ODL MCA

MASTER OF COMPUTER APPLICATIONS - MACHINE LEARNING & AI

PROGRAMME GUIDE

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INTRODCUTION

Dive into a hands-on learning experience in Machine Learning and Artificial Intelligence (ML/AI), where education aligns with real-world applications. Explore a wide range of cutting-edge specializations, ensuring your skills stay relevant in the fast-evolving tech landscape.

PROGRAMME OUTCOMES

Program outcomes outline what students will know and be able to do upon graduation, focusing on the skills, knowledge and behaviors developed during the program.

1. **Problem Analysis & Design:** Apply ML/AI concepts, algorithms and techniques to analyze and solve complex computational problems.
2. **Programming Proficiency:** Develop and implement solutions using programming languages and tools for machine learning and AI applications.
3. **Ethical Responsibility:** Uphold ethical principles and professional responsibilities to create AI solutions that benefit society.
4. **Effective Communication:** Clearly articulate problem analyses, model designs and findings through written reports and presentations.
5. **Societal Contribution**: Leverage advanced ML/AI knowledge to drive sustainable development and societal progress.
6. **Collaboration:** Excel as an individual contributor or team member/leader in diverse, multidisciplinary AI projects.
7. **Lifelong Learning:** Cultivate the ability to independently pursue continuous learning to adapt to advancements in ML/AI technologies.

PROGRAMME SPECIFIC OUTCOMES

PSOs are statements that describe what the graduates of a specific engineering program should be able to do:

1. **PSO1:** Master advanced concepts in machine learning, deep learning, data preprocessing, natural language processing, computer vision and reinforcement learning.
2. **PSO2:** Demonstrate proficiency in using ML/AI frameworks and tools to build predictive models and intelligent systems.
3. **PSO3:** Apply ML/AI techniques to design cost-effective, scalable solutions addressing societal challenges.
4. **PSO4:** Develop user-friendly AI-driven applications, including chatbots, recommendation systems and autonomous solutions.
5. **PSO5:** Utilize computational tools to simulate and optimize domains using advanced ML/AI

methodologies.

6. **PSO6:** Apply machine learning and AI techniques to design and develop intelligent systems for data-driven decision-making and automation.
7. **PSO7:** Leverage ML/AI algorithms to analyze complex datasets and create predictive models for real-world applications.

SALIENT FEATURES

- **Virtual Industry Interactions**: Engage in online expert sessions, virtual industry talks and live case studies to explore ML/AI applications, identify real-world challenges and learn cutting-edge immersive technologies.
- **Industry-Relevant Trainings**: Equip students with ML/AI skills to meet industry demands in immersive technology sectors.
- **Holistic Development:** Foster well-rounded growth through participation in sports, cultural activities and professional enhancement initiatives.
- **Project Driven Learning:** Learning via real-life projects to gain experiential learning on AI/ML practices.
- **Professional Enhancement:** Offer Courses that help in enhancing professional skill sets and learning industry's ethical practices.
- **Contemporary Curriculum:** Deliver in-depth knowledge in core ML/AI areas such as deep learning, data science, natural language processing and advanced data visualisation.

PROGRAMMECODE: **DE16B4**

DURATION OF THEPROGRAMME:

Minimum Duration 2 years

Maximum Duration 4 years

MEDIUM OF INSTRUCTION/EXAMINATION:

Medium of instruction and Examination shall be English.

PROGRAMME STRUCTURE MCA - MACHINE LEARNING & AI					
Term	**Core Courses (CR I, CR II, CR III) CR I+II – (8+4) 12 x 4 Credits CR III - 2x 4 Credits**	**Discipline Specific Electives (DSE) 4 x 4 Credits**	**Skill Enhancement Courses (SEC) 4 x 4 Credits**	**Generic Electives (GE) 4 x 4 Credits**	**Credits**
I	Discipline Specific Core- I Discipline Specific Core- II Discipline Specific Core- III Discipline Specific Core- IV Discipline Specific Core- V		**SEC- I**		**24**
II	Discipline Specific Core- VI Discipline Specific Core-VII Discipline Specific Core- VIII Discipline Specific Core- IX Discipline Specific Core- X Discipline Specific Core- XI		**SEC- II**		**28**
III	Discipline Specific Core- XII **CR III –** Seminar on Summer Training OR Course from the GE basket 1 which is not chosen as Generic Elective (GE).	**DSE- I** **DSE- II**	**SEC-III**	**GE-I GE- II** (Finance, General Management, Marketing)	**28**
IV	**CR III -** Project Work	**DSE- III** **DSE-IV**	**SEC-IV**	**GE-III GE- IV** (Finance, General Management, Marketing)	**24**
Total	**56 Credits**	**16 Credits**	**16 Credits**	**16 Credits**	**104**

PROGRAMME SCHEME MCA - MACHINE LEARNING & AI					
COURSE CODE	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**
TERM 1					
DECAP437	SOFTWARE ENGINEERING PRACTICES	4	30	70	0
DECAP444	OBJECT ORIENTED PROGRAMMING USING C++	4	30	40	30
DECAP446	DATA WAREHOUSING AND DATA MINING	4	30	70	0
DECAP448	LINUX AND SHELL SCRIPTING	4	30	40	30
DECAP453	DATA COMMUNICATION AND NETWORKING	4	30	70	0
SEC-I	SKILL ENHANCEMENT COURSE I	4	30	70	0
DECAP012	FUNDAMENTALS OF COMPUTER AND C PROGRAMMING	S/U		BRIDGE COURSE#	
DEMTH006	ELEMENTARY MATHEMATICS	S/U		BRIDGE COURSE#	
#Bridge courses are applicable only to candidates having no Computers or Mathematics background. Further details are provided on Page 8.					
TERM 2					
DECAP615	PROGRAMMING IN JAVA	4	30	40	30
DECAP770	ADVANCED DATA STRUCTURES	4	30	40	30
DECAP456	INTRODUCTION TO BIG DATA	4	30	40	30
DECAP470	CLOUD COMPUTING	4	30	70	0
DEMTH403	MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE	4	30	70	0
DECAP472	WEB TECHNOLOGIES	4	30	40	30
SEC-II	SKILL ENHANCEMENT COURSE II	4	30	70	0
TERM 3					
DECAP776	PROGRAMMING IN PYTHON	4	30	40	30
SEC-III	SKILL ENHANCEMENT COURSE III	4	30	40	30
DECAP515	FUNDAMENTALS OF MACHINE LEARNING	4	30	40	30
DECAP516	NATURAL LANGUAGE PROCESSING	4	30	40	30
GE-I	GENERIC ELECTIVE I	4	30	70	0
GE-II	GENERIC ELECTIVE II	4	30	70	0
DECAP735	SEMINAR ON SUMMER TRAINING	4	30	0	70
	OR				
	Course from the GE basket 1 which is not chosen as Generic Elective (GE).		30	70	0
TERM 4					
SEC-IV	SKILL ENHANCEMENT COURSE IV	4	30	70	0
DECAP527	DEEP LEARNING	4	30	40	30
DECAP794	ADVANCE DATA VISUALIZATION	4	30	40	30
GE-III	GENERIC ELECTIVE III	4	30	70	0
GE-IV	GENERIC ELECTIVE IV	4	30	70	0
DECAP788	PROJECT WORK	4	30	0	70
TOTAL CREDITS		**104**			

SKILL ENHANCEMENT COURSES (SEC) BASKET								
SR. NO.	**COURSE CODE**	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**	**AREA**	**TERM**
1	DEPEA515	ANALYTICAL SKILLS-I	4	30	70	0	PROFESSIONAL ENHANCEMENT	1
2	DEPEA516	ANALYTICAL SKILLS-II	4	30	70	0	PROFESSIONAL ENHANCEMENT	2
3	DECAP538	ALGORITHM DESIGN AND ANALYSIS	4	30	40	30	COMPUTER APPLICATION	3
4	DECAP951	SOFTWARE PROJECT MANAGEMENT	4	30	70	0	COMPUTER APPLICATION	4

GENERIC ELECTIVE (GE) BASKET 1								
SR. No.	**COURSE CODE**	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**	**ELECTIVE AREA**	**TERM**
1	DEMGN581	ORGANIZATIONAL BEHAVIOUR AND HUMAN RESOURCE DYNAMICS	4	30	70	0	GENERAL MANAGEMENT	3
2	DEMKT503	MARKETING MANAGEMENT	4	30	70	0	MARKETING	3
3	DEFIN542	CORPORATE FINANCE	4	30	70	0	FINANCE	3
GENERIC ELECTIVE (GE) BASKET 2								
SR. No.	**COURSE CODE**	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**	**ELECTIVE AREA**	**TERM**
1	DEMGN578	INTERNATIONAL BUSINESS ENVIRONMENT	4	30	70	0	GENERAL MANAGEMENT	3
2	DEMKT509	CONSUMER BEHAVIOUR	4	30	70	0	MARKETING	3
3	DEFIN548	INTERNATIONAL FINANCIAL MANAGEMENT	4	30	70	0	FINANCE	3
GENERIC ELECTIVE (GE) BASKET 3								
SR. No.	**COURSE CODE**	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**	**ELECTIVE AREA**	**TERM**
1	DEMGN801	BUSINESS ANALYTICS	4	30	70	0	GENERAL MANAGEMENT	4
2	DEMKT505	DIGITAL AND SOCIAL MEDIA MARKETING	4	30	70	0	MARKETING	4
3	DEFIN508	INTERNATIONAL BANKING AND FOREX MANAGEMENT	4	30	70	0	FINANCE	4
GENERIC ELECTIVE (GE) BASKET 4								
SR. No.	**COURSE CODE**	**COURSE TITLE**	**Cr.**	**CA**	**ETE (Theory)**	**ETE (Practical)**	**ELECTIVE AREA**	**TERM**
1	DEOPR639	OPERATIONS MANAGEMENT AND RESEARCH	4	30	70	0	GENERAL MANAGEMENT	4
2	DEMKT517	CUSTOMER RELATIONSHIP MANAGEMENT	4	30	70	0	MARKETING	4
3	DEFIN576	SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT	4	30	70	0	FINANCE	4

Note:

1. Students can opt only one area from discipline specific elective basket that will be applicable for the whole program.
2. Students can opt only one area from generic elective basket that will be applicable for the whole program.
3. In case of Seminar on Summer Training, student may choose one Course from the GE basket 1 which is not chosen as GenericElective (GE).
4. S and U grades are awarded only in case of courses with Zero credit: S for Satisfactory performance and U for Unsatisfactory performance in a course.
5. **For candidates having no Computers or Mathematics* background, Bridge course(s) will be applicable in 1st Term as per following details:**
    - **No Mathematics background:** 01 Mathematics Bridge course DEMTH006 is applicable
    - **No Computers background:** 01 Computers Bridge course DECAP012 is applicable
    - **No Mathematics and No Computers background:** 01 Mathematics course DEMTH006 and 01 Computer course DECAP012 are applicable

*Mathematics/ Statistics/ QT/ Business Mathematics

Course code	DECAP437	Course Title	SOFTWARE ENGINEERING PRACTICES

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: apply theoretical foundation of software engineering in practical software development

CO2: analyze the need of software maintenance activities

CO3: discuss the software life cycle models

CO4: apply software engineering practices to create complex software designs

CO5: identify the importance of the software development process

Unit No.	Content
Unit 1	**Introduction to software engineering**: define software engineering, software process, software engineering practices
Unit 2	**Software process models**: software development life cycle (SDLC), classical software development lifecycle model, prototyping model, V model, incremental Model, introduction to agile method of software development
Unit 3	**Requirement engineering**: requirement engineering, requirement eliciting/gathering, negotiating requirement, validating requirement, requirement analysis, stakeholder analysis
Unit 4	**Requirement specification**: software requirement specification document, characteristics of a good SRS, functional and non-functional requirement
Unit 5	**Design**: design process, design concepts, coupling, cohesion, data flow diagram (DFD), flow chart, architectural design, component-based design, object-oriented design, class-based components, use case diagram, class diagram, activity diagram
Unit 6	**User interface design**: golden rules, interface design models, interface design process, interface design activities
Unit 7	**Standards**: good coding practices, coding standards, code reusability, documentation, documentation standards
Unit 8	**Software testing**: test design, test planning, test case definition, test case template
Unit 9	**Testing strategies**: black box testing, white box testing, sanity testing, smoke testing
Unit 10	**Testing levels**: unit testing, integration testing, system testing, acceptance testing, regression testing
Unit 11	**Bugs**: bug/defect definition, bugs life cycle, bug tracking, bug tracking tool (bugzilla overview)
Unit 12	**Software maintenance**: software maintenance, software supportability, reengineering, business process reengineering, software reengineering, restructuring, economics of reengineering
Unit 13	**Product metrics**: measure, metrics and indicators, measurement principles, function-based metrics, metrics for specification quality
Unit 14	**Software process improvement**: approaches to SPI, maturity models, SPI process

READINGS:

1. FUNDAMENTALS OF SOFTWARE ENGINEERING by RAJIB MALL, PHI LEARNING
2. AN INTEGRATED APPROACH TO SOFTWARE ENGINEERING by PANKAJ JALOTE, NAROSA PUBLISHING HOUSE

Course code	DECAP444	Course Title	OBJECT-ORIENTED PROGRAMMING USING C++

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	70	30

Course Outcomes: Through this course, students will be able to

CO1: understand the concepts of Object-oriented programming

CO2: distinguish between the procedure-oriented and object-oriented programming languages

CO3: apply the concept of file handling and exception handling mechanisms

CO4: develop applications using the concepts of Object-oriented programming

CO5: validate the code formulation by passing various test cases

Unit No.	Contents
Unit 1	**Principles of OOPs and basics of C++:** Basic Concepts of Object Oriented Programming, Object Oriented Languages, Benefits of OOP's Specifying Class, Access specifies, Defining member functions, Nesting of member functions, Private member functions, Arrays within class
Unit 2	**Constructors and Destructors:** Constructors, Parameterized constructors, Copy Constructor and Dynamic Constructor, Multiple Constructor in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Destructors
Unit 3	**Functions and Compile Time Polymorphism:** Call by Value & Call by Reference, Objects as function arguments, Inline Functions, Making outside function inline, Friend functions, Static Data Members & Functions, Function Overloading
Unit 4	**Inheritance:** Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance
Unit 5	**Operator Overloading:** Rules for operator overloading, Overloading unary operators, Overloading binary operators, Overloading binary operators using Friend Function
Unit 6	**Type Conversion:** Type conversions: Basic to Class Type, Class to Basic Type, One Class to Another Class Type
Unit 7	**Run-time Polymorphism:** Virtual Base Classes, Abstract Classes, Pointer to Object, This Pointer, Pointer to Derived Class
Unit 8	**Virtual Functions:** Virtual Function, Pure Virtual Function, Early Vs Late Binding
Unit 9	**Working with Streams and Files:** C++ Streams, C++ Stream Classes, Classes for File Stream Operation, Opening & Closing Files, Detection of End of File
Unit 10	**More on Files:** More about Open( ): File modes, File pointer & manipulator, Sequential Input & output Operation, Updating a File : Random Access, Command Line Arguments
Unit 11	**Generic Programming with Templates:** Need of Template, Class Template, Function Template, Overloading of Function Template
Unit 12	**More on Templates:** Recursion with Template Function, Class Template and Inheritance, Difference between Templates and Macros
Unit 13	**Exception Handling:** Principles of Exception Handling, Exception Handling Mechanism, Multiple Catch Statements, Catching Multiple Exceptions
Unit 14	**More on Exception Handling:** Re-throwing Exceptions, Exceptions in Constructors and Destructors, Controlling Uncaught Exceptions

LABORATORY WORK:

IMPLEMENTATION OF C++ PROGRAMMING CONCEPTS (CLASSES AND OBJECTS, CONSTRUCTOR AND DESTRUCTORS, FUNCTION OVERLOADING AND OPERATOR OVERLOADING, INHERITANCE, WORKING WITH FILES, TEMPLATES AND EXCEPTION HANDLING)

READINGS:

1. OBJECT ORIENTED PROGRAMMING WITH ANSI & TRUBO C++ by ASHOK N. KAMTHANE, PERASON EDUCATION
2. OBJECT ORIENTED PROGRAMMING IN C++ by ROBERT LAFORE, GALGOTIA PUBLICATIONS
3. THE C++ PROGRAMMING LANGUAGE by BJARNE STROUSTRUP, PEARSON

Course code	DECAP446	Course Title	DATA WAREHOUSING AND DATA MINING

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: Understand the various concepts of data warehousing like metadata, data mart, summary table, fact data and dimension data.

CO2: Sail along with the various approaches in data mining.

CO3: Familiarize with the various data ware housing and data mining tools.

CO4: observe the various methods to extract knowledge using data mining techniques

CO5: evaluate current trends in data mining such as web mining, spatial-temporal mining.

CO6: apply different data mining methodologies with information systems.

CO7: research of database systems and able to improve the decision-making process.

Unit No.	Contents
Unit 1	**Data Warehousing and Online Analytical Processing**: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation
Unit 2	**Introduction to data mining**: Basic concepts of data mining, Different types of data repositories, Data mining functionalities, Concept of interesting patterns, Data mining tasks, Current trends, Major issues and ethics in data mining
Unit 3	**Data Warehousing Architecture:** Operational Data and Data store, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and highly summarized Data, Archive/Backup Data, Meta-Data, architecture model, 2-tier, 3-tier and 4-tier data warehouse, End user Access tools.
Unit 4	**Installation and development environment overview:** Downloading and installing Rapid miner and WEKA tool from source websites, Installing Rapid miner and WEKA tool on your windows computer
Unit 5	**Introduction to mining tools:** Introduction to Rapid miner, Introduction to WEKA tool, features of tools, Comparison between Rapid Miner and WEKA, Overview of interface.
Unit 6	**Extracting Data Sets:** Importing data into Rapid miner using different formats of files, Storing and retrieving data using rapid miner, Graphical representation of data in rapid miner, Hands on practice problems on data import/export
Unit 7	**Data Preprocessing:** Data cleaning, Data integration and transformation, Data reduction, Discretization and concept hierarchy generation
Unit 8	**Data Pre-processing using rapid miner:** Identification and removal of duplicates, Apply operations for handling Meta data like rename or attribute role definition, Identify and remove the missing values in the data set, Apriori method for finding frequent item set WEKA / Rapid miner tool, Apply data mining pre-processing techniques and methods to large data sets, Hands on practice problems on data pre-processing
Unit 9	**Association and Correlation Analysis:** Basic concepts of frequent pattern and association rule, frequent item set generation with Apriori algorithm and FP Growth algorithm, Rule generation, Applications of Association rules

Unit 10	**Clustering Algorithms and Cluster Analysis:** Measures of similarity, K means partitioning method, k-medoids method, CLARANS method, Agglomerative and divisive clustering hierarchical method, BIRCH method,, Density based methods - Subspace clustering, Graph- based clustering - MST clustering, Cluster evaluation, Outlier detection and analysis
Unit 11	**Classification:** Introduction to classification, Introduction to Classification methods , Basic concepts of binary classification, Bayes theorem and Naive Bayes classifier, Association based classification, Rule based classifiers, Nearest neighbor classifiers, Decision Trees, Random Forest, Perceptrons, Multi-category classification, Model over fitting, Cross validation
Unit 12	**Prediction and Classification using WEKA Tool:** Applying model for prediction, Bayesian Classification on new imported data, Bayesian Classification on existed dummy data set, Decision Tree classification on both new and dummy data sets, Practice problems on classification methods, Applications of classification for web mining
Unit 13	**Clustering methods using WEKA Tool:** Introduction to clustering, Introduction to Clustering algorithms, Differentiate clustering and classification, K-means clustering, Hierarchical clustering algorithm,
Unit 14	**Applications of Data Warehousing and Data Mining:** Case studies of Data Warehousing in financial data analysis and retail industries, Case studies of Data Warehousing in Indian Railway reservation system and other industrial use, Case study on forecasting weather reports

READINGS:

1. DATA MINING: CONCEPTS AND TECHNIQUES by JAWEI HAN, MICHELINE KAMBER AND JIAN PE, MORGAN KAUFMANN
2. DATA WAREHOUSING, DATA MINING AND OLAP by ALEX BERSON AND STEPHEN J. SMITH, MC GRAW HILL
3. BUILDING THE DATA WAREHOUSE by INMON W. H, WILEY

Course code	DECAP448	Course Title	LINUX AND SHELL SCRIPTING

WEIGHTAGE		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: **Through this course, students will be able to**

CO1: learn about Linux environment and basic Linux administration tasks.

CO2: demonstrate comprehensive introduction to shell scripting/programming in LINUX.

CO3: explain various basic Linux commands and C system programming and debugging techniques in Linux environment.

CO4: analyze the usage of Linux utilities, organize directory structures, and develop useful shell scripts.

CO5: interpret and configure different Linux servers like samba, FTP, Apache and NFS.

Unit No.	Contents
Unit- 1	**Getting started with Linux:** The History of UNIX and GNU–Linux, What Is So Good About Linux, Overview of Linux, Additional Features of Linux
Unit- 2	**Installation Guide:** Booting Linux Installation Program, Partitioning Hard Drives, Setting up Swap Space, Choosing Partitions to Format Booting with LILO, Multi-boot with Other Operating Systems, Logging In from a Terminal or Terminal Emulator, More About Logging In, Run levels.
Unit- 3	**Connecting to Internet:** Network interfacing tool, Connecting to LAN, DNS (Static and Dynamic connection).
Unit- 4	**Installing software:** RPM management tool, Querying RPM packages, Package installation in TAR format, Adding & removing packages.
Unit- 5	**Utilities:** Basic Utilities, Working with Files, Pipe, Four More Utilities, Compressing and Archiving Files, Locating Commands
Unit- 6	**File Systems:** Obtaining User and System Information, Communicating with Other Users, Directory Files and Ordinary Files, Pathnames, Working with Directories, Access Permissions, Access Control Lists, Links.
Unit- 7	**The Shell and popular editors:** The Command Line, Standard Input and Standard Output, Running a Command in the Background, Filename Generation/Pathname Expansion, Built-ins, Using VIM to Create and Edit a File, Introduction to vim Features, Command Mode, Input Mode, Emacs versus Vim, Getting Started with Emacs, Basic Editing Commands
Unit- 8	**The Bourne Again Shell and TC Shell:** Shell Basics, Parameters and Variables, Special Characters, Processes, Re-executing and Editing Commands, Aliases, Functions, Controlling bash, Entering and Leaving the TC Shell, Features Common to the Bourne Again and TC Shells
Unit- 9	**Programming the Bourne Again Shell:** Control Structures, File Descriptors, Parameters and Variables, Built-in Commands, Expressions
Unit- 10	**Linux System Administration:** System Administrator and Super user, Rescue Mode, SELinux, System Operation, System Administration Utilities, Setting Up a Server, Important Files and Directories, File Types, File systems, Configuring User and Group Accounts, Backing Up Files, Scheduling Task, System Reports, Parted.
Unit- 11	**Web Server Configuration:** Apache Web Server, Installing Apache, Configuring Web server, Starting Apache, Setting up first web page.
Unit- 12	**File Server Configuration:** FTP protocol, Starting FTP server, Using FTP server, Using FTP client to test anonymous read access, Testing FTP server.
Unit- 13	**Samba Servers:** Overview of SAMBA server, Installing SAMBA server, SAMBA configuration with SWAT and starting SWAT service, Starting and stopping the SAMBA server, Adding SAMBA user, Creating and configuring SAMBA share.

Unit- 14	**Network File System:** NFS overview, Planning an NFS installation, Configuring an NFS server, Configuring an NFS client, Using Automount services, Examining NFS security.

READINGS:

1. DATA COMMUNICATION AND NETWORKING by B.A. FOROUZAN, MCGRAW HILL EDUCATION
2. DATA AND COMPUTER COMMUNICATIONS by WILLIAM STALLINGS, PEARSON

Course code	DECAP453	Course Title	DATA COMMUNICATION AND NETWORKING

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: recognize different networking devices and their functionalities

CO2: understand the importance of data communication

CO3: utilize the role of protocols in networking

CO4: analyse the services and features of the various layers of network

Unit No.	Contents
Unit 1	**Introduction to data communication and computer networks:** data communication system-components and characteristics; protocol – its component and functions; definition, characteristics, applications and classification of computer networks – PAN, LAN, MAN, WAN, internetworks, network topologies.
Unit 2	**Data and signals:** Analog and digital data, Analog and digital signals, transmission impairments and performance metrics and transmission modes: simplex, half duplex and full duplex.
Unit 3	**3 Digital and Analog Transmission:** digital transmission: line coding, modulation: PCM, DM, ASK, FSK, PSK, amplitude, frequency and phase modulation.
Unit 4	**Network models:** Layered architecture, benefits of layered architecture, OSI Reference Model, TCP/IP protocol suite, functions of layers in OSI and TCP/IP models, addressing in OSI and TCP/IP models.
Unit 5	**Physical layer:** Services of physical layer, transmission medium – wired and wireless, switching – message switching, circuit switching, datagram packet switching, virtual circuit packet switching, networking devices - modem, repeater, network interface card, connectors, transceiver, hub-active, passive and intelligent; bridge- local, remote, wireless; switches, routers-static and dynamic; gateways
Unit 6	**Data link layer - error and flow control:** Introduction, types of errors, one and two dimensional parity method, hamming code, cyclic redundancy check (CRC); framing-character stuffing, bit stuffing, introduction to flow and error control, protocols for noiseless and noisy channels - simplest protocol, stop-and-wait protocol; stop-and- wait ARQ, go-back-n ARQ, selective repeat ARQ.
Unit 7	**Data link layer - medium access control protocols:** High- level Data Link Control Protocol (HDLC), Point-to-Point Protocol (PPP), random access - pure ALOHA and slotted ALOHA, persistent and non-persistent CSMA, CSMA/CD, CSMA/CA; controlled access.
Unit 8	**Network layer - logical addressing:** IPV4 addressing, Classful Addressing, Classless Addressing, sub netting, network address translation, classless inter domain routing, IPV6 addressing, internet control messaging protocol (ICMP), address resolution protocol (ARP), reverse address resolution protocol (RARP).
Unit 9	**Network layer – routing:** unicast routing: routing characteristics, routing algorithms, comparison of routing algorithms; broadcast and multicast routing: broadcast routing, multicast routing, routing in adhoc networks; routing protocols: distance vector, link state, path vector.

Unit 10	**Transport layer - protocols:** services of transport layer, multiplexing and demultiplexing, connection oriented and connectionless services, connection establishment, connection release, port addressing, connectionless transport using UDP, connection-oriented transport using TCP – handshaking
Unit 11	**Transport layer - congestion control and QoS:** General principles of congestion control, congestion avoidance and prevention policies; quality of service- types of traffic, traffic shaping, leaky bucket algorithm, token bucket algorithm.
Unit 12	**Application layer – services and protocols:** remote login (TELNET), file transfer protocol (FTP), domain name system (DNS), e-mail - simple mail transfer protocol (SMTP), post office protocol (POP), internet message access protocol (IMAP).
Unit 13	**Internet and WWW:** internet basics, hypertext transfer protocol (http), world wide web (www), securing e-mail, security in internet – IPsec, VPN, overview of Digital Signature and Digital certificates technology.
Unit 14	**Network Security:** network security issues, goals of network security, approaches to network security, cryptography, principles of cryptography, encryption and decryption, public/private key encryption, firewalls, types of firewall technology - network level and application level; IP packets filter screening routers, limitations of firewalls.

READINGS:

1. DATA COMMUNICATION AND NETWORKING by B.A. FOROUZAN, MCGRAW HILL EDUCATION
2. DATA AND COMPUTER COMMUNICATIONS by WILLIAM STALLINGS, PEARSON
3. MS-EXCEL-WORKING WITH WORKSHEET, FORMULAS & FUNCTIONS, INSERTING CHARTS, PRINTING IN EXCEL
4. MS-POWERPOINT-VIEWS, DESIGNING, VIEWING, PRESENTING & PRINTING OF SLIDES.
5. INTERNET: NAVIGATING WITH INTERNET EXPLORER; SURFING THE NET, USING SEARCH ENGINES; USING EMAIL FACILITY.

Course code	DECAP012	Course Title	FUNDAMENTALS OF COMPUTER AND C PROGRAMMING

Course Outcomes: Through this course, students will be able to

CO1: Understand basic concepts and terminology of information technology.
CO2: understand the basic concepts of programming like data types, control structures, functions and arrays
CO3: perceive problem solving through C programming
CO4: build sequential steps and procedures to solve a given problem
CO5: demonstrate the use of pointers and dynamic memory allocation
CO6: implement the knowledge and insights to create solutions

Unit No.	Contents
Unit 1	**Computer Fundamentals:** Characteristics & Generation of Computers, Block diagram of Computer. Application of IT in various sectors. I/O Devices. **Memory:** Types, Units of memory, RAM, ROM, Secondary storage devices – HDD, Flash Drives and Optical Disks: DVD, SSD.
Unit 2	**Operating Systems:** operating system basics, Purpose of the operating system, types of operating system, providing a user interface, Running Programs, Sharing Information, Managing Hardware, Enhancing an OS with utility software.
Unit 3	**Data Communications:** Introduction to Data Communication: Definition and advantages, Types of Networks, Network topologies, Transmission Media, Modems.
Unit 4	**Data Base Management Systems**: Introduction to Database Management System, Components of DBMS, Database Vs. Tables, Data Models, Relational Model, Basics of RDBMS and SQL.
Unit 5	**Basics of C Language**: Machine Language, Assembly Language, High Level Languages, C Program Structure, Character Set, Identifiers and Keywords, Constants and Variables.
Unit 6	**Unformatted and Formatted I/O:** Functions- printf(), scanf(), getchar(), putchar(), gets(), puts(), Expressions.
Unit 7	**Data Types & Operators:** Various data types - data range, size, Unary and Binary operators, Arithmetic Operators, Relational Operators, Logical Operators, Conditional Operators, Assignment Operator, Bitwise Operators.
Unit 8	**Control Structure:** Designing structured programs by using Top-Down design, Type conversion and Type modifiers, if statements - simple if, if-else, multiple if, if-else ladder, nested if, switch-case statement.
Unit 9	**Looping Statements:** While, do-while & for statements, break and continue statements, goto statement.
Unit 10	**Functions**: Function Definition and Prototypes, Scope rules - Local and Global scope of functions, Function arguments - passing arguments by value and passing arguments by reference, Return Type of function, Recursion, Library Functions.
Unit 11	**Arrays:** Declaring arrays in C, Defining and Processing of 1-dimensional and 2-dimensional arrays, Passing array as an argument to function, Multi-dimensional Arrays.
Unit 12	**Array Applications** - Sorting and Searching, Character Arrays.
Unit 13	**Strings** : Defining and Initializing strings, Reading and Writing strings, Processing of strings, String Library Functions - strcat(), strcpy(), strcmp(), strlen(), strrev().
Unit 14	**Storage Classes:** Storage class specifiers, Scope of a variable, Auto, Static, Extern, Register, Static variables and functions, Const Qualifier.

READINGS:

1. PRADEEP K. SINHA & PRITI SINHA COMPUTER FUNDAMENTALS, BPB PUBLICATIONS
2. C: THE COMPLETE REFERENCE by HERBERT SCHILDT, MC GRAW HILL
3. PROGRAMMING IN ANSI C by E. BALAGURUSWAMY, MC GRAW HILL

Course code	DEMTH006	Course Title	ELEMENTARY MATHEMATICS

Course Outcomes: Through this course, students will be able to

CO1: describe basic concepts of set theory, relations and functions with the help of various examples.
CO2: understand the basics of number system and use them to solve Quadratic equations and linear inequalities.
CO3: analyze the arrangement and combinations of objects through permutations and combinations and use it in binomial theorem.
CO4: determine the pattern in sequences and solve the infinite series.
CO5: explain the concept of matrices and determinants and solve the system of linear equations with the help of matrices.
CO6: analyse and use the different kinds of techniques to find dispersion in a data and calculate the probability of a random experiment.

Unit No.	Contents
Unit 1	**Sets 1:** sets and their representations, the empty set, finite and infinite sets, equal sets, subsets
Unit 2	**Sets 2:** universal sets, Venn Diagrams, Operations on sets, Compliment of a set
Unit 3	**Relation:** Cartesian Product of sets, Definition and examples of relations
Unit 4	**Function:** Definition and examples of functions, some functions and their graphs (constant function, identity function, polynomial function, rational functions, modulus function, signum function, Greatest integer function), algebraic operations on functions
Unit 5	**Complex numbers and Quadratic Equations:** Complex Numbers, Algebra of Complex Numbers, The Modulus and the Conjugate of a Complex Number, Argand Plane and Polar Representation
Unit 6	**Linear Inequalities:** Inequalities, Algebraic Solutions of Linear Inequalities in One Variable and their Graphical Representation
Unit 7	**Permutations and Combinations:** Fundamental Principle of Counting, Permutations
Unit 8	**Combinations:** combinations and related examples
Unit 9	**Binomial Theorem:** Binomial theorem for positive integral indicies
Unit 10	**Sequence and Series:** Sequence, Series, Geometric Progression, Geometric and Arithmetic Mean and their relation
Unit 11	**Matrices:** Matrix, Types of Matrices, Operations on Matrices, Transpose of a Matrix, Symmetric and Skew Symmetric Matrices, Invertible Matrices
Unit 12	**Determinants:** Determinant, Area of a Triangle, Minors and Cofactors, Adjoint and Inverse of a Matrix
Unit 13	**Statistics:** Measures of dispersion, Range, Mean Deviation, Standard deviation
Unit 14	**Probability:** Probability, Axiomatic Approach to probability

READINGS:

1. MATHEMATICS TEXTBOOK FOR CLASS XI by NCERT, NCERT NEW DELHI
2. MATHEMATICS TEXTBOOK FOR CLASS XII PART-I by NCERT, NCERT NEW DELHI

Course code	DECAP615	Course Title	PROGRAMMING IN JAVA

WEIGHTAGE		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: learn the structure and model of the Java programming language

CO2: understand the accessibility of fields and methods of an object through String and String Builder classes

CO3: develop applications in Java programming language to solve problems

CO4: evaluate user requirements for software functionality and assess its implementation in java

CO5: implement Lambda functions.

CO6: demonstrate object serialization with file handling and exception handling to overcome run-time errors

Unit No.	Contents
Unit 1	**Introduction:** Introduction to basic java concepts, JDK, JRE, JVM, wrapper classes, inner and nested classes
Unit 2	**Arrays and Strings:** working with arrays and strings, String, String Buffer and String Builder classes, access specifies, inheritance
Unit3	**Collection Framework:** Array List class, List Iterator interface, Linked list class, Tree Set class, Priority Queue class
Unit 4	**More on Collection Framework:** Comparable and Comparator, Properties class, Lambda expressions
Unit 5	**Multithreading:** implementing multithreading, life cycle of a thread, thread communication,
Unit 6	**More on Multithreading**: suspending, resuming, deadlock and stopping threads
Unit 7	**Synchronization:** thread synchronization, handling exceptions during multithreading.
Unit 8	**Swings:** JButton class, JRadioButton class, JTextArea class, JComboBox class, JTable class.
Unit 9	**More on Swings:** JColorChooser class, JProgressBar class, JSlider class
Unit 10	**Layouts**: layout manager, Border Layout, Grid Layout, Flow Layout, Box Layout, Card Layout
Unit 11	**Managing data using JDBC**: introduction to JDBC, Connectivity with database, CRUD operations, Connection interface
Unit 12	**More on JDBC:** Statement interface, Result Set interface, Prepared Statement, Result Set Meta Data, and Database Metadata.
Unit 13	**Network Programming:** Java network terminology, socket classes, server socket classes
Unit 14	**More on Network Programming**: URL class, URL connection class, Datagram Socket class, Java socket programming

Laboratory Work:

Implementation of JAVA Programming Concepts (Classes and objects, constructor, function overloading, inheritance, working with files, exception handling and multithreading, JDBC, network programming)

READINGS:

1. JAVA: THE COMPLETE REFERENCE by HERBERT SCHILDT, MCGRAW HILL EDUCATION
2. INTRO TO JAVA PROGRAMMING (COMPREHENSIVE VERSION) by Y. DANIEL LIANG, PEARSON PUBLICATION
3. PROGRAMMING WITH JAVA by E. BALAGURUSAMY, MC GRAW HILL PUBLICATION

Course code	DECAP770	Course Title	ADVANCED DATA STRUCTURES

WEIGHTAGE		
CA	ETE(Th.)	ETE
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: perceive advanced data structures and perform operations on them

CO2: understand abstract data types and algorithmic complexity

CO3: apply suitable data structure for solving problems

CO4: implement hashing and collision resolution techniques

CO5: evaluate the performance of various algorithms

Unit No.	Contents
Unit 1	**Introduction:** need of data structures and algorithms, time and space complexity of algorithms, asymptotic notations, average and worst case analysis,
Unit 2	**Arrays vs linked lists**: operations on arrays and linked lists.
Unit3	**Stacks:** implementation of stacks, applications of stacks: quick sort, parenthesis checker, arithmetic expression conversion and evaluation, tower of Hanoi problem, role of stack in recursion,
Unit 4	**Queues**: implementation of queues, priority queue, applications of queues
Unit 5	**Search trees:** binary search trees: searching, insertion and deletion operations
Unit 6	**Tree data structure 1**: AVL trees: balancing operations, b-trees: properties and operations,
Unit 7	**Tree data structure 2:** red-black trees. splay trees: properties and operations, 2-3 trees: properties and operations
Unit 8	**Heaps:** introduction to heaps, min heap, max heap, operations on heap, applications of heap: priority queue implementation
Unit 9	**More on heaps**: heap sort, binomial heaps, Fibonacci heaps
Unit 10	**Graphs:** type of graphs, adjacency matrix and linked adjacency chains, connected components and spanning trees
Unit 11	**More on Graphs:** breadth first search, depth first search, network flow problems, Warshall's algorithm for shortest path, topological sort
Unit 12	**Hashing techniques:** linear list representation, hash table representation, hash functions
Unit 13	**collision resolution:** separate chaining, open addressing-linear probing, quadratic probing
Unit 14	**More on hashing:** double hashing, rehashing

LABORATORY WORK:

Arrays vs linked lists: operations on arrays and linked lists.

Stacks: implementation of stacks, applications of stacks: quick sort, parenthesis checker, arithmetic expression conversion and evaluation, tower of Hanoi problem, role of stack in recursion,

Queues: implementation of queues, priority queue, applications of queues

Search trees: binary search trees: searching, insertion and deletion operations

Tree data structure 1: AVL Trees: balancing operations, b-trees: properties and operations,

Tree data structure 2: red-black trees. splay trees: properties and operations, 2-3 trees: properties and operations

Heaps: introduction to heaps, min heap, max heap, operations on heap, applications of heap: priority queue implementation

READINGS:

1. DATA STRUCTURES AND ALGORITHMS IN C++ by ADAM DROZDEK, THOMSON EDUCATIONAL PUBLISHING
2. DATA STRUCTURES AND ALGORITHM ANALYSIS IN C by MARK ALLEN WEISS, ADDISON-WESLEY
3. DATA STRUCTURES AND ALGORITHMS by AHO, HOPCRAFT, ULLMAN, PEARSON
4. INTRODUCTION TO ALGORITHMS by CORMEN, THOMAS H., LEISERSON, CHARLES E., RIVEST, RONALD L., STEIN, CLIFFORD, PHI LEARNING PVT LTD

Course Code	DECAP456	Course Title	INTRODUCTION TO BIG DATA

WEIGHTAGE		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: analyze the need and importance of fundamental concepts and principles of Big Data

CO2: apply internal functioning of different modules of Big Data and Hadoop

CO3: evaluate the big data ecosystem and appreciate its key components

CO4: design and implement big data analytics solutions using advanced tools, machine learning techniques, and visualization methods.

Unit No.	Contents
Unit 1	**Introduction to Big Data:** Big Data and its importance, The V's of Big Data, Challenges and Applications of Big Data, Tools used in Big Data Scenario.
Unit 2	**Foundations for Big Data:** Distributed file system, scalable computing over internet, programming models for big data.
Unit3	**Data Models:** Data model vs. data format, data stream, understanding data lakes, exploring streaming sensor data.
Unit 4	**NOSQL Data Management:** Introduction to NoSQL, aggregate data models, aggregates key-value and document data models relationships, graph databases, schema less databases, materialized views, distribution models, sharding, version, Map reduce partitioning and combining, composing map-reduce calculations.
Unit 5	**Introduction to Hadoop:** Understand what Hadoop is, learning about other open-source software related to Hadoop, understand how Big Data solutions can work on the Cloud, Hadoop - Big Data Overview, Hadoop - Big Data Solutions.
Unit 6	**Hadoop Administration:** Hadoop - Environment Setup, Hadoop - HDFS Overview, Starting HDFS, Hadoop - Command Reference.
Unit 7	**Hadoop Architecture:** Understand the main Hadoop components, learn how HDFS works, List data access patterns for which HDFS is designed, describe how data is stored in an HDFS cluster.
Unit 8	**Hadoop Master Slave Architecture:** Hadoop – Map Reduce, Hadoop – Streaming, Hadoop – Multi Node Cluster, Creating User Account, Configuring Key Based Login, Installing Hadoop and Configuring Hadoop on Master Server.
Unit 9	**Hadoop Node Commands:** Configuring Master Node, Configuring Slave Node, Format Name Node on Hadoop Master, Starting Hadoop Services, Adding a New Data Node in the Hadoop Cluster, Adding User and SSH Access.
Unit 10	**Map Reduce Applications:** Map Reduce workflows – unit tests with MR Unit – test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN failures in classic Map-reduce and YARN job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats.
Unit 11	**Hadoop Ecosystem:** Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zookeeper, IBM Info Sphere Big Insights and Streams.
Unit 12	**Predictive Analytics:** Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations, Visual data analysis techniques, interaction techniques, Systems and applications
Unit 13	**Data Analytics with R:** Machine Learning, Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Big Data Analytics with Big R.

Unit 14	**Big data management using SPLUNK:** data integration process, Big Data Management and Processing using Datameer, Installing Splunk Enterprise on Windows, Installing Splunk Enterprise on Linux, Exploring Splunk Queries.

READINGS:

1. BIG DATA by ANIL MAHESHWARI, MC GRAW HILL
2. UNDERSTANDING BIG DATA: ANALYTICS FOR ENTERPRISE CLASS HADOOP AND STREAMING DATA by GEORGE LAPIS, CHRIS EATON, TOM DEUTSCH, PAUL ZIKOPOULOS, DIRK DEROOS, MC GRAW HILL.
3. BIG DATA AND ANALYTICS by SEEMA ACHARYA, SUBHASHINI CHELLAPPAN, WILEY

Course Code	DECAP470	Course Title	CLOUD COMPUTING

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO2: Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.

CO4: evaluate cloud virtualization technologies, security mechanisms, and standards to design secure and efficient cloud-based solutions.

Unit No.	Content
Unit-1	**Cloud computing introduction**: cloud computing fundamentals, history of cloud computing, cloud components, usage scenarios and applications
Unit-2	**Cloud computing architecture and models:** why cloud computing matters, issues in cloud, cloud architecture, cloud storage, NIST cloud computing reference model, Cloud cube model.
Unit-3	**Cloud services**: Types of cloud services, service providers, software as a service, platform as a service, infrastructure as a service, database as a service, monitoring as a service, communication as services.
Unit-4	**Introduction to big data:** Big data, Hadoop framework, introduction to Mapreduce, phases of Mapreduce.
Unit-5	**File system in cloud:** Google file system, architecture of Google file system, operations of Google file system, Hadoop distributed file system, architecture of HDFS, operations of HDFS, comparison of GFS and HDFS.
Unit-6	**Collaborating using Google cloud:** create word documents in collaboration, collaborating on spreadsheets, collaborating using Google forms, storing and sharing files.
Unit-7	**Collaborating on event management:** collaborating on calendars, schedules and task management, creation of to-do lists, Collaborating on Contact Management.
Unit-8	**Collaborating on Project Management:** Project Management, project management tools, management of project using a cloud-based project management tool.
Unit-9	**Collaborating on Databases:** understanding databases, working of databases, working of online databases, exploring web-based databases, evaluating online databases.
Unit-10	**Collaborate using web-based communication:** web-based communication tools, web mail services, instant messaging tools, web conferencing tools, social networks and groupware, blogs and wikis.
Unit-11	**Virtualization concepts**: need for virtualization, types of virtualization, Features of virtualization, working of virtualization in cloud, pros and cons of virtualization.
Unit-12	**Virtual machine:** virtual machine properties, interpretation and binary translation, hypervisors, types of hypervisors, HLL VM: Xen, KVM, VMware, virtual box, hyper-V.
Unit-13	**Security and standards in Cloud**: security in clouds, security challenges, the open cloud consortium, the distributed management task force, standards for application developers, standards for messaging, standards for security
Unit-14	**Application of cloud computing:** end user access to cloud computing, application of cloud service in various areas of life, mobile internet devices and the cloud

READINGS:

1. CLOUD COMPUTING: "A PRACTICAL APPROACH by ANTOHY T VELTE, MC GRAW HILL
2. CLOUD COMPUTING FOR DUMMIES by BLOOR R., KANFMAN M., HALPER F. JUDITH URWITZ,WILEY
3. CLOUD COMPUTING: IMPLEMENTATION, MANAGEMENT AND SECURITY by JOHN W. RITTINGHOUSE, AND JAMES F. RANSOME, CRC PRESS

Course code	DEMTH403	Course Title	MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: recall formal logical arguments of propositional logic

CO2: perceive problem solving through the basics of combinatorics

CO3: compare the basic discrete structures and algorithms

CO4: apply the concepts of trees to find the shortest path

CO5: infer properties of graphs and be able to relate these to practical examples

CO6: formulate and prove theorems about trees, connectivity, coloring and planar graphs

Unit No.	Contents
Unit- 1	Introduction to proposition, conjunction, disjunction & negation, propositions and truth table, Tautologies and contradictions, equivalence of formulas, duality law.
Unit- 2	Predicates, the statement function, variables and quantifiers, predicate formulas. Methods of proof (Inference Theory).
Unit- 3	Partially Ordered Sets, HASSE Diagrams of POSETS, Well-Ordered Sets, Lattices, Bounded Lattices, Distributive Lattices
Unit- 4	Introduction to Boolean algebra, Basic Definitions, Duality, Basic Theorems, Boolean Algebras as Lattices
Unit- 5	Basic Counting Principles, Mathematical Functions, Permutations
Unit- 6	Combinations, the Pigeonhole Principle
Unit- 7	Terminology and special types of graphs, graph isomorphism
Unit- 8	Paths, cycles and connectivity
Unit- 9	Euler and Hamilton path and graphs
Unit- 10	shortest path problems, planner graphs,
Unit- 11	graph coloring, chromatic number of graphs
Unit- 12	tree and its properties, rooted tree
Unit- 13	spanning and minimum spanning tree, binary search tree
Unit- 14	infix, prefix, and post-fix notation, pre-order traversal, in-order traversal, and post-order traversal

READINGS:

1. DISCRETE MATHEMATICS AND ITS APPLICATIONS by KENNETH H ROSEN., M.G.Hills
2. DISCRETE MATHEMATICS (SCHAUM'S OUTLINES) (SIE) by SEYMOUR LIPSCHUTZ, MARC LIPSON, VARSHA H. PATIL, MCGRAW HILL EDUCATION

Course code	DECAP472	Course Title	WEB TECHNOLOGIES

WEIGHTAGE		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: understand the website layout creation using HTML language.

CO2: apply the website planning, management and maintenance techniques

CO3: apply dynamic website creation using JavaScript and Query

CO4: illustrate logic implementation on a web page

CO5: understand how to manage versatile data on a web page

Unit No.	Contents
Unit- 1	**Overview of HTML:** structure of HTML page, working with tags and attributes, working with list and inline elements, implementing tables and forms
Unit- 2	**DHTML with CSS**: concepts of selectors, formatting tags with CSS, responsive layout designing using CSS flexbox
Unit- 3	**Introduction to Bootstrap**: introduction to bootstrap, associating bootstrap with mobile web interfaces
Unit- 4	**Using the framework**: starter template, bootstrap theme, bootstrap-grids, bootstrap- jumbotron, bootstrap-narrow jumbotron
Unit- 5	**Navbars in action**: bootstrap-navbar, bootstrap-static top navbar, bootstrap-fixed navbar
Unit- 6	**Custom components**: bootstrap-cover, carousel, blog, dashboard, sign-in page, justified nav, sticky footer, sticky footer with navbar
Unit- 7	**Introduction to ReactJS**: Reactjs architecture, Reactjs and web development
Unit- 8	**Pure React concepts**: setting up webpage using react and react DOM, constructing elements with data, concept of DOM rendering, working with factories in react
Unit- 9	**Using React with JSX**: defining react elements using JSX, concept of trans piling and babel, working with recipes and webpack
Unit- 10	**State management and component tree in ReactJS**: validating properties with react, managing data using state in react, using component tree to manage state
Unit- 11	**Working with React router and server:** web page management by incorporating react router, data driven web applications and router parameters, react based server rendering, react based server communication
Unit- 12	**Components in detail:** stateful vs stateless components, creating class-based components, more about set State () method, Passing props to class-based components, passing function as props
Unit- 13	**Styling components:** Introduction to CSS modules, creating mobile responsive components
Unit- 14	**Functional programming with Javascript:** programming constructs in Javascript, introduction to es6 class, components of es6 class

LABORATORY WORK:

1. Program to implement basic concepts of HTML.
2. Program to implement CSS3.
3. Program to implement the box model and positioning properties in CSS3.
4. Program to implement basics of bootstrap.
5. Program to implement the basics of JavaScript.
6. Program to implement Objects in JavaScript.
7. Program to implement Arrays in JavaScript.
8. Program to implement Functions in JavaScript.
9. Program to build web applications in JavaScript.

10 Program to implement the concept of Dynamic views in JavaScript.

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READINGS:

1. HTML 5 BLACK BOOK, COVERS CSS 3, JAVASCRIPT, XML, XHTML, AJAX, PHP AND JQUERY, 2ND DT EDITORIAL SERVICES
2. HTML & CSS: THE COMPLETE REFERENCE, by THOMAS A. POWELL, MC GRAW HILL

Course code	DECAP776	Course Title	PROGRAMMING IN PYTHON

WEIGHTAGE		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: understand the basic structure and features of Python programming

CO2: interpret object-oriented programming concepts such as encapsulation, inheritance and polymorphism as implemented in Python

CO3: apply pandas and NumPy for data analysis

CO4: implement machine learning algorithms

CO5: analyze real-life situation specific problems and perceive solutions

CO6: build exploratory data analysis and visualizations

Unit No.jk.	Contents
Unit- 1	**Python basics:** introduction, data types and operators, control statements, functions
Unit- 2	**Python data structures: s**trings, lists, sets, tuples and dictionaries
Unit- 3	**OOP concepts:** OOP features, encapsulation, inheritance
Unit- 4	**More on OOP concepts:** function overloading, operator overloading and method overriding,
Unit- 5	**Exception handling**: catching exceptions, catching multiple exceptions, raising exceptions, custom exception
Unit- 6	**Introduction to NumPy**: arrays vs lists, array creation routines, arrays from existing data, indexing and slicing
Unit- 7	**Operations on NumPy arrays**: array manipulation, broadcasting, binary operators
Unit- 8	**NumPy functions**: mathematical functions, statistical functions, sort, search and counting functions
Unit- 9	**Handling data with pandas**: introduction to pandas, series, Dataframe, sorting, working with csv files, operations using data frame
Unit- 10	**Data cleanup:** investigation, matching and formatting
Unit- 11	**Data visualization:** introduction to matplotlib, line plot, multiple subplots in one figure, bar chart, histogram, box and whisker plot, scatter plot, pie charts
Unit- 12	**Data visualization:** introduction to seaborne, seaborne Vs matplotlib, data visualization using seaborne
Unit- 13	**Machine learning:** introduction, types of machine learning
Unit- 14	**Machine learning algorithms:** linear regression, k-nearest neighbours, decision trees, random forests, k-means clustering

LABORATORY WORK:

Implementation of Python programming concepts (control statements, functions, strings, lists, sets, tuples, dictionaries, OOP concepts, exception handling, NumPy arrays and functions, pandas, data visualization, machine learning algorithms)

READINGS:

1. PROGRAMMING AND PROBLEM SOLVING WITH PYTHON by ASHOK KAMTHANE, AMIT ASHOK KAMTHANE, MCGRAW HILL 2ND EDITION
2. HANDS-ON DATA ANALYSIS WITH NUMPY AND PANDAS by CURTIS MILLE, KINDLE EDITION
3. PYTHON FOR DATA ANALYSIS by WES MCKINNEY, O'REILLY MEDIA
4. MACHINE LEARNING FOR ABSOLUTE BEGINNERS by OLIVER THEOBALD, KINDLE EDITION

Course code	DECAP515	Course Title	FUNDAMENTALS OF MACHINE LEARNING

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: define the concepts of linear algebra and multivariate calculus

CO2: demonstrate the usage of various python libraries for data handling and visualization

CO3: explain the concepts of dimensionality reduction using PCA.

CO4: make use of fuzzy logic to handle uncertainty in data

CO5: examine various swarm optimization techniques to solve optimization problems

Unit No.	Content
Unit 1	**Introduction to Machine Learning:** Meaning of Machine Learning, Logistic Regression, Interpretation of Logistic Regression, Motivation for Multilayer Perceptron, Multilayer Perceptron Concepts, Multilayer Perceptron Math Model, Deep Learning, Example: Document Analysis, Interpretation of Multilayer Perceptron, Transfer Learning, Model Selection
Unit 2	**Neural Networks:** Hierarchical Structure of Images, Convolution Filters, Convolutional Neural Network, CNN Math Model, How the Model Learns, Advantages of Hierarchical Features, CNN on Real Images, Applications in Use and Practice, Deep Learning and Transfer Learning, Introduction to PyTorch
Unit 3	**Basics of Model learning:** Definition of Learning, Evaluation of Networks, How Do We Learn Our Network, Handling Big Data, Early Stopping, Model Learning with PyTorch
Unit 4	**Linear algebra:** Introduction to linear algebra, operations with vectors, modulus and inner product, cosine and dot product, projection, changing basis, matrices, solving simultaneous equation problems, types of matrix transformation, determinants and inverses, matrices changing basis, orthogonal matrices, eigen values and eigen vectors
Unit 5	**Multivariate calculus:** Introduction to multivariate calculus, definition of a derivative, differentiation examples & special cases, product rule, chain rule, differentiate with respect to anything, The Jacobian, The Hessian, multivariate chain rule, building approximate functions, power series, linearization, multivariate Taylor
Unit 6	**Dimensionality Reduction:** Statistics of dataset, orthogonal projections, problem setting and PCA objective, finding the coordinates of the projected data, steps of PCA, linear discriminant analysis, kernel PCA
Unit 7	**Dimensionality Reduction:** Statistics of dataset, orthogonal projections, problem setting and PCA objective, finding the coordinates of the projected data, steps of PCA, linear discriminant analysis, kernel PCA
Unit 8	**Fuzzy logic:** Basic definition and terminology, set-theoretic fuzzy operations, fuzzy sets and operations on fuzzy sets, fuzzy relations, fuzzy rules and fuzzy reasoning, fuzzy inference system, fuzzification and defuzzification methods, fuzzy based expert system.
Unit 9	**Unsupervised learning:** k-means clustering, EM algorithm.
Unit 10	**Swarm optimization techniques:** Swarm intelligence, ant colony optimization, swarm intelligence in bees, cuckoo search, Firefly Algorithm, Crow Search Algorithm, Hybrid Wolf-Bat Algorithm, Whale Search Algorithm, grasshopper optimization
Unit 11	**Convolutional Neural Networks:** Breakdown of the Convolution (1D and 2D), Core Components of the Convolutional Layer, Activation Functions, Pooling and Fully Connected Layers, Training the Network, Transfer Learning and Fine-Tuning, CNN with PyTorch.

Unit 12	**Introduction to Reinforcement Learning:** Introduction to Reinforcement Learning, Reinforcement Learning Problem Setup, Example of Reinforcement Learning in Practice, Reinforcement Learning with PyTorch, Moving to a Non-Myopic Policy, Q Learning, Extensions of Q Learning, Limitations of Q Learning.
Unit 13	**Introduction to Deep Q Learning:** Deep Q Learning Based on Images, Connecting Deep Q Learning with Conventional Q Learning
Unit 14	**Making Comparisons and Basic Calculation:** Word Vectors and Their Interpretation, Relationships Between Word Vectors, Inner Products Between Word Vectors, Intuition into Meaning of Inner Products of Word Vectors, Introduction of Attention Mechanism, Queries, Keys, and Values of Attention Network, Self-Attention and Positional Encodings, Attention-Based Sequence Encoder, Coupling the Sequence Encoder and Decoder, Cross Attention in the Sequence-to-Sequence Model, Multi-Head Attention, The Complete Transformer Network

READINGS:

1. DESIGNING DATA VISUALIZATIONS: REPRESENTING INFORMATIONAL RELATIONSHIPS by JULIE STEELE, NOAH ILIINSKY, KINDLE EDITION
2. MASTERING PYTHON DATA VISUALIZATION PAPERBACK by KIRTHI RAMAN, PACKT PUBLISHING

Course code	DECAP516	Course Title	NATURAL LANGUAGE PROCESSING

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: Define the perceptions of Logistic Regression, Classification and Vector Spaces, Machine Translation, Probabilistic Models, Sequence Models, Attention Models in Natural Language Processing**.**

CO2: Understand the concepts of Sentiment Analysis, Vector Space Models, Hidden Markov Models, Language Models, Recurrent Neural Networks, and Siamese Networks used for Natural Language understanding and generation.

CO3: Apply Machine Learning algorithms, Semantic analysis, and Syntactic analysis to Natural Language Processing leads to design Real-time NLP applications, NLP tools and systems.

CO4: analyze the notions of Autocorrect, Autocomplete, Word Embeddings with Neural Networks and Syntax, Semantics, and Pragmatics of a Statement written in a Natural Language.

CO5: evaluate the sys tems using appropriate Descriptions, Visualizations, and Statistics to communicate the problems of the English language for Natural Language Processing through Semantic and Syntactic analysis.

CO6: develop NLP tools to Translate Words, Translate Languages, Text Generation, Summarize Text, Word embedding, Build Chatbots, and question answering.

Unit No.	Content
Unit 1	**Natural Language Processing with Classification and Vector Spaces:** Sentiment Analysis with Logistic Regression: Extract Features from Text into Numerical Vectors, Binary Classifier using a Logistic Regression, Sentiment Analysis with Naïve Bayes: Bayes' rule for Conditional Probabilities, Naive Bayes Classifier
Unit 2	**Vector Space Models and Machine Translation :** Vector Space Models: Vector Space Models Capture Semantic Meaning, Relationships between Words, Create Word Vectors, Capture Dependencies between Words, Visualize the Relationships in Two Dimensions Using PCA
Unit 3	**Machine Translation and Document Search:** Transform Word Vectors, Assign to Subsets using Locality Sensitive Hashing, Machine Translation and Document Search
Unit 4	**Natural Language Processing with Probabilistic Models** : Autocorrect: Minimum Edit Distance, Dynamic Programming, Spellchecker to Correct Misspelled Words, Part of Speech Tagging and Hidden Markov Models: About Markov Chains and Hidden Markov Models, Part-Of-Speech Tags using a Text Corpus.
Unit 5	**Autocomplete and Language Models:** N-gram Language Models work by Calculating Sequence Probabilities, Autocomplete Language Models using a Text Corpus.
Unit 6	**Word Embeddings with Neural Networks**: Word Embeddings, Semantic Meaning of Words, NLP Tasks, Continuous Bag-Of-Words
Unit 7	**Natural Language Processing with Sequence Models**: Neural Networks for Sentiment Analysis: Neural Networks for Deep Learning, Positive or Negative Sentiment Categories
Unit 8	**Recurrent Neural Networks for Language Modelling:** Traditional Language Models, RNNs and GRUs, Sequential Data for Text Prediction, Next-Word Generator using a Simple RNN
Unit 9	**LSTMs and Named Entity Recognition:** Long Short-Term Memory units (LSTMs), Vanishing Gradient Problem, Named Entity Recognition Systems, Named Entity Recognition System using an LSTM

Unit 10	**Siamese Networks**: Neural Network made of Two Identical Networks and Merged Together, Identifies Duplicates in a Dataset.
Unit 11	**Natural Language Processing with Attention Models**: Neural Machine Translation: Shortcomings of a Traditional seq2seq Model, Attention Mechanism, Neural Machine Translation Model with Attention.
Unit 12	**Text Summarization:** Compare RNNs and other Sequential Models, Modern Transformer Architecture, Text Summaries.
Unit 13	**Building Models/ Case Studies** : Question Answering: Transfer Learning with State-Of-The-Art Models, T5 and Bert, Model for Answering Questions
Unit 14	**Chatbot:** Examine Unique Challenges, Transformer Models Face and their Solutions, Chatbot using a Reformer Model.

List of Practical/ Experiments

- Build a Binary Classifier for Tweets using a Logistic Regression.
- Build a Naive Bayes Tweet Classifier.
- Create Word Vectors that Capture Dependencies between Words, then Visualize their relationships in Two Dimensions using PCA.
- Transform Word Vectors and Assign them to Subsets using Locality Sensitive Hashing.
- Build your own Spellchecker to Correct Misspelled Words.
- Create Part-of-Speech Tags for a Wall Street Journal Text corpus using Markov models.
- Build your own Autocomplete Language model using a Text corpus from Twitter using N-gram Language models.
- Build your own Continuous Bag-of-Words model to Create Word Embeddings from Shakespeare text.
- Build a Sophisticated Tweet Classifier that places Tweets into Positive or Negative Sentiment categories, using a Deep Neural Network.
- Build your own Next-Word Generator using a simple RNN on Shakespeare Text data.
- Build your own Named Entity Recognition system using an LSTM and Data from Kaggle.
- Build your own Siamese Network that Identifies Question Duplicates in a Dataset from Quora.
- Build a Neural Machine Translation model with Attention that Translates English Sentences into German.
- Create a Tool that Generates Text Summaries.

READINGS:

1. NATURAL LANGUAGE PROCESSING by ELA KUMAR, DREAMTECH PRESS
2. SPEECH AND LANGUAGE PROCESSING: AN INTRODUCTION TO NATURAL LANGUAGE PROCESSING, COMPUTATIONAL LINGUISTICS AND SPEECH RECOGNITION by DANIEL JURAFSKY, JAMES H. MARTIN, PEARSON

Course code	DECAP527	Course Title	DEEP LEARNING

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: define TensorFlow and use it for building various deep learning algorithms

CO2: illustrate the use of Keras to assess different deep learning models

CO3: apply different architectures of deep convolutional neural networks for image classification

CO4: analyze the need of autoencoders and prioritize appropriate hyperparameters for optimization

CO5: explain recurrent neural networks for modeling sequential data

CO6: develop artificial neural networks using TensorFlow and Keras to solve real-world problems

Unit No.	Content
Unit 1	**Deep Learning, Deep Learning Frameworks, and Software Libraries**: Introduction to ANN, Architecture of ANN, Introduction to deep learning, Reasons to go deep, An old problem: The Vanishing Gradient, Deep Learning Platforms, Deep Learning Libraries
Unit 2	**Introduction to TensorFlow:** Introduction to TensorFlow, Installation of TensorFlow, TensorFlow ranks and tensors, TensorFlow's computation graphs, variables in TensorFlow, TensorFlow optimizers, transforming tensors as multidimensional data arrays, visualization with Tensorboard
Unit 3	**Deep Learning models using Keras::** Introduction to Keras, Keras Installation, Keras Layers and Models, Implementing a Linear Regression Model, Image Classification with Keras, Multi-layer Perceptron Learning for Classification, Building Text Classification Model
Unit 4	**Overfitting and Underfitting in Deep Learning Models**: Overfitting and Underfitting, Save and Load Model, Hyperparameter Tuning
Unit 5	**Introduction to Convolutional Neural Networks (CNNs):** Introduction to CNNs, Building Blocks of Convolutional Neural Networks, Determining the Size of Convolution Output, Performing Discrete Convolution in 2D
Unit 6	**Building Deep CNNs with TensorFlow:** Putting Everything Together to Build a CNN, implementing a Deep Convolutional Neural Network using TensorFlow, Transfer Learning with Pre-trained CNN, Data Augmentation
Unit 7	**Advanced Topics in CNNs**: Image Segmentation, Evaluation Metrics for Image Classification
Unit 8	**Introduction to Autoencoders:** Introduction to Autoencoders, Need for Autoencoders, Architecture of Autoencoder, Denoising Autoencoders
Unit 9	**Advanced Autoencoder Techniques:** Data Compression using Autoencoders, Variational Autoencoders, Sparse Autoencoders
Unit 10	**Introduction to Recurrent Neural Networks (RNNs):** Introduction to RNNs, Modeling Sequential Data, Understanding the Structure and Flow of an RNN
Unit 11	**Implementing RNNs with TensorFlow:** Computing Activation in an RNN, Implementing a Multilayer RNN for Sequence Modeling in TensorFlow, Text Classification with an RNN
Unit 12	**Advanced RNN Techniques:** Text Generation with an RNN, Time Series Forecasting, LSTM Units
Unit 13	**Sequence Classification with LSTM:** Sequence Classification with LSTM, Stacked LSTM for Sequence
Unit 14	**Generative Adversarial Networks**: neural style transfer, Introduction to generative models, overview of GAN structure, discriminator, generator, building GAN, problems with GANs, CycleGAN, Adversarial FGSM

List of Practicals / Experiments:

- Program to perform different operations on tensors in TensorFlow.
- WAP to perform text classification using keras.
- WAP to perform regression using Keras.
- WAP to save and load trained model in keras.
- WAP to perform image classification using dense layers.
- WAP to implement image classification using CNN and evaluate the performance of the model.
- WAP to identify and avoid underfitting and overfitting in DNN and improving model performance using hyper parameter tuning.
- WAP to perform transfer learning and fine tuning.
- WAP to perform data augmentation.
- WAP to perform image denoising using autoencoders.
- WAP for anomaly detection using autoencoders.
- WAP to perform text classification using RNN.
- WAP to implement Generative Adversarial Networks (GANS).

READINGS:

1. DEEP LEARNING by AMIT KUMAR DAS, PEARSON EDUCATION INDIA
2. ADVANCED DEEP LEARNING WITH TENSORFLOW 2 AND KERAS - SECOND EDITION by ROWEL ATIENZA, PACKT PUBLISHING

Course Code	DECAP794	Course Title	ADVANCE DATA VISUALISATION

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: discuss the terminology used in Tableau Prep.

CO2: identify how Tableau Prep approaches data sampling.

CO3: construct and understand data prep flows that address common scenarios encountered in data preparation, as applied to common data use cases.

CO4: review the quality of the data and perform exploratory analysis.

CO5: manage and Connect Data Source.

Unit No.	Content
Unit-1	**Introduction to Data Visualization**: Acquiring and Visualizing Data, Simultaneous acquisition and visualization, Applications of Data Visualization, Keys factors of Data Visualization. Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content.
Unit-2	**Making charts interactive and animated**: Data joins, updates and exits, interactive buttons, Updating charts, Adding transactions, using keys , wrapping the update phase in a function, Adding a Play button to the page, Making the Play button go, Allow the user to interrupt the play, sequence.
Unit-3	**Managing, organizing and enhancing data:** Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization
Unit-4	**Creation of Hierarchies:** Create hierarchies to drill down into data, Creating groups for data, Creating and Using Sets Create data filters, Create calculated fields, Combine data sources using data blending, Creating & using Parameters, Bringing in More data with Joins
Unit-5	**Chart types and their usage in tableau:** Defining data and their different visualization ways, Building various charts, Visualizing data using Bar Chart, Lines Charts, Scatterplots, Heat maps, Histograms, Maps, Dual Axis, Charts, Pie Charts.
Unit-6	**Visualization data with advanced analytics:** Polygon Maps, Bump Charts, Control charts, Funnel charts, Pareto charts, Waterfall charts, Usage and filtration of data with charts, Visualizing categorical data, Visualizing time series data, Visualizing multiple variables, Visualizing geospatial data, Map box integrations, Web Mapping Services, Background Images
Unit-7	**Interactive dashboards and story points in tableau:** Creating a dashboard, Designing dashboard, Add motions, Adding interactivity with actions, Dashboard layout and formatting, Add extra detail to visualization using Marks Shelf, Add Size, Shape, Labels, Details, Tool tips in visualization, Sharing and collaborating dashboards.
Unit-8	Story Points and how to create them, Designing effective slide presentations to showcase data story, Publish online business dashboards with Tableau, Exporting Pdfs, Sharing Dashboard Securely
Unit-9	**Introduction:** Installation of TABLEAU, Tableau Interface, Data Types, Tableau features **Tableau Data Sources:** Connecting data with tableau, Joining data sources, Combine data sources using data blending, Creating and Using Sets Create data filters, Creating & using Parameters, Bringing in More data with Joins
Unit-10	**Managing, organizing and enhancing data in tableau:** Splitting data, Pivoting &Transforming data, Blue & green pills Filters, Blue & green pills effect on dates, Cleaning

	data by Bulk Re-aliasing, Setting data defaults, Create hierarchies to drill down into data, Creating groups for data, Create calculated fields
Unit-11	**Sharing your Work**: Tableau data source, Tableau data extract, Tableau workbook, Tableau packaged workbook.
Unit-12	**Mathematical and visual analytics in tableau**: Aggregate calculations, Date calculations, Logic calculations, Number calculations, String calculations, Type calculations, LOD Expressions, Add reference lines and trend lines
Unit-13	**Interactive dashboards and story points in tableau**: Creating a dashboard, Designing dashboard, Add motions, Adding interactivity with actions, Dashboard layout and formatting, Add extra detail to visualization using Marks Shelf, Add Size, Shape, Labels
Unit-14	**Publishing work:** Sharing and collaborating dashboards, Story Points and how to create them, Designing effective slide presentations to showcase data story, Publish online business dashboards with Tableau, Exporting Pdfs, Sharing Dashboard Securely

READINGS:

1. DESIGNING DATA VISUALIZATIONS: REPRESENTING INFORMATIONAL RELATIONSHIPS by JULIE STEELE, NOAH ILIINSKY, KINDLE EDITION
2. MASTERING PYTHON DATA VISUALIZATION PAPERBACK by KIRTHI RAMAN, PACKT PUBLISHING

Course Code	DEPEA515	Course Title	ANALYTICAL SKILLS-I

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: observe the basic concepts of reasoning and quantitative aptitude

apply the learned concepts to solve the company specific reasoning and quantitative aptitude tests

CO3: analyze the problem and use logic to interpret and handle different situations

CO4: understand the concepts to solve the problems in given time

CO5: reproduce the concepts and use it to solve the applications

CO6: evaluate the knowledge by cracking online tests

Unit No.	Content
Unit 1	**Number system**: classification of numbers, rules of divisibility, multiplication and squaring of numbers, HCF & LCM of numbers, cyclicity of unit digit, remainder theorem
Unit 2	**Average**: average of numbers, arithmetic mean, weighted average
Unit 3	**Mathematical operations**: BODMAS rule, calculation based problem, conversion of symbols into signs
Unit 4	**Percentage**: commodity price increase/decrease, comparison based questions, population based examples, successive percent changes, budget based problems
Unit 5	**Profit and loss**: cost price, selling price, profit and loss, calculation of profit/loss percent, false weight, discount, successive discount, marked price
Unit 6	**Direction sense test**: understanding of directions, different types of practice problems
Unit 7	**Blood relation**: cracking jumbled up descriptions, relation puzzle, coded relations
Unit 8	**Number, ranking and time sequence**: number test, ranking test, time sequence test
Unit 9	**Ratio and proportion**: ratio and its types, proportion and its types, direct and indirect variations, partnership
Unit 10	**Alligation or mixture**: concept and rules of alligation, problem based on mixing of liquids/items
Unit 11	**Problem on ages and numbers**: problems on ages, problem on numbers
Unit 12	**Permutation and combination:** factorial, difference between permutation & combinations, circular permutation, arrangement and selection based problems, distribution and division **Probability**: experiment, sample space, event, probability of occurrence of an event, bayes theorem, odds of an event, selection based problems, binomial distribution
Unit 13	**Logical Venn diagram and set theory:** Venn diagram based problems, concept of set theory **Syllogism**: all, some and none relations, related statements with Venn diagram
Unit 14	**Data interpretation**: basics of data interpretation, average and percentage, tabulation, bar graphs, pie charts, line graphs

READINGS:

1. QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATIONS by Dr. R S AGGARWAL, S CHAND PUBLISHING
2. A MODERN APPROACH TO VERBAL & NON-VERBAL REASONING by Dr. R S AGGARWAL, S CHAN PUBLISHING
3. MAGICAL BOOK ON QUICKER MATHS by M TYRA, BANKING SERVICE CHRONICLE
4. ANALYTICAL REASONING by M.K. PANDEY, BANKING SERVICE CHRONICLE

Course Code	DEPEA516	Course Title	ANALYTICAL SKILLS-II

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to
CO1: apply logical reasoning to understand, interpret and handle different situations.
CO2: solve efficiently the company specific logical reasoning tests.
CO3: apply logical reasoning to prioritize and manage time.
CO4: decide to build the logic
CO5: examine the problem and handle it
CO6: apply the logics

Unit No.	Contents
Unit- 1	Time and Work: chain rule, computation of work done together, men, women, children-based problems, wages-based work problems, alternate day work
Unit- 2	Pipes and Cisterns: inlet-outlet, part of tank filled, time-based problems, alternate work
Unit- 3	Time and Distance: concept of time speed and distance, conversion of Units, average speed concept, different types of problems
Unit- 4	Problem on trains: relative speed concept, faster and slower train, Boats and streams and races: downstream and upstream, linear and circular track
Unit- 5	Sequence and series completion: series completion, analogy, classification, arithmetic and geometric progression
Unit- 6	Alphabet test and logical sequence of words: alphabetical order of words, letter-word problems, rule detection, alphabetical quibble, word formation by unscrambling letters, word formation using Letters of a given word, alpha-numeric sequence puzzle, logical sequence of words
Unit- 7	Coding-Decoding: letter coding, number/symbol coding, substitution, matrix coding, mixed letter coding, mixed number coding
Unit- 8	Simple interest: basics of principal, rate and time, rate computation, time computation, amount computation
Unit- 9	Compound interest: concept of simple and compound interest, questions based on relation between compound and simple interest
Unit- 10	Calendar: calculating odd days, basic concept of calendar, finding the exact day
Unit- 11	Clocks: concept of clock, angle computation, facts Insert the missing character: set of figures, set of arrangements, set of matrix
Unit- 12	Data sufficiency: check sufficiency of data to answer the given questions Coding inequalities: basic operations, rules of inequalities, coded relations
Unit- 13	Puzzle test: seating/placing arrangements, comparison type questions, sequential order of things, family-based problems
Unit- 14	Non-Verbal Reasoning: series of figures, analogy of figures, classification of figures

READINGS:

1. QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATIONS by DR. R S AGGARWAL, S CHAND PUBLISHING
2. A MODERN APPROACH TO VERBAL & NON-VERBAL REASONING by DR. R S AGGARWAL, S CHAND PUBLISHING
3. MAGICAL BOOK ON QUICKER MATHS by M TYRA, BANKING SERVICE CHRONICLE
4. ANALYTICAL REASONING by M.K. PANDEY, BANKING SERVICE CHRONICLE

Course Code	DECAP538	Course Title	ALGORITHM DESIGN AND ANALYSIS

WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	40	30

Course Outcomes: Through this course, students will be able to

CO1: perceive the need of different algorithm design techniques

CO2: design and implement algorithms using divide and conquer, greedy approach, dynamic programming and backtracking

CO3: apply specific algorithms for solving computational problems like pattern matching, minimum spanning tree and shortest-path problems

CO4: analyze the asymptotic performance of algorithms

Unit No.	Content
Unit-1	**Introduction:** elementary data structures, basic computational models, analysis of algorithms: best case, average case and worst-case behaviour, asymptotic notations: big O notation, recursion, recurrence relations to analyse recursive algorithms
Unit-2	**Divide and conquer:** general method, binary search, merge sort, quick sort, and arithmetic with large integers.
Unit-3	**Greedy method**: General Method, Knapsack problem, Minimal Spanning Trees - Prim's and Kruskal's algorithm, single source shortest paths
Unit-4	**Dynamic programming**: general method, chained matrix multiplication, optimal storage on tapes
Unit-5	**More on Dynamic programming**: all-pairs shortest paths, optimal binary search trees
Unit-6	**Backtracking:** general method, the 8-queens problem, graph coloring, Hamiltonian cycles
Unit-7	**Branch and bound:** general method, 0/1 knapsack problem, travelling salesperson
Unit-8	**Pattern matching:** design of algorithms for pattern matching problems: brute force, knuth-morris-pratt, boyer moore algorithms
Unit-9	Huffman coding and data compression problems
Unit-10	**Lower bound theory**: comparison tree, oracles and adversary arguments
Unit-11	**More on lower bound theory**: lower bounds through reductions
Unit-12	**Approximation:** approximation basics, task scheduling, bin packing
Unit-13	**Intractable problems**: basic concepts, non-deterministic algorithms, NP completeness
Unit-14	**More on intractable problems**: examples of NP-hard and NP-complete problems, cook's theorem, problem reduction

LABORATORY WORK:

Implementation of algorithm design and analysis concepts (Divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, pattern matching, lower bound theory, intractable problems)

READINGS:

1. FUNDAMENTALS OF COMPUTER ALGORITHMS by E. HOROWITZ AND S. SAHANI, GALGOTIA PUBLICATIONS
2. DESIGN AND ANALYSIS OF ALGORITHMS by HIMANSHU B. DAVE, PEARSON
3. DESIGN & ANALYSIS OF ALGORITHMS by R.C.T. LEE, MCGRAW HILL EDUCATION
4. DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS by JOHN E. HOPCROFT, ADDISON-WESLEY

Course Code	DECAP951	Course Title	SOFTWARE PROJECT MANAGEMENT

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: apply python libraries for data analysis and machine learning model development

CO2: evaluate important features from a given dataset

CO3: apply machine learning models for real world problems

CO4: evaluate the performances of different machine learning models

Unit No.	Contents
Unit- 1	**Introduction to Software Project Management**: what is project? software project vs. other types, activities by software project mgt. plans, methods and methodologies, problems with software projects
Unit- 2	**Step Wise Project Planning**: project scope, objectives, infrastructure, characteristics, effort estimation, risk identification.
Unit- 3	**Program Management & Project Evaluation**: meaning, managing allocation of resources, creating program, individual projects, technical assessment, cost benefit analysis & risk evaluation
Unit- 4	**Project Approach:** intro, technical plan, choice of process models: waterfall, v-process, spiral, Prototyping, incremental delivery
Unit- 5	**Effort Estimation:** meaning, problems with estimation, basis, estimation techniques, Albrecht function point analysis, functions mark ii, COCOMO Model
Unit- 6	**Activity Planning:** objectives, project schedule, network planning model, time dimension, identifying critical path
Unit- 7	**Risk Management:** categories of risk, identification. assessment, schedule risk, applying pert technique
Unit- 8	**Resource Allocation:** identifying resource requirements, scheduling resources, publishing the resource schedule & cost schedule, scheduling sequence
Unit- 9	**Monitoring & Control:** creating frameworks, data collection, visualizing progress, cost monitoring, change control
Unit- 10	**Software Quality:** introduction, defining software quality, ISO 9126, software measures, product vs. process quality management, external standards
Unit- 11	**Small Projects:** introduction, problems with student projects, content of project plan
Unit- 12	**Software configuration management: SCM,** managing contracts, types of contracts, stages In contract placement, contract management and acceptance
Unit- 13	**People Management**: understanding behavior, organizational behavior, selecting the right person for the job, selecting the right person for the job
Unit- 14	**Organization and team structures**: decision making, leadership, organizational structures, stress health and safety, ISO and CMMI models, overview of project management tools

LABORATORY WORK:

1. Creating an activity schedule for a project.
2. Setting up resources.
3. Assigning resources to tasks.
4. Create a baseline.
5. Track plan by specific date.
6. Track plan as % complete.
7. Viewing critical path in a project.
8. Resolve resource over allocation.
9. Leveling over allocated resources.
10. Checking plan's cost.

READINGS:

1. SOFTWARE PROJECT MANAGEMENT by BOB HUGHES, MIKE COTTERELL, RAJIB MALL, MCGRAW HILL
2. SOFTWARE PROJECT MANAGEMENT IN PRACTICES by PANKAJ JALOTE, PEARSON
3. SOFTWARE PROJECT MANAGEMENT: A UNIFIED FRAMEWORK by WALKER ROYCE, PEARSON

Course Code	DEMGN581	Course Title	ORGANISATIONAL BEHAVIOUR AND HUMAN RESOURCE DYNAMICS

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: enumerate the concept of management practices and organizational behavior

CO2: develop and sharpen acumen of how different management thoughts can be used to improve organization functioning

CO3: analyze the importance of management practices and important organizational behavior dimensions at different levels of organization

CO4: appraise the dynamics of industrial relations and to manage them as per statutory regulations

CO5: apply human resource management functions to handle emerging issues

Unit No.	Content
Unit-1	**Organizational behavior:** relationship between management and organization behavior, model of OB and contributing disciplines to the OB field **Foundations of individual behavior:** values, attitude and job satisfaction, theories of learning and behavior modification
Unit-2	**Personality:** theories of personality and its assessment, transactional analysis and attribution theory of perception **Emotions:** emotional intelligence and affective events theory of emotion **Motivation:** early and contemporary theories of motivation
Unit-3	**Group dynamics:** group dynamics and its significance, types of groups, formation and stages of group development, group performance factors **Team development:** team formation, its types and difference between group and team
Unit-4	**Organizational conflict and negotiations:** conflict sources, types and levels of conflict, traditional and modern approaches to conflict, resolution of conflict through negotiation **Stress:** sources and consequences of stress, stress management techniques
Unit-5	**Introduction:** External and Internal Forces of environment affecting HRM, Objectives and functions of HRM. **Human Resource Planning:** HRP process, Barriers and Prerequisites for Successful HRP.
Unit-6	**Job Analysis:** Methods of Collecting Job Data, Potential Problems with Job Analysis, Process of Job Analysis, Job Design and its approaches,
Unit-7	**Recruitment & Selection:** Meaning, Recruitment process, Recruitment Methods, Challenges in India and Selection Process
Unit-8	**Talent Management:** talent management, talent retention, talent acquisition and sources of talent acquisition **Orientation, induction and placement:** process of orientation, induction and placement programme, Evaluation of Orientation Programme
Unit-9	**Training and Development:** employee training, difference in training and development, methods of training, methods of management development, people capability maturity model
Unit-10	**Career planning and management:** career management, process of career planning, challenges in career planning.
Unit-11	**Performance management system:** performance management, performance planning, performance appraisal, potential appraisal, feedback and counselling.
Unit-12	**Compensation management:** types and theories of compensation, concept of wages, factors influencing compensation management, incentives and fringe benefits, employee

	engagement and retention.
Unit-13	**Managing industrial relations:** major actors and their roles in IR, factors influencing IR, approaches to IR, grievance handling procedure
Unit-14	**Industrial Disputes:** industrial disputes, methods of settlement of industrial disputes, trade unions and their challenges in India

READINGS:

1. ORGANIZATIONAL BEHAVIOUR by STEPHEN P. ROBBINS. TIMOTHY A. JUDGE. NEHARIKA VOHRA, PEARSON
2. MANAGEMENT by MANAGEMENT by STEPHEN P. ROBBINS. MARY COULTER. NEHARIKA VOHRA, PEARSON
3. HUMAN RESOURCE MANAGEMENT by DESSLER, G. AND VARKKEY, B, PEARSON

Course Code	DEMKT503	Course Title	MARKETING MANAGEMENT

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: analyze and respond to environmental and competitive changes, their impact on marketing planning, strategies and practices

CO2: apply the conceptual frameworks, theory and techniques to various marketing contexts

CO3: prepare marketing and sales plan appropriate to the needs of customers and contexts

CO4: determine strategies for developing new products and services that are consistent with evolving market needs

Unit No.	Content
Unit-1	**Introduction:** market and marketing, definition, nature and scope of marketing, exchange process, functions of marketing, core marketing concepts
Unit-2	**Marketing orientations:** evolution of modern marketing concept, holistic marketing concepts, new marketing orientations selling vs. marketing
Unit-3	**Marketing mix:** 7 P's & 7 C's of Marketing, 4 A's of Marketing, customer quality, value and satisfaction, Michael E. Porters chain analysis model
Unit-4	**Marketing environment**: Significance of scanning marketing environment; Analysis of macro environment of marketing – economic, demographic, socio-cultural, technological, political legal and ecological; Impact of micro and macro environment on marketing decisions
Unit-5	**Consumer behaviour:** buyer behaviour, different consumer roles, need for studying buyer behaviour, different buying motives, consumer buying decision process and influences, consumer vs. business buying behaviour, industrial buying process
Unit-6	**Segmentation decisions**: market segmentation, characteristics of a segment, bases for segmenting a consumer market, levels of market segmentation, factors influencing selection of market segments
Unit-7	**Targeting and positioning:** Benefits of market segmentation; Criteria for effective market segmentation; Target market selection and strategies; Positioning – concept, bases and process
Unit-8	**Product decisions:** concept and classification, layers of products, major product decisions, product-mix, new product development stages, packaging and labelling, product life cycle (PLC) – concept and appropriate strategies adopted at different stages
Unit-9	**Pricing decisions:** pricing – objectives, price sensitivity, factors affecting price of a product, pricing methods and strategies, ethical issues in product and pricing decisions
Unit-10	**Distribution planning:** channels of distribution – concept and importance, different types of distribution middlemen and their functions, selection, motivation and performance appraisal of distribution middlemen
Unit-11	**Distribution decisions:** decisions involved in setting up the channel, channel management strategies, distribution logistics – concept, importance and major logistics decisions, channel integration and systems, ethical issues in distribution decisions
Unit-12	**Distribution decisions:** retailing and wholesaling, types of retail formats, retail theories, retailing strategies, non-Store retailing, wholesaling – nature and importance, types of wholesalers, developments in retailing and wholesaling in indian perspective

Unit-13	**Promotion decisions:** role of promotion in marketing, promotion mix, integrated marketing communication, concept, communication process and promotion, determining promotion mix, factors influencing promotion mix, developing promotion campaigns, sales promotion, direct marketing, public relations, digital and social media
Unit-14	**Trends in marketing:** service Marketing, e-marketing, green marketing, customer relationship management, rural marketing, other emerging trends, ethical issues in marketing

READINGS:

1. KOTLER, P. & KELLER, K. L. (2017). MARKETING MANAGEMENT. PEARSON
2. MCCARTHY, E. J., CANNON, J. & PERREAULT, W. (2014). BASIC MARKETING. MCGRAW-HILL EDUCATION
3. ETZEL, M. J., WALKER, B. J., STATON, W. J., & PANDIT, A. (2010).MARKETING CONCEPTS AND CASES. TATA MCGRAW HILL

Course Code	DEFIN542	Course Title	CORPORATE FINANCE

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: understanding finance function with respect to its evolution and growth

CO2: understanding the concept of Time Value of Money and interpreting the results based on calculations.

CO3: analyzing financing needs of the businesses and designing an optimum capital structure

CO4: understanding the retention and distribution of profits and impact on business valuation.

Unit No.	Content
Unit-1	**Financial Management:** An Overview**,** evolution of finance, the basic goal: creating shareholder value, agency issues, business ethics and social responsibility
Unit-2	**Sources of Finance:** Long term and Short-term sources of finance- Ordinary shares, Preferences shares, redeemable irredeemable debentures, Debt vs. Equity.
Unit-3	**Money Market Instruments:** Treasury Bills, Commercial Papers, Certificate of Deposits, Treasury Management and Treasury Operations in corporate. External Commercial Borrowings, Financing for MSMEs
Unit-4	**Time Value of Money concept:** Compounding and discounting, Future value and Present value, Annuities, Effective interest rates
Unit-5	**Investment Decisions:** Capital Budgeting Decisions, Rationale of Capital Budgeting, Non-Discounting Capital Budgeting Techniques - Payback period, Profitability Index, Accounting Rate of Return
Unit-6	**Investment Decisions:** Discounting Techniques of Capital Budgeting - NPV, IRR, Discounting Payback Period Method, Estimation of Cash Flows, NPV v/s IRR, Risk analysis in Capital Budgeting - Sensitivity Analysis, Certainty Equivalent Approach
Unit-7	**Cost of Capital:** Meaning and Concept, Cost of Debt, Cost of Equity, Cost of Retained Earnings, Calculation of WACC, International Dimensions in Cost of Capital
Unit-8	**Financing Decisions:** Capital Structure, Theories and Value of the firm - Net Income Approach, Net Operating Income Approach, Traditional Approach, Modigliani Miller Model, Determining the optimal Capital Structure, Checklist for Capital Structure Decisions, Costs of Bankruptcy and Financial Distress.
Unit-9	**EBIT-EPS Analysis:** Concept of Leverage, Types of Leverage: Operating Leverage, Financial Leverage, Combined Leverage.
Unit-10	**Dividend Decisions:** Factors determining Dividend Policy, Theories of Dividend Gordon Model, Walter Model, MM Hypothesis
Unit-11	**Forms of Dividend:** Cash Dividend, Bonus Shares, Stock Split, Stock Repurchase, Dividend Policies in practice.
Unit-12	**Working Capital Management:** Working Capital Policies, Risk-Return trade-off, Cash management, Receivables management
Unit-13	**Corporate Governance:** Value-based Corporate culture, Disclosures, transparency and accountability, Corporate Governance and Human Resource Management, Evaluation of performance of board of directors, Succession planning, Public sector undertakings and corporate governance, Insider trading, Lessons from corporate failure

Unit-14	**Economic outlook and Business Valuation:** Impact of changing business environment on corporate valuation, climate change and corporate valuation, Business sustainability and corporate valuation, Role of environmental, social, and governance (ESG) factors in corporate valuation

READINGS:

1. FUNDAMENTALS OF CORPORATE FINANCE by JONATHAN BERK, PETER DeMARZO& JARRED HARDFORD, PEARSON
2. CORPORATE FINANCE by STEPHEN A. ROSS, RANDOLPH W. WESTERFIELD & JEFFREY JAFFE, McGRAW HILL

Course Code	DEMGN578	Course Title	INTERNATIONAL BUSINESS ENVIRONMENT

WEIGHTAGE	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: analyze business environment and trends to take decisions with respect to international business operations

CO2: interpret and apply international trade theories in international business operations

CO3: identify and critically analyse the role of foreign exchange market and usage of fundamental instruments for currency exchange

CO4: develop skills on analysing the business data, and problem solving in other functional areas such as marketing, business strategy and human resources

CO5: develop responsiveness to contextual social issues/ problems and exploring solutions, understanding business ethics and resolving ethical dilemmas

CO6: identify aspects of the global business and cross-cultural understanding

Unit No.	Content
Unit 1	**Overview of international business environment**: Introduction to international business, types of international business, globalization and international Business;
Unit 2	**Components of international Business environment**: social environment, political and legal environment, economic environment, technological environment
Unit 3	**The external environment and challenges**: assessing risk in international business, Recent world trade and foreign Investment trends, environment Influence on Trade and investment patterns
Unit 4	**International Trade theories**: theory of absolute advantage, theory of comparative advantage, factor proportion theory, the diamond model of national competitive advantage, factor mobility theory
Unit 5	**Protectionism and trading environment**: Globalization trends and challenges; environment for foreign trade and investment, governmental influence on trade and investments; tariff and non-tariff barriers
Unit 6	**Economic Integration and Co-operation**: cross national cooperation and agreements, Role of international organizations: WTO, IMF, Regional Economic Integrations
Unit 7	**International financial markets**: foreign exchange market mechanism, exchange rate arrangement, determinants of exchange Rates, exchange rate movements and their impact
Unit 8	**Global Debt and Equity Markets**: Euro Currency market, offshore financial centres, International Banks, Non-Banking Financial service firms; stock markets
Unit 9	**Global Competitiveness**: Export Management, Technology and global Competition, world economic growth and the environment
Unit 10	**Internationalization strategies**: Theories of internationalization, Modes of operations in International Business, export and import strategy
Unit 11	**Forms and Ownership of Foreign Production**: Types of collaborative arrangements; Licensing, joint ventures & consortium approaches, Managing International

	Collaborations
Unit 12	**International business diplomacy**: Negotiating an International business, issues in asset protection, Multilateral sentiments
Unit 13	**Country evaluation and selection**: Opportunity and risk matrix, analysis of Macro and micro indicators, country comparison tools
Unit 14	**Globalization and society**: globalization with social responsibility, Ethical Dimensions of Labor Conditions, Ethics and the Environment, legislation for anti-competitive and unfair trade practices

READINGS:

1. DANIELS, RADEBAUGH, SULLIVAN & SALWAN, INTERNATIONAL BUSINESS ENVIRONMENTS AND OPERATIONS by PEARSON
2. INTERNATIONAL BUSINESS - COMPETING IN THE GLOBAL MARKETPLACE by CHARLES W HILL, ARUN KUMAR JAIN, MCGRAW HILL

Course Code	DEMKT509	Course Title	CONSUMER BEHAVIOR	
			WEIGHTAGES	
			CA	ETE(Th.)
			30	70

Course Outcomes: Through this course, students will be able to

CO1: understand the implications of consumer behaviour concepts & theories for businesses and wider society.

CO2: discern how individuals and groups influence consumer behaviour, and how marketers utilize this knowledge to help achieve organizational objectives.

CO3: analyse the dynamic interplay of internal and external factors influencing consumer behaviour and accordingly develop a marketing strategy.

CO4: articulate practical and comprehensive managerial understanding of consumer behaviour.

CO5: develop the understanding of marketing regulation, consumer protection act and contemporary issues in consumer behaviour.

Unit No.	Content
Unit 1	**Consumer Behaviour and Marketing strategy**: consumer behaviour, market strategy and applications of consumer behaviour.
Unit 2	**Market Analysis and Consumer Decisions:** market analysis components, segmentation strategy and consumer decisions and consumer behaviour models.
Unit 3	**Culture and Group influence**: cultural and group influence on consumer behaviour, concept of culture, cross cultural marketing strategy, the household life cycle and marketing strategy.
Unit 4	**Groups, Reference Group and Diffusion of Innovation**: groups, types of groups, reference group influence on consumption process & marketing strategies and diffusion of innovation.
Unit 5	**Perception**: perception, exposure, attention and interpretation, perception and marketing strategy.
Unit 6	**Learning and Personality:** memory's role in learning, learning theories, brand image and product positioning, brand equity and brand leverage motivation, personality and emotion.
Unit 7	**Motivation and Emotion**: motivation theory and marketing strategy use of personality in marketing practice, emotions and marketing strategy.
Unit 8	**Attitude and Market Segmentation**: attitude, influencing attitude, attitude components and change strategies, market segmentation and product development strategies based on attitudes.
Unit 9	**Self-Concept and Consumer Decisions**: nature of lifestyle, the VALS system consumer decision process and types of consumer decisions.
Unit 10	**Consumer Decision Making Process**: process of problem recognition and uncontrollable determinants of problem recognition, marketing strategy and problem recognition, information, alternative evaluation and selection, types and sources of information, consumer decision making and evaluation criteria.
Unit 11	**Decision Rules and Attributes of consumers:** decision rules for attitude-based choices, attributes affecting retail outlet selection, consumer characteristics and outlet choice, in-store and online influence on brand choice and evaluation criteria.

Unit 12	**Post purchase Processes and Dissonance**: post purchase processes, post purchase dissonance, product use and non-use, disposition.
Unit 13	**Purchase Evaluation and Customer Satisfaction**: purchase evaluation, customer satisfaction, dissatisfaction responses, repeat purchase and customer commitment.
Unit 14	**Consumer Behaviour and Marketing Regulation**: regulation and marketing to children, regulation and marketing to adults, consumer protection act and contemporary issues in consumer behaviour.

READINGS:

1. CONSUMER BEHAVIOUR- BUILDING MARKETING STARTEGY by DEL I HAWKINS, DAVID LMOTHERSBAUGH, & AMIT MOOKERJEE, MCGRAW HILL EDUCATION
2. CONSUMER BEHAVIOUR by KUMAR, S. R., SCHIFFMAN, L.G., WISENBLIT J., PEARSON
3. CONSUMER BEHAVIOUR by RAJNEESH KRISHNA, OXFORD UNIVERSITY PRESS.
4. SCHIFFMAN, L. G., &KANUK, L. L. CONSUMER BEHAVIOUR. NEW DELHI, PRENTICE HALL.

Course Code	DEFIN548	Course Title	INTERNATIONAL FINANCIAL MANAGEMENT	
			WEIGHTAGES	
			CA	ETE(Th.)
			30	70

Course Outcomes: Through this course, students will be able to

CO1: understand the critical financial issues of international firms and international investors in present scenario.

CO2: analyze the framework of exchange rates and foreign exchange exposures and forces affecting exchange rates.

CO3: evaluate the international capital structure and international capital budgeting mechanism of multinational corporations.

CO4: analyze the different modes of raising finance in international market and significance of international finance in MNCs.

Unit No.	Content
Unit 1	**Introduction to International Financial management:** domestic vs. international finance, International financial market integration, currency crisis, and global recession and risk spill over.
Unit 2	**Balance of Payments** - structure - contents of current, capital, and reserve accounts – linkages and impact on exchange rates, capital markets, and economy - understanding bop structure of a country for investment and raising finance.
Unit 3	**Foreign Exchange Markets and Exchange Rate Mathematics**: nature, functions, transactions, participants, forex markets in India, forex dealing, foreign exchange regimes, foreign exchange rate determination, factors affecting foreign exchange.
Unit 4	**Forecasting Foreign Exchange Rate:** exchange rate forecasting– purchasing power parity, covered and uncovered interest rate parity – international fisher's effect - forward rate parity – influence of these parity relationships on exchange rates.
Unit 5	**Foreign Exchange Spot and Derivative Market**: spot and forward contracts- cash and spot forex trading, forward contracts- long and short forward contract, foreign exchange futures contract- contract specification trading at national stock exchange of India.
Unit 6	**Management of Foreign Exchange Risk:** foreign exchange exposure: risk, measurement and management: global firms foreign exchange exposure - transaction, economic and translation exposures, potential currency exposure impact on global firms and investor performance.
Unit 7	**International Capital Markets** - sources of international finance - debt and equity markets – international equity diversification, short-term vs long-term finance – export import finance.
Unit 8	**Capital Structure of the Multinational Firm:** international capital structure – parent vs subsidiary norms, global capital structure – factors affecting the choice of markets and structure. international cost of capital – calculation – cost of foreign debt, cost of foreign equity, use of international CAPM.

Unit 9	**Capital Budgeting of the Multinational Firm:** international capital budgeting – key issues – unique cashflows – adjusted present value approach. foreign direct investment – motives – determinants – international portfolio diversification.
Unit 10	**Working Capital Management of the Multinational Firm:** international working capital management – international cash management – decentralized vs centralized cash management – bilateral vs multilateral netting – central cash pool.
Unit 11	**Option Contracts** American and European currency options, call and put option, option and risk management strategies. introduction to currency swap, foreign exchange risk management strategies through forward contracts, future contracts, money market hedges, and options contracts.
Unit 12	**Managing Foreign Operations**: ADRs; benefits and costs of ADR holdings for investors; benefits and costs of ADR issuance for corporations, external commercial borrowing and international refinancing, issues and challenges before multinational subsidiaries.
Unit 13	**Foreign Direct Investment and Cross Border Acquisitions:** global trends in FDI, benefits of investing overseas, political risk and FDI., cross border mergers and acquisitions.
Unit 14	**Country Risk Analysis-** nature of country risk assessment, techniques to assess country risk, raters of country risk, multinational capital budgeting: problems and issues in foreign investment analysis, techniques of multinational capital budgeting- NPV, IRR, APV.

READINGS:

1. SHAPIRO, A.C. (2013). MULTINATIONAL FINANCIAL MANAGEMENT. (10THED.). JOHN, INC.
2. BUCKLEY, A. (2009). MULTINATIONAL FINANCE. (5THED.). PEARSON EDUCATION.
3. LEVI, M.D. (2018). INTERNATIONAL FINANCE. (6TH ED.). ROUTLEDGE PUBLICATIONS
4. MADURA, J. (2018). INTERNATIONAL FINANCIAL MANAGEMENT. (13THED.). CENGAGE LEARNING INDIA PVT LTD.

Course Code	DEMGN801	Course Title	BUSINESS ANALYTICS	
			WEIGHTAGES	
			CA	ETE(Th.)
			30	70

Course Outcomes: Through this course, students will be able to

CO1: apply quantitative modelling and data analysis techniques to problems of real world

CO2: employ best practices in data visualization to develop charts, maps, tables, and other visual Representations techniques to communicate findings to diverse audiences

CO3: identify and describe complex business problems in terms of analytical models

CO4: apply appropriate analytical methods to find solutions to business problems that achieve stated Objective

Unit No.	Content
Unit 1	**Business analytics and summarizing business data:** Overview of business analytics: scope, application, R-studio environment for business analytics, basics of R: packages, vectors, datatypes and data structures
Unit 2	**Summarizing business data**: One variable and two variables statistics, concept of pipes operator, functions to summarize variables: select, filter, mutate, arrange, summarize and group by
Unit 3	**Business data visualization**: Basic graphs: bar-graph, line-chart, histogram, box and scatterplot, advanced data visualization: graphics for correlation, deviation, ranking, distribution and composition
Unit 4	**Business forecasting using time series**: Time series modelling, exploration of time series data using R, ARIMA, GARCH, VAR methodologies for time series analysis
Unit 5	**Business prediction using generalised linear models**: Logistic regression and statistical inference with application, survival analysis and its application
Unit 6	**Machine learning for businesses:** Supervised models: K-NN and decision trees, unsupervised models: K-means and hierarchical clustering, classification and prediction accuracy
Unit 7	**Text analytics for business**: Creating and refining text data, inferences through graphs, topic modelling and TDM analysis, sentiment analysis
Unit 8	**Business intelligence**: Introduction to business intelligence, role of data and data base management, role of data mining in business strategy
Unit 9	**Data visualization**: Role of visualization in business intelligence, introduction to charts, graphs and maps
Unit 10	**Data environment and preparation**: Managing metadata, extracts and live data, cross database joints and union
Unit 11	**Data blending**: Data prep with text and excel files, understating data types, extracting data from various file formats
Unit 12	**Design fundamentals and visual analytics**: Filters, sorting, groups and sets, interactive filters, forecasting, use of tooltip, reference line, parameter, drill down and hierarchies
Unit 13	**Decision analytics and calculations**: Types of calculations, logic calculations (including if comment, nested if command etc.), data calculations, string calculations

Unit 14	**Mapping**: Role of maps in business intelligence and visualization, editing unrecognized locations

READINGS:

1. R FOR EVERYONE: ADVANCED ANALYTICS AND GRAPHICS by JARED P. LANDER, PEARSON
2. VISUAL DATA STORYTELLING WITH TABLEAU by LINDY RYAN, PEARSON
3. TEXT MINING WITH R: A TIDY APPROACH by JULIA SILGE AND DAVID ROBINS, SHROFF PUBLISHERS & DISTRIBUTORS PVT. LTD
4. MASTERING TABLEAU by DAVID BALDWIN AND MARLEEN MEIER, PACKT PUBLISHING

Course Code	DEMKT505	Course Title	DIGITAL AND SOCIAL MEDIA MARKETING

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: define social media marketing goals necessary to achieve successful online campaigns.

CO2: describe the stages of the social media marketing strategy development process.

CO3: develop effective social media marketing strategies for various types of industries.

CO4: devise integrated social media marketing strategies using a variety of services, tools, and platforms to accomplish marketing objectives.

CO5: analyze the progress in achieving social media goals using a variety of powerful measurement tools, services, and metrics.

Unit No.	Content
Unit 1	**Evolution of digital marketing:** the digital consumer & communities online, digital marketing landscape.
Unit 2	**Search Engine Marketing:** Pay Per Click (PPC) and online advertising, search engine optimization and search engine marketing.
Unit 3	**Social media and consumer engagement**: Social feedback cycle, social web and engagement, operations and marketing connection.
Unit 4	**Customer engagement:** affiliate marketing & strategic partnerships, Email marketing, Content strategies.
Unit 5	**Social media marketing plan**: planning cycle, observing social media presence, conducting a competitive analysis, setting goals, determining strategies, monitoring.
Unit 6	**Social listening:** importance of social analytics, know your influencers, customer insights.
Unit 7	**Engagement on the social web:** permission vs. interruption marketing, initial entry strategy: passive vs. active, principles of success, rules of engagement, defining social media marketing ethics, global perspective
Unit 8	**Social networks:** marketing with social networks, white label social networks, the future of social networks
Unit 9	**Publishing blogs:** introduction to blogs, everyone is a publisher, marketing benefits of blogging, linking a blog to marketing objectives, creating a content strategy, tips for successful blogging, monitoring the blogsphere.
Unit 10	**Publishing podcasts and webinars:** creating and sharing podcasts, marketing with podcasting, hosting webinars, marketing with webinars and/or podcasts
Unit 11	**Sharing photos, images and videos:** marketing with photo sharing, marketing with online videos, how to create appealing video content, sharing online videos, encouraging user generated content
Unit 12	**Engagement on the social web:** permission vs. interruption marketing, initial entry strategy: passive vs. active, principles of success, rules of engagement, defining social media marketing ethics, global perspective
Unit 13	**Social networks:** marketing with social networks, white label social networks, the future of social networks

Unit 14	**Publishing blogs:** introduction to blogs, everyone is a publisher, marketing benefits of blogging, linking a blog to marketing objectives, creating a content strategy, tips for successful blogging, monitoring the blogsphere.

READINGS:

1. SOCIAL MEDIA MARKETING by DAVE EVANS & JAKE MCKEE
2. SOCIAL MEDIA MARKETING: A STRATEGIC APPROACH (BARKER ET AL.)
3. ADVANCED SOCIAL MEDIA MARKETING (TOM FUNK)

Course Code	DEFIN508	Course Title	INTERNATIONAL BANKING AND FOREX MANAGEMENT

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: understand the dimensions of international banking
CO2: establish legal and regulatory issues in international banking institutions
CO3: demonstrate foreign exchange market operations
CO4: analyze and understand the way in which the international financial system operates

Unit No.	Content
Unit 1	**International banking:** Global trends and developments in international banking, international financial centers, offshore banking units, SEZs, profitability of international banking operations
Unit 2	**Types of banking:** Correspondent banking and inter -bank banking, investment banking, wholesale banking, retail banking, merchant banking
Unit 3	**International institutions:** International financial institutions, legal and regulatory aspects, risk management
Unit 4	**International finance:** Fundamental principles of lending to MNCs, documentation and monitoring
Unit 5	**International agencies:** International credit policy agencies and global capital markets, raising resources
Unit 6	**Project finance:** Project and infrastructure finance, financing of mergers and acquisitions
Unit 7	**Foreign exchange evolution:** Meaning, elements, Importance, evolution of exchange rate system, International Monetary system, Gold standard
Unit 8	**Foreign exchange business:** Foreign exchange management act (FEMA), foreign exchange management philosophy, different types of exchange rates
Unit 9	**Regulations :** RBI and FEDAI role in regulating foreign exchange, rules regarding rate structure, cover operations, dealing room activities and risk management principles, correspondent bank arrangements
Unit 10	**Foreign banking products:** NRI customers various banking and investment products available under FEMA, remittance facilities
Unit 11	**International trade:** Regulations covering international trade, various aspects of international trade, government policies
Unit 12	**International regulating agencies:** DGFT and their schemes, customs procedures, banks' role in implementing these policies and schemes, wto-its impact
Unit 13	**Banking documents:** Balance of payment, balance of trade, current account and capital account convertibility, documents used in trade, role of banks in foreign trade, letters of credit
Unit 14	**Foreign exchange:** Exchange control relating to foreign trade, import and export finance, laws governing trade finance, role of EXIM bank, risks involved in foreign trade finance

READINGS:

1. INTERNATIONAL BANKING by P. SUBRAMANIAN, MACMILLAN
2. INTERNATIONAL BANKING OPERATIONS by B. Y. OLKAR, A. K. TRIVEDI, A. K. PATWARDHAN, A. R. PAWSE, MACMILLAN

Course Code	DEOPR639	Course Title	OPERATIONS MANAGEMENT AND RESEARCH

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: analyze how to optimally utilize the resources.

CO2: apply the concepts in solving real life problems.

CO3: adapt different opinions and make correct judgment.

CO4: select right decision-making tools.

Unit No.	Contents
Unit- 1	**Introduction to Operations Management**: introduction and scope of operation management, production of goods versus delivery of services, product-process matrix
Unit- 2	**Forecasting**: introduction, features and elements of forecasting, forecast based on judgment and opinion, forecast based on time- series data, associative forecasting techniques, concept of forecasting errors
Unit- 3	**Product and service design:** design process, product design, service design
Unit- 4	**Process selection and facility layout**: introduction, process types, product and service profiling, automation, facility layout, line balancing
Unit- 5	**Location planning and analysis**: need and nature of location decisions, factors that affect location decisions, evaluating location alternatives
Unit- 6	**Management of quality**: defining quality-dimensions of quality, determinants of quality, the cost of quality, quality tools, total quality management
Unit- 7	**Quality control**: inspection, control charts for variables (mean and range chart), control charts for attributes (p-chart, c-chart), run test
Unit- 8	**Inventory management**: nature and importance of inventories, inventory counting systems and inventory costs, economic production quantity, quantity discounts, EOQ model
Unit- 9	**Buying and sourcing in e-commerce**: definition e-sourcing and e- buying, typical e- sourcing cycle, barriers to successful e-sourcing deployment and how to overcome them, benefits of e-sourcing
Unit- 10	**Planning**: Aggregate Production Planning; Master Production Schedule and MRP, MRP-II, ERP
Unit- 11	**Maintenance**: Preventive maintenance, Breakdown maintenance, Replacement
Unit- 12	**Supply chain management**: need, elements and benefit of effective SCM, logistics and reverse logistics, requirements and steps for creating an effective supply chain, lean vs. agile supply chains
Unit- 13	**JIT and lean operations**: goals and building blocks of lean systems
Unit- 14	**Emerging issues in operations management**: Sustainable Operations Management, Trends in Operations Management

READINGS:

1. OPERATIONS MANAGEMENT by WILLIAM J STEVENSON, MCGRAW HILL EDUCATION
2. OPERATIONS MANAGEMENT by NORMAN GAITHER, GREGORY FRAZIER, CENGAGE LEARNING

Course Code	DEMKT517	Course Title	CUSTOMER RELATIONSHIP MANAGEMENT

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: develop an insight and new learning in the area of customer relationship management.

CO2: identify and respond to customers' needs, expectations and issues to build productive and rewarding relationships with customers.

CO3: discuss the conceptual foundations of relationship marketing and its implications for further knowledge development in the field of business.

CO4: develop a conceptual understanding and the knowledge pertaining to practical application for building and managing partnering relationships with customers and suppliers.

CO5: analyse how CRM is being used in consumer and business markets-implementation, management, benefits, problems and solutions.

Unit No.	Content
Unit-1	**Introduction to CRM:** definition, CRM as a business strategy, elements of CRM, processes and systems, entrance, applications and success of CRM.
Unit-2	**Conceptual Foundations:** evolution and benefits of CRM; building customer relationship and zero customer defection.
Unit-3	**Strategy and Organization of CRM:** customer-supplier relationships, CRM as an integral business strategy and the relationship-oriented organization.
Unit-4	**CRM Marketing Aspects:** customer knowledge, communication and multichannel, the individualized customer proposition and the relationship policy.
Unit-5	**Analytical CRM:** relationship data management, data analyses and datamining, segmentation and selections, retention and cross-sell analyses.
Unit-6	**Operational CRM:** call centre management, use of internet, website and applications of direct mail.
Unit-7	**CRM Systems and their Implementation:** CRM systems, implementation of CRM systems, and the future aspects.
Unit-8	**E-CRM:** application of e-CRM technologies-emails, websites, chat rooms, forums and other channels.
Unit-9	**CRM Process:** introduction and objectives of a CRM process, an insight into CRM and ECRTA and online CRM.
Unit-10	**Developing CRM Strategy:** role of CRM in business strategy and understanding service quality with regard to CRM.
Unit-11	**CRM Links in E-Business:** E-Commerce and customer relationships on the internet.
Unit-12	**Economics of Customer Relationship Management**: market share Vs customer share orientation, customer life time value and customer profitability.
Unit-13	**CRM Implementation:** choosing the right CRM solution and framework for implementing CRM.

Unit-14	**CRM Application in B2B and B2C Market:** importance of CRM in B2B and B2C market, benefits of B2C and B2B CRM, B2B and B2C application in banking and hospitality sectors.

READINGS:

1. CUSTOMER RELATIONSHIP MANAGMENT by ED PEELEN, PEARSON EDUCATION INDIA
2. THE CRM HANDBOOK- A BUSINESS GUIDE TO CUSTOMER RELATIONSHIP MANAGEMENT by JILL DYCHE, PEARSON EDUCATION INDIA.
3. CUSTOMER RELATIONSHIP MANAGEMENT-GETTING IT RIGHT by JUDITH W. KINCAID. PEARSON EDUCATION INDIA.

Course Code	DEFIN576	Course Title	SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

WEIGHTAGES	
CA	ETE(Th.)
30	70

Course Outcomes: Through this course, students will be able to

CO1: assess the characteristics of different Investment alternatives and how to trade in the stock market

CO2: apply different valuation models to find the intrinsic value of the shares

CO3: use the fundamental and technical analysis to predict the stock price movement

CO4: construct, revise and evaluate portfolios of different securities

Unit No.	Content
Unit-1	**Introduction to Security Analysis**: securities market structure, major Indian stock exchanges, stock exchange players, investment objectives, investment process, investment alternatives, investment alternatives evaluation and common error in investment process
Unit-2	**Risk and Return**: concept of return, measurement of return, concept of risk, types of risk, measurement of risk
Unit-3	**Equity valuation**: balance sheet valuation, dividend discount model, free cash flow model, earning multiplier approach
Unit-4	**Fixed Income and Other Investment Alternatives**: pricing, yields and risks of investments in fixed income securities, real estate, commodities, other alternative investments, strategies for investments in various investment alternatives
Unit-5	**Efficient Market Hypothesis:** forms of EMH, test for EMH, depository system, depository process and participants, calculation of sensex and nifty, listing of securities
Unit-6	**Fundamental Analysis**: industry analysis, economic analysis, company analysis, introduction to fundamental analysis, financial health
Unit-7	**Technical Analysis:** technical indicators, Dow Theory, fundamental v/s technical analysis, Elliot wave theory, chart patterns
Unit-8	**Portfolio Construction and Management**: portfolio risk, portfolio return, diversification, Markowitz model
Unit-9	**Portfolio Risk and Return Management**: portfolio risk and return with different correlations, efficient frontier, optimal portfolio
Unit-10	**Asset Pricing**: standard capital asset pricing model, capital asset pricing model, arbitrage pricing theory
Unit-11	**Derivative and Regulatory Aspect**: meaning and reasons of derivative trading, types of derivatives, forward, futures and options, regulation of derivative market
Unit-12	**Evaluation of Portfolio Performance**: Sharpe's performance index, Treynor's performance index, Jensen performance index
Unit-13	**Portfolio Revision**: active and passive management, rupee cost averaging, constant rupee plan, constant ratio plan, variable ratio plan
Unit-14	**Contemporary Issues in Investment**: fintech scope and challenges, algo trading issues and development, robo advisors, high frequency trade

READINGS:

1. SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT by K SASIDHARAN & ALEX K MATHEWS, MCGRAW HILLEDUCATION
2. SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT by PUNITHAVATHY PANDIAN, VIKAS PUBLISHING HOUSE