

ODL MCA

MASTER OF COMPUTER APPLICATIONS -

DATA SCIENCE

PROGRAMME GUIDE

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INTRODCUTION

Step into a realm of practicality within MCA classes, tailored to mirror real-world data science scenarios. Embrace cutting-edge specializations in data science, ensuring your education aligns with the dynamic and evolving landscape of technology.

PROGRAMME OUTCOMES

Program outcomes describe what students are expected to know and be able to do upon completion of the program, focusing on the skills, knowledge and professional behaviors acquired throughout the course:

1. **Industry Immersion for Data Science:** Engage in industry-oriented activities such as webinars, virtual labs and real-time case studies to explore data science applications and understand real-world business problems.
2. **Industry-Ready Graduates:** Equip students with in-demand data science skills including data analysis, machine learning, big data tools and AI to meet current and future industry needs.
3. **Holistic Development:** Participate in coding competitions, data hackathons, research-based projects and interactive activities to support comprehensive academic and personal growth.
4. **Data Science Projects:** Undertake capstone and course-based projects that emphasize practical skills in data preprocessing, visualization, modeling and deploying AI/ML solutions.
5. **Industry Collaboration:** Collaborate with industry experts through guest lectures, mentorship programs and internship opportunities to gain applied knowledge and workplace exposure.
6. **Professional Enhancement:** Strengthen communication, analytical thinking, problem-solving and team collaboration skills necessary for successful careers in data-driven roles.
7. **Data Science Tool Proficiency:** Gain hands-on experience with contemporary tools and platforms such as Python, R, SQL, Power BI, Tableau, Hadoop and Spark.
8. **Contemporary Curriculum in Data Science:** Master core computing areas including programming, databases, cloud computing and software engineering with a focused track in data science, AI and emerging technologies.

PROGRAMME SPECIFIC OUTCOMES

PSOs are statements that describe what students of a specific engineering program should be able to achieve upon completing the program.

1. **PSO1:** Master advanced data science concepts, including programming, data structures, databases, statistical modeling, machine learning and big data analytics.

2. **PS02:** Demonstrate proficiency in using data science tools and frameworks (e.g. Pandas, Spark) for data analysis, simulation and digital transformation.
3. **PS03:** Apply data science techniques to analyze, design and develop cost-effective, data-driven solutions for societal and industrial problems.
4. **PS04:** Create user-friendly, scalable solutions for web, mobile or cloud platforms using data science and analytics.
5. **PS05:** Utilize computational tools to implement machine learning and AI models for predictive analytics and domain-specific transformations.
6. **PS06:** Apply data science to analyze large datasets, uncover actionable insights and optimize decision-making processes.
7. **PS07:** Apply data science techniques to simulate real life industry problems.

SALIENT FEATURES

- **Virtual Industry Interactions:** Engage in online expert sessions, virtual industry talks and live case studies to explore Data Science applications, identify real-world challenges and learn cutting-edge immersive technologies.
- **Industry-Relevant Trainings:** Prepares students for data science careers with hands-on training in industry-standard tools and methodologies.
- **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 Data Science practices.
- **Industry Immersion:** Collaborations with industry through training, projects and guest lectures provide practical, real-world data science experience.
- **Professional Enhancement:** Offer Courses that help in enhancing professional skill sets and learning industry's ethical practices.

PROGRAMMECODE: DE16B4

DURATION OF THE PROGRAMME:

Minimum Duration 2 years

Maximum Duration 4 years

MEDIUM OF INSTRUCTION/EXAMINATION:

Medium of instruction and Examination shall be English.

**PROGRAMME STRUCTURE
MCA – DATA SCIENCE**

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 - DATA SCIENCE**

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#	
DEMT006	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
DEMT403	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
DECAP790	PROBABILITY AND STATISTICS	4	30	40	30
DECAP792	DATA SCIENCE TOOL BOX	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 OR 1 Course from the GE basket 1 which is not chosen as Generic Elective (GE).	4	30	0	70
	30		70	0	
TERM 4					
SEC-IV	SKILL ENHANCEMENT COURSE IV	4	30	70	0
DECAP794	ADVANCE DATA VISUALIZATION	4	30	40	30
DECAP737	MACHINE LEARNING	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								
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SR. No.	COURSE CODE	COURSE TITLE	Cr.	C A	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.	C A	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 Generic Elective (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

C01: apply theoretical foundation of software engineering in practical software development

C02: analyze the need of software maintenance activities

C03: discuss the software life cycle models

C04: apply software engineering practices to create complex software designs

C05: 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++
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WEIGHTAGES		
CA	ETE(Th.)	ETE (Pr.)
30	70	30

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

C01: understand the concepts of Object-oriented programming

C02: distinguish between the procedure-oriented and object-oriented programming languages

C03: apply the concept of file handling and exception handling mechanisms

C04: develop applications using the concepts of Object-oriented programming

C05: 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 specifier, 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

C01: Understand the various concepts of data warehousing like metadata, data mart, summary table, fact data and dimension data.

C02: Sail along with the various approaches in data mining.

C03: Familiarize with the various data warehousing and data mining tools.

C04: observe the various methods to extract knowledge using data mining techniques

C05: evaluate current trends in data mining such as web mining, spatial-temporal mining.

C06: apply different data mining methodologies with information systems.

C07: 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

C01: learn about Linux environment and basic Linux administration tasks.

C02: demonstrate comprehensive introduction to shell scripting/programming in LINUX.

C03: explain various basic Linux commands and C system programming and debugging techniques in Linux environment.

C04: analyze the usage of Linux utilities, organize directory structures, and develop useful shell scripts.

C05: 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: analyze 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
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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
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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

C01: learn the structure and model of the Java programming language

C02: understand the accessibility of fields and methods of an object through String and String Builder classes

C03: develop applications in Java programming language to solve problems

C04: evaluate user requirements for software functionality and assess its implementation in java

C05: implement Lambda functions.

C06: 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 specifier, 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. 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
C01: perceive advanced data structures and perform operations on them
C02: understand abstract data types and algorithmic complexity
C03: apply suitable data structure for solving problems
C04: implement hashing and collision resolution techniques
C05: 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

C01: apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

C02: identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

C03: analyze various cloud programming models and apply them to solve problems on the cloud.

C04: 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 HURWITZ, WILEY
3. CLOUD COMPUTING: IMPLEMENTATION, MANAGEMENT AND SECURITY by JOHN W. RITTINGHOUSE, AND JAMES F. RANSOME, CRC PRESS

Course code	DEMT403	Course Title	MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE	
			WEIGHTAGES	
			CA	ETE(Th.)
			30	70

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

C01: recall formal logical arguments of propositional logic

C02: perceive problem solving through the basics of combinatorics

C03: compare the basic discrete structures and algorithms

C04: apply the concepts of trees to find the shortest path

C05: infer properties of graphs and be able to relate these to practical examples

C06: 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

C01: understand the website layout creation using HTML language.

C02: apply the website planning, management and maintenance techniques

C03: apply dynamic website creation using JavaScript and Query

C04: illustrate logic implementation on a web page

C05: 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.
- .

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

C01: understand the basic structure and features of Python programming

C02: interpret object-oriented programming concepts such as encapsulation, inheritance and polymorphism as implemented in Python

C03: apply pandas and NumPy for data analysis

C04: implement machine learning algorithms

C05: analyze real-life situation specific problems and perceive solutions

C06: 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: strings, 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 seaborn, seaborn Vs matplotlib, data visualization using seaborn
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	DECAP790	Course Title	PROBABILITY AND STATISTICS		
			WEIGHTAGES		
			CA	ETE(Th.)	ETE (Pr.)
			30	40	30

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

CO1: experiment to carry out simple data investigations for categorical variables. They interpret and compare data displays. Students conduct chance experiments, list possible outcomes and recognize variations in results.

CO2: measure a random variable that describe randomness or an uncertainty in certain realistic situation

CO3: employ the different types of data and choose an appropriate way to display them.

CO4: identify and compare techniques for collecting data from primary and secondary sources, and identify questions and issues involving different data types

Unit No.	Content
Unit-1	Introduction to probability: Elements of Set Theory, Sample Space and Probability Measure, Statistical Independence, Conditional Probability, Counting Sample Points, Mutually and pair wise independent events, multiplication theorem of probability for independent events, Baye's theorem.
Unit-2	Introduction to statistics and data analysis: Statistical Inference, Samples, Populations and Experimental Design, Measures of Location: The Sample Mean and Median, Measures of Variability, Discrete and Continuous Data, Statistical Modeling, Scientific Inspection, and Graphical Diagnostics, Graphical Methods and Data Description, General Types of Statistical Studies.
Unit-3	Mathematical expectations: Definition, expected value of random variable, expected value of function of a random variable, properties of expectations, Various measures of Central Tendency, Dispersion, skewness and Kurtosis for continuous probability distribution, continuous distribution function, Variance, Properties of variance, covariance.
Unit-4	Moments: Chebyshev Inequality, Moments of Two or More Random Variables, Moments of Sums of Random Variables, Moment Generating Function, Properties of moment generating function, cumulants, Raw and central moments.
Unit-5	Relation between moments: raw moments & central moments, Effect of change of origin and scale on moments, Pearsonian coefficients Measures of skewness, kurtosis.
Unit-6	Correlation, regression and analysis of variance: Pearson's Correlation coefficient, Spearman's Rank correlation coefficient, Regression Concepts, Regression lines, Multiple correlation and regression, Analysis of Variance- One-way classification and two-way classification.
Unit-7	Standard distribution: Binomial, Poisson, Negative Binomial Distribution, Normal Distribution and their properties
Unit-8	Statistical quality control: Introduction, Process control, control charts for variables – X and R, X and S charts control, charts for attributes: p chart, np chart, c chart and their applications in process control
Unit-9	Index numbers: Learn about the need of index numbers, explain the different methods of constructing index numbers, evaluate the tests for judging the soundness of an index number.

Unit-10	Time series: Explain about time series, describe components of time series, and define measurement of variations of time series.
Unit-11	Sampling theory: Sampling Theory, Random Samples and random Numbers, Sampling with and without replacement, sampling distributions, sampling distribution of means, sampling distribution of properties, sampling distribution of differences and sum, standard errors, software demonstration of elementary sampling Theory.
Unit-12	Hypothesis testing: Definition of hypothesis, interpret statistical procedure of hypothesis testing, use application of hypothesis testing in several business contexts.
Unit-13	Tests of significance: Based On t, F and Z Distributions: -Student's (t) distribution, definition, properties, critical value of t, Application of t-distribution, Test for single mean, t-test for difference of mean, Fischer Z- transformation, F-statistic, critical value of F distribution, application.
Unit-14	Statistical tools and techniques: Bayesian Concepts, Bayesian Inferences, Bayes Estimates Using Decision Theory Framework, Statistical Tools: Excel, R-Studio and SPSS.

READINGS:

1. FUNDAMENTALS OF MATHEMATICAL STATISTICS by S.C. GUPTA AND V. K. KAPOOR, SULTAN CHAND & SONS (P) LTD.
2. PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS by RONALD E. WALPOLE, PEARSON

Course Code	DECAP792	Course Title	DATA SCIENCE TOOL BOX		
			WEIGHTAGE		
			CA	ETE(Th.)	ETE (Pr.)
			30	40	30

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

- C01:** understand the concept and need for data science.
C02: discuss the various phases in the data analytics lifecycle.
C03: analyze the fundamental areas of study in data science
C04: understand the concept of data preprocessing.
C05: understand the importance of data visualization.
C06: learn the various data visualization software and libraries.
C07: understand different types of machine learning techniques
C08: use Python for developing machine learning algorithms
C09: use various data science tools for developing algorithms

Unit No.	Content
Unit-1	Introduction to Data Science: Why learn data science?, Life cycle of data analytics: Data discovery, Data preparation, Model planning, Model building, Communicate results, Operationalization. Type of data analysis: Descriptive analysis, Diagnostic analysis, Predictive analysis, Prescriptive analysis, types of data analytics.
Unit-2	Data pre-processing: Introduction to data preprocessing, Data preprocessing, Data wrangling, Data types and forms, Possible data error types.
Unit-3	Various data preprocessing operations: Data cleaning, Data integration, Data transformation, Data reduction, Data discretization.
Unit-4	Data Plotting and Visualization: Introduction to data visualization, Visual encoding, Data visualization software, Data visualization libraries, Basic data visualization tools, Advanced data visualization tools, Data visualization types.
Unit-5	Role of statistics in data science: Hypothesis testing, null hypothesis, alternative hypothesis, Statistical significance: Type 1 and type 2 errors, Data science, p-value, ANOVA, Chi-square test.
Unit-6	Machine learning: Introduction, types of machine learning techniques, learning problems and system, designing a learning system, concept of learning task.
Unit-7	Unsupervised learning: Introduction to Clustering algorithms, K Means, K mode, K median, Performance measures of clustering.
Unit-8	Supervised learning: Introduction to Classification algorithms, KNN (k-nearest neighbors) algorithm, Naïve Bayes algorithm, cross-validation and metrics.
Unit-9	Regression models: Introduction to regression, types of regression, Machine linear regression, machine logistic regression, regularization, performance metrics.
Unit-10	Weka: Introduction to weka tool, Data import, Choose model (algorithm), Hands on analysis of clustering and classification algorithms.
Unit-11	Excel data analysis: Introduction to excel data analysis, Data analysis tool pack, Descriptive statistics, Analysis of variance (ANOVA), Regression, Histogram.
Unit-12	R tool: Introduction R, RStudio, Some important R data structures: Vectors, character strings, Matrices, Lists, Dataframe, R programming structure.

Unit-13	NumPy and Pandas: Introduction to python, NumPy, understanding data types in python, Pandas for data analysis, data indexing and selection: Data selection in series, Data selection in DataFrame, Missing data in Pandas, Handling missing data
Unit-14	Machine learning packages in python: Data import, Visualization with Matplotlib, simple line and scatter plots, Seaborn, heatmap, Introducing Sci-kit learn package.

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. NORMAN MATLOFF, "THE ART OF R PROGRAMMING", NO STARCH PRESS, 2011.
2. JASON BELL, "MACHINE LEARNING: HANDS-ON FOR DEVELOPERS AND TECHNICAL PROFESSIONALS", WILEY PUBLICATION, 2015
3. JAKE VANDERPLAS, "PYTHON DATA SCIENCE HANDBOOK", O'REILLY, 2017.
4. ALEXANDER LOTH, NATE VOGEL AND SOPHIE SPARKES, "VISUAL ANALYTICS WITH TABLEAU", WILEY, 2019.
5. GYPSY NANDI AND RUPAM KUMAR SHARMA, "DATA SCIENCE FUNDAMENTALS AND PRACTICAL APPROACH", BPB PUBLISHER, 2020.
6. KENNETH CUKIER AND VIKTOR MAYER-SCHÖNBERGER, BIG DATA: A REVOLUTION THAT WILL TRANSFORM HOW WE LIVE, WORK, AND THINK, HODDER AND STOUGHTON, 2013.
7. DANIEL T. LAROSE , CHANTAL D. LAROSE, DATA MINING AND PREDICTIVE ANALYTICS, SECOND ED., WILEY PUBLICATION, 2015
8. BERTT LANTZ, MACHINE LEARNING WITH R: EXPERT TECHNIQUES FOR PREDICTIVE MODELING, 3RD EDITION, APRIL 15, 2019.

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	DECAP737	Course Title	MACHINE LEARNING		
			WEIGHTAGES		
			CA	ETE(Th.)	ETE (Pr.)
			30	40	30

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

C01: apply python libraries for data analysis and machine learning model development

C02: evaluate important features from a given dataset

C03: apply machine learning models for real world problems

C04: evaluate the performances of different machine learning models

Unit No.	Content
Unit- 1	Introduction to Machine Learning: History of Machine Learning, Basic definitions, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Issues in machine learning, Different Applications of Machine learning.
Unit- 2	Python Basics: Introduction to Python, Jupiter Notebook, and Python packages for data Science.
Unit- 3	Data Pre-processing: Introduction to Data Analysis, Importing and Exporting Data in python, Data wrangling, Exploratory Data Analysis.
Unit- 4	Pre-processing Implementation in python
Unit- 5	Regression: Simple Linear Regression, Multiple Linear Regression, Non-Linear Regression, A mathematical formulation of Regression models, Model Evaluation in Regression Models.
Unit- 6	Regression Implementation: Implementation and performance analysis of Linear Regression, Multi Regression, Non-Linear Regression
Unit- 7	Classification: Classification Problems, Decision Boundaries, K-Nearest Neighbours, Decision Trees, Building Decision Tree, Training and Visualizing a Decision Tree.
Unit- 8	Classification Algorithms: Logistic Regression, Support Vector Machine, Margin, Kernel function and Kernel SVM.
Unit- 9	Classification Implementation: Implementation and performance analysis of KNN, SVM and Logistic Regression
Unit- 10	Clustering: Introduction, K-Means Algorithm, A mathematical formulation of the K-Means algorithm, Hierarchal Clustering.
Unit- 11	Ensemble methods: Bagging, random forests, boosting.
Unit- 12	Clustering Implementation: Implementation and performance analysis of k-Means and Hierarchal Clustering, Implement and compare any two ensemble-based machine learning approaches on different datasets.
Unit- 13	Neural network: Biological Structure of a Neuron, Perceptron, multilayer networks and back propagation, introduction to deep neural Networks, Evaluation Metrics of machine learning models.
Unit- 14	Neural network Implementation: Design of an Artificial Neural Network for given dataset, Implement and compare the performances of any three-machine learning based classification models on different datasets

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

C01: observe the basic concepts of reasoning and quantitative aptitude

C02: apply the learned concepts to solve the company specific reasoning and quantitative aptitude tests

C03: analyze the problem and use logic to interpret and handle different situations

C04: understand the concepts to solve the problems in given time

C05: reproduce the concepts and use it to solve the applications

C06: 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 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	DEPEA516	Course Title	ANALYTICAL SKILLS-II
			WEIGHTAGES
			CA
			ETE(Th.)
			30
			70

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

C01: apply logical reasoning to understand, interpret and handle different situations.

C02: solve efficiently the company specific logical reasoning tests.

C03: apply logical reasoning to prioritize and manage time.

C04: decide to build the logic

C05: examine the problem and handle it

C06: 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	DEMG581	Course Title	ORGANISATIONAL BEHAVIOUR AND HUMAN RESOURCE DYNAMICS
			WEIGHTAGES
			CA
			ETE(Th.)
			30
			70

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

C01: enumerate the concept of management practices and organizational behavior

C02: develop and sharpen acumen of how different management thoughts can be used to improve organization functioning

C03: analyze the importance of management practices and important organizational behavior dimensions at different levels of organization

C04: appraise the dynamics of industrial relations and to manage them as per statutory regulations

C05: 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 VARKEY, 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

C01: analyze and respond to environmental and competitive changes, their impact on marketing planning, strategies and practices

C02: apply the conceptual frameworks, theory and techniques to various marketing contexts

C03: prepare marketing and sales plan appropriate to the needs of customers and contexts

C04: 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

C01: analyze business environment and trends to take decisions with respect to international business operations

C02: interpret and apply international trade theories in international business operations

C03: identify and critically analyse the role of foreign exchange market and usage of fundamental instruments for currency exchange

C04: develop skills on analysing the business data, and problem solving in other functional areas such as marketing, business strategy and human resources

C05: develop responsiveness to contextual social issues or problems and exploring solutions, understanding business ethics and resolving ethical dilemmas

C06: identify aspects of the global business and cross-cultural understanding

Unit No.	Content
Unit-1	Overview of international business environment: Globalization and international Business; introduction to international business, types of 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 centers, 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 Labour Conditions, Ethics and the Environment, legislation for anti-competitive and unfair trade practices

READINGS:

1. DANIELS, RADEBAUGH, SULLIVAN & SALWAN, INTERNATIONAL BUSINESS ENVIRONMENTS AND OPERATIONS
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

C01: understand the implications of consumer behaviour concepts & theories for businesses and wider society.

C02: discern how individuals and groups influence consumer behaviour, and how marketers utilize this knowledge to help achieve organizational objectives.

C03: analyse the dynamic interplay of internal and external factors influencing consumer behaviour and accordingly develop a marketing strategy.

C04: articulate practical and comprehensive managerial understanding of consumer behaviour.

C05: 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 STRATEGY by DEL I HAWKINS, DAVID L MOTHERSBAUGH, & 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 investor scenario.

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

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

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

C01: define social media marketing goals necessary to achieve successful online campaigns.

C02: describe the stages of the social media marketing strategy development process.

C03: develop effective social media marketing strategies for various types of industries.

C04: devise integrated social media marketing strategies using a variety of services, tools, and platforms to accomplish marketing objectives.

C05: 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 blogosphere.

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, ACMILLAN

Course Code	DEOPR639	Course Title	OPERATIONS MANAGEMENT AND RESEARCH
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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 HILL EDUCATION
2. SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT by PUNITHAVATHY PANDIAN, VIKAS PUBLISHING HOUSE