while designing MapReduce	2		

Module – 4: Understanding Hadoop YARN Architecture and Mahout				
4.1	Background of YARN, YARN Architecture	2		
4.2	Working of YARN, What is Mahout?, Machine Learning, Collaborative Filtering	2		
4.3	Clustering, Classification, Mahout Algorithms, Environment for Mahout.	2		
Module -5: Exploring Hive				
5.1	Introducing Hive, Hive Services	2		
5.2	Data Types in Hive, Built-In Functions in Hive	2		
5.3	Hive DDL, Data Manipulation in Hive	2		
5.4	Data Retrieval in Hive, Using Joins in Hive	2		
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**		**-**
	Total No. of Practical Hours		**00**	

Textbook:

1. Big Data: Black Book, DT Editorial Services, Wiley India Pvt Ltd, 2015 Edition

Reference Book:

1. Big Data Analytics with R and Hadoop, Vignesh Prajapati, -Packt Publishing 2013

    Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business

    Intelligence and Analytic Trends for Today's Business", 1st Edition, AmbigaDhiraj, Wiley CIO

    Series, 2013.

2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.

3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data EMC

    Education Services, Wiley India Pvt Ltd.

Online Resources:

1. https://www.coursera.org/learn/introduction-to-big-data-with-spark-hadoop

Code: 21CS6O02	Course: Cyber Security
Credits: 3	L:T:P - 3:0:0
SEE: 50%	CIE: 50%
SEE Hours: 3	Max. Marks: 100

Prerequisites if any	Basics of computer concepts
Learning objectives	1. To study various types of cyber-attacks and cyber-crimes 2. To study the defensive techniques against cyber-attacks

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	To describe various types of cyber-attacks and cyber-crimes	Understanding
CO2	To demonstrate threats and risks within context of the cyber security	Apply
CO3	Analyze the implications of security challenges faced by use of mobile devices in an organization	Apply
CO4	Analyse the defensive technique using Phishing cyber-attacks	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	-	-	-	-	3	3	-	3	-	-	2	3		-	3
CO2	-	-	-	-	3	3	-	3	-	-	2	3		-	3
CO3	-	-	-	-	3	3	-	3	-	-	2	3		-	3
CO4	-	-	-	-	3	3	-	3	-	-	2	3		-	3

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Introduction				
1.1	Introduction to cybercrime Cyber crime and information security	2	-	-
1.2	who are Cybercriminals, Classification of Cybercrimes,	3	-	-
1.3	Cybercrime: The Legal Perspectives, An Indian Perspective, Cybercrime and the Indian ITA 2000,A global perspective on cybercrimes	2	-	-
Module – 2: Cyber Offenses				
2.1	Introduction, How criminal plan the attacks	2	-	-
2.2	Social engineering, Cyber stalking	2	-	-
2.3	Cyber cafe and cybercrimes, Botnets	2	-	-
2.4	The fuel for cybercrime, Attack vector	2	-	-

Module – 3: Cyber crime			
3.1	Mobile and Wireless devices Introduction, Proliferation of mobile and wireless devices	2	-	-
3.2	Trends in mobility, Security challenges posed by mobile devices	2	-	-
3.3	Registry setting for mobile devices, Authentication service security,	2	-	-
3.4	Attacks on mobile/ cell phones, Mobile devices security implications for organizations	2	-	-
3.5	Organization measures for handling mobile, Organizational security policies.	2	-	-
Module – 4: Tools and method used in Cybercrime			
4.1	Introduction, Proxy servers and anonymizers, Phishing, Password cracking,	2		
4.2	Key loggers and spywares, Virus and worms	2		
4.3	Trojan horses and backdoors, Steganography,	2		
4.4	DoS and DDoS attacks, SQL injection, Buffer overflow	2		
Module – 5: Phishing and identity theft			
5.1	Introduction	3		
5.2	Phishing	4		
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**	-	
	Total No. of Practical Hours	**00**		

Textbook:

1. Cyber Security by Nina Godbole, Belapure, Wiley India, 1st edition copyright 2011, reprint 2013.

REFERENCE BOOK:

1. Computer Forensics and Cyber Crime An Introduction by Marjie T. Britz, Pearson publication, 3rd edition, 2013. EBOOK:

2. Introduction to computer Networks and cyber security by chwan-Hwa, David Irwin, CRC Press, 2013.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview

Prerequisites if any	NIL
Learning objectives	1. Understand the basic concepts of .Net platform and fundamentals of C# programming. 2. Review the basic pillars of object-oriented programming concepts. 3. Apply the exception handling technique to handle different types of errors.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain the basics of .Net platform and the role of base class libraries, role of common intermediate language and namespaces.	Understanding
CO2	Discuss the fundamentals of c# and to build the basic c# program using different constructs.	Apply
CO3	Review the basic pillars of object-oriented programming concepts to design c# program	Apply
CO4	Analyze the exception handling technique and apply to handle different types of errors.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	3	-	-	-	-	2	2	2	3	2
CO2	2	-	2	-	3	-	-	-	-	2	2	2	3	2
CO3	2	-	2	-	3	-	-	-	-	2	2	2	3	2
CO4	2	-	2	-	3	-	-	-	-	2	2	2	3	2

Mapping Strength: Strong– 3   Medium – 2   Low – 1

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**THE PHILOSOPHY OF .NET:** Understanding the Previous State of Affairs, The .NET Solution,	1	-	-
1.2	The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies),	2	-	-
1.3	The Role of the Common Intermediate Language, The Role of .NET Type Metadata	1	-	-
1.4	The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions.	2	-	-
1.5	Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Run-time A tour of the .NET Namespaces.	2	-	-
	Module – 2			
2.1	**C# LANGUAGE FUNDAMENTALS:** The Anatomy of a Basic C# Class	1	-	-
2.2	Creating objects: Constructor Basics, The Composition of a C# Application	2	-	-

2.3	Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class,	2	-	-
2.4	Understanding Value Types and Reference Types, The Master Node System.Object	2	-	-
2.5	The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types Boxing and Unboxing, Defining Program Constants	2	-	-
Module – 3				
3.1	**C# LANGUAGE FUNDAMENTALS:** C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators	2	-	-
3.2	Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifiers	2	-	-
3.3	Array Manipulation in C #, String Manipulation in C#	2	-	-
3.4	C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.	2	-	-
Module – 4				
4.1	**OBJECT- ORIENTED PROGRAMMING WITH C#:** Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type	2	-	-
4.2	Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo-Encapsulation: Creating Read-Only Fields,	2	-	-
4.3	The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The "Protected" Keyword, Nested Type Definitions,	2	-	-
4.4	The Third Pillar: C #'s Polymorphic Support, Casting Between.	2	-	-
Module – 5				
5.1	**EXCEPTIONS:** Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class,	2	-	-
5.2	Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception),	2	-	-
5.3	Custom Application-Level Exception (System. System Exception), Handling Multiple Exception,	1	-	-
5.4	The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System.	2	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	-
	Total No. of Practical Hours			**00**

Textbook:

1. **C# and the .NET platform** - Andrew Troelsen, Special Edition, Dream Tech Press, India, 2003.

Reference Book:

1. **Inside C#** - Tom Archer, WP Publishers, 2001.
2. **Head First C#: A Learner's Guide to Real-World Programming with C# and .NET Core -by Andrew Stellman , Jennifer Greene 4th edition, O'Reilly Publication**

Online Resource:

1. https://www.coursera.org/learn/c-sharp-for-dot-net

Code: 21CS6O04　　　　**Course: Blockchain Technology concepts and Applications**
Credits: 3　　　　　　　　　　　　　　　　　　　**L:T:P: 3:0:0**
SEE: 50%　　　　　　　　　　　　　　　　　　　　**CIE: 50%**
SEE Hours: 3　　　　　　　　　　　　　　　　　　**Max. Marks:100**

Prerequisites if any	Basic knowledge of Computer networks and cryptography
Learning objectives	1. Comprehend the importance and benefits of Blockchain technology. 2. Learn the various uses and applications of blockchain technology. 3. Understand the difference between a blockchain ledger and a database. 4. Know the different types of blockchain technology. 5. Learn how blockchain technology works.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Discuss the basics of Blockchain decentralized system compared to centralized system.	Understanding
CO2	Analyze the concepts of secure Hash algorithms in Blockchain	Apply
CO3	Explain different consensus algorithm, Byzantine agreement methods and Ethereum system	Apply
CO4	Describe importance of application of smart contracts and usage of bit coins	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1		3	3
CO2	-	3	2	-	1	2	-	-	-	-	-	1		3	3
CO3	3	2	2	-	1	2	2	-	-	-	-	1		3	3
CO4	3	2	2	1	2	2	2	-	-	-	-	1		3	3

Mapping Strength:　　　**Strong– 3**　　　**Medium – 2**　　　**Low – 1**

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Basics of Blockchain				
1.1	Introduction: Concept of Blockchain, History, Definition of Blockchain, Fundamentals of Blockchain	1	-	-
1.2	Characteristics of Blockchain, Consensus in Trust-Building Exercise, Public, Private, and Hybrid Blockchains, Distributed Ledger Technologies	1	-	-
1.3	DLT Decentralized Applications and Databases, Architecture of Blockchain, Transactions	1	-	-
1.4	Chaining Blocks, Value Proposition of Blockchain Technology, Decentralized System: Introduction, Distributed Decentralized Databases	2	-	-
1.5	Decentralized Enterprise, Decentralization, Disintermediation	2	-	-

	Module – 2: Hash Functions			
2.1	Hash Functions: Introduction, Hashing Message Authentication Code, Secure Hash Algorithms (SHA-1)	2	-	-
2.2	Secure Hash Algorithm Version 3, Distributed Hash Tables	1	-	-
2.3	Hashing and Data Structures, Hashing in Blockchain Mining	2	-	-
2.4	Consensus: Introduction, Consensus Approach	1	-	-
2.5	Consensus Algorithms	2	-	-
2.6	Byzantine Agreement Methods	1	-	-
	Module – 3: Blockchain Components			
3.1	Blockchain Components: Introduction, Ethereum, History, Ethereum Virtual Machine	1	-	-
3.2	Working of Ethereum, Ethereum Clients, Ethereum Key Pairs	1	-	-
3.3	Ethereum Addresses, Ethereum Wallets	1	-	-
3.4	Ethereum Transactions	1	-	-
3.5	Ethereum Languages, Ethereum Development Tools	1	-	-
3.6	Cryptography: Introduction, Cryptography, Cryptography Primitives	1	-	-
3.7	Symmetric Cryptography, Asymmetric Cryptography	2	-	-
	Module – 4: Smart Contracts			
4.1	Smart Contracts: Introduction, Smart Contracts	1	-	-
4.2	Absolute and Immutable, Contractual Confidentiality	1	-	-
4.3	Law Implementation and Settlement	1	-	-
4.4	Characteristics, Internet of Things	1	-	-
4.5	Utilities: Smart Grid, Proofs of Origin, Supply Chain Management	1	-	-
	Module – 5: Bitcoins			
5.1	Bitcoins: Introduction, Working of Bitcoin	1	-	-
5.2	Merkle Trees, Bitcoin Block Structure, Bitcoin Address	2	-	-
5.3	Bitcoin Transactions, Bitcoin Network, Bitcoin Wallets	2	-	-
5.4	Bitcoin Payments, Bitcoin Clients, Bitcoin Supply	1	-	-
5.5	Decentralized Applications: Introduction, Today's Web Applications Requirement, Mining in Blockchain Bitcoin	1	-	-
5.6	Blocks Validation and Identification, Bitcoins Creation, Mining Hardware, Mining Software	2	-	-
5.7	Running Miner Software, Executing Several Miners, Bitcoins Management, Reasons for Bitcoin Mining	2	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. Blockchain Technology: Concepts and Applications by Kumar Saurabh, Ashutosh Saxena
2. Beginning Blockchain: A Beginners Guide to Building Blockchain Solutions by Bikramaditya Singhal & Gautam Dhameja & Priyansu Sekhar Panda

Reference Book:

1. Imran Bashir, Mastering Blockchain: Distributed ledgers, Decentralization and Smart Contracts explained. 2nd Edition, March 2018.
2. Malcolm Campbell-Verduyn, Bitcoin And Beyond Cryptocurrencies, Blockchains, And Global Governance.
3. S. Shuka, M. Dhawan, S. Sharma. S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications
4. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming
5. Antonopoulos, Mastering Bitcoin.

Online Resource:

1. **https://onlinecourses.nptel.ac.in/noc22_cs44/preview**

Code: 21CS6O05 **Course: Introduction to Machine Learning**
Credits: 3 **L:T:P - 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	To understand and implement basic machine learning algorithms using sci-kit learn library.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the different types of machine learning and implement a simple perception learning algorithm	Apply
CO2	Implement Classifiers using sci-kit learn	Apply
CO3	Understand the various methods of data preprocessing	Understanding
CO4	Understand various dimensionality reduction and model evaluation techniques and ensemble algorithm using sc-kit learn	Understanding Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	1	3	3	3	3	-	-	-	-	-	-	-		2	2
CO2	1	3	3	3	3	-	-	-	-	-	-	-		2	2
CO3	1	3	3	3	3	-	-	-	-	-	-	-		2	2
CO4	1	3	3	3	3	-	-	-	-	-	-	-		2	2

Mapping Strength: **Strong– 3** **Medium – 2** **Low – 1**

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: Giving Computers the Ability to Learn from Data				
1.1	The three different types of machine learning	1	-	-
1.2	Introduction to basic terminology and notations	1	-	-
1.3	A road map for building machine learning systems	1	-	-
1.4	Using Python for machine learning	1	-	-
1.5	Artificial neurons – a brief glimpse into the early history of machine learning	1	-	-
1.6	The formal definition of an artificial neuron	1	-	-
1.7	The perceptron learning rule	1	-	-
1.8	Implementing a perceptron learning algorithm in Python	1	-	-
1.9	Training a perceptron model on the Iris dataset	1	-	-
Module – 2: A Tour of Machine Learning Classifiers Using Scikit-learn				
2.1	First steps with scikit-learn	1	-	-
2.2	Modelling class probabilities via logistic regression	2	-	-
2.3	Margin classification with support vector machines	2	-	-
2.4	Solving nonlinear problems using a kernel SVM	2	-	-
2.5	Decision tree learning	1	-	-
2.6	K-nearest neighbors – a lay learning algorithm	1	-	-

Module – 3: Building good training datasets – data preprocessing & Dimensionality Reduction				
3.1	Dealing with missing data	1	-	-
3.2	Handling categorical data	1	-	-
3.3	Partitioning a dataset into separate training and test datasets	1	-	-
3.4	Bringing features onto the same scale	1	-	-
3.5	Selecting meaningful features	2	-	-
3.6	Assessing feature importance with random forests	1	-	-
3.7	Unsupervised dimensionality reduction via principal component analysis	2	-	-
Module – 4: Compressing data via Dimensionality reduction & Model Evaluation				
4.1	Supervised data compression via linear discriminant analysis	2	-	-
4.2	Using kernel principal component analysis for nonlinear mappings	3	-	-
4.3	Streamlining workflows with pipelines	1	-	-
4.4	Using k-fold cross-validation to assess model performance	1	-	-
4.5	Debugging algorithms with learning and validation curves	1	-	-
Module – 5: Combining Different Models for Ensemble Learning				
5.1	Looking at different performance evaluation metrics	2	-	-
5.2	Combining classifiers via majority vote	1	-	-
5.3	Bagging	1	-	-
5.4	Leveraging weak learners via adaptive boosting	1	-	-
Total No. of Lecture Hours		**40**	-	-
Total No. of Tutorial Hours			**00**	-
Total No. of Practical Hours				**00**

Textbook:

1. "Python Machine Learning", Unlock deeper insights into machine learning with this vital guide to cutting-edge predictive analytics, Sebastian Raschka, 3rd Edition, Packt Publishing Ltd., 2019

Reference Book:

1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and machine learning) The MIT Press Cambridge, 3rd Edition, 2014
2. Simon Rogers, Mark Girolami, A first course in machine learning, Chapman, & Hall/CRC machine learning & pattern recognition, 2011

Online Resource:

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Code: 21CS6O06	Course: Programming in Java

Code: 21CS6O06 **Course: Programming in Java**
Credits: 3 **L:T:P - 3:0:0**
SEE: 5% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	C programming, OOPS concepts
Learning objectives	1. Distinguish Object-Oriented programming paradigm from Procedure-Oriented Programming 2. Use the Java programming language for various programming technologies.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Develop Java programs using Object-Oriented paradigm	Understanding
CO2	Demonstrate Java code utilities in packages, interfaces and String class	Apply
CO3	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	2	3	1	1	-	-	-	-	-	-	-			
CO2	3	3	3	2	1	-	-	-	-	-	-	-			
CO3	3	3	2	1	1	-	-	-	-	-	-	-			

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**

Course Structure

No	Modules	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1:				
1.1	What is Object Orientation? What is OO development? OO themes	1	-	-
1.2	Evidence for usefulness of OO development; OO modeling history	2	-	-
1.3	Modeling as Design Technique: Modeling; abstraction	1	-	-
1.4	The three models. Class Modeling: Object and class concepts	2	-	-
1.5	Link and associations concepts; Generalization and inheritance	3	-	-
Module – 2:				
2.1	Java's magic: Byte code; Java Development Kit (JDK)	1	-	-
2.2	The Java Buzzwords, Simple Java programs	1	-	-
2.3	Datatypes, arrays, Control Statements	1	-	-
2.4	Classes: Classes fundamentals; Declaring objects	2	-	-
2.5	Constructors	1	-	-
2.6	This keyword, garbage collection	1	-	-
2.7	Inheritance: inheritance basics, using super	2	-	-
2.8	Creating multi-level hierarchy, method overriding	2	-	-
Module – 3: Inheritance, Packages & Interfaces				
3.1	Packages	2	-	-
3.2	Access Protection in packages	1	-	-
3.3	Importing Packages	1	-	-
3.4	Interfaces	2	-	-

3.5	Interface references and variables	2	-	-
3.6	Default Interface methods	2	-	-
Module – 4				
4.1	Multi-Threaded Programming: What are threads?	1	-	-
4.2	How to make the classes 'threadable'	2	-	-
4.3	Extending threads; Implementing 'runnable'	1	-	-
4.4	Thread Synchronization	1	-	-
Module – 5				
5.1	String Handling: String Constructors	1	-	-
5.2	String Length, String Operations	2	-	-
5.3	Character Extraction, String Comparison	1	-	-
5.4	Searching String	1	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours	**00**		-
	Total No. of Practical Hours		**00**	

Textbook:

1. Herbert Schildt, *Java The Complete Reference-Eleventh Edition*, McGraw Hill; Eleventh edition (10 December2020)

2. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2ndEdition, Pearson Education/ PHI, 2007.

Reference Book:

1. Dr. R. Nageswara Rao, Core Java, An Integrated Approach, Dream tech Press, 2016.
2. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008
3. Rajkumar Buyya, S Thamarai selvi, xing chenchu, Object oriented Programming with java, Tata McGraw Hill Education Private Limited, 2009
4. Richard A Johnson, An Introduction to Java Programming and Object-Oriented Application Development, Delmar Cengage Learning, 2007.

Online Resources:

MIT Free Course on "Introduction to Programming in Java"

1. https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
Udacity Free Course

2. https://www.udacity.com/course/java-programming-basics--ud282

Code: 21CS6C05   **Course: Minor Project**
Credits: 2   **L:T:P 0:0:4**
CIE: 50 Marks   **Max. Marks: 50**

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Conceptualize, design and implement solutions for specific problems	Apply
CO2	Apply resource management skills for projects and Communicate the solutions through presentations and technical reports	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	-	2	3	1	2	1	1	-	-	-	-	-		2	2
CO2	-	-	-	-	-	-	1	1	1	1	1	2		2	2

Mapping Strength: **Strong– 3**   **Medium – 2**   **Low – 1**