LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF) FOR POSTGRADUATE PROGRAMME

(With effect from 2022-23)

MSc Computer Science
Department of Computer Science and Applications

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI -60003

PREFACE

The study of algorithmic processes, computational machinery, and computation is the major focus of the discipline of Computer Science. The theoretical study of algorithms, computing, and information to the practical difficulties of implementing computational systems in software are dealt with in this programme. The Master of Computer Science postgraduate program predominantly focuses on the three aspects, namely, Curriculum on par to meet the industry demands, acquire core competency and skills to develop software applications and Employability/Entrepreneurship skills. This program provides a concrete course of study in computing and significant aspects of computer programming. It also explores various programming principles and paradigms. It helps to learn the essential elements of the courses such as Digital Forensics and Cybersecurity, Robotic process Automation, Blockchain Technology etc.,

The curriculum is supposed to assist in the preservation of standards utilized in Hardware and Software Technologies across the country. Students in all fields of Computer Science at post graduate level must learn about these topics. The practical based approach to the curriculum planning intends to deliver the knowledge and concepts of various subjects like Advanced Java Programming, Machine Learning, Software Engineering, Web programming, Digital Image processing etc., and tools cutting across the Software and IT industry to be learned at MSc level. The curriculum, which is based on computer science technology, includes implementations of the programming languages and tools.

The curriculum is based on some of the most important skill sets that employer have identified. Any exposure to the IT industry necessitates a thorough knowledge and grasp of these topics. Each course is crucial in light of the students' future prospects in the sector, as advancement from here could lead to positions in research and development, IT, or as an entrepreneur.

Students should master the curriculum using advanced tools and technology such as graphical representations and online tools for putting the written code into practice. Students are exposed to modern tools because of the curriculum's design. In this curriculum, more emphasis is given to content related to sustainability, skill acquisition, and entrepreneurship.

Students will be able to apply their knowledge in the future course of their further education, job, or research with the support of this curriculum and knowledge of the practical application of the courses. Students are expected to have knowledge in each area in order to meet industry needs, requests, and technological advancements.

The curriculum, teaching pedagogy, and assessment methods are assigned with appropriate cognitive levels as per BLOOM's Taxonomy. The OBE-based evaluation methods will pave way for the assessment of the cognitive levels of the students and evaluate the expected course outcome attainment.

CONTENTS

VISION AND MISSION OF LOYOLA COLLEGE

VISION

Towards holistic formation of youth, grounded in excellence, through accompaniment to serve the humanity.

MISSION

- To provide inclusive education through an integral and holistic formative pedagogy.
- To promote skills that prepares them for the future.
- To kindle in young minds the spirit of social and environmental justice with a blend of academic excellence and empathy.
- To stimulate critical and conscientious scholarship leading to meaningful and innovative human Capital.

CORE VALUES

- Cura Personalis
- Pursuit of Excellence
- Moral Rectitude
- Social Equity
- Fostering solidarity
- Global Vision
- Spiritual Quotient

VISION AND MISSION OF THE DEPARTMENT

VISION

To be the premier department in shaping young minds to achieve eminence in digital transformation.

MISSION

To provide a learning ambience and curiosity to explore new avenues with social responsibilities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

(School of Computational sciences)

PEOs	STATEMENTS
PEO1	**LEARNING ENVIRONMENT AND LIFE LONG LEARNING** To access academic facilities in an environment of inclusiveness and inquisitiveness for effective and immersed learning throughout life to attain excellence in the chosen field of computational sciences.
PEO2	**GLOBALLY RELEVANT CURRICULUM AND SCIENTIFIC TEMPERAMENT** To think innovatively, analyze scientifically and make decisions appropriately, for handling contemporary global concerns through the knowledge earned in the computational sciences curriculum.
PEO3	**ACADEMIC EXCELLENCE AND CORE COMPETENCY** To excel in modern computational techniques and compete in higher studies/career, for addressing contemporary challenging problems with ease.
PEO4	**SKILL DEVELOPMENT AND ENTREPRENEURSHIP** To develop analytical, logical and critical problem-solving skills for executing professional work and become experts/entrepreneurs in the field of computational sciences.
PEO5	**ENVIRONMENT AND SUSTAINABILITY** To identify real world problems concerning environment and other issues; and apply the expertise in the computational sciences, to face the challenges and provide sustainable solutions.
PEO6	**PROFESSIONALISM AND ETHICS WITH SOCIAL RESPONSIBILITY** To equip themselves with the necessary competency towards professionalism in the computational sciences maintaining ethical standards in addressing the needs of industry and society.

PROGRAMME OUTCOMES (POs)
(School of Computational sciences)

POs	STATEMENTS
PO1	**DISCIPLINARY KNOWLEDGE, INFORMATION/DIGITAL LITERACY & LIFE-LONG LEARNING** To acquire scholarly knowledge for life-long learning of the respective discipline of computational sciences and demonstrate digital literacy.
PO2	**CRITICAL, ANALYTICAL & SCIENTIFIC THINKING IN PROBLEM-SOLVING** To critically explore, scientifically analyze and develop solutions through various computational techniques for real time problems.
PO3	**GLOBALLY RELEVANT CURRICULUM, INDUSTRY REQUIREMENTS AND RESEARCH COMPETENCE** To acquire research competence and meet industry needs through a globally relevant curriculum.
PO4	**PROFESSIONALISM AND ETHICS** To cultivate a promising work culture within ethical frameworks demonstrating exemplary professionalism.
PO5	**TEAMWORK AND EFFECTIVE COMMUNICATIONS** To manifest effective communication skills for constructive team work and progress as professionals in key positions in the respective domains.
PO6	**EMPOWERMENT WITH EMPATHY TOWARDS SUSTAINABLE SOCIAL AND ENVIRONMENTAL CONSCIOUSNESS** To realize social and environmental problems with empathy and contribute the computational expertise to face the challenges and provide sustainable solutions.
PO7	**SKILL DEVELOPMENT, EMPLOYABILITY, LEADERSHIP AND ENTREPRENEURSHIP** To develop expertise and professional skills for employment in the domain of computational sciences and emerge as leaders and entrepreneurs.

PROGRAMME SPECIFIC OUTCOMES (PSOs)
M.Sc. Computer Science

PSOs	STATEMENTS
PSO1	To automate existing processes into simplified computations by applying innovative ideas with collaborative teamwork.
PSO2	To propose a desirable solution to the problem with proper system study, development and execution.
PSO3	To enrich knowledge on the emerging technologies through immersive learning and exploration.
PSO4	To pursue learning and contribute through socially relevant areas of research.
PSO5	To cater to the needs of the industry by providing sustainable solutions with globally relevant curriculum.
PSO6	To empower the students with domain knowledge and adequate skills for employability and entrepreneurship.
PSO7	To lead a successful life with social responsibilities, positive attitude and ethical values.

Correlation Rubrics

High	Moderate	Low	No Correlation
3	2	1	0

Mapping of PEOs with Vision and Mission

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
Vision	3	3	3	3	3	3
Mission	3	3	3	3	3	3

Mapping of POs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
PO1	3	2	3	3	3	3
PO2	3	3	3	3	3	3
PO3	3	3	2	2	3	3
PO4	3	3	3	3	2	3
PO5	3	2	3	3	3	3
PO6	3	3	2	3	3	3
PO7	3	3	2	3	3	2

Mapping of PSOs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
PSO1	3	3	3	2	2	3
PSO2	3	3	3	3	2	2
PSO3	3	3	3	3	3	3
PSO4	3	3	3	2	3	3
PSO5	2	3	3	3	3	3
PSO6	3	3	3	3	3	3
PSO7	3	3	3	3	3	3

Mapping of PSOs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
PSO1	3	3	3	3	3	3	3
PSO2	3	3	3	3	2	3	3
PSO3	3	3	3	3	2	2	3
PSO4	2	3	3	3	2	3	3
PSO5	3	3	3	3	3	3	3
PSO6	3	3	3	3	3	3	3
PSO7	2	3	3	3	3	3	3

M.Sc. COMPUTER SCIENCE – OVERALL COURSE STRUCTURE
(2022 - Restructured Curriculum)

Sem	Course Code	Course Title	T/L/P	Category	Credits	Contact Hours
I	PCS1MC01	Advanced Java Programming	T	MC	4	4
I	PCS1MC02	Machine Learning using Python	T	MC	4	4
I	PCS1MC03	Modern database management	T	MC	4	4
I	PCS1MC04	Digital Forensics and Cybersecurity	T	MC	4	4
I	PCS1MC05	Modern software engineering	T	MC	4	4
I	PCS1MC06	**Lab-I** Advanced Java Programming Lab	L	MC	4	5
I	PCS1MC07	**Lab–II** Machine Learning using Python Lab	L	MC	4	5
II	PCS2MC01	Design and Analysis of Algorithms	T	MC	4	4
II	PCS2MC02	Web Programming	T	MC	4	5
II	PCS2MC03	Research Methodology	T	MC	2	4
II	PCS2MC04	**Lab-III** Design and Analysis of Algorithms using Python Lab	L	MC	4	5
II	PCS2MC05	**Lab–IV** Web Programming Lab	L	MC	4	5
		Based on students' preference two courses will be offered	T	ME	2	4
II		Self study course #	T	SSC	2	2
II		MOOC			2	2
II		Cross Disciplinary (between schools, purely internal)	T	CD	1	3
II		Summer Internship #	P	SI	1	-
III	PCS3ID01	Statistics for Computer Science	T	ID	3	6
III	PCS3MC01	Principles of Compiler design	T	MC	4	4
III	PCS2MC02	Digital Image Processing	T	MC	3	4
III	PCS3MC03	**Lab–V** Digital Image Processing Lab	L	MC	4	4

III	PCS3MC04	Wireless Adhoc Networks	T	MC	3	4
III		Soft skills #	T	SK	1	2
III		Value added course #	T	VA	1	3
III		Service Learning #	T	SL	1	2
III	PCS3PJ01	**Lab-VI** Mini Project	P	PJ	4	4
IV	PCS4PJ02	Major Project	P	PJ	20	30
		TOTAL			**97 +2**	**120***

* 120 contact hours and 11 outside class # Outside class

Major Elective (ME)

Sem	Course Code	Course Title	T/L/P	Category	Credits	Contact Hours
I	PCS2ME01/ PCS2ME02	Robotic Process Automation/ Blockchain Technology	T	ME	2	4
II	PCS2ME03/ PCS2ME04	Mobile Application Development Lab/ Big data analytics Lab	L	ME	2	4
III	PCS3ME01/ PCS3ME02/ PCS3ME03/ PCS3ME04	Cloud Computing Lab/ Internet Of Things Lab / Bioinformatics / Natural Language processing	L/T	ME	2	4

Courses offered to other departments

Sem	Course Code	Course Title	T/L/P	Category	Credits	Contact Hours
II	PCS2CD01/ PCS2CD02	Digital Marketing Lab / Data Visualization lab	L	CD	1	3
III	PCS3VA01	Web Development and Hosting	L	VA	1	3
III	PCS3VA02	Animation through Blender	L	VA	1	3
IV	PCS3ID01	Statistics for Computer Science	T	ID	6	3

MC – Major Core; **ME** - Major Elective; **ID** - Inter-Disciplinary; **MO** - MOOC; **LS** - Life Skills; **SK** - Soft Skills; **CD** - Cross Disciplinary; **VA** - Value Added; **SI** - Summer Internship; **SL** - Service Learning; **PJ** – Project; **SSC** – Self Study Course.

PART	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV	Credits
MC	Advanced Java Programming (4h/4c)	Design and Analysis of Algorithms (4h/4c)	Principles of Compiler design (4h/4c)		79
	Advanced Java Programming Lab (5h/4c)	Design and Analysis of Algorithms using Python Lab (5h/4c)	Digital Image Processing (4h/3c)		
	Machine Learning using Python (4h/4c)	Web Programming (5h/4c)	Digital Image Processing Lab (4h/4c)		
	Machine Learning using Python Lab (5h/4c)	Web Programming Lab (5h/4c)	Wireless Adhoc Networks (4h/3c)		
	Modern database management (4h/4c)	Research Methodology (4h/2c)	Mini Project (4h/4c)		
	Digital Forensics and Cybersecurity (4h/4c)				
	Modern software engineering (4h/4c)				
ME		Robotic Process Automation/ Blockchain Technology (4h/2c)	Cloud Computing /IOT /Bioinformatics /Natural Language processing (4h/2c)		4
		Mobile Application Development Lab / Big data analytics Lab (4h/2c)			
ID			Statistics for Computer Science (6h/3c)		3
SSC		Self-Study (2h/2c) #			2##
MOOC		MOOC (2h/2c)			2
SS		Soft skills (2h/1c) #	Soft Skills #(2h/1c)		2
CD		Digital Marketing Lab / Data Visualization lab (3h/1c)			1

VA			Value Added Courses (from other Institutions) # (3h/1c)		**1**
SI		Summer Internship (3 to 4 Weeks) # (1c)			**1**
SL			Service Learning (2h/1c)		**1**
PJ				Major Project (30h/20c)	**5**
Hr/C	**30h/28c**	**(30h+21c)/(4+4##)c**	**(30h+23c)/(7h+3c)**	**30h/20c**	**(120)h/ (97+2)c**

PG Restructured CBCS curriculum with effective from June, 2022

MC – Major Core; **ME**-Major Elective; **ID**-Inter-Disciplinary; **MO**-MOOC; **LS**-Life Skills;

SK- Soft Skills; **CD**-Cross Disciplinary;

VA- Value Added; **SI**-Summer Internship; **SL**-Service Learning; **PJ**-Project

* Based on students' preference two courses will be offered from the pool of 10.

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COURSE DESCRIPTORS

Course Code	PCS1MC01
Course Title	ADVANCED JAVA PROGRAMMING
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	I
Regulation	2022

COURSE OVERVIEW

1. This course provides the major aspects of Java related technologies.
2. It gives basic knowledge of servlets and Server-side Programming.
3. It elucidates the JDBC concepts.
4. It facilitates to develop dynamic web pages.
5. It provides in depth knowledge to develop web-based enterprise applications.

COURSE OBJECTIVES

1. To understand the Java database connectivity.

2. To familiarize in Servlets.

3. To develop Server-side programming.

4. To gain knowledge in Java technologies.

5. To develop applications at Enterprise level.

Prerequisites	Basic Knowledge of Java programming.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	J2EE Overview: Enterprise Architecture types- objectives-Features of Java EE Platform. Java EE: Architecture – Containers – developing applications – Application Servers. Web applications: HTTP protocol – Introduction to web applications – Web containers – web architecture models – MVC architecture.	12	CO1 CO2 CO3 CO4 C05	K1, K2, K3, K4, K5, K6

	JDBC: Features - APIs - Classes and Interfaces - JDBC Processes: JDBC basic steps			
II	Servlets: Features – 3-Tier applications – Servlet API –Servlet life cycle - Creating sample servlet – working with ServletConfig, ServletContext, HttpServletRequest and HttpServletResponse – Request Delegation and Request scope – servlet collaboration. Sessions: Introduction – Session tracking Mechanisms - Java servlet API for session tracking — creating application.	12	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5,K6
III	Java Server Pages (JSP): Features – advantages – architecture – life cycle – basic tags – action tags – Unified EL – functions with EL – Java Server Pages Standard Tag Library (JSTL): features – Tag Libraries – Core Tag Library – Internationalization Tag Library – SQL Tag Library – Functions Tag Library – Applications Using Tag Libraries.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Enterprise java applications (EJB) Fundamentals—architecture – classifications – Session bean: introduction – Stateless Session Bean- Stateful Session Bean- implementation. Message Driven Bean (MDB): Characters – Structure – Life cycle - Implementation – Managing transactions in java EE applications. Case Study.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Java Persistence API (JPA): Introduction – Introduction to Entities – Lifecycle of entity – Entity Relationship types – Mapping collection based relationships – Entity Inheritance. The Java Persistence Query Language (JPQL): Functions, statements - Clauses – conditional expressions --Query API - Creating a simple application – Configuring the application	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Kogent learning solutions Inc. "Java Server Programming Java EE6 BLACK BOOK" , Reprinted 2013, Dreamtech press.

Suggested readings

1. Jim Keogh, "The Complete reference to J2EE", reprint 2012, Tata McGraw-Hill edition.

2. David Geary, Cay S. Horstmann "Core JavaServer Faces" Third edition, 2010, Prentice Hall.

3. Hall Brown "Core Servlet and JavaServer pages", Second edition, reprint 2011, Pearson Education.

4. Andrew Lee Rubinger, Bill Burke "Enterprise JavaBeans 3.1" Sixth Edition. 2010, O'REILLY.

Web Resources:

1. https://docs.oracle.com/javaee/6/api/javax/faces/webapp/FacesServlet.html
2. https://www.guru99.com/jsp-tutorial.html
3. https://www.oracle.com/java/technologies/javaserverfaces.html
4. https://dzone.com/articles/a-detailed-guide-to-ejbs-with-code-examples

Course Outcomes (COs)

	ADVANCED JAVA PROGRAMMING	COGNITIVE LEVEL
CO 1	To examine and illustrate server-side programming.	K1, K2
CO 2	To apply servlets and JDBC.	K3
CO 3	To analyze and correlate Java technologies.	K4
CO 4	To support in developing applications to solve real world problems.	K5
CO 5	To develop Enterprise level web applications.	K6

Course Code	**PCS1MC02**
Course Title	**MACHINE LEARNING USING PYTHON**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	I
Regulation	2022

COURSE OVERVIEW

1. This course introduces the fundamental concepts of Machine learning and its applications.
2. This course also covers complex machine learning algorithms to build predictive models using Python.
3. It enables better decision making, predictive analysis, visualization and pattern discovery.
4. It also explains the advanced machine learning algorithms such as CNN, RNN and Reinforcement learning.

COURSE OBJECTIVES

1. To understand the various techniques and concepts of Machine learning.
2. To employ the Python libraries for model building.
3. To apply principles of Machine learning to solve predictive tasks.
4. To explore the Machine Learning algorithms in Python to solve real-world problems.

Prerequisites	Basic knowledge in Programming language.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	Introduction to Machine Learning: Different Forms - Machine Learning Categories - Frameworks for Building Machine Learning Systems - Machine Learning Python Packages. Fundamentals of Machine Learning: Scales of Measurement - Feature Engineering - Exploratory Data Analysis (EDA) -	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	Supervised Learning– Regression.				
II	Supervised Learning – Classification: Logistic Regression - Evaluating a Classification Model Performance - ROC Curve - Decision Trees - Support Vector Machine (SVM) – k Nearest Neighbors (kNN) - Time-Series Forecasting. Unsupervised Learning Process Flow: Clustering - K-means - Finding Value of k - Hierarchical Clustering - Principal Component Analysis (PCA)	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Model Diagnosis and Tuning: Optimal Probability Cutoff Point - Rare Event or Imbalanced Dataset - Bias and Variance - K-Fold Cross-Validation - Ensemble Methods – Bagging – Boosting - Ensemble Voting – Stacking - Hyper Parameter Tuning.- - Random Forest.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Text Mining and Recommender Systems: Data Assemble - Data Preprocessing - Data Exploration - Model Building - Text Similarity - Text Clustering. - Text Classification - Sentiment Analysis - Recommender Systems.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Deep and Reinforcement Learning: Artificial Neural Network (ANN) - Multilayer Perceptrons (Feedforward Neural Network - Convolution Neural Network (CNN) - Recurrent Neural Network (RNN) - Transfer Learning - Reinforcement Learning.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Manohar Swamynathan, Mastering Machine Learning with Python in six steps, Apress, First edition, 2017
2. Jiawei Han, MichelineKamber, jian Pei. Data Mining Concepts and Techniques, Morgan Kaufmann Publishers, Third edition, 2012.
3. Daniel T. Larose, Chandal D. Lorose, " Data Mining and Predictive Analysis" , Wiley, 2nd Edition.

Suggested readings

1. 1. Samir Madhavan, Mastering Python for Data Science, PACKT Publishing, First edition, 2015
2. Joel Gurus , Data science from Scratch, O'relly, First edition, 2015
3. Ian Witten, Data mining: Practical Machine Learning Tools and Techniques, Fourth edition, Morgan Kaufmann Publishers

Web Resources

1. https://www.tutorialspoint.com/python_data_science/index.htm

2. https://realpython.com/tutorials/data-science/

3. https://cognitiveclass.ai/learn/data-science-with-python

Course Outcomes (Cos)

MACHINE LEARNING USING PYTHON (MC)		COGNITIVE LEVEL
CO 1	To describe and understand the concepts of Machine Learning.	K1, K2
CO 2	To implement Data Visualization and Machine Learning Techniques.	K3
CO 3	To analyze the various Data Science techniques, supervised and unsupervised learning algorithms.	K4
CO 4	To compare the performance of various data mining algorithms.	K5
CO 5	To propose solutions for real world problems using huge volume of data.	K6

Course Code	PCS1MC03
Course Title	MODERN DATABASE MANAGEMENT
Credits	4
Hours/Week	4
Category	Major Core (Theory)
Semester	I
Regulation	2022

COURSE OVERVIEW
1. This course provides the features of database management system and the modeling.
2. It facilitates the query language features to retrieve data in the required formats.
3. It enables to normalize the tables for efficient storage and retrieval.
4. It also focuses the data warehousing and analysis.
5. It emphasizes the data correctness through database audits.

COURSE OBJECTIVES
1. To understand the architecture and the storage representations of databases.
2. To design databases as a normalized collection of data storages.
3. To develop efficient queries to fetch the required data from multiple tables.
4. To maintain the data governance through data integration and data transformation.
5. To administer the databases from deadlock and tune the performance.

Prerequisites	Basic Knowledge in information management.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Components of the database environment- Database development process-System lifecycle-Alternative information system development-Three schema Architecture Approaches- Managing the range of people involved in application database development-Modelling Data- Introduction : E-R model -Modelling the business rules-Modelling entities and	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	attributes-Modelling relationship.				
II	Logical database design and the relational model-Relational data model- Relational keys- integrity constraints- Transforming ER diagrams- steps in Normalization-functional dependences and keys. Physical database design process- Designing fields – identifying missing / data- denormalizing and partitioning data. Designing physical data files- destiny files.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Introduction to SQL-SQL Environment-creating tables with data integrity controls-Usage of select – Views-Retrieval-Processing multiple tables-Sub queries-Steps involved in writing queries – Better query design –Ensuring transaction integrity – Recent environment and extensions to SQL –Triggers and routines – Embedded SQL and Dynamic SQL.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Base configuration of data warehousing – Operational Vs. informational systems-Data warehouse architectures-Characteristics of data warehouse data-Derived data layer-Integration with Big data and Analytics- Data Quality and Integration – Introduction – Data governance – Managing data quality-Master data management-Data Integration – Data Transformation.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Data administration-Introduction-Roles of data and database administrators-open source database management systems-managing data security-security features of database software –Sarbanes Oxley and databases-Database backup and recovery-Maintaining transaction integrity-Controlling concurrent access-types of locks-Deadlock management-Data dictionaries and repositories – Tuning the database performance – Data availability.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Jeff Hoffer, Ramesh Venkataraman, Heikki Topi , Modern Database Management, Twelfth Edition, Pearson, 2015.

Suggested Readings

1. Ramez Elmasri , Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Person,2016.
2. Raghu Ramakrishnan , Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. C. J. Date, A Kannan, S Swamynathan , "An Introduction to Database Systems", Eighth Edition, Pearson,2006.

Web Resources

1. https://www.javatpoint.com/dbms-tutorial
2. http://www.gbv.de/dms/ilmenau/toc/249984369.PDF
3. https://www.jbiet.edu.in/coursefiles/cse/HO/cse2/DBMSI-III.pdf

Course Outcomes (Cos)

	MODERN DATABASE MANAGEMENT	COGNITIVE LEVEL
CO 1	To recognize and understand the functionalities of databases.	K1, K2
CO 2	To articulate the mechanisms to retrieve data from different database representations.	K3
CO 3	To discover the methodologies to maintain the data to be stored in an organized way.	K4
CO 4	To appraise the data without loss of information and assess them with the compliance of audits.	K5
CO 5	To develop the strategies to manage the data efficiently through backup and recovery.	K6

Course Code	PCS1MC04
Course Title	**DIGITAL FORENSICS AND CYBERSECURITY**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	I
Regulation	2022

COURSE OVERVIEW

1. This course provides the awareness of the information threats and protecting data.
2. It facilitates the scientific approaches on crime investigations on digital transactions.
3. It aims at securing data and preventing unauthorized access.
4. It also focuses on the Digital Forensics tools.
5. It emphasizes the data privacy over the internet and provides mechanisms for retaining privacy.

COURSE OBJECTIVES

1. To understand the technical requirements and the backgrounds for the digital investigation.
2. To explore the investigation methodologies for operating systems and gadgets.
3. To understand various types of cyber-attacks and cyber-crimes.
4. To learn threats and risks within the context of cyber security.
5. To study the defensive techniques against the cyber-attacks.

Prerequisites	Basic Knowledge in information management.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	An overview of Digital Forensics-Preparing Digital Forensics investigations- understanding data recovery work stations and software – Understanding storage formats for digital evidence-determining the best acquisition- usage of acquisition tools- validating data acquisitions- performing RAID acquisition	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	tools- using other forensics tools.				
II	Understanding the Windows, Linux and Macintosh File systems- File structures and storage schemes- Windows registry-virtual machines -Addressing the needs of Digital Forensics tools- Digital Forensics software tools and Hardware tools –validating and testing Forensics software- Recovering graphics files-Digital Forensics analysis and validation.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6	
III	Virtual Machine Forensics, Live acquisitions and Network Forensics- E-mail and social media investigations-mobile device forensics and the internet of everything-cloud forensics.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6	
IV	Cyber offenses-How criminals plan the attacks-Cyberstalking-Botnets-cybercrime and cloud computing- Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era-Security Challenges Posed by Mobile Devices-Registry Settings for Mobile Devices-Authentication service Security- Attacks on Mobile/Cell Phones-Physical security Counter measures for Laptops.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6	

V	Introduction to Tools and methods used in Cybercrime-Proxy servers and Anonymizers-Phishing-Password Cracking- Keyloggers and spywares- Virus and worms-staganography-Dos and DDos attacks-SQL Injection-Buffer overflow-Attacks on wireless Networks.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Bill Nelson, Amelia Phillips and Chris Steuart, "Guide to Computer Forensics and investigations" , Cengage Publication, Sixth edition ,2019

2. Nina Godbole, Sunit Belapure, " Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India, 2013.

Suggested Readings

1. Irfan Shakeel, "Introduction to Computer Forensics and Digital Investigation", Infosec institute, 2015.
2. Richard Boddington, "Practical digital forensics", Packt Publishing, Birmingham, UK, 2016.
3. William Oettinger Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt, Kindle Edition.
4. Gerard Johansen, "Digital Forensics and Incident Response: Incident response techniques and procedures to respond to modern cyber threats", Packt, Kindle Edition,2nd Edition.
5. Michael Nieles, Kelley Dempsey Victoria, Yan Pillitteri , "An Introduction to Information Security", NIST Special Publication 800-12 Revision 1, 2017.

Web Resources

1. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/2a54509d-b6bb-43d8-8250-eae26782c392/FORC%20Book%201.pdf
2. https://www.nist.gov/system/files/documents/2017/05/08/intro-to-digital-forensics.pdf
3. http://www.ijocrweb.com/pdf/2017/October-December/13263_REVIEW%20ARTICLE.pdf
4. https://ptgmedia.pearsoncmg.com/images/9780789741158/samplepages/9780789741158.pdf
5. https://www.skillsforcare.org.uk/Documents/Topics/Digital-working/An-Introduction-to-Cyber-Security.pdf

Course Outcomes (COs)

	DIGITAL FORENSICS AND CYBER SECURITY	COGNITIVE LEVEL
CO 1	To recognize and understand the forensic investigations and the need for cyber security.	K1, K2
CO 2	To employ the concepts of digital forensics and cyber security in the resources used.	K3
CO 3	To analyze various methodologies involved in attacks and responses.	K4
CO 4	To persuade the impact of vulnerability of attacks.	K5
CO 5	To adapt the privacy policies to secure data.	K6

Course Code	PCS1MC05
Course Title	**MODERN SOFTWARE ENGINEERING**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	1
Regulation	2022

COURSE OVERVIEW
1. This course provides knowledge on standardized software development.
2. It supports to empowers the skill of the software problem identification and design
3. It covers the development of object oriented system development
4. This course progresses on different software testing techniques
5. It is designed to insight on the software development and management in global perspective

COURSE OBJECTIVES
1. To expertise in the software engineering principles and techniques
2. To apply Software Project Management Practices
3. To acquire familiarity about project development with software engineering standards
4. To Study various methods of software testing and management strategies.
5. To develop self-reliance and technical expertise with global standards.

Prerequisites	Basics of software project development.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**Introduction Software Engineering** Software and software engineering - Process models: Prescriptive- Specialized - Unified – Agile Development: agility – Agile Process – Extreme Programming – Other Agile process- tool set. Requirement Modelling: Scenario-Based, UML, Data and Class-Based. Project Estimation: Empirical and Specialized estimation	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	techniques.				
II	**Software Scheduling and Design:** Project Scheduling – task-set – Scheduling – Design: Object Oriented View- Concepts and models – designing class based components (Objet – Oriented) – Component – Component Based development - Component design for WebApps – Interface Design steps – WebApp Design.	**12**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	**Software Quality and testing strategies:** Software Quality Types – SQ Dilemma - Achieving SQ - Risk Management: Identification- Projection – Refinement – Testing conventional Software applications – Testing web application - Object-Oriented testing strategies – Testing OOA and OOD models – OO Testing strategies – OO testing Methods – Object based class and inter-class testing.	**12**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	**Project Management and Software Process improvement:** Project Management Concepts – Review techniques – Reengineering: Business Process – software - Reverse – Restructuring. Software Process Improvement – Capability Maturity Model Integration –People Capability Maturity Model.	**12**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	**Emerging Trends in Software Engineering and Process Models:** Software trends - Identification - Technology Trends – Tools –Related trends. – Globalisation issues in project Management – Impacts of Internet in Project management – People Focused Process Model. - Case Studies.	**12**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Roger Pressman.S., "Software Engineering: A Practitioner's Approach", McGraw Hill, 8th Edition. 2019.
2. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill, Ninth Reprint, 2015.

Suggested Readings

1. Ivar Jacobson,"Object Oriented Software Engineering: A Use Case Driven Approach)" Pearson India, 8th edition reprint 2014
2. Ian Sommerville, Software Engineering, 9th Edition: Addison-Wesley, 2016.
3. Shari Lawrence Pfleeger, Joanne M. Atlee,"Software Engineering: Theory and Practice", Pearson Educaction 4th Edition, 2015.
4. Robert C. Martin," Agile Software Development, Principles, Patterns, and Practices", Pearson Education, 3rd edition reprint, 2015

Web Resources

1. https://slideplayer.com/slide/13859622/
2. http://www.engppt.com/2011/12/software-engineering-pressman
3. https://www.powershow.com/view/3aff83ODQ0M/Software_Project_Management_powerpoint_ppt_presentation.

Course Outcomes (Cos)

	MODERN SOFTWARE ENGINEERING	COGNITIVE LEVEL
CO 1	To recall and discuss the basics of software engineering process.	K1, K2
CO 2	To apply the project development and management procedures.	K3
CO 3	To evaluate the working of design and development principles.	K4
CO 4	To measure and reframe the developed applications.	K5
CO 5	To integrate with the global standard of software development.	K6

Course Code	**PCS1MC06**
Course Title	**ADVANCED JAVA PROGRAMMING LAB**
Credits	4
Hours/Week	5
Category	Major Core (MC) - Lab
Semester	I
Regulation	2022

COURSE OVERVIEW

1. This course provides the major aspects of Java related technologies.
2. It gives basic knowledge of servlets and Server-side Programming.
3. It elucidates the JDBC concepts.
4. It facilitates to develop dynamic web pages.
5. It provides in depth knowledge to develop web-based enterprise applications.

COURSE OBJECTIVES

1. To develop and implement server-side programming.
2. To understand the JDBC.
3. To excel in Java technologies.
4. To develop effective dynamic web page.
5. To develop applications at Enterprise level.

Prerequisites	Basic Knowledge in Java programming.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	1. Creating Static web pages. 2. Creating dynamic web pages. 3. Creating simple JDBC applications	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

II	4. Creating servlet applications.	15	CO1	K1,K2,K3,
	5. Creation of login form servlet (Creating and managing session).		CO2	K4,K5,K6
	6. Creating online shopping application Session tracking.		CO3 CO4 CO5	
III	7. JSP program for Registration	15	CO1	K1,K2,K3,
	8. Detect locale, language settings & local specific time		CO2	K4,K5,K6
	9. JSP Program to validate user applications.		CO3 CO4	
	10. JSP Program to manipulate records from database		CO5	
IV	11. Working with stateless session Bean.	15	CO1	K1,K2,K3,
	12. Working with Stateful Session Bean.		CO2	K4,K5,K6
	13. Working with Message Driven Bean.		CO3 CO4	
	14. Working with Entity Bean.		CO5	
V	15. Working with entities.	15	CO1	K1,K2,K3,
	16. Working with clauses.		CO2	K4,K5,K6
	17. Working with conditional expressions.		CO3 CO4	
	18. Implementing error handling.		CO5	
	19. Creating a Simple JPA application.			

Text Books

1. Kogent learning solutions Inc. "Java Server Programming Java EE6 BLACK BOOK", Reprinted 2013, Dreamtech press.

Suggested Readings

1. Jim Keogh, "The Complete reference to J2EE", reprint 2012, Tata McGraw-Hill edition.

2. David Geary, Cay S. Horstmann "Core JavaServer Faces" Third edition, 2010, Prentice Hall.

3. Hall Brown "Core Servlet and JavaServer pages", Second edition, reprint 2011, Pearson Education.

4. Andrew Lee Rubinger, Bill Burke "Enterprise JavaBeans 3.1" Sixth Edition. 2010, O'REILLY.

Web Resources

1. https://www.tutorialspoint.com/jsf/index.htm
2. https://www.tutorialspoint.com/ejb/ejb_create_application.htm
3. https://www.educba.com/jpql/

Course Outcomes (COs)

ADVANCED JAVA PROGRAMMING LAB		COGNITIVE LEVEL
CO 1	To examine and illustrate server-side programming	K1, K2
CO 2	To apply servlets and JDBC.	K3
CO 3	To analyze and correlate Java technologies.	K4
CO 4	To support in developing effective applications to solve real world problems.	K5
CO 5	To develop Enterprise level web applications	K6

Course Code	**PCS1MC07**	
Course Title	**MACHINE LEARNING USING PYTHON - LAB**	
Credits	4	
Hours/Week	5	
Category	Major Core (MC) – Lab	
Semester	I	
Regulation	2022	

COURSE OVERVIEW

1. This course deals the fundamental concepts of Machine learning and its applications.
2. This course also implements the machine learning algorithms to build predictive models using Python.
3. It enables better decision making, predictive analysis, visualization and pattern discovery.
4. It also implements the advanced machine learning algorithms such as CNN, RNN and Reinforcement learning.

COURSE OBJECTIVES

1. To utilize the various techniques and concepts of Machine learning.
2. To employ the Python libraries for model building.
3. To apply principles of Machine learning to analyze business problems.
4. To explore the Machine Learning algorithms in Python to solve real-world problems.

Prerequisites	Basic knowledge in Programming language.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	1. Data manipulation with Numpy and pandas 2. Data visualization with Matplotlib 3. Dealing with Missing Data and Handling Categorical Data 4. Build the Linear Regression model.	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6
II	5. Build and validate the logistic	15	CO1	K1,K2,K3,

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			CO2	K4,K5,K6
	regression model. 6. Build a model with Decision Tree. 7. Build a model with Support Vector Machine(SVM) 8. Build a Model with K Nearest Neighbors (KNN) 9. Implement K Means clustering 10. Implement Hierarchical clustering.		CO3 CO4 CO5	
III	11. Implement Bagging method. 12. Implement Boosting method. 13. Implement Stacking method.	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	14. Implement Data preprocessing techniques for Text Data 15. Explore Data exploration for Text Data 16. Implement Text Classification.	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	17. Build a model with Multi- Layer Perceptron algorithm 18. Exercises for Convolutional Neural Network. 19. Exercise to implement Recurrent Neural Networks.	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Manohar Swamynathan, Mastering Machine Learning with Python in six steps, Apress, First edition, 2017.

2. Manaranjan Pradhan, U Dinesh Kumar,"Machine Learning using python", Wiley.

Suggested Readings

1. Samir Madhavan, Mastering Python for Data Science, PACKT Publishing, First edition, 2015.

2. Joel Gurus , Data science from Scratch, O'relly, First edition, 2015.

Web Resources

1. https://www.tutorialspoint.com/python_data_science/index.htm

2. https://realpython.com/tutorials/data-science/

3. https://cognitiveclass.ai/learn/data-science-with-python

Course Outcomes (COs)

MACHINE LEARNING USING PYTHON LAB (MC)		COGNITIVE LEVEL
CO 1	To describe and understand the basic concepts of Python.	K1, K2
CO 2	To implement the Machine Learning techniques in Python.	K3
CO 3	To apply the various supervised and unsupervised learning algorithms in Python.	K4
CO 4	To compare the various machine learning algorithms in Python	K5
CO 5	To create and evaluate machine learning models to solve real world problems using Python.	K6

Course Code	PCS2MC01
Course Title	**Design and Analysis of Algorithms**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	II
Regulation	2022

COURSE OVERVIEW
1. This course focuses on algorithms for both comprehensive and traditional methods.
2. It aims to give an introductory knowledge on design and analysis of algorithm.
3. It explores the time and space complexity.
4. It also focuses on the implementation of simple and complex algorithms systematically

COURSE OBJECTIVES
1. To understand the significance of Design and Analysis of Algorithms.
2. To recognize the complexity of algorithms in terms of time and space.
3. To obtain the solution within the polynomial time.
4. To apply various strategies for the similar problems and determine the efficiency.

Prerequisites	Basic Knowledge of data structures.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	**Fundamentals of DAA and simple Analysis** Introduction – Fundamentals – Problem types – Data Structures – Analysis Frame work – Notations – Recursive and Non-recursive Algorithms – Brute Force – Selection sort and Sequential Search.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	**Divide and Conquer, Decrease and Conquer** Introduction to Divide and Conquer – Merge Sort and Binary search. Introduction to Decrease and Conquer – Insertion sort, Depth First Search and Breadth First Search.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	**Transform and conquer, Space and Time tradeoffs** Introduction to Transform and conquer – Presorting and Heapsort. Introduction to Space and Time tradeoffs – Sorting by counting and B+Trees.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	**Dynamic Programming, Memory functions** Introduction to dynamic programming – Determination of Binomial coefficient and Floyds's algorithm to all pairs shortest paths problem.Introduction to Memory functions – Knapsack problem and solution	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	**Greedy Technique, comparative study of solutions and Limitations of Algorithm power** Introduction to Greedy Technique –Prim's algorithm and Kruskal's algorithm.Introduction to P, NP and NP – complete problems, Backtracking, Branch and Bound , Approximation algorithms and case studies.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Book

 1. Anany Levitin Introduction to the design and analysis of algorithms, Pearson India Education Services Pvt. Ltd. 3rd Edition 2019

Suggested Readings

 1. V. Aho , John E. Hopcroft and Jeffrey D. Ullman (2009), The Design and Analysis of Computer Algorithms, Pearson Education for South Asia.

2. Parag H. Dave, Himanshu B. Dave (2013), Design and Analysis of Algorithms, Pearson

Web Resources

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htmhttps://www.guru99.com/design-analysis-algorithms-tutorial.html

Course Outcomes (Cos)

DESIGN AND ANALYSIS OF ALGORITHMS (MC)		COGNITIVE LEVEL
CO 1	To identify and discuss the different design aspects of algorithms.	K1, K2
CO 2	To articulate the potential of problem solving.	K3
CO 3	To analyze and deduce various techniques in developing solution.	K4
CO 4	To evaluate the impact of techniques used in solving the problems.	K5
CO 5	To assess the modern techniques to solve the real world problems.	K6

Course Code	PCS2MC02
Course Title	**WEB PROGRAMMING**
Credits	5
Hours/Week	5
Category	Major Core (MC) - Theory
Semester	II
Regulation	2022

COURSE OVERVIEW

1. This course deals with ASP.NET Server controls, HTML controls, Validation controls and Data controls.
2. It introduces database-driven web development with ADO.NET and SQL Server.
3. It handles authentication and authorization for web applications.
4. It focuses on WCF.

COURSE OBJECTIVES

1. To develop ASP.NET Web application-using server controls.
2. To create rich database applications using ADO.NET.
3. To apply ASP.NET security features for authenticating the web site.
4. To utilize data controls in web applications.

Prerequisites	Basic knowledge in HTML, Database and Programming skills.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library – Integrated Development Environment (IDE) - understanding Namespaces and Assemblies- Anatomy of a Web Form- Anatomy of an ASP.NET Application - Server controls - HTML control Classes - Page Class- Application	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	Events - Web Control Classes and Events.			
II	Validation controls - Rich Controls - State Management –Transferring content from one page to another page - Cookies- Files and streams-File system information - file uploads - ADO.NET-Data Provider model, Direct Access model, Disconnected Data Access model, Data Binding- Data Controls- Authentication and Authorization.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Themes and Master Pages: Consistent Web Site, CSS and Scene files, Master Pages: Content placeholder and Nested Master page -Web Services: XML Web Services, Creating and Designing an XML Web Service, Creating Web Service Consumers, Discovering Web Services Using UDDI.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Advanced Concepts: WPF: Introduction - create WPF application - Windows Client .NET - WPF programming model features - WPF Features.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	WCF: Framework: WCF Contract, Service Contract, Operation Contract, Data Contract - Service Hosting - IIS Hosting - Local host (Service Host), Broadcasting – Messaging - Data Base Servicing - WCF testclient tool - Svcconfigeditor tool - Svcutil Tool.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

   1. Matthew MacDonald, "Beginning ASP.NET 4 in C# 2010", APRESS, 2010.

   2. Patel Chirag,"Advance .Net Technology" ,2nd Edition,Dreamtech, 2011.

Suggested readings

1. Matthew MacDonald, "Pro ASP.NET 4 in C# 2010", APRESS, 2010.
2. BillEvjen, Scott Hanselman "Professional ASP.NET 3.5 in C# and VB", Wrox Publication, 2011.
3. Imar Spaanjaars, "Beginning ASP.NET 4 in C# and VB", Wrox Publications, 2010.

Web Resources

1. https://www.javatpoint.com/c-sharp-example

2.https://www.w3schools.com/asp/webpages_intro.asp

3.https://www.c-sharpcorner.com/csharp-tutorials

4.https://www.tutorialspoint.com/csharp/index.htm

Course Outcomes (COs)

	WEB PROGRAMMING (MC)	COGNITIVE LEVEL
CO 1	To identify and understand the goals and objectives of .NET framework.	K1, K2
CO 2	To implement the concepts in ASP.NET with C# language.	K3
CO 3	To analyze functions for data management in ASP.NET.	K4
CO 4	To assess a Web application using ADO.NET.	K5
CO 5	To develop a software to solve real-world problems using ASP.NET and SQL Server.	K6

Course Code	PCS2MC03
Course Title	Research Methodology
Credits	2
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	II
Regulation	2022

COURSE OVERVIEW
1. This course introduces the basic concepts of research.
2. It deals with research design and various types of research.
3. This course provides the systematic approach to the design and formulation of research proposal.
4. It also focuses on the ethical issues in research.

COURSE OBJECTIVES
1. To familiarize the fundamentals of research.
2. To understand the concepts of research design.
3. To explore the methodologies for writing a research report and thesis
4. To describe the ethical issues in educational research.

Prerequisites	Basic Knowledge in research.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**Research Methodology Introduction-** Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	**Defining the Research Problem** - selecting the problem - necessity of defining the problem- technique involved in defining a problem – **Research design**- Meaning of research design – Features of a good design- important concepts relating to research design – Different research designs-basic principles of experimental design.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	**Writing a research proposal –** The research proposal in quantitative and qualitative research – contents of a research proposal- preamble/introduction – the research problem – objectives of the study – hypothesis to be tested – study design-measurement procedures – sampling-analysis of data – structure of the report – problems and limitations-work schedule.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	**Preparation of thesis and research papers-** IMRD structure for research reporting- structure of thesis and research papers-formatting requirements of a thesis-Formatting requirements of a thesis-thesis editing-writing a research report-referencing-bibliography- The structure of a research paper-other considerations in the preparation of articles- conference papers-electronic publications-short notes and other forms of reports –publishing the research paper.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	**Ethics** – Intellectual creations – plagiarism – self-plagiarism – misrepresentation – authorship – confidentiality and conflict of interest – an ethics checklist-case study.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Kothari, C.R., Gaurav Garg, Research Methodology: Methods and Techniques. New Age International. Publishers, Fourth edition 2019.- unit 1 & 2

2. Ranjith Kumar, Research Methodology a step-by-step guide for beginners- SAGE publications - V edition – 2019- Unit 3

3. C. George Thomas, Research Methodology and scientific writing – Ane Books – 2015 unit 4

   Justin Zobel, Writing For Computer Science, Springer -Third Edition. Unit-5

Suggested Readings

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International Publishers (Second revised edition)

2. R. Paneer Selvam (2014), Research Methodology, 4/e. Prentice Hall India Learning Private Limited.

Web Resources

1. University Grants Commission Guidance Document GOOD ACADEMIC RESEARCH PRACTICES September 2020, Published by Secretary University Grants Commission- https://www.ugc.ac.in/e-book/ UGC_ GARP_ 2020_ Good%20 Academic%20 Research%20 Practices.

2. Recent research ethics policy from Government of India - https://www.ccmb.res.in/newsfiles/year-2020/csir_ethics_2020.pdf

Course Outcomes (COs)

	RESEARCH METHODOLOGY	COGNITIVE LEVEL
CO 1	To recognize and understand the significance of research.	K1, K2
CO 2	To employ the concepts in research design.	K3
CO 3	To analyze the steps used in forming a research proposal.	K4
CO 4	To evaluate the impact of quality research.	K5
CO 5	To adapt ethics and appropriate methodologies in research.	K6

Course Code	**PCS2MC04**
Course Title	**Design and Analysis of Algorithms using Python - Lab**
Credits	04
Hours/Week	05
Category	Major Core (MC) - Lab
Semester	I
Regulation	2022

COURSE OVERVIEW

1. This course enables the implementation of high quality algorithms.

2. It aims to analyze the implementation techniques for the algorithms.

3. It deals with the data structures to represent the data for the algorithms.

4. It also focuses on the developing optimum solutions to the real world problems.

COURSE OBJECTIVES

1. To implement algorithms in python language.

2. To explore modern techniques to solve the problems.

3. To understand and utilize various functions and packages available in Python.

4. To analyze the efficiency of algorithms.

Prerequisites	Basic Knowledge of data structures.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Python Language Foundations 1. Data structure to accept and store data 2. File system to store and retrieve standard data (Dataset) 3. Brute Force – Selection sort 4. Brute Force –Sequential Search	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	5. Divide and Conquer – Merge Sort 6. Divide and Conquer –Binary search 7. Decrease and Conquer – Insertion sort 8. Decrease and Conquer –Depth First Search 9. Decrease and Conquer –Breadth First Search	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	10. Transform and conquer – Presorting 11. Transform and conquer –Heapsort 12. Space and Time tradeoffs – Sorting by counting 13. Space and Time tradeoffs B+ Tree	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	14. Dynamic programming – Determination of Binomial coefficient 15. Dynamic programming –Floyds's algorithm to all pairs shortest paths problem 16. Memory functions – Knapsack problem	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	17.Greedy Technique – Prim's algorithm 18.Greedy Technique –Kruskals algorithm 19. Backtracking : Subset sum problem 20. Branch and Bound : Assignment problem	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Reema Thareja, Python Programming: using problem solving approach, Oxford University Press, 2017.
2. Miller Bradley N. Franklin Problem Solving with Algorithms and Data Structures Using Python, Beedle & Associates Inc., 2011.
3. Anany Levitin, Introduction to the design and analysis of algorithms, Pearson India Education Services Pvt. Ltd., 3rd edition, 2019.

Suggested Readings

1. Hemant Jain, Problem Solving in Data Structures & Algorithms Using Python: Programming Interview Guide, Taren Technologies, 2016
2. Narasimha Karumanchi , Data Structure and Algorithmic Thinking with Python,

careermonk.com, 2015

Web Resources

1. Problem Solving with Algorithms and Data Structures using Python
   https://runestone.academy/runestone/books/published/pythonds/index.html
2. Data Structures and Algorithms in Python
   https://jovian.ai/learn/data-structures-and-algorithms-in-python
3. Data Structures & Algorithms in Python
   https://towardsdatascience.com/data-structures-algorithms-in-python-68c8dbb19c90

Course Outcomes (COs)

DESIGN AND ANALYSIS OF ALGORITHMS USING PYTHON - LAB		COGNITIVE LEVEL
CO 1	To understand the constructs of Python.	K1, K2
CO 2	To illustrate the use of various data structures.	K3
CO 3	To apply and analyze sorting and searching techniques.	K4
CO 4	To evaluate the time and space complexity.	K5
CO 5	To create solutions for the real world problems.	K6

Course Code	**PCS2MC05**
Course Title	**WEB PROGRAMMING LAB**
Credits	5
Hours/Week	5
Category	Major Core (MC) – Lab
Semester	II
Regulation	2022

COURSE OVERVIEW

4. This course deals with ASP.NET Server Controls, HTML Controls, ValidationControls and Data

    Controls.

5. It introduces database-driven web development with ADO.NET and SQL Server.
6. It handles authentication and authorization for web applications.
7. It focuses on WCF.

COURSE OBJECTIVES

1. To develop ASP.NET Web application-using Server controls.
2. To create rich database applications using ADO.NET.
3. To apply ASP.NET security features for authenticating the web site.
4. To utilize data controls in web applications.

Prerequisites	Basic knowledge in HTML, Database and Programming skills.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	1. Web application using Web controls. 2. Web application using List controls. 3. Web Page design using Rich control.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	4. Validate user input using Validation controls. 5. Implement Master Form with Web application. 6. Web application using Data Controls.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	7. Data binding with Web controls 8. Data binding with Data Controls. 9. Database application to perform insert, update and delete operations. 10. Database application using Data Controls to perform insert, delete, edit, paging and sorting operation.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	11. Create a Web application that illustrates the use of themes and master pages with Site-Map. 12. Implementation of Authentication 13. Implementation of Authorization	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	14. Ticket reservation using ASP.NET controls. 15. Online examination using ASP.NET controls. 16. Create the simple application to demonstrate the WCF concept.	**15**	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Robin Nixon, 2012. A step by step guide to creating dynamic website. Learning PHP, MySQL, Javascript and CSS, 2nd Edition, O'Reilly.

2. Matthew MacDonald, "Beginning ASP.NET 4 in C# 2010", APRESS, 2010.

Suggested readings

1 Vikram Vaswani, 2005. How to do everything with PHP and MySQL, 1st Edition, Tata McGraw Hill.

2. Vikram Vaswani, 2017. A beginner's guide PHP, 1st Edition, McGraw Hill Education.

3. Luke Welling, 2017. PHP and MySQL web development, 5th Edition, Pearson Education.

4. Matthew MacDonald, "Pro ASP.NET 4 in C# 2010", APRESS, 2010.

5. BillEvjen, Scott Hanselman "Professional ASP.NET 3.5 in C# and VB", Wrox Publication, 2011.

6. ImarSpaanjaars, "Beginning ASP.NET 4 in C# and VB", Wrox Publications, 2010..

Web Resources

1. https://www.javatpoint.com/c-sharp-example

2. https://www.w3schools.com/asp/webpages_intro.asp

3. https://www.c-sharpcorner.com/csharp-tutorials.

4. https://www.tutorialspoint.com/csharp/index.htm

Course Outcomes (COs)

	WEB PROGRAMMING (MC) LAB	COGNITIVE LEVEL
CO 1	To identify and understand the goals and objectives of .NET framework.	K1, K2
CO 2	To implement the concepts in ASP.NET with C# language.	K3
CO 3	To analyze functions for data management in ASP.NET.	K4
CO 4	To assess a Web application using ADO.NET.	K5
CO 5	To develop a software to solve real-world problems using ASP.NET and SQL Server.	K6

Course Code	PCS2ME01
Course Title	ROBOTIC PROCESS AUTOMATION
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Theory
Semester	II
Regulation	2022

COURSE OVERVIEW

1. This course provides the basic concepts of Robotic Process Automation.
2. It helps to familiarize the RPA tools that are most relevant in the industry.
3. It explores the various options/tools available in UiPath Studio.
4. It familiarizes the domains in which RPA plays a pivotal role.

COURSE OBJECTIVES

1. To understand the fundamentals of Robotic Process Automation.
2. To offer comprehensive knowledge on developing software robots.
3. To explore the challenges and risks when implementing RPA.
4. To familiarize the creation of bots and implement simple bots.

Prerequisites	Basic knowledge in Programming.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Scope and techniques of automation - Robotic Process Automation – Components of RPA - RPA platforms- About UIPath - Learning UIPath Studio	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6
II	Sequence – Activities – Using activities with workflows - Control flow – Assign, Delay, Break, while, do while, for each, if, switch activity - Data manipulation – Variables and scope, Data table usage with examples.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

III	Taking control of the Controls – Finding and attaching windows – Finding the control – Act on controls – mouse and keyboard activities - Working with UIExplorer – Handling events – Screen scraping.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Handling User events and Assistant Bots – Monitoring system event triggers – Launching an assistant bot on a keyboard event - Exception handling – Common exceptions and ways to handle them – Debugging techniques – Error reporting.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	Managing and maintaining the code – Project organization – Nesting workflows – Reusability of workflows - Deploying and maintaining the Bot - Publishing using publish utility.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Alok Mani Tripathi, 2018. Learning Robotic Process Automation, 1st Edition, Packt Publishers.

Suggested readings

1. Tom Taulli, 2020. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,O'Reilly.
2. Gerardus Blokdyk, 2020. Robotic Process Automation RPA – A complete guide, Kindle edition. Nandan Mullakara, Arun Kumar Asokan , 2020. Robotic Process Automation Projects, Packt Publishing.

Web Resources

1. https://www.automationanywhere.com/rpa/robotic-process-automation
2. https://enterprisersproject.com/article/2019/5/rpa-robotic-process-automation-how-explain
3. https://www.cio.com/article/227908/what-is-rpa-robotic-process-automation-explained.html

Course Outcomes (COs)

	ROBOTIC PROCESS AUTOMATION (SE)	COGNITIVE LEVEL
CO 1	To understand the fundamentals of automation.	K1, K2
CO 2	To explore the avenues in which RPA is used.	K3
CO 3	To analyze and interpret an RPA implementation plan.	K4
CO 4	To evaluate the requirements of processes for using RPA.	K5
CO 5	To develop the competence to design a software robot.	K6

Course Code	PCS2ME02
Course Title	**BLOCKCHAIN TECHNOLOGY**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Theory
Semester	II
Regulation	2022

COURSE OVERVIEW

1. Blockchain technology encompasses the fundamentals of cryptocurrency security.

2. The aim of the course is to introduce cryptocurrency and investigate its types.

3. The course explores about smart contracts, ICOs and applications.

4. It course highlights the different aspects of Blockchain security.

COURSE OBJECTIVES

1. To understand cryptocurrencies and explore the uses of Blockchain

2. To be able to explain the different components involved in Blockchain.

3. To analyze the importance of cryptocurrency security.

4. To comprehend the risks involved in distributed ledger technology.

Prerequisites	Basic knowledge on cyber security.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Origin of Blockchain – Blockchain solution – Components of Blockchain – Block in a Blockchain – Technology and Future – Blockchain Types and Consensus Mechanism: Decentralization and Distribution – Types of Blockchain – Consensus Protocol – Cryptocurrency	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	Bitcoin, Altcoin and Token: Bitcoin and the Cryptocurrency – Cryptocurrency Basics – Types of Cryptocurrencies – Cryptocurrency usage – Public Blockchain System: Public Blockchain – The Bitcoin Blockchain – Ethereum Blockchain	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Smart Contracts: Smart Contract – Characteristics of Smart Contract – Types of Smart Contracts – Types of Oracles – Smart Contracts in Ethereum – Private Blockchain System: Key characteristics – Private Blockchain and Open Source – State Machine – PAXOS, RAFT, Byzantine Fault – Multichain	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Initial Coin Offering: Blockchain Fundraising Methods – Launching an ICO – Investing in an ICO – Pros and Cons of ICO – Evolution of ICO – ICO platforms – Security in Blockchain: Security Aspects – Security and Privacy challenges – Performance and Scalability – Identity Management and Authentication	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	Applications of Blockchain: Blockchain in Banking and Finance – Blockchain in Education – Blockchain in Energy – Blockchain in Healthcare – Blockchain in Real-estate – Blockchain and IoT – Limitations and Challenges of Blockchain	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, "Blockchain Technology", Universities Press, 2020

Suggested readings

1. Kumar Saurabh, Ashutosh Saxena "Blockchain Technology Concepts and Applications", Wiley, 2020.

2.	Don Tapscott, Alex Tapscott, "Blockchain Revolution" Paperback, 1st Edition, 2018

Web Resources

1. https://www.javatpoint.com/blockchain-tutorial
2. https://www.tutorialspoint.com/blockchain/index.htm

Course Outcomes (COs)

BLOCKCHAIN TECHNOLOGY		COGNITIVE LEVEL
CO 1	To identify and discover the concepts of cryptocurrency.	K1, K2
CO 2	To examine the different applications of Blockchain.	K3
CO 3	To analyze Smart contracts and ICOs.	K4
CO 4	To summarize the security aspects of Blockchain.	K5
CO 5	To combine and deploy the various structures of Blockchain.	K6

Course Code	PCS2ME03
Course Title	**MOBILE APPLICATION DEVELOPMENT LAB**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	II
Regulation	2022

COURSE OVERVIEW

1. This course facilitates to understand android SDK.

2. It helps to acquire basic knowledge on Android application development.

3. It also utilizes rapid prototyping techniques to design and develop mobile interfaces.

4. This course gives practical knowledge to develop and deploy android applications

COURSE OBJECTIVES

1. To analyze the features of Android.

2. To configure Android environment and development tools.

3. To understand persistence data storage mechanism in Android.

4. To embed graphics and animation in developing android applications.

Prerequisites	Knowledge of JAVA Programming.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	The First App: Java and Android- The development environment- Android app- Our first Android app. Designing Layouts: Exploring Android UI design, Real world Layouts. Introducing Android Software Development Platform: The directory structure of an Android Project- Leveraging Android XML. 1. Develop an app to display Hello World on screen.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	2. Develop an application that uses GUI components, fonts and colors. 3. Implement linear layout and absolute layout.			
II	Screen Layout Design: Views and Layouts: Android view hierarchies- Defining screen Layouts: Using XML. UI Design: Buttons, Menus and Dialogs: Using Android UI elements (widgets)-Using Menus in Android- Adding Dialogs. 4. Implement frame layout, table layout and relative layout. 5.Develop an application that draws basic graphical primitives on the screen. 6. Implement Text view and Edit Text 7. Implement Auto Complete Text View. 8. Develop an application to create an activity.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	An Introduction to Graphics Resources in Android: Introducing the Drawables- Using Bit map images- Creating Animation. Adding Interactivity: Handling UI Events: An overview of UI events- Handling OnClick Events. 9. Implement login window using UI controls. 10. Implement Checkbox, Radio Button and Radio Group. 11. Implement Progress Bar. 12. Implement List View, Grid View, Image View and Scroll View. 13. Implement Custom Toast Alert.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Understanding Content Providers: An Overview-Defining a content provider-Working with a Database. Understanding Intents and Intent Filters: What is Intent? -	12	CO1 CO2 CO3 CO4	K1,K2,K3, K4,K5,K6

	Intent Resolution- Using Intents with Activities- Android Services- Using Intents with Broadcast Receivers. 14. Implement Date and Time Picker. 15. Implement content provider. 16. Create a simple app for registration form.		CO5	
V	Using SQLite Databases in our Apps: The Android SQLite API. Upgrading SQLite- Adding Locations and Maps: Updating the database- Updating View Fragment- Adding location permissions Publishing Apps: Prepare to publish-Building the publishable APK file. 17. Create a database for your application. 18. Implement an application that creates an alert upon receiving a message. 19. Create an android application to navigate to web page, send sms and email using filters.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. John Horton, 2018. Android Programming for Beginners, Packt Publishing, UK.
2. Wallace Jackson 2017. Android Apps for Absolute Beginners, Fourth Edition, APress, India.

Suggested Readings

1. Jerome DiMarzio, "Beginning Android Programming with Android Studio", 4thEdition, 2016.
2. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", 2017.
3. Dixit Prasanna kumar," Android", Vikas Publications, New Delhi,2014,ISBN: 9789325977884

Web Resources

1. https://developer.android.com/guide
2. https://www.tutorialspoint.com/android
3. http://developer.android.com/guide/index.html
4. https://www.javatpoint.com/android-tutorial

Course Outcomes (Cos)

	MOBILE APPLICATION DEVELOPMENT LAB	COGNITIVE LEVEL
CO 1	To remember and understand the components and structure of mobile application development.	K1, K2
CO 2	To apply the various mobile application development frameworks.	K3
CO 3	To analyze the working principles of UI elements and resources.	K4
CO 4	To recommend the role of database for the android framework.	K5
CO 5	To create and deploy applications to the Android marketplace for distribution.	K6

Course Code	PCS2ME04
Course Title	**BIG DATA ANALYTICS LAB**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	II
Regulation	2022

COURSE OVERVIEW

1. This course deals the fundamental concepts of big data analytics.
2. It explores on SPARK tool to work with big data.
3. It provides skill to stream and compute decision with huge data.
4. 4. It enables the real-time integration of large volumes of dataset.

COURSE OBJECTIVES

1. To learn the perspectives of Big Data analytics.
2. To understand Forecasting methods used in business applications with huge data.
3. To learn about the analytical process of Big Data in Spark environment.
4. To acquire knowledge and build distributed systems in Spark.
5. To enrich with various data analytical techniques in real-time systems.

Prerequisites	Basics of database.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**INTRODUCTION TO BIG DATA AND SPARK** Introduction — Best Practices for Big Data Analytics —characteristics of big data— Validating -Understanding Big Data Storage. Introduction to Spark Apache -Spark Ecosystem - Setting up the Spark Python Environment – Execution of a PySpark Program – Resilient Distributed Datasets –	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	Spark Architecture – Spark Project Workflow **EXERCISE:** 1. Program involving Resilient Distributed Datasets 2. Program involving Transformations and Actions			
II	**ASSOCIATION RULE** Association Rules Apriori Algorithm — Evaluation Rules - Applications— Finding Association & similarity. Content Based - Knowledge Based- Hybrid Approaches. Spark Programming - Loading and Storing Data – Transformations – Actions – Key-Value of resilient distributed dataset and local value of Resilient Broadcast Variables – Accumulators. **EXERCISE:** 3. Program on Apriori and Association rules 4. Program involving Key-Value Resilient Distributed Datasets 5. Program involving Local Variables, Broadcast Variables and Accumulators	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	**SOCIAL NETWORK ANALYSIS** Definitions – Relational and probabilistic Neighbor Classifier -Relational logistic Regression - Collective Inference. Spark and SQL - Spark Session – Data Frames – Schema of a Data Frame – Operations supported by Data Frames – Filter, Join, GroupBy, Aggregate operations – Nesting the Operations – Temporary Tables – Viewing and Querying Temporary Tables- Linear Regression. **EXERCISE:** 6. Program involving Filter, Join, GroupBy, Aggregate operations 7. Execution of data Viewing and Querying Temporary Tables. 8. Program on Linear Regression	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

IV	**CLUSTERING** Introduction-Clustering- K-means - Use Cases - Overview of the Method — Determining the Number of Clusters — Diagnostics - Spark Streaming Use Cases for Realtime data Analytics – Transferring, Summarizing– Data Sources supported by Spark Streaming – Principal component analysis. **EXERCISE:** 9. Program on Principal Component Analysis 10.Program using Text Pre-processing with TF-IDF 11. Program on K-Means Clustering	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	**CLASSIFICATION** Decision Trees -Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes –Theorem & Classifier. – SPARK Flat files, TCP/IP – Flume – Kafka – Kinesis – Streaming Context –SPARK Programming for Random Forest Classification – Text Pre-processing with TF-IDF – Naïve Bayes Classification –Recommendation Engines. **EXERCISE:** 12. Program using Decision Tree Classification 13.Program for Random Forest Classification 14. Program for Naïve Bayes Classification	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Third edition 2020.
2. Baesens, , Analytics in a Big Data World: The Essential Guide to Data Science and Its applications, Wiley India Private Limited, First edition 2014
3. Tomasz Drabos, Danny Lee, "Learning PySpark", PACKT, 2017.
4. Padma Priya Chitturi, "Apache Spark for Data Science", PACKT, 2017.

Suggested Readings

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
2. Michael Minelli, Michele Chambers, 2013, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO
3. Holden Karau, " Learning Spark". PACKT, 2016.
4. Sandy Riza, "Advanced Analytics with Spark", O' Reilly, 2016.

Web Resources

1. http://www.bigdatauniversity.com/dataanalytics
2. https://www.edx.org/course/big-data-analytics-using-spark

Course Outcomes (COs)

BIG DATA ANALYTICS		COGNITIVE LEVEL
CO 1	To define and describe the basics of data analytics.	K1, K2
CO 2	To demonstrate various algorithms of data analytics.	K3
CO 3	To correlate the application with relevant datasets.	K4
CO 4	To measure the performance across various techniques.	K5
CO 5	To integrate and formulate decisions for the real-time systems relating to its datasets.	K6

Course Code	PCS2CD01
Course Title	**DIGITAL MARKETING LAB**
Credits	01
Hours/Week	03
Category	Cross Disciplinary (CD) - Lab
Semester	II
Regulation	2022

COURSE OVERVIEW

1. Digital Marketing is the promotion of brands to connect with potential customers using Internet and other forms of communication.
2. This course gives in-depth knowledge of digital marketing strategies.
3. It also explores various tools to implement different types of digital marketing techniques.
4. It explains the creation of social media and email accounts.

COURSE OBJECTIVES

1. To understand the fundamentals of digital marketing strategies.
2. To demonstrate the creation of websites using WordPress.
3. To explore the various tools and features in content creation.
4. To familiarize with creating and customizing YouTube channels.

Prerequisites	Basic knowledge in Internet.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Introduction of the digital marketing - Digital vs. traditional Marketing - Digital Marketing Channels. Web design - Optimization of Web sites. 1. Installation of wordpress and usage of themes Creation of a website using wordpress.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	Internet Marketing and Digital Marketing Mix – Internet Marketing, opportunities and challenges; Content Marketing: Tools to create and manage content and blog. 2. Usage of Google Analytics and creation of an account. Content creation (Presentation / Videos/ Poster)	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Introduction of Social Media Marketing-Facebook Marketing: Business through Facebook Marketing, Creating Advertising Campaigns, Digital Marketing Strategies through Instagram and Snapchat. 3. Social Media Account creation. 4. Scheduling Posts.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	E-mail marketing- E-mail marketing plan- E-mail marketing campaign analysis - Keeping up with conversions. 5. Email marketing account creation. 6. Developing E-MAIL campaign.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	YouTube content Marketing :Creating business accounts on YouTube • YouTube Advertising - YouTube Analytics 7. Youtube channel creation and customizing channel. 8. Uploading videos in channel.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Puneet Singh Bhatia, 2017. Fundamentals of Digital Marketing, 1st Edition, Pearson Publication.
2. ShiwaniKarwal, 2015. Digital Marketing Handbook: A Guide to search engine optimization, Pay per click marketing, Email Marketing and Content Marketing, 1st Edition, Create Space Independent Publishing platform.

Suggested readings

1. Damian Ryan, 2017. Understanding Digital Marketing: Marketing Strategies for engaging the Digital Generation, 4th Edition, Koganpage publication.
2. Puneet Singh Bhatia, 2019. Fundamentals of Digital Marketing, 2nd Edition, Pearson Education.
3. Chuck Hemann and Ken Burbary, 2013. Digtial Marketing Analytics, Making sense of

consumer data in a digital world, Que Publishing.

Web Resources

1. https://www.digitalmarketer.com/digital-marketing/assets/pdf/ultimate-guide-to-digital-marketing.pdf
2. https://www.webmarketingacademy.in/beginners-guide-to-digital-marketing-with resource
3. https://www.mediakings.com.au/wp-content/uploads/2014/05/Ian_Dodson_-The_Art_of_Digital_Marketing.pdf
4. https://neilpatel.com/what-is-digital-marketing/

Course Outcomes (COs)

DIGITAL MARKETING LAB		COGNITIVE LEVEL
CO 1	To describe and understand the key elements of digital marketing strategies.	K1, K2
CO 2	To implement digital marketing concepts.	K3
CO 3	To analyze and interpret content creation and email marketing.	K4
CO 4	To explain the design of social media account using digital marketing tools.	K5
CO 5	To create online campaigns and YouTube channels using digital marketing strategies.	K6

Course Code	PCS2CD02
Course Title	**DATA VISUALIZATION LAB**
Credits	1
Hours/Week	3
Category	Cross Disciplinary (CD) - Lab
Semester	II
Regulation	2022

COURSE OVERVIEW

1. This course deals with the main concepts of visual analytics with hands-on using Tableau.
2. It enables to create effective charts and interactive dashboards in many business scenarios.
3. It facilitates to develop projects like visual analytics, creating dashboards and story-telling with Tableau.
4. It also explains the concepts of filters, parameters, maps, graphs and table calculations.

COURSE OBJECTIVES

1. To understand the basic and advanced concepts on Tableau.
2. To Build and organize data visualization with Tableau.
3. To apply principles of Data Visualization to analyze business problems.
4. To explore the Data visualization concepts in Tableau.

Prerequisites	Basic knowledge on computers.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Introduction and Getting stared with Tableau: Tableau workspace – working with Measures and Dimensions – working with marks – saving, opening and sharing the workbook. Adding Data Source in Tableau: Setting up a data connector – selecting Data Tables – Joins – Union – Data Protection and Data Governance.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	1. Exercise to selecting Data Tables, Join and Union. 2. Implement Data Protection and Data Governance in Tableau.			
II	Creating Data Visualization: Chart Types - Bar charts , legend – Filters – Line charts – High light Tables – Heat Maps - Bullet chart – Cumulative sums with waterfall charts. 3. Create Bar , Line Charts for the given dataset. 4. Create Heat Maps, Bullet Chart and waterfall charts.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Aggregate Functions, calculated Fields and Parameter: Aggregation in calculated fields – Date calculation. 5. Exercise to implement Aggregate functions. 6. Exercise to perform Data calculations.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Maps: Symbol Maps – Filled Maps – Density Maps – Map Layers – Maps with Pie Charts. 7. Exercise to implement symbol Maps, Filled Maps and Density Maps. 8. Implement Maps with Pre charts.	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	Advanced Analytics: Trends, Forecasts, Clusters and other statistical Tools: overview of Tableau Analytics pane – Trend Lines – Forecasts – Cluster Analysis. 9. Exercise for cluster analysis and Forecasting. 10. Create Trend Lines for a given dataset	9	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Alexander loth, "Visual Analytics with Tableau", WILEY., 2019.

Suggested Readings

1. Linda Ryan, "Visual Data Storytelling with Tableau", First Edition, Pearson Paperback – 2018

2. Noab lliinsky, Julie Steele, Data Visualizations" OReilly, 2018

Web Resources

1.https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

2.https://www.analyticsvidhya.com/blog/2017/07/data-visualisation-made-easy/

3.https://intellipaat.com/blog/tutorial/tableau-tutorial/

Course Outcomes (COs)

	DATA VISUALIZATION LAB	COGNITIVE LEVEL
CO 1	To understand and describe the main concepts of data visualization.	K1, K2
CO 2	To implement Data Visualization Techniques.	K3
CO 3	To analyze the various Data Visualization Concepts.	K4
CO 4	To compare the effectiveness of various types of charts and maps.	K5
CO 5	To create insightful visuals with Tableau Tools.	K6

Course Code	PCS3MC01
Course Title	**PRINCIPLES OF COMPILER DESIGN**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	III
Regulation	2022

COURSE OVERVIEW
1. This course deals with the basic techniques of Compiler Design.
2. It describes the various phases of Compiler.
3. It provides the skill to design different parsers.
4. It explains efficient Data Flow Algorithms.

COURSE OBJECTIVES
1. To understand the basic concepts of high level language translation and phases of compiler design.
2. To acquire knowledge on Lexical Analysis.
3. To inculcate different types of parsers.
4. To demonstrate intermediate code using technique of syntax directed translation.
5. To illustrate the various optimization techniques for designing the DAG.

Prerequisites	Basic knowledge in programming.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	Introduction to Compilers: Overview of the Compiler and its Structure – Analysis of the source program -. Phases of Compiler - Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5

II	Syntax Analysis: Role of Parser – Grammars – Error Handling – Regular Grammar - Regular Expression – Context-free grammars – Top down Parsing Algorithms : backtracking, recursive descent parsing, predictive parsers, LL(1) parser – Bottom up Parsing Algorithms : shift-reduce parsing, LR parser – Error Handling and Recovery in Syntax Analyzer.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5
III	Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking Syntax Directed Translation Mechanisms, Attributed Mechanisms And Attributed Definition.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5
IV	Run-Time Environment And Code Generation : Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1,K2,K3, K4, K5
V	Code optimization - Purpose of Code optimization- Scope of Code optimization- Local optimization - Loop optimization – Directed Acyclic Graph (DAG) - Global Data Flow Analysis – Efficient Data Flow Algorithm.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5

Text Books

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2013.

Suggested Readings

1. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

2. O.G.Kakde, Compiler Design, Laxmi Publications, fourth Edition, 2015.

3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2011.

Web Resources

1. https://www.smartzworld.com/notes/compiler-design-notes-pdf-cd-2/

2. https://www.tutorialspoint.com/compiler_design/index.htm

3. https://sites.google.com/site/hemavathibitcse/my-forms.

4. https://www.iare.ac.in/sites/default/files/IARE_CD_%20LECTURE_%20NOTES.pdf

Course Outcomes (COs)

PRINCIPLES OF COMPILER DESIGN		COGNITIVE LEVEL
CO 1	To identify and understand the functionality of various phases of compiler.	K1, K2
CO 2	To implement different parsers using Context Free Grammar.	K3
CO 3	To analyze the source program with the phases of Compiler.	K4
CO 4	To assess various optimization techniques for data flow analysis.	K5
CO 5	To develop efficient Data Flow Algorithm .	K6

Course Code	PCS3MC02
Course Title	**DIGITAL IMAGE PROCESSING**
Credits	3
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	III
Regulation	2022

COURSE OVERVIEW

1. This course is designed to understand the concepts of digital images.

2. It includes theoretical concepts of enhancement techniques in digital image processing.

3. It explains different pre-processing techniques like filtering, noise removal.

4. It provides various compression techniques for image processing.

5. It helps to understand the colour models and segmentation techniques.

COURSE OBJECTIVES

1.   To understand the digital images and its transformations.

2.   To learn different colour, noise models.

3.   To explore different enhancement techniques.

4.   To apply different compression techniques in image processing.

5.   To analyze applications of digital image processing in different areas.

Prerequisites	Basic knowledge in Mathematics.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Image sampling and quantization: Basic concepts in sampling and Quantization-Representing Digital Image-Spatial and Intensity Resolution-Image Interpolation. Basic Relationship between Pixels-Neighbors of a pixel-Adjacency, connectivity, regions and boundaries-Distance Measures.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6
II	Basic Intensity Transformations Functions: Image Negative-Log Transformation –Power-	12	CO1 CO2	K1,K2,K3, K4,K5,K6

				CO3	
				CO4	
	Law Transformations-piecewise-Linear Transformation functions. Histogram Processing: Histogram Equalization-Histogram Matching-Image smoothing using Frequency Domain filter: Ideal Low pass filters-Butterworth Low pass filters-Gaussian Low pass filters			CO5	
III	Image Sharpening using frequency Domain filters: Ideal High pass filter-Butterworth High pass filters- Gaussian High pass filters-Unsharp masking-High boost filtering and High Frequency Emphasis filtering. Image Restoration and Reconstruction: A model of the image Degration /Restoration Process .Noise Models: Important Noise Probability Density Function. Colour Image Processing: Colour Fundamentals-Colour Models: The RGB colour Model-The CMY and CMYK colour Models-HIS colour Model.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Image Compression: Fundamentals- basic Compression Methods: Huffman coding-Arithmetic coding-LZW coding-Run-Length coding –Symbol based coding-Bit Plane coding –Block Transform coding –Predictive coding –Wavelet coding. Morphological Image Processing: Preliminaries-Erosion and Dilation: Erosion-Dilation-Duality. Opening and closing-The Hit or Miss Transformation.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Image segmentation: Detection of Isolated Points –Line detection-Edge models. Thresholding: Basic Global Thresholding-Multiple thresholds-Variable Thresholding. Representation and Description: Representation: Chain codes-Polygonal approximation -signature. Boundary Descriptors: simple descriptors-Shape numbers. Regional Descriptor: simple descriptors-Topological Descriptors-Texture.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Gonzalez & Woods, Digital Image Processing, , Pearson education, 2018 ,Fourth edition.

Suggested Readings

1. Jain Anil K., Fundamentals Digital Image Processing, Prentice Hall India, 2010.
2. Pratt W.K, Digital Image Processing, John Wiley & Sons, 2007, Third

Web Resources

1. www.imageprocessingplace.com
2. https://www.javatpoint.com/dip-image-transformations
3. https://www.dynamsoft.com/blog/insights/image-processing/image-processing-101-color-models/

Course Outcomes (COs)

	DIGITAL IMAGE PROCESSING	COGNITIVE LEVEL
CO 1	To understand and define the concepts of digital images.	K1, K2
CO 2	To apply processing techniques on digital images.	K3
CO 3	To analyze digital image and its processing techniques.	K4
CO 4	To evaluate the effectiveness of different compression techniques and color models.	K5
CO 5	To adapt appropriate processing techniques in digital images.	K6

Course Code	PCS3MC03
Course Title	**DIGITAL IMAGE PROCESSING LAB**
Credits	4
Hours/Week	4
Category	Major Core (MC) - Lab
Semester	III
Regulation	2022

COURSE OVERVIEW

1. This course provides skill to understand details of digital image using MATLAB

2. It includes practical knowledge of enhancement techniques in digital image processing.

3. It explores compression methods and color models.

4. It also includes implementation of different processing techniques in digital images using MATLAB

COURSE OBJECTIVES

1. To manipulate matrices using MATLAB

2. To read, write and analysis the details of digital images using MATLAB

3. To perform different enhancement in digital images.

4. To compare different compression techniques.

5. To analyze applications of digital image procession in different area in MATLAB.

Prerequisites	Basic knowledge in matrices and programming.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	1. Introduction to Image Processing Toolbox. 2. Simple matrix manipulations. 3. Read and write digital images. 4. Implementation of Fourier transformation.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	5. Apply different image enhancement techniques.
	  i. Brightness.
	  ii. Thresholding
	  iii. Negative of an image.
	6. Plot the histogram of an image and do the histogram equalization.
	7. Convert color models among RGB, HSV, YC_bC_r.
		12	CO1
			CO2
			CO3
			CO4
			CO5
				K1,K2,K3, K4,K5,K6

III	8. Implement Gray level slicing (intensity level slicing). 9. Read an image and to extract 8 different planes (bit plane slicing). 10. Implement various Smoothing spatial filters.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

IV	11. Read an image and apply
	  i. Gaussian 3x3 mask
	  ii. High pass filter
	  iii. High boost filtering.
	12. Implement various low pass filters and high pass filter in frequency domain.
	13. Implement erosion and dilation using Different structure element (square, ball, line).
		12	CO1
			CO2
			CO3
			CO4
			CO5
				K1,K2,K3, K4,K5,K6

V	14. Implement various edge detection
	  i. Sobel
	  ii. Prewitt
	  iii. Roberts
	  iv.Canny
	15. Implement image representation.
		12	CO1
			CO2
			CO3
			CO4
			CO5
				K1,K2,K3, K4,K5,K6

Text Books 1. Gonzalez & Woods, Digital Image Processing, , Pearson education, 2018 ,Fourth edition.				

Suggested Readings

1. Rafael C. Gonzalez, Richard E.Woods,Steven L.Eddins, Digital Image Processing using MATLAB , Pearson education, 2010 , second edition .

2. Chris Solomon, Toby Breckon, Fundamentals of Digital Image Processing,A Practical Approach with Examples in Matlab,Wiley,2011

Web Resources

1. https://in.mathworks.com/
2. www.mathworks.com/access/helpdesk/help/pdf_doc/matlab/getstart.pd
3. https://www.cin.ufpe.br/~sbm/DEN/Digital%20Image%20Processing%20Using%20Matlab%20(Gonzalez).pdf

Course Outcomes (COs)

	DIGITAL IMAGE PROCESSING LAB	COGNITIVE LEVEL
CO 1	To understand and define the concepts of digital images.	K1, K2
CO 2	To apply processing techniques on digital images.	K3
CO 3	To analyze digital image and its processing techniques.	K4
CO 4	To evaluate the effectiveness of different compression techniques and color models.	K5
CO 5	To create real time application using appropriate processing techniques in digital image.	K6

Course Code	PCS3MC04
Course Title	**WIRELESS ADHOC NETWORKS**
Credits	3
Hours/Week	4
Category	Major Core (MC) - Theory
Semester	III
Regulation	2022

COURSE OVERVIEW

1. This course enables the students to a new technology area in research and industry.
2. It explains the fundamental principles of Ad-hoc Networks.
3. It discusses the concepts of Ad-hoc network protocols.
4. It gives an outline of current and emerging trends in Ad-hoc Wireless Networks.

COURSE OBJECTIVES

1. It describes the unique issues in ad-hoc/sensor networks.
2. It explains the current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
3. It discusses the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
4. It explores the challenges in designing routing and transport protocols for wireless Ad-hoc/sensor networks.

Prerequisites	Basic knowledge of technology.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Ad-hoc Wireless Networks Introduction:- cellular and adhoc wireless network, applications of wireless adhoc network- military applications, collaborative and distributed computing, emergency operations, wireless mesh network, wireless	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

	sensor network, wireless hybrid network, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet.			
II	MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks Architectures and protocols, 2nd Edition, Pearson Education, 2014.

Suggested Readings

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education, 2004.
4. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education.

Web Resources

1. https://www.pdfdrive.com/ad-hoc-mobile-wireless-networks-principles-protocols-and-applications-second-edition-d164639595.html
2. https://www.pdfdrive.com/fundamentals-of-wireless-sensor-networks-theory-and-e17927630.html
3. https://www.pdfdrive.com/wireless-ad-hoc-networking-personal-area-local-area-and-the-sensory-area-networks-wireless-networks-and-mobile-communications-e185711415.html

Course Outcomes (COs)

	WIRELESS ADHOC NETWORKS	COGNITIVE LEVEL
CO 1	To understand the fundamentals of the wireless adhoc network.	K1, K2
CO 2	To integrate the existing network and improve its quality of service	K3
CO 3	To analyze the appropriate protocol for various applications	K4
CO 4	To Compare the quality of service at different level.	K5
CO 5	To Examine the security measures at different level.	K6

Course Code	PCS3ME01
Course Title	CLOUD COMPUTING LAB
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	III
Regulation	2022

COURSE OVERVIEW

1. This course deals with the types of cloud services and deployment models.

2. It provides knowledge about the different types of Virtualization.

3. It helps to understand the resource management.

4 It explains various database services in cloud.

COURSE OBJECTIVES

1. To understand and implement the different services and models in cloud.

2. To know the types of deployment models.

3. To explore the virtualization in cloud computing.

4. To implement different database services in cloud.

Prerequisites	Basic knowledge in Internet.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Introduction to Cloud Computing - Deployment Models Introduction: Public Deployment Model – Private Deployment Model. 1. Signing up for AWS 2. AWS Free usage tier 3. AWS management console	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6
II	Cloud Deployment Models: Virtual Private Deployment Model – Hybrid Deployment	12	CO1 CO2	K1,K2,K3, K4,K5,K6

	Model – Community Deployment Model. 1. Simple Email Service 2. Virtual Private Cloud (VPC)		CO3 CO4 CO5	
III	Virtualization: Levels of Virtualization - Virtualization Support at the OS Level - Virtualization of CPU, Memory, and I/O Devices- EC2 Instance. 1. Launching your first AWS instance 2. Setting up security and Security groups 3. Choosing & Creating a new Amazon Machine Images (AMI) 4. Public and Private IP's 5. Deploying a new instance from the created AMI	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Virtual Clusters and Resource Management - Virtualization for Data Center - Cloud Computing and Service Models - Architectural Design of Compute and Storage Clouds - Simple Storage Services (S3) 1. Creating and deleting buckets 2. Adding objects to buckets 3. Getting objects 4. Deleting objects 5. Bucket Permissions / Versioning	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Relational Database Service (RDS) - Selecting the Engine - Configuring the Database Engine ¬-Creating your Database - Setting up automatic backups - Authorizing access to the DB via DB Security Groups 1. Relational Database Service (RDS) 2. Hosting a website 3. Uploading/Downloading Apps	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rajkumar Buyya, James Broberg and Andrzej M.goscinski, "Cloud computing: Principles and Paradigms", Wiley, 2013.

Suggested Readings

1. Rittinghouse, John W and James F. Ransome, "Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
2. Arshdeep Bahhga and Vijay Madisetti, "Cloud Computing Hands on Approach", 1st Edition, University Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S.Thamaraiselvi, Mastering cloud computing, 1st Edition,Tata McGraw, 2013.

Web Resources

1. https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.guru99.com/cloud-computing-for-beginners.html
4. http://www.mb.net/resources/cloud-computing-resources.aspx.
5. http://www.mastertheboss.com/cloud-computing/in-the-cloud-computing-a- beginners-tutorial
6. https://annauniversityedu.blogspot.com/2020/11/CC-notes-anna-university.html

Course Outcomes (COs)

	CLOUD COMPUTING LAB	COGNITIVE LEVEL
CO 1	To identify and understand the key technologies of cloud computing.	K1, K2
CO 2	To implement the concepts of virtualization.	K3
CO 3	To analyze various services and development models.	K4
CO 4	To assess challenges and security issues in Cloud computing.	K5
CO 5	To develop skill to practice current cloud technologies.	K6

Course Code	PCS3ME02
Course Title	**INTERNET OF THINGS (IOT) LAB**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	III
Regulation	2022

COURSE OVERVIEW
1. This course focuses on developing solution to the needs of society.
2. It aims to give an introductory knowledge on connected gadgets.
3. It explores the design guidelines of the network.
4. It also focuses on the implementation of complex network.

COURSE OBJECTIVES
1. To understand the concepts of connected objects.
2. To recognize protocols to join in a standard network.
3. To explore the various techniques to acquire the data from the tiny devices.
4. To apply the solution for automated systems.

Prerequisites	Basic Knowledge of network communication technologies.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Connecting an Arduino to the Web: Introduction - Internet connectivity - Interacting with sensors and actuators - Configuring - Grabbing the content from a web page - Sending data to the cloud 1. Connecting sensors to Arduino board 2. Posting the sensor data online 3. Retrieving online data 4. Monitoring sensor data from a cloud dashboard	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	Interacting with Web Services - Introduction - Temboo platform- Features 5. Tweeting from an Arduino board 6. Posting updates on Facebook 7. Sending text message notifications 8. Storing data on Google Drive	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Machine-to-Machine Interactions - Introduction - Types of IoT interaction -Basic local M2M interactions 9. Cloud M2M with IFTTT 10. M2M alarm system 11. Automated light controller 12. Automated sprinkler controller	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Home Automation - Introduction - setting up controllers - Wifi / RFID/ ZIGBEE devices 13. Controlling the coffee machine from cloud 14. Dim LEDs from anywhere in the world 15. Remote controlled garage door 16. Home automation dashboard in the cloud	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	General IOT Projects - Introduction - Bitcoin - GPS module - GPS tracker - Robotic platform-distance sensors 17. Building a digital candle 18. Building a Bitcoin ticker with Arduino 19. Building a simple GPS tracker 20. Building a mobile robot	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Marco Schwartz, Internet of Things with Arduino Cookbook, Packt Publishing Ltd., 2016

Suggested Readings

1.ArshdeepBahga, Vijay Madisetti, Internet of things – A hands-on approach 2018.

2.Joseph Bambara, Ron Espinosa, Steven Wolff, Paul Allen, M. Ridgway Barker (2019)

3. Pethuru Raj, PhD, Anupama C. Raman(2017), The Internet of Things, Taylor & Francis, CRC Press

Web Resources

1.https://www.comsoc.org/publications/best-readings/internet-things

2.https://mitpress.mit.edu/books/internet-things

3. https://circuitdigest.com/internet-of-things-iot-projects

Course Outcomes (COs)

INTERNET OF THINGS (IOT) LAB		COGNITIVE LEVEL
CO 1	To understand and describe the various applications of IOT.	K1, K2
CO 2	To articulate the power of IOT in business automation.	K3
CO 3	To analyze and deduce the changes in modern technology by the advent of IOT.	K4
CO 4	To evaluate the impact of data analytics in leveraging business outcomes.	K5
CO 5	To create the solutions for industrial automation.	K6

Course Code	PCS3ME03
Course Title	**BIO INFORMATICS**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	III
Regulation	2022

COURSE OVERVIEW

1. This course focuses on analysing and interpreting vast biological data using computational techniques.
2. It aims at the development of biological databases, algorithms, and simulation.
3. It empowers to develop and implement computational algorithms and software tools to develop algorithms to understand biological processes.
4. This course is designed to nurture skills and explore tools in bioinformatics.

COURSE OBJECTIVES

1. To understand the biological databases, predictions, simulations
2. To analyze and interpret biological data using computational techniques.
3. To gain knowledge in major aspects of bioinformatics.
4. To effectively develop computational algorithms and software tools to understand biological processes.

Prerequisites	Basic Knowledge of biology, database, networks.

SYLLABUS				
UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Introduction--goal-scope-applications-limitations. Introduction to Biological databases: Introduction - categories-pitfalls-Information retrieval: Entrez - Gen Bank - SRS.-Pairwise Sequence Alignment: methods – scoring matrices- significance - Database similarity searching: requirements– BLAST - FASTA– Multiple sequence alignment: Exhaustive and Heuristic Algorithm.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	Profiles and Markov model and Hidden Markov models: PSSM –Profiles: PSI-BLAST – Markov model: types- Hidden Markov model: score computation-Applications.-structural Bioinformatics: Protein structure basics – Protein structure visualization- comparison and classification – protein secondary structure prediction – protein tertiary structure prediction – RNA structure prediction.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	Bioinformatics algorithms and simulation Graph Algorithms – Combinational pattern matching – clustering and trees - Monte Carlo Simulation Methods: Introduction, Theory of Metropolis Method, Monte-carlo algorithm, Implementation of the Metropolis Monte-Carlo method, Monte-Carlo Simulation of molecules. Monte-Carlo simulation for protein folding. Application of Molecular simulations - Protein folding modeling, substrate receptor interactions.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	Current techniques Probabilistic Approaches: Introduction to probability - Bayes' Theorem - Bayesian networks - Markov networks Nearest Neighbour and Clustering Approaches: Introduction - Nearest neighbour method - Nearest neighbour approach for secondary structure protein folding prediction - Clustering - Application guidelines. - Bioinformatics applications.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

V	Neural Networks: Method-Application guidelines - Bioinformatics applications - Genetic Algorithms: Single-objective genetic algorithms – method – example - Multi-objective genetic algorithms – method - Application guidelines - Genetic algorithms – bioinformatics applications	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. "Essential Bioinformatics" JIN XIONG, Texas A&M University, Cambridge University Press The Edinburgh Building, Cambridge cb2 2ru, UK Jin Xiong 2006 (unit 1,2)
2. "Molecular modelling, Principles and Applications", Andrew R. Leach, Glaxo Wellcome Research and Development, Pearson Education Limited, Second Edition. (unit 3)
3. "Intelligent Bioinformatics"- The application of artificial intelligence techniques to bioinformatics problems, Edward Keedwell and Ajit Narayanan School of Engineering, Computer Science and Mathematics University of Exeter, UK, John Wiley & Sons Ltd. (unit 4 and 5)

Suggested Readings

1. "Bioinformatics The Machine Learning Approach", Pierre Baldi Søren Brunak
2. Molecular Modelling and Simulation: An Interdisciplinary Guide. Authors: Schlick, Tamar (Publisher: Springer-Verlag New York)
3. "Bioinformatics Sequence and Genome Analysis",David W.Mount,Cold Spring Harbor Laboratory Press,
4. " Bioinformatics: Algorithms, Techniques and Applications", Ion Mandoiu, Alexander Zelikovsky
5. An introduction to bioinformatics algorithms by Neil C. Jones, Pavel Pevzner. MIT Press. 2004

Web Resources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5506686/
2. https://www.ebi.ac.uk/training/online/courses/bioinformatics-terrified/what-makes-a-good-bioinformatics-database/primary-and-secondary-databases/
3. https://libraryguides.mcgill.ca/bioinformatics/databases
4. https://www.ncbi.nlm.nih.gov/books/NBK464187/
5. https://www.ibm.com/cloud/learn/monte-carlo-simulation
6. https://www.nptel.ac.in/courses/102106065

Course Outcomes (COs)

	BIO INFORMATICS	**COGNITIVE LEVEL**
CO 1	To understand the basics of bioinformatics and biological databases.	K1, K2
CO 2	To apply computational techniques to analyze biological data.	K3
CO 3	To analyze computational algorithms and software tools to ease an understanding of the biological processes.	K4
CO 4	To support in developing algorithms and tools in bioinformatics.	K5
CO 5	To develop applications using algorithms, current techniques and neural networks.	K6

Course Code	PCS3ME04
Course Title	**NATURAL LANGUAGE PROCESSING**
Credits	2
Hours/Week	4
Category	Major Elective (ME) - Lab
Semester	3
Regulation	2022

COURSE OVERVIEW

    1. This course deals with the basics of natural language processing.

    2. It deals the technical knowledge syntactic and semantic analysis.

    3. It familiarize on available NLP software libraries and data-sets.

    4. It moderates complex systems for various NLP systems.

    5. It acquaint on the strategies for NLP system evaluation and error analysis.

COURSE OBJECTIVES

    1.   To familiarize on pragmatics of natural languages.

    2.   To describe the relationship between NLP and neural language models.

    3.   To determine various linguistic and its statistical features using NLP tasks.

    4.   To build real-time systems for various NLP problems.

    5.   To evaluate the NLP system outcomes and suggest solutions.

Prerequisites	Basics of language syntax and semantics.

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**Cos**	**COGNITIVE LEVEL**
I	**Introduction to NLP** Overview: Origins and challenges of NLP- Theory of Language -Features of Indian Languages and applications of NLP - NLP phases, Difficulty of NLP including ambiguity- Spelling error and Noisy Channel Model- Concepts of Parts-of-speech and Formal Grammar of English.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5, K6

II	**Language Modelling: N-gram and Neural Language Models** Language Modelling with N-gram, Simple N-gram models, smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
III	**Parts-of-speech Tagging** Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
IV	**Parsing** Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6
V	**Semantics** Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5,K6

Text Books

1. Jurafsky Dan and Martin James H. "Speech and Language Processing", Prentice-Hall, 3rd Edition, 2018.

Suggested Readings

1. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing", Cornell University press, 2018.

Web Resources

1. https://web.stanford.edu/~jurafsky/slp3/
2. https://www.tutorialspoint.com/natural_language_processing/index.htm
3. https://www.youtube.com/watch?v=oWsMIW5xUc&list=PLLssT5z_DsK8HbD2sPcUIDfQ7zmBarMYv

Course Outcomes (COs)

NATURAL LANGUAGE PROCESSING		COGNITIVE LEVEL
CO 1	To define and discover the basics of language processing.	K1, K2
CO 2	To interpret on various language process models.	K3
CO 3	To evaluate on the parts and grammars of languages.	K4
CO 4	To compare the parsing across various languages.	K5
CO 5	To construct language parser and apply it across various applications.	K6

MINI PROJECT

Course Code	PCS3PJ01
Course Title	Mini Project
Credits	04
Hours/Week	04
Category	Project(PJ)
Semester	III
Regulation	2022

Course Overview
1. This course aims to apply programming skills for solving real-time problems.
2. Introduce and implement software engineering techniques for developing medium- sized software projects.
3. This aims to learn and plan for Project Scheduling, resource utilization, testing and evaluation.
4. Target on preparation of industry standard project progress and project reports.

Course Objectives
1. To build a new software system based on practical skills.
2. To expand the knowledge on various domains, platforms and software developing environments.
3. To gain confidence in software conceptualization, design, development and implementation.
4. To be familiarized to various methods and techniques used for effective project management.
5. To know and develop software project management skills and their roles and responsibilities.

Prerequisites	Good knowledge in the subject.

Course Outcomes (COs)

	MINI PROJECT	COGNITIVE LEVEL
CO 1	To select and understand the basics of software problem identification.	K1, K2
CO 2	To apply and Design with engineered models and necessary environment.	K3
CO 3	To classify and plan the relationships among project scheduling and planning process.	K4
CO 4	To appraise and evaluate the development and implementation process.	K5
CO 5	To prepare with adoption and revise the improvement of the developed software.	K6

Course Code	PCS3ID01
Course Title	**STATISTICS FOR COMPUTER SCIENCE**
Credits	3
Hours/Week	6
Category	Inter Disciplinary (ID) - Theory
Semester	III
Regulation	2022

Course Overview:
1. Able to analyse basic characteristics of the features.
2. Can perform Univariate and Bivariate analysis.
3. Enable decision making using testing of hypothesis.
4. Based on the relation of the features can be able to form factors.
5. Enable to perform dimension reduction and feature selection.

Course Objective:
1. To perform exploratory data analysis.
2. To study the relationship between the features and develop a model.
3. To apply statistical techniques and derive factors.
4. To perform dimension reduction and feature selection and fine-tune the precision of the model.

Pre requisites:	Basic understanding of Statistics**.**

SYLLABUS				
UNIT	**CONTENT**	**HRS**	**COs**	**COGNITIVE LEVEL**
I	Sampling Techniques – Data Classification – Tabulation – Frequency and graphic Representation – Measures of Central Tendency – Measures of Variation – Quartiles and Percentiles – Moments - Skewness and Kurtosis.	14	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
II	Scatter Diagram – Karl Pearson's Correlation Coefficient – Rank Correlation - Correlation Coefficient for Bivariate Frequency Distribution – Regression Coefficients – Fitting of Regression Lines.	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6

III	Statistical Tests of Significance - Test of significance for mean(s), variance(s), correlation coefficient(s), regression coefficient, based on t, Chi-square and F-distributions. Applications of Chi-square in test of significance (independence of attributes, goodness of fit).	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
IV	Introduction to Factor Analysis – Meaning, Objectives and Assumptions – Designing a Factor Analysis Study – Deriving Factors – Assessing Overall Factors – Validation of Factor Analysis.	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
V	Introduction to Discriminant Analysis – Concepts, Objectives and Applications – Procedure for conducting Discriminant Analysis – Stepwise Discriminant	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6

TEXTBOOKS:

1. Gupta, S.C. and Kapoor, V.K.: "Fundamentals of Mathematical Statistics", Sultan &Chand & Sons, New Delhi, 11th Ed, 2002.
2. Joseph F Hair, William C Black etal , "Multivariate Data Analysis" , Pearson Education, 7th edition, 2013.
3. Joseph F Hair, William C Black etal , "Multivariate Data Analysis" , Pearson Education, 7th edition, 2013.
4. T. W. Anderson , "An Introduction to Multivariate Statistical Analysis, 3rd Edition", Wiley, 2003.

SUGGESTED READING:

1. James D.Miller, "Statistics for Data Science", Packt, 2017.
2. Chatfield C, A.J.Collins, "Introduction to Multivariate Analysis", Springer Nature, 2020.
3. Dawn Iacobucci, "Multivariate Statistics and Marketic Analytics", 2014.

WEB RESOURCES:

1. Descriptive Statistics:

https://www.coursera.org/lecture/data-analysis-with-python/descriptive-statistics-j0BSu

2. Factor Analysis:

https://www.youtube.com/watch?v=UgrCLMHDMb4

3. Inferential Statistics:

https://www.youtube.com/watch?v=yqbTMINVanc

Course Outcomes (Cos)

PDS 3701- INTER DISCIPLINARY: STATISTICS FOR COMPUTER SCIENCE (IDE)		COGNITIVE LEVELS
CO1	Concepts of descriptive Statistics and definitions.	K1, K2
CO2	Problems in correlation and regression and its interpretation.	K3
CO3	Frame appropriate model and test its significance.	K4
CO4	Perform Factor analysis and its efficiency.	K5
C05	Data reduction and feature selection using discriminant analysis.	K6

MAJOR PROJECT

Course Code	PCS4PJ02
Course Title	Major Project
Credits	20
Hours/Week	30
Category	Project(PJ)
Semester	IV
Regulation	2022

Course Overview

1. This course aims to implement the acquired programming skills for solving real-time problems.
2. This implements software engineering techniques to develop software projects in the industry.
3. Its purpose is to learn and plan for project scheduling, resource utilization and evaluation as per industry standards.
4. It aims to create familiarity on industry standard project documentation, project progress and reporting.

Course Objectives

1. To construct new software system imparting the learned theory and practical programing skills.
2. To expand knowledge about various domains, platforms, and software developing environments as per industry standards.
3. To gain confidence in problem modularizing, designing, testing and implementation in accordance with industry standards.
4. To get habituated to the various procedures and practices used for effective project management.
5. To understand and develop the software project management skills and responsibilities in the industry.

Prerequisites	Good knowledge in the subject.

Course Outcomes (COs)

	MAJOR PROJECT	COGNITIVE LEVEL
CO 1	To identify and classify the basics of a real-world problem into software solutions	K1, K2
CO 2	To compute and illustrate standard design and t he necessary environment.	K3
CO 3	To classify and plan the relationships among project scheduling and planning process.	K4
CO 4	To asses.s and measure the software development and implementation process.	K5
CO 5	To manage with the adoption and revise on the improvement of the developed software.	K6

VALUE ADDED COURSES

Course Code	PCS3VA01
Course Title	WEB DEVELOPMENT AND HOSTING
Credits	1
Hours/Week	3
Category	VALUE ADDED COURSE (VAC) - Lab
Semester	III
Regulation	2022

Course Overview
1. This course demonstrates the groundwork for design theory principles using drupal.
2. The programme covers the fundamentals of website development, with an emphasis on document structure and content.
3. It provides a variety of basic skills in web design, and subsequent units explore site management, server-side and client-side scripting.

It provides "real world" experience creating and developing websites for local community groups.

Course Objectives
1. It will help to learn the skills and project-based experience required for entry-level positions in web design and development.
2. Students will be able to design websites using a range of design principles.
3. Students will gain an understanding of the different methods by which websites are developed.

Prerequisites	NIL

SYLLABUS

Unit	Content	Hrs	COs	Cognitive Level
I	Installing Drupal: System requirements – Installing Drupal 8 – Trouble shooting your installation. Basic concepts of Drupal: Modules – entities – nodes and fields – taxonomy, views and themes – user roles and permissions. Getting started with the Drupal 8 UI: The Drupal 8 user interface – how does Drupal handle – responsive project – structure, configuration and appearance – people, reports and extend	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

II	Creating basic content: Introduction to site building – creating and enhancing page content – creating articles and working with article comments. Drupal 8 structure and site organization: Creating and Managing menus – managing taxonomy – working with view modules and blocks.	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	Working with advanced content: Working with forms and fields – creating new content types – adding interaction with queries – forms API – form upload system – plug and play plugins	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	Working with menus – Render array and creating tabs and subtabs – place holder – hooks – theming	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K4, K5, K6
V	Database API – creating a simple site – content, blocks, menus – views – Drupal distributions – Drupal modules – Drupal themes – development	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

Reference Books

1. Matt Glaman, Drupal 8 development cookbook, Packt publishing.
2. Lynn Beijley, Seamus Bellamy, Drupal for Dummies, 2nd edition, Wiley publishers.
3. James Barnett, Drupal 8 for absolute beginners Apress publishers.

Suggested Readings

1. Jose Fernandes, Digital Marketing by Drupal, Packt publishing.
2. Chaz Chumley, William Hurley, Mastering Drupal 8, Packt publishing.

Web Resources

1. www.drupal.org

COURSE OUTCOMES (COs)

Cos	CO Description	Cognitive Level
CO1	To understand the basic concepts of Drupal	K1, K2
CO2	To apply the concepts to create website layouts and content.	K3
CO3	To enhance page content using flexible and intuitive design	K4
CO4	To compare and use the various themes and packages	K5
CO5	To create a simple shopping site.	K6

Course Code	PCS3VA02
Course Title	ANIMATION THROUGH BLENDER
Credits	1
Hours/Week	3
Category	VALUE ADDED COURSE (VAC) - Lab
Semester	III
Regulation	2022

Course Overview

1. This course presents the fundamentals of 3D and animation.
2. It covers navigating and creating within Blender as well as the many tools used along the way.
3. This course is project-based in order to improve the skills learned along the way in order to create artwork and animations.
4. It provides the fundamentals and more advanced areas of 3D production.

Course Objectives

1. It will help to learn the skills 3D modelling, texturing and animation through blender is a course that can aid students create a 3D model and animate the same.

2. It helps understand the basics and the more advanced skills to masterfully navigate and create their own works of 3D art.
3. It will help them to create their own characters and animation scenes.
4. Using blender students will master the basics of animation such as trajectory, lighting, bones and movement to their 3D models
5. Students will have the confident in working with blender in media industry.

Prerequisites	None

SYLLABUS

Unit	Content	Hrs	COs	Cognitive Level
I	Blender interface – curves , meshes, translation, rotation, scaling, 2D shapes in blender , Materials and textures	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

II	Lighting and cameras: Light and shape – 3D geometrics – camera panel – lens – preview and lamp sub context – world setting	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	Sculpt mode: tools, textures, retopology. Armatures: Bones management – layer system – pose mode – constraints – parenting organic or mechanical object. Blender particles: Smoke, fire static	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	Simulations: Rigid body simulation – smoke simulation – fluids simulation – cloth simulation.	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3 K4, K5, K6
V	Animation – keyframe – timeline – frames blender modifier: array, bevel, curve, lattice, wave, multiple, Boolean, deform, mirror, skin, subdivision, build – rendering	16	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Gordon Fisher, Blender 3D basics, Packt publishing.
2. Allan Britto, The beginners guide, 1st edition.
3. Oscar Beachler and Xury Greer, Packt publishing.

Suggested Readings

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC Press.
2. Christopher Kuhn, Blender 3D Incredible Machines, Packt Publishing.

Web Resources

1. www.blender.org

COURSE OUTCOMES (COs)

Cos	CO Description	Cognitive Level
CO1	To understand the basic concepts Blender interface	K1, K2
CO2	To apply concepts of 3D tools	K3
CO3	To enhance and create innovative characters	K4
CO4	To collate sculpt modes, simulations blender modifier to develop new models.	K5
CO5	To create own 3D animated design.	K6

LOCF BASED DIRECT ASSESSMENTS
COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED CIA QUESTION PAPER FORMAT (PG)

SECTION		Q. NO	COGNITIVE LEVEL (CL)					
			K1	K2	K3	K4	K5	K6
A	(5 x 1 = 5) Answer ALL	1(a)	+					
		(b)	+					
		(c)	+					
		(d)	+					
		(e)	+					
	(5 x 1 = 5) Answer ALL	2(a)		+				
		(b)		+				
		(c)		+				
		(d)		+				
		(e)		+				
B	(1 x 8 = 8) Answer 1 out of 2	3			+			
		4			+			
C	(1 x 8 = 8) Answer 1 out of 2	5				+		
		6				+		
D	(1 x 12 = 12) Answer 1 out of 2	7					+	
		8					+	
E	(1 x 12 = 12) Answer 1 out of 2	9						+
		10						+
No. of CL based Questions with Max. marks			5 (5)	5 (5)	1 (8)	1 (8)	1 (12)	1 (12)
No. of CO based Questions with Max. marks			CO1		CO2	CO3	CO4	CO5
			10 (10)		1 (8)	1 (8)	1 (12)	1 (12)

Forms of questions of **Section A** shall be MCQ, Fill in the blanks, True or False, Match the following, Definition, Missing letters. Questions of **Sections B, C, D and E** could be Open Choice/ built in choice/with sub sections. Component III shall be exclusively for cognitive levels K5 and K5 with 20 marks each. CIA shall be conducted for 50 marks with 90 min duration.

COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED END SEMESTER EXAMINATION QUESTION PAPER FORMAT (PG)

SECTION		Q. NO	COGNITIVE LEVEL (CL)					
			K1	K2	K3	K4	K5	K6
A	(5 x 1 = 5) Answer ALL	1(a)	+					
		(b)	+					
		(c)	+					
		(d)	+					
		(e)	+					
	(5 x 1 = 5) Answer ALL	2(a)		+				
		(b)		+				
		(c)		+				
		(d)		+				
		(e)		+				
B	(3 x 10 = 30) Answer 3 out of 5	3			+			
		4			+			
		5			+			
		6			+			
		7			+			
C	(2 x 12.5 = 25) Answer 2 out of 4	8				+		
		9				+		
		10				+		
		11				+		
D	(1 x 15 = 15) Answer 1 out of 2	12					+	
		13					+	
E	(1 x 20 = 20) Answer 1 out of 2	14						+
		15						+
No. of CL based Questions with Max. marks			5 (5)	5 (5)	3 (30)	2 (25)	1 (15)	1 (20)
No. of CO based Questions with Max. marks			CO1		CO2	CO3	CO4	CO5
			10 (10)		3 (30)	2 (25)	1 (15)	1 (20)

IMPORTANT

- Forms of questions of **Section A** shall be MCQ, Fill in the blanks, True or False, Match the following, Definition, Missing letters.
- Questions of **Sections B, C, D and E** could be Open Choice/ built in choice/questions with sub divisions.
- Maximum sub divisions in questions of Sections B, C shall be 2 and 4 in Sections D, E).

TOTAL MARKS DISTRIBUTION OF DIRECT ASSESSMENTS BASED ON CL AND CO (PG)

Course Outcome	CO1		CO2	CO3	CO4	CO5	TOTAL
Cognitive Levels	K1	K2	K3	K4	K5	K6	
CIA 1	5	5	8	8	12	12	50
CIA 2	5	5	8	8	12	12	50
Comp III	-	-	-	-	20	20	40
Semester	5	5	30	25	15	20	100
Total Marks (CL)	15 (6%)	15 (6%)	46 (19%)	41 (17%)	59 (25%)	64 (27%)	240
Total Marks (CO)	30 (12%)		46 (19%)	41 (17%)	59 (25%)	64 (27%)	240