

**ODL MCA**

**MASTER OF COMPUTER APPLICATIONS -  
AR/VR (GAME DEVELOPMENT)**

**PROGRAMME GUIDE**

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## INTRODCUTION

Immerse yourself in a transformative MCA programme tailored for augmented reality (AR) and virtual reality (VR) technologies. This curriculum bridges theoretical learning with practical, real-world AR/VR applications, equipping students with skills aligned with the rapidly evolving immersive technology landscape.

## PROGRAMME OUTCOMES

Programme outcomes outline the competencies, knowledge and behaviors students will master by graduation, specifically tailored to AR/VR expertise.

- 1. Analysis & Design of AR/VR Solutions:** Apply computer science principles to design and solve complex problems in AR/VR environments.
- 2. Immersive Coding Skills:** Develop and implement AR/VR applications using specialized programming tools and simulation platforms.
- 3. Ethics in Immersive Technology:** Uphold ethical standards in AR/VR development, ensuring responsible and societal-focused innovations.
- 4. Communication:** Effectively articulate AR/VR project findings, create comprehensive design documentation and deliver clear presentations.
- 5. Societal Impact:** Leverage advanced AR/VR concepts to contribute to sustainable, socially impactful solutions.
- 6. Individual and Team Work:** Excel as an individual contributor or team member in multidisciplinary AR/VR projects.
- 7. Life-long Learning:** Stay adaptable and prepared for continuous learning to keep pace with advancements in AR/VR technologies.

## PROGRAMME SPECIFIC OUTCOMES

PSOs define the specialized capabilities AR/VR MCA graduates will possess:

- 1. PSO1:** Master advanced programming, data structures, databases, networking, and AR/VR-specific tools for immersive application development.
- 2. PSO2:** Demonstrate proficiency in computational tools for AR/VR simulation and digital transformation.
- 3. PSO3:** Apply AR/VR technologies to design cost-effective, impactful solutions for societal challenges.
- 4. PSO4:** Develop user-friendly AR/VR, mobile, web or cloud-based applications tailored to societal needs.
- 5. PSO5:** Utilize computational tools to integrate machine learning (ML) and artificial intelligence (AI) into AR/VR solutions.

6. **PS06:** Create immersive AR/VR experiences using advanced computer science concepts and simulation tools.
7. **PS07:** Simulate cyber threats in virtual environments and develop robust defense mechanisms for AR/VR systems.

### SALIENT FEATURES

- **Virtual Industry Interactions:** Engage in online expert sessions, virtual industry talks and live case studies to explore AR/VR applications, identify real-world challenges and learn cutting-edge immersive technologies.
- **Industry-Relevant Trainings:** Equip students with AR/VR-specific skills to meet industry demands in immersive technology sectors.
- **Holistic Development:** Foster well-rounded growth through participation in sports, cultural activities and professional enhancement initiatives.
- **Project Driven Learning:** Learning via real-life projects to gain experiential learning on AI/ML practices.
- **Professional Enhancement:** Offer Courses that help in enhancing professional skill sets and learning industry's ethical practices.
- **Contemporary AR/VR Curriculum:** Deliver in-depth knowledge in AR/VR by gaining expertise in core computing areas like programming, databases and web development with a special focus on AR/VR and mobile app integration.

**PROGRAMMECODE: DE16B4**

**DURATION OF THEPROGRAMME:**

**Minimum Duration** 2 years

**Maximum Duration** 4 years

**MEDIUM OF INSTRUCTION/EXAMINATION:**

Medium of instruction and Examination shall be English.

**PROGRAMME STRUCTURE**  
**MCA - AR/VR (GAME DEVELOPMENT)**

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

**PROGRAMME SCHEME  
MCA - AR/VR (GAME DEVELOPMENT)**

COURSE CODE	COURSE TITLE	Cr.	CA	ETE (Theory)	ETE (Practical)
<b>TERM 1</b>					
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#		
<b>#Bridge courses are applicable only to candidates having no Computers or Mathematics background. Further details are provided on Page 8.</b>					
<b>TERM 2</b>					
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
<b>TERM 3</b>					
DECAP776	PROGRAMMING IN PYTHON	4	30	40	30
SEC-III	SKILL ENHANCEMENT COURSE III	4	30	40	30
DECAP473	GAME DEVELOPMENT USING UNITY ENGINE	4	30	40	30
DECAP824	UNREAL PROGRAMMING USING C++	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	4	30	0	70
	1 Course from the GE basket 1 which is not chosen as Generic Elective (GE).		30	70	0
<b>TERM 4</b>					
SEC-IV	SKILL ENHANCEMENT COURSE IV	4	30	70	0
DECAP825	GAME AI & REINFORCEMENT LEARNING	4	30	40	30
DECAP826	VIRTUAL REALITY AND AUGMENTED REALITY IN GAME DEVELOPMENT	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
<b>TOTAL CREDITS</b>			<b>104</b>		

**SKILL ENHANCEMENT COURSES (SEC) BASKET**

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

**GENERIC ELECTIVE (GE) BASKET 1**

SR. No.	COURSE CODE	COURSE TITLE	Cr.	CA	ETE (Theory)	ETE (Practical)	ELECTIVE AREA	TERM
1	DEMGN581	ORGANIZATIONAL BEHAVIOUR AND HUMAN RESOURCE DYNAMICS	4	30	70	0	GENERAL MANAGEMENT	3
2	DEMKT503	MARKETING MANAGEMENT	4	30	70	0	MARKETING	3
3	DEFIN542	CORPORATE FINANCE	4	30	70	0	FINANCE	3

**GENERIC ELECTIVE (GE) BASKET 2**

SR. No.	COURSE CODE	COURSE TITLE	Cr.	CA	ETE (Theory)	ETE (Practical)	ELECTIVE AREA	TERM
1	DEMGN578	INTERNATIONAL BUSINESS ENVIRONMENT	4	30	70	0	GENERAL MANAGEMENT	3
2	DEMKT509	CONSUMER BEHAVIOUR	4	30	70	0	MARKETING	3
3	DEFIN548	INTERNATIONAL FINANCIAL MANAGEMENT	4	30	70	0	FINANCE	3

**GENERIC ELECTIVE (GE) BASKET 3**

SR. No.	COURSE CODE	COURSE TITLE	Cr.	CA	ETE (Theory)	ETE (Practical)	ELECTIVE AREA	TERM
1	DEMGN801	BUSINESS ANALYTICS	4	30	70	0	GENERAL MANAGEMENT	4
2	DEMKT505	DIGITAL AND SOCIAL MEDIA MARKETING	4	30	70	0	MARKETING	4
3	DEFIN508	INTERNATIONAL BANKING AND FOREX MANAGEMENT	4	30	70	0	FINANCE	4

**GENERIC ELECTIVE (GE) BASKET 4**

SR. No.	COURSE CODE	COURSE TITLE	Cr.	CA	ETE (Theory)	ETE (Practical)	ELECTIVE AREA	TERM
1	DEOPR639	OPERATIONS MANAGEMENT AND RESEARCH	4	30	70	0	GENERAL MANAGEMENT	4
2	DEMKT517	CUSTOMER RELATIONSHIP MANAGEMENT	4	30	70	0	MARKETING	4
3	DEFIN576	SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT	4	30	70	0	FINANCE	4

**Note:**

1. Students can opt only one area from discipline specific elective basket that will be applicable for the whole program.
2. Students can opt only one area from generic elective basket that will be applicable for the whole program.
3. In case of Seminar on Summer Training, student may choose one Course from the GE basket 1 which is not chosen as Generic Elective (GE) area.
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 1<sup>st</sup> 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

<b>Course code</b>	<b>DECAP437</b>	<b>Course Title</b>	<b>SOFTWARE ENGINEERING PRACTICES</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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

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

<b>Course code</b>	<b>DECAP444</b>	<b>Course Title</b>	<b>OBJECT-ORIENTED PROGRAMMING USING C++</b>
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<b>WEIGHTAGES</b>		
<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
<b>30</b>	<b>70</b>	<b>30</b>

**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

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

<b>Course code</b>	<b>DECAP446</b>	<b>Course Title</b>	<b>DATA WAREHOUSING AND DATA MINING</b>
			<b>WEIGHTAGES</b>
			<b>CA</b>
			<b>ETE(Th.)</b>
			<b>30</b>
			<b>70</b>

**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 ware housing 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.

<b>Unit No.</b>	<b>Contents</b>
<b>Unit 1</b>	<b>Data Warehousing and Online Analytical Processing:</b> Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation
<b>Unit 2</b>	<b>Introduction to data mining:</b> 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
<b>Unit 3</b>	<b>Data Warehousing Architecture:</b> 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.
<b>Unit 4</b>	<b>Installation and development environment overview:</b> Downloading and installing Rapid miner and WEKA tool from source websites, Installing Rapid miner and WEKA tool on your windows computer
<b>Unit 5</b>	<b>Introduction to mining tools:</b> Introduction to Rapid miner, Introduction to WEKA tool, features of tools, Comparison between Rapid Miner and WEKA, Overview of interface.
<b>Unit 6</b>	<b>Extracting Data Sets:</b> 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
<b>Unit 7</b>	<b>Data Preprocessing:</b> Data cleaning, Data integration and transformation, Data reduction, Discretization and concept hierarchy generation
<b>Unit 8</b>	<b>Data Pre-processing using rapid miner:</b> 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
<b>Unit 9</b>	<b>Association and Correlation Analysis:</b> 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

<b>Unit 10</b>	<b>Clustering Algorithms and Cluster Analysis:</b> 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
<b>Unit 11</b>	<b>Classification:</b> 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
<b>Unit 12</b>	<b>Prediction and Classification using WEKA Tool:</b> 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
<b>Unit 13</b>	<b>Clustering methods using WEKA Tool:</b> Introduction to clustering, Introduction to Clustering algorithms, Differentiate clustering and classification, K-means clustering, Hierarchical clustering algorithm,
<b>Unit 14</b>	<b>Applications of Data Warehousing and Data Mining:</b> 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

<b>Course code</b>	<b>DECAP448</b>	<b>Course Title</b>	<b>LINUX AND SHELL SCRIPTING</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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.

<b>Unit No.</b>	<b>Contents</b>
<b>Unit- 1</b>	<b>Getting started with Linux:</b> The History of UNIX and GNU-Linux, What Is So Good About Linux, Overview of Linux, Additional Features of Linux
<b>Unit- 2</b>	<b>Installation Guide:</b> 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.
<b>Unit- 3</b>	<b>Connecting to Internet:</b> Network interfacing tool, Connecting to LAN, DNS (Static and Dynamic connection).
<b>Unit- 4</b>	<b>Installing software:</b> RPM management tool, Querying RPM packages, Package installation in TAR format, Adding & removing packages.
<b>Unit- 5</b>	<b>Utilities:</b> Basic Utilities, Working with Files, Pipe, Four More Utilities, Compressing and Archiving Files, Locating Commands
<b>Unit- 6</b>	<b>File Systems:</b> Obtaining User and System Information, Communicating with Other Users, Directory Files and Ordinary Files, Pathnames, Working with Directories, Access Permissions, Access Control Lists, Links.
<b>Unit- 7</b>	<b>The Shell and popular editors:</b> 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
<b>Unit- 8</b>	<b>The Bourne Again Shell and TC Shell:</b> 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
<b>Unit- 9</b>	<b>Programming the Bourne Again Shell:</b> Control Structures, File Descriptors, Parameters and Variables, Built-in Commands, Expressions
<b>Unit- 10</b>	<b>Linux System Administration:</b> 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.
<b>Unit- 11</b>	<b>Web Server Configuration:</b> Apache Web Server, Installing Apache, Configuring Web server, Starting Apache, Setting up first web page.
<b>Unit- 12</b>	<b>File Server Configuration:</b> FTP protocol, Starting FTP server, Using FTP server, Using FTP client to test anonymous read access, Testing FTP server.
<b>Unit- 13</b>	<b>Samba Servers:</b> 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

<b>Course code</b>	<b>DECAP453</b>	<b>Course Title</b>	<b>DATA COMMUNICATION AND NETWORKING</b>
			<b>WEIGHTAGES</b>
			<b>CA</b>
			<b>ETE(Th.)</b>
			<b>30</b>
			<b>70</b>

**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

<b>Unit No.</b>	<b>Contents</b>
<b>Unit 1</b>	<b>Introduction to data communication and computer networks:</b> 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.
<b>Unit 2</b>	<b>Data and signals:</b> Analog and digital data, Analog and digital signals, transmission impairments and performance metrics and transmission modes: simplex, half duplex and full duplex.
<b>Unit 3</b>	<b>3 Digital and Analog Transmission:</b> digital transmission: line coding, modulation: PCM, DM, ASK, FSK, PSK, amplitude, frequency and phase modulation.
<b>Unit 4</b>	<b>Network models:</b> 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.
<b>Unit 5</b>	<b>Physical layer:</b> 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
<b>Unit 6</b>	<b>Data link layer - error and flow control:</b> 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.
<b>Unit 7</b>	<b>Data link layer - medium access control protocols:</b> 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.
<b>Unit 8</b>	<b>Network layer - logical addressing:</b> 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).
<b>Unit 9</b>	<b>Network layer - routing:</b> 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.

<b>Unit 10</b>	<b>Transport layer - protocols:</b> 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
<b>Unit 11</b>	<b>Transport layer - congestion control and QoS:</b> General principles of congestion control, congestion avoidance and prevention policies; quality of service- types of traffic, traffic shaping, leaky bucket algorithm, token bucket algorithm.
<b>Unit 12</b>	<b>Application layer - services and protocols:</b> 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).
<b>Unit 13</b>	<b>Internet and WWW:</b> 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.
<b>Unit 14</b>	<b>Network Security:</b> 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.

<b>Course code</b>	<b>DECAP012</b>	<b>Course Title</b>	<b>FUNDAMENTALS OF COMPUTER AND C PROGRAMMING</b>
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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

<b>Unit No.</b>	<b>Contents</b>
<b>Unit 1</b>	<b>Computer Fundamentals:</b> Characteristics & Generation of Computers, Block diagram of Computer. Application of IT in various sectors. I/O Devices. <b>Memory:</b> Types, Units of memory, RAM, ROM, Secondary storage devices – HDD, Flash Drives and Optical Disks: DVD, SSD.
<b>Unit 2</b>	<b>Operating Systems:</b> 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.
<b>Unit 3</b>	<b>Data Communications:</b> Introduction to Data Communication: Definition and advantages, Types of Networks, Network topologies, Transmission Media, Modems.
<b>Unit 4</b>	<b>Data Base Management Systems:</b> Introduction to Database Management System, Components of DBMS, Database Vs. Tables, Data Models, Relational Model, Basics of RDBMS and SQL.
<b>Unit 5</b>	<b>Basics of C Language:</b> Machine Language, Assembly Language, High Level Languages, C Program Structure, Character Set, Identifiers and Keywords, Constants and Variables.
<b>Unit 6</b>	<b>Unformatted and Formatted I/O:</b> Functions- printf(), scanf(), getchar(), putchar(), gets(), puts(), Expressions.
<b>Unit 7</b>	<b>Data Types &amp; Operators:</b> Various data types - data range, size, Unary and Binary operators, Arithmetic Operators, Relational Operators, Logical Operators, Conditional Operators, Assignment Operator, Bitwise Operators.
<b>Unit 8</b>	<b>Control Structure:</b> 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.
<b>Unit 9</b>	<b>Looping Statements:</b> While, do-while & for statements, break and continue statements, goto statement.
<b>Unit 10</b>	<b>Functions:</b> 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.
<b>Unit 11</b>	<b>Arrays:</b> Declaring arrays in C, Defining and Processing of 1-dimensional and 2-dimensional arrays, Passing array as an argument to function, Multi-dimensional Arrays.
<b>Unit 12</b>	<b>Array Applications</b> - Sorting and Searching, Character Arrays.
<b>Unit 13</b>	<b>Strings</b> : Defining and Initializing strings, Reading and Writing strings, Processing of strings, String Library Functions - strcat(), strcpy(), strcmp(), strlen(), strrev().
<b>Unit 14</b>	<b>Storage Classes:</b> 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

<b>Course code</b>	<b>DEMT006</b>	<b>Course Title</b>	<b>ELEMENTARY MATHEMATICS</b>
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**Course Outcome: 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.

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

<b>Course code</b>	<b>DECAP615</b>	<b>Course Title</b>	<b>PROGRAMMING IN JAVA</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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

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

#### **Laboratory Work:**

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

#### **READINGS:**

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

<b>Course code</b>	<b>DECAP770</b>	<b>Course Title</b>	<b>ADVANCED DATA STRUCTURES</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**Course Outcome:** 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

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

<b>Course Code</b>	<b>DECAP456</b>	<b>Course Title</b>	<b>INTRODUCTION TO BIG DATA</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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.

<b>Unit No.</b>	<b>Contents</b>
<b>Unit 1</b>	<b>Introduction to Big Data:</b> Big Data and its importance, The V's of Big Data, Challenges and Applications of Big Data, Tools used in Big Data Scenario.
<b>Unit 2</b>	<b>Foundations for Big Data:</b> Distributed file system, scalable computing over internet, programming models for big data.
<b>Unit3</b>	<b>Data Models:</b> Data model vs. data format, data stream, understanding data lakes, exploring streaming sensor data.
<b>Unit 4</b>	<b>NoSQL Data Management:</b> 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.
<b>Unit 5</b>	<b>Introduction to Hadoop:</b> 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.
<b>Unit 6</b>	<b>Hadoop Administration:</b> Hadoop - Environment Setup, Hadoop - HDFS Overview, Starting HDFS, Hadoop - Command Reference.
<b>Unit 7</b>	<b>Hadoop Architecture:</b> 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.
<b>Unit 8</b>	<b>Hadoop Master Slave Architecture:</b> Hadoop – Map Reduce, Hadoop – Streaming, Hadoop – Multi Node Cluster, Creating User Account, Configuring Key Based Login, Installing Hadoop and Configuring Hadoop on Master Server.
<b>Unit 9</b>	<b>Hadoop Node Commands:</b> 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.
<b>Unit 10</b>	<b>Map Reduce Applications:</b> 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.
<b>Unit 11</b>	<b>Hadoop Ecosystem:</b> 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.
<b>Unit 12</b>	<b>Predictive Analytics:</b> Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations, Visual data analysis techniques, interaction techniques, Systems and applications
<b>Unit 13</b>	<b>Data Analytics with R:</b> Machine Learning, Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Big Data Analytics with Big R.

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

<b>Course Code</b>	<b>DECAP470</b>	<b>Course Title</b>	<b>CLOUD COMPUTING</b>				
			<b>WEIGHTAGES</b>				
			<table border="1"> <tr> <td style="text-align: center;"><b>CA</b></td> <td style="text-align: center;"><b>ETE(Th.)</b></td> </tr> <tr> <td style="text-align: center;"><b>30</b></td> <td style="text-align: center;"><b>70</b></td> </tr> </table>	<b>CA</b>	<b>ETE(Th.)</b>	<b>30</b>	<b>70</b>
<b>CA</b>	<b>ETE(Th.)</b>						
<b>30</b>	<b>70</b>						

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

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

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

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

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

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

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

**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

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

<b>Course code</b>	<b>DECAP472</b>	<b>Course Title</b>	<b>WEB TECHNOLOGIES</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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

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

<b>Course code</b>	<b>DECAP776</b>	<b>Course Title</b>	<b>PROGRAMMING IN PYTHON</b>		
			<b>WEIGHTAGE</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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

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

<b>Course code</b>	<b>DECAP473</b>	<b>Course Title</b>	<b>GAME DEVELOPMENT USING UNITY ENGINE</b>		
			<b>WEIGHTAGES</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

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

**CO1:** analyze game requirements and mechanics to create effective design documents and demonstrate comprehension

**CO2:** demonstrate proficiency in using Unity game engines to develop interactive game environments

**CO3:** apply scripting fundamentals in C# to implement game logic and decision-making

**CO4:** exhibit a comprehensive skill set in game development, enabling them to create immersive and interactive game experiences across platforms

<b>Unit No.</b>	<b>Content</b>
<b>Unit 1</b>	<b>Introduction to Game Design:</b> Game Design Fundamentals: Understanding Game Requirements, Mechanics, and Storytelling, Game Design Documentation: Creating Effective Design Documents for Game Development, Introduction to Game Engines: Engine Concepts and Development Tools, Unity Engine Basics: Introducing Unity, IDE Basics, and Unity Concepts
<b>Unit 2</b>	<b>Game Design Principles and Theory:</b> Exploring Game Design Principles and Philosophies, <b>Game Analysis:</b> Analyzing Existing Games and Extracting Design Lessons
<b>Unit 3</b>	<b>Scripting Fundamentals:</b> Basics of C# Language Concepts and Creating Scripts, Game Logic and Decision Making: Understanding Game Loops, Decision Making, and Functions, Variable Management: Variable Scope and Access, Displaying Data in Games
<b>Unit 4</b>	<b>Movement and Physics:</b> Implementing Simple Movements and Rotations, Introduction to Physics: Understanding 2D/3D Physics Concepts and Rigidbody Components, Handling Input: Input Handling in Unity and Scripting Input-Based Interactions
<b>Unit 5</b>	<b>Game Object Management:</b> Organizing Game Objects: Parent-Child Relationships, Prefabs, and Object Hierarchy, Object Lifecycle: Creating, Destroying, Activating, and Deactivating Objects, Advanced Object Control: Controlling Object Lifespans and Behavior with Invoke and Coroutines
<b>Unit 6</b>	<b>World Building and Audio:</b> Building Virtual Worlds: Setting Boundaries, Creating Tile-Based Environments, and Mini-Maps, Audio Integration: Adding Sound Files, Scripting Sounds, and Implementing Simple Unity Animations, Animation and Interaction: Using Animator States, Scripting Animations, and Integrating Animations with Colliders
<b>Unit 7</b>	<b>Artificial Intelligence:</b> AI Fundamentals: Understanding Artificial Intelligence Concepts, Flowcharts, and Algorithms, Scripting AI: Implementing Basic AI Behavior in Games
<b>Unit 8</b>	<b>User Interfaces:</b> Introduction to UI: Unity UI Controls, Buttons, and Design Concepts, Advanced UI: Implementing Other UI Controls and Designing Effective User Interfaces
<b>Unit 9</b>	<b>Advanced Scripting and Interactivity:</b> Advanced Scripting Techniques: Script Optimization, Event Handling, and Code Organization, Interactive Gameplay: Implementing Player Feedback Systems, Game Object Interactions, and Environmental Effects
<b>Unit 10</b>	<b>Optimization and Performance:</b> Performance Optimization: Profiling and Optimizing Game Performance, Memory Management: Understanding Memory Usage and

	Optimization Techniques
<b>Unit 11</b>	<b>Multiplatform Publishing:</b> Publishing Basics: Publishing Games to PC, Mac, and Linux Computers, Mobile Publishing: Publishing Games to Smartphones and Tablets, Console Publishing: Publishing Games to Game Consoles
<b>Unit 12</b>	<b>Networking and Multiplayer:</b> Networking Fundamentals: Understanding Networked Game Architecture and Concepts, Multiplayer Implementation: Implementing Basic Multiplayer Functionality in Games
<b>Unit 13</b>	<b>Advanced Game Development Topics:</b> Procedural Content Generation: Generating Dynamic Game Content Using Algorithms, Advanced Physics: Implementing Complex Physics Interactions and Simulations
<b>Unit 14</b>	<b>Final Project and Portfolio Development:</b> Capstone Project: Developing a Complete Game Project from Concept to Delivery, Portfolio Development: Building a Professional Portfolio Showcasing Game Projects and Skills

### LABORATORY WORK:

1. Students will create a comprehensive design document for a game concept, outlining game requirements, mechanics, and storytelling elements.
2. Students will familiarize themselves with Unity by creating a simple game project, exploring IDE basics, and understanding key Unity concepts such as scenes, game objects, and components.
3. Students will practice writing scripts in C# to implement basic game logic, decision-making, and variable management, and display relevant data in a Unity project.
4. Students will implement simple object movements, rotations, and basic physics interactions using Unity's Rigidbody components and scripting.
5. Students will learn to organize game objects effectively using parent-child relationships, prefabs, and object hierarchy in Unity.
6. Students will integrate sound files, and script sounds, and implement simple animations in Unity, enhancing the audio-visual aspects of their game projects.
7. Students will implement basic AI behavior in games using flowcharts, algorithms, and scripting techniques in Unity.
8. Students will design and implement user interfaces using Unity's UI controls, buttons, and other UI elements, focusing on usability and aesthetics.
9. Students will optimize scripts, handle events, and organize code effectively to enhance the interactivity and performance of their game projects.
10. Students will learn techniques for profiling and optimizing game performance, as well as managing memory usage effectively to ensure smooth gameplay experiences across different platforms.

### READINGS:

1. MASTERING GAME DESIGN WITH UNITY 2021: IMMERSIVE WORKFLOWS, VISUAL SCRIPTING, PHYSICS ENGINE, GAME OBJECTS, PLAYER PROGRESSION, by SCOTT TYKOSKI, BPB PUBLICATION
2. HANDS-ON UNITY 2022 GAME DEVELOPMENT - THIRD EDITION, by NICOLAS ALEJANDRO BORROMEO, PCKECT PUBLICATION

<b>Course code</b>	<b>DECAP824</b>	<b>Course Title</b>	<b>UNREAL PROGRAMMING USING C++</b>		
		<b>WEIGHTAGES</b>			
		<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>	
		<b>30</b>	<b>40</b>	<b>30</b>	

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

**CO1:** conceptualize, plan, and execute game development projects

**CO2:** exhibit proficiency in game design principles, documentation, and implementation

**CO3:** demonstrate mastery of Unreal Engine and C++ programming, enabling them to develop advanced game systems and optimize game performance

**CO4:** competence in designing, developing, and deploying multiplayer game modes to create immersive multiplayer experiences

<b>Unit No.</b>	<b>Content</b>
<b>Unit 1</b>	<b>Introduction to Game Development Process:</b> Overview of Game Development Lifecycle, Understanding Game Ideation and Conceptualization, Brainstorming Game Ideas and Creating Concept Documents, Developing a Project Plan and Timeline for Game Development
<b>Unit 2</b>	<b>Game Design Fundamentals:</b> Principles of Game Design and Player Experience, Creating Detailed Game Design Documents (GDD), Balancing Gameplay Mechanics and Systems, Incorporating Storytelling and Progression Elements
<b>Unit 3</b>	<b>Introduction to Unreal Engine:</b> Introduction to Unreal Engine Interface and Project Setup, Understanding Unreal Engine's Programming Architecture, Overview of Blueprints Visual Scripting System, Creating Basic Game Systems in Unreal Engine
<b>Unit 4</b>	<b>C++ Programming in Unreal Engine:</b> Introduction to the C++ Programming Language in Unreal Engine, Setting up Development Environment and Compiling C++ Code, Implementing Advanced Gameplay Systems with C++, Optimizing Code Performance and Memory Management
<b>Unit 5</b>	<b>Player Controls and Input Management:</b> Implementing Player Controls for Movement, Camera, and Interactions, Handling Input Events and Mapping Player Input to In-Game Actions, Designing Responsive and Customizable Control Schemes, Integrating Different Input Devices for Enhanced Player Experience
<b>Unit 6</b>	<b>Game AI Development:</b> Designing AI Behaviors for Non-Player Characters (NPCs), Implementing Path finding Algorithms and Navigation Systems, Creating Dynamic AI Reactions and Interactions, Balancing AI Difficulty and Player Challenge
<b>Unit 7</b>	<b>Advanced Gameplay Mechanics:</b> Implementing Physics-Based Interactions and Dynamic Environments, Developing Complex Character Movement and Animation Systems, Integrating Interactive Objects and Environmental Effects, Exploring Advanced Combat and Weapon Systems
<b>Unit 8</b>	<b>Game Optimization and Performance:</b> Understanding Performance Profiling and Optimization Techniques, Optimizing Code Efficiency, Resource Usage, and Rendering Pipeline, Implementing Level of Detail (LOD) Systems for Performance Scaling, Testing and Benchmarking Game Performance Across Different Platforms
<b>Unit 9</b>	<b>Multiplayer Networking Essentials:</b> Introduction to Multiplayer Networking Concepts and Architecture, Implementing Networked Gameplay Systems and Replication, Designing Server-Client Communication Protocols, Testing and Debugging Multiplayer Networked Games

<b>Unit 10</b>	<b>Multiplayer Game Modes and Deployment:</b> Designing and Developing Multiplayer Game Modes and Mechanics, Balancing Multiplayer Gameplay for Competitive and Cooperative Experiences, Deploying Multiplayer Games to Online Platforms and Servers, Managing Game Servers and Player Communities
<b>Unit 11</b>	<b>Advanced Gameplay Mechanics:</b> Implementing Physics-Based Interactions and Dynamic Environments, Developing Complex Character Movement and Animation Systems, Integrating Interactive Objects and Environmental Effects, Exploring Advanced Combat and Weapon Systems
<b>Unit 12</b>	<b>Game Optimization and Performance:</b> Understanding Performance Profiling and Optimization Techniques, Optimizing Code Efficiency, Resource Usage, and Rendering Pipeline, Implementing Level of Detail (LOD) Systems for Performance Scaling, Testing and Benchmarking Game Performance Across Different Platforms
<b>Unit 13</b>	<b>Multiplayer Networking Essentials:</b> Introduction to Multiplayer Networking Concepts and Architecture, Implementing Networked Gameplay Systems and Replication, Designing Server-Client Communication Protocols, Testing and Debugging Multiplayer Networked Games
<b>Unit 14</b>	<b>Multiplayer Game Modes and Deployment:</b> Designing and Developing Multiplayer Game Modes and Mechanics, Balancing Multiplayer Gameplay for Competitive and Cooperative Experiences, Deploying Multiplayer Games to Online Platforms and Servers, Managing Game Servers and Player Communities

#### LABORATORY WORK:

1. Students will engage in brainstorming sessions to generate game ideas and create concept documents for selected game concepts.
2. Students will develop a detailed project plan and timeline for game development, incorporating milestones and deliverables.
3. Students will learn to create basic game systems using Blueprints Visual Scripting in Unreal Engine.
4. Students will implement advanced gameplay mechanics such as physics-based interactions, dynamic environments, and combat systems in Unreal Engine.
5. Students will optimize game performance by profiling code, managing resources, and implementing performance scaling techniques.
6. Students will design and develop multiplayer game modes, focusing on competitive and cooperative gameplay experiences.
7. Students will test and debug multiplayer networked games, ensuring smooth gameplay experiences and robust server-client communication.
8. Students will deploy multiplayer games to online platforms and servers, managing game servers and player communities.
9. Students will integrate different input devices and design responsive and customizable control schemes for enhanced player experience.
10. Students will design AI behaviors for NPCs, implement path finding algorithms, and create dynamic AI reactions and interactions.

**READINGS:**

1. GAME DEVELOPMENT WITH UNREAL ENGINE 5: LEARN THE BASICS OF GAME DEVELOPMENT IN UNREAL ENGINE 5, by LYNN MITCHELL, CLIFF SHARIF, BPB PUBLICATION
2. BEGINNING UNREAL GAME DEVELOPMENT: FOUNDATION FOR SIMPLE TO COMPLEX GAMES USING UNREAL ENGINE 4, by DAVID NIXON, APRESS PUBLICATION

<b>Course Code</b>	<b>DECAP538</b>	<b>Course Title</b>	<b>ALGORITHM DESIGN AND ANALYSIS</b>		
			<b>WEIGHTAGES</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

**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

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

<b>Course Code</b>	<b>DECAP951</b>	<b>Course Title</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>
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<b>WEIGHTAGES</b>	
<b>CA</b>	<b>ETE(Th.)</b>
<b>30</b>	<b>70</b>

**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

<b>Unit No.</b>	<b>Contents</b>
<b>Unit- 1</b>	<b>Introduction to Software Project Management:</b> what is project? software project vs. other types, activities by software project mgt. plans, methods and methodologies, problems with software projects
<b>Unit- 2</b>	<b>Step Wise Project Planning:</b> project scope, objectives, infrastructure, characteristics, effort estimation, risk identification.
<b>Unit- 3</b>	<b>Program Management &amp; Project Evaluation:</b> meaning, managing allocation of resources, creating program, individual projects, technical assessment, cost benefit analysis & risk evaluation
<b>Unit- 4</b>	<b>Project Approach:</b> intro, technical plan, choice of process models: waterfall, v-process, spiral, Prototyping, incremental delivery
<b>Unit- 5</b>	<b>Effort Estimation:</b> meaning, problems with estimation, basis, estimation techniques, Albrecht function point analysis, functions mark ii, COCOMO Model
<b>Unit- 6</b>	<b>Activity Planning:</b> objectives, project schedule, network planning model, time dimension, identifying critical path
<b>Unit- 7</b>	<b>Risk Management:</b> categories of risk, identification. assessment, schedule risk, applying pert technique
<b>Unit- 8</b>	<b>Resource Allocation:</b> identifying resource requirements, scheduling resources, publishing the resource schedule & cost schedule, scheduling sequence
<b>Unit- 9</b>	<b>Monitoring &amp; Control:</b> creating frameworks, data collection, visualizing progress, cost monitoring, change control
<b>Unit- 10</b>	<b>Software Quality:</b> introduction, defining software quality, ISO 9126, software measures, product vs. process quality management, external standards
<b>Unit- 11</b>	<b>Small Projects:</b> introduction, problems with student projects, content of project plan
<b>Unit- 12</b>	<b>Software configuration management: SCM,</b> managing contracts, types of contracts, stages In contract placement, contract management and acceptance
<b>Unit- 13</b>	<b>People Management:</b> understanding behavior, organizational behavior, selecting the right person for the job, selecting the right person for the job
<b>Unit- 14</b>	<b>Organization and team structures:</b> 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	DECAP825	Course Title	GAME AI & REINFORCEMENT LEARNING		
			WEIGHTAGES		
			CA	ETE(Th.)	ETE (Pr.)
			30	40	30

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

**C01:** Apply reinforcement learning concepts to design intelligent agents in Unity.

**C02:** Evaluate performance of RL algorithms (DQN, Policy Gradients) in Unity environments

**C03:** Observe and analyze agent behavior for debugging and optimization in Unity.

**C04:** Analyze and implement collaborative/competitive multi-agent RL scenarios.

**C05:** Analyze and customize RL agents with hyperparameter tuning and behavior design.

Unit No.	Content
Unit 1	<b>Introduction to Reinforcement Learning:</b> Definition and Concepts of Reinforcement Learning (RL), Fundamentals of Unity Engine for RL
Unit 2	<b>Types of Reinforcement Learning Algorithms:</b> Overview of RL Algorithms, Deep Q-Learning (DQN), Policy Gradient Methods
Unit 3	<b>RL Frameworks and Libraries:</b> Introduction to Unity ML-Agents Toolkit, Other RL Frameworks and Libraries, Implementing RL Agents in Unity
Unit 4	<b>Ethics and Considerations in RL Game Development:</b> Ethical Considerations in RL, Case Studies and Examples
Unit 5	<b>Basics of Unity Game Development for RL:</b> Creating RL Environments in Unity, Unity Physics Integration for RL
Unit 6	<b>Debugging and Optimization Techniques in Unity for RL:</b> Debugging Techniques in Unity, Optimization Techniques for RL in Unity
Unit 7	<b>Collaborative and Competitive RL in Unity Environments:</b> Implementing Collaborative RL, Implementing Competitive RL
Unit 8	<b>Advanced RL Algorithms in Game Development:</b> Proximal Policy Optimization (PPO) in Unity, Actor-Critic Architectures for RL
Unit 9	<b>Transfer Learning and Unity Environments:</b> Transfer Learning Techniques for RL in Unity, Implementing Transfer Learning in Unity Environments
Unit 10	<b>Hyperparameter Tuning for RL in Unity:</b> Understanding Hyperparameters in RL, Techniques for Hyperparameter Tuning in Unity
Unit 11	<b>Customizing RL Agents in Unity:</b> Utilizing Unity Asset Store for RL Development, Customizing RL Agent Behavior in Unity
Unit 12	<b>Dynamic Environment Generation and Simulations:</b> Dynamic Environment Generation Techniques, Integrating Simulations and Game Physics for RL
Unit 13	<b>Adaptive Learning Rates and Techniques in Unity:</b> Adaptive Learning Rate Methods for RL, Implementing Adaptive Techniques in Unity
Unit 14	<b>Real-time Training and Inference of RL Agents in Unity:</b> Real-time Training Methods for RL Agents, Inference of RL Agents in Unity Environments

#### LABORATORY WORK:

1. Students will learn to set up the Unity ML-Agents Toolkit and create their first RL environment.
2. Students will implement the DQN algorithm to train an RL agent to navigate a Unity environment.
3. Students will explore policy gradient methods and implement algorithms such as REINFORCE in

Unity.

4. Students will learn debugging techniques specific to RL agents in Unity and troubleshoot common issues.
5. Students will optimize the performance of RL agents in Unity by implementing techniques such as reward shaping and action space reduction.
6. Students will implement collaborative RL scenarios in Unity, where multiple agents work together to achieve a common goal.
7. Students will design and implement competitive RL scenarios in Unity, where agents compete against each other to achieve individual goals.
8. Students will explore transfer learning techniques for RL in Unity and apply them to train RL agents more efficiently.
9. Students will learn about hyperparameters in RL and experiment with different tuning techniques to improve agent performance.
10. Students will explore methods for real-time training and inference of RL agents in Unity, allowing agents to adapt and learn in real-world scenarios.

**READINGS:**

1. LEARN UNITY ML - AGENTS - FUNDAMENTALS OF UNITY MACHINE LEARNING, by MICHEAL LANHAM, PACKT PUBLICATION
2. HANDS-ON REINFORCEMENT LEARNING FOR GAMES, by MICHEAL LANHAM, PACKT PUBLICATION

<b>Course Code</b>	<b>DECAP826</b>	<b>Course Title</b>	<b>VIRTUAL REALITY AND AUGMENTED REALITY IN GAME DEVELOPMENT</b>		
			<b>WEIGHTAGES</b>		
			<b>CA</b>	<b>ETE(Th.)</b>	<b>ETE (Pr.)</b>
			<b>30</b>	<b>40</b>	<b>30</b>

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

- C01:** demonstrate an understanding of the principles and concepts of Augmented Reality (AR) and virtual Reality (VR) development
- C02:** design and develop immersive AR experiences using AR Foundation in Unity, including implementing AR interactions, tracking, and mobile applications
- C03:** create immersive VR experiences in Unity for various VR platforms, including Oculus and HTC vive, by implementing VR interactions, navigation, and optimization techniques
- C04:** equipped with advanced skills in AR/VR development, including UI design, 3D modeling, environmental design, advanced interactions, audio design, and optimization for performance and deployment

<b>Unit No.</b>	<b>Content</b>
<b>Unit-1</b>	<b>Introduction to AR/VR Development:</b> Overview of Augmented Reality (AR) and Virtual Reality (VR), Introduction to Unity Engine for AR/VR Development
<b>Unit-2</b>	<b>Unity Basics for AR/VR:</b> Getting Started with Unity Interface and Project Setup, Understanding Game Objects, Components, and Transformations, Introduction to Unity Scripting with C#, Implementing Basic Interactions and User Interfaces in Unity
<b>Unit-3</b>	<b>Building AR Experiences in Unity:</b> Setting Up AR Foundation in Unity, Understanding ARCore and ARKit, Implementing AR Interactions and Tracking, Creating AR Applications for Mobile Devices
<b>Unit-4</b>	<b>Building VR Experiences in Unity:</b> Setting Up VR Development Environment in Unity, Understanding VR Platforms: Oculus, HTC Vive, and Others, Implementing VR Interactions and Navigation, Optimizing VR Experiences for Performance
<b>Unit-5</b>	<b>User Interface Design for AR/VR:</b> Design Principles for AR/VR User Interfaces, Creating Immersive UI Elements in Unity, Implementing Gesture-based Interactions in AR/VR, Designing Menus, HUDs, and Feedback Systems
<b>Unit-6</b>	<b>3D Modeling and Asset Creation for AR/VR:</b> Overview of 3D Modeling Software (e.g., Blender, Maya), Creating 3D Models and Textures for AR/VR Environments, Rigging and Animating 3D Characters and Objects, Importing and Integrating Assets into Unity
<b>Unit-7</b>	<b>Environmental Design for AR/VR:</b> Understanding Scene Design Principles for AR/VR, Creating Immersive Environments with Unity Terrain, Implementing Lighting and Shading Techniques, Adding Visual Effects and Atmosphere to VR Environments
<b>Unit-8</b>	<b>Advanced Interactions in AR/VR:</b> Implementing Physics-based Interactions in Unity, Adding Object Manipulation and Interaction Mechanics, Implementing Teleportation and Locomotion Systems, Exploring Hand Tracking and Body Gestures for Interaction
<b>Unit-9</b>	<b>Audio Design for AR/VR:</b> Importance of Audio in Immersive Experiences, Implementing Spatial Audio in Unity, Creating Ambience and Sound Effects for AR/VR Environments, Integrating Music and Voiceovers into AR/VR Experiences
<b>Unit-10</b>	<b>AR Cloud and Multiuser AR Experiences:</b> Understanding AR Cloud Platforms (e.g., ARCore Cloud Anchors), Implementing Multiuser AR Experiences in Unity, Collaborative AR

	Development Techniques, Designing Shared AR Spaces and Experiences
<b>Unit-11</b>	Optimization and Performance in AR/VR: Optimizing Rendering Performance for AR/VR Applications, Implementing Level of Detail (LOD) Systems, Memory Management and Resource Optimization Techniques, Testing and Profiling AR/VR Applications for Performance
<b>Unit-12</b>	<b>AR/VR Platforms and Deployment:</b> Deploying AR/VR Applications to Mobile Devices, Publishing AR/VR Applications on App Stores (iOS, Android), Distribution and Deployment Strategies for AR/VR Experiences
<b>Unit-13</b>	<b>Future Trends and Emerging Technologies in AR/VR:</b> Exploring the Future of AR/VR Technology, Trends in AR/VR Hardware and Software Development, Introduction to AR Glasses, Mixed Reality (MR), and Spatial Computing
<b>Unit-14</b>	<b>Final Project and Showcase: Capstone Project:</b> Developing an AR/VR Application from Concept to Deployment, Presenting and Showcasing AR/VR Projects

### LABORATORY WORK:

1. Students will set up Unity for AR/VR development, including installing necessary plugins and configuring project settings.
2. Students will implement basic AR interactions such as object placement, rotation, and scaling using AR Foundation in Unity.
3. Students will develop VR experiences in Unity for Oculus Rift or HTC Vive, including implementing teleportation, grabbing objects, and navigating VR environments.
4. Students will design and implement immersive UI elements for AR/VR applications in Unity, including menus, HUDs, and feedback systems.
5. Students will create 3D models and textures using Blender or Maya and integrate them into Unity for use in AR/VR environments.
6. Students will design immersive environments for AR/VR applications using Unity Terrain, lighting, shading techniques, and visual effects.
7. Students will implement advanced interactions in AR/VR environments, such as physics-based interactions, object manipulation, and teleportation systems.
8. Students will implement spatial audio in Unity for AR/VR applications, including creating ambience, sound effects, and integrating music and voiceovers.
9. Students will develop multiuser AR experiences using AR Cloud platforms, implementing collaborative AR development techniques and designing shared AR spaces.
10. Students will optimize rendering performance for AR/VR applications in Unity, including implementing LOD systems, memory management, and testing for performance profiling.

### READINGS:

1. UNITY VIRTUAL REALITY PROJECTS: EXPLORE THE WORLD OF VIRTUAL REALITY by BUILDING IMMERSIVE AND FUN VR PROJECTS USING UNITY 3D, by JONATHAN LINOWES, PACKT PUBLICATION
2. UNITY 2018 AUGMENTED REALITY PROJECTS: BUILD FOUR IMMERSIVE AND FUN AR APPLICATIONS USING ARKIT, ARCORE, AND VUFORIA, by JESSE GLOVER, PACKT PUBLICATION

<b>Course Code</b>	<b>DEPEA515</b>	<b>Course Title</b>	<b>ANALYTICAL SKILLS-I</b>
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<b>WEIGHTAGES</b>	
<b>CA</b>	<b>ETE(Th.)</b>
<b>30</b>	<b>70</b>

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

CO1: observe the basic concepts of reasoning and quantitative aptitude

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

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
<b>Unit 1</b>	<b>Number system:</b> classification of numbers, rules of divisibility, multiplication and squaring of numbers, HCF & LCM of numbers, cyclicity of unit digit, remainder theorem
<b>Unit 2</b>	<b>Average:</b> average of numbers, arithmetic mean, weighted average
<b>Unit 3</b>	<b>Mathematical operations:</b> BODMAS rule, calculation based problem, conversion of symbols into signs
<b>Unit 4</b>	<b>Percentage:</b> commodity price increase/decrease, comparison based questions, population based examples, successive percent changes, budget based problems
<b>Unit 5</b>	<b>Profit and loss:</b> cost price, selling price, profit and loss, calculation of profit/loss percent, false weight, discount, successive discount, marked price
<b>Unit 6</b>	<b>Direction sense test:</b> understanding of directions, different types of practice problems
<b>Unit 7</b>	<b>Blood relation:</b> cracking jumbled up descriptions, relation puzzle, coded relations
<b>Unit 8</b>	<b>Number, ranking and time sequence:</b> number test, ranking test, time sequence test
<b>Unit 9</b>	<b>Ratio and proportion:</b> ratio and its types, proportion and its types, direct and indirect variations, partnership
<b>Unit 10</b>	<b>Alligation or mixture:</b> concept and rules of alligation, problem based on mixing of liquids/items
<b>Unit 11</b>	<b>Problem on ages and numbers:</b> problems on ages, problem on numbers
<b>Unit 12</b>	<b>Permutation and combination:</b> factorial, difference between permutation & combinations, circular permutation, arrangement and selection based problems, distribution and division <b>Probability:</b> experiment, sample space, event, probability of occurrence of an event, bayes theorem, odds of an event, selection based problems, binomial distribution
<b>Unit 13</b>	<b>Logical Venn diagram and set theory:</b> Venn diagram based problems, concept of set theory <b>Syllogism:</b> all, some and none relations, related statements with Venn diagram
<b>Unit 14</b>	<b>Data interpretation:</b> basics of data interpretation, average and percentage, tabulation, bar graphs, pie charts, line graphs

## READINGS:

1. QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATIONS by Dr. R S AGGARWAL, S CHAND PUBLISHING
2. A MODERN APPROACH TO VERBAL & NON-VERBAL REASONING by Dr. R S AGGARWAL, S CHAN PUBLISHING

3. MAGICAL BOOK ON QUICKER MATHS by M TYRA, BANKING SERVICE CHRONICLE
4. ANALYTICAL REASONING by M.K. PANDEY, BANKING SERVICE CHRONICLE

<b>Course Code</b>	<b>DEPEA516</b>	<b>Course Title</b>	<b>ANALYTICAL SKILLS-II</b>
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<b>WEIGHTAGES</b>	
<b>CA</b>	<b>ETE(Th.)</b>
<b>30</b>	<b>70</b>

**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

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

<b>Course Code</b>	<b>DEMG581</b>	<b>Course Title</b>	<b>ORGANISATIONAL BEHAVIOUR AND HUMAN RESOURCE DYNAMICS</b>
			<b>WEIGHTAGES</b>
			<b>CA</b>
			<b>ETE(Th.)</b>
			<b>30</b>
			<b>70</b>

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

**CO1:** enumerate the concept of management practices and organizational behavior

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

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

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

**CO5:** apply human resource management functions to handle emerging issues

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

<b>Unit-11</b>	<b>Performance management system:</b> performance management, performance planning, performance appraisal, potential appraisal, feedback and counselling.
<b>Unit-12</b>	<b>Compensation management:</b> types and theories of compensation, concept of wages, factors influencing compensation management, incentives and fringe benefits, employee engagement and retention.
<b>Unit-13</b>	<b>Managing industrial relations:</b> major actors and their roles in IR, factors influencing IR, approaches to IR, grievance handling procedure
<b>Unit-14</b>	<b>Industrial Disputes:</b> 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

<b>Course Code</b>	<b>DEMKT503</b>	<b>Course Title</b>	<b>MARKETING MANAGEMENT</b>
			<b>WEIGHTAGES</b>
			<b>CA</b>
			<b>ETE(Th.)</b>
			<b>30</b>
			<b>70</b>

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

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

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

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

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

<b>Unit No.</b>	<b>Content</b>
<b>Unit-1</b>	<b>Introduction:</b> market and marketing, definition, nature and scope of marketing, exchange process, functions of marketing, core marketing concepts
<b>Unit-2</b>	<b>Marketing orientations:</b> evolution of modern marketing concept, holistic marketing concepts, new marketing orientations selling vs. marketing
<b>Unit-3</b>	<b>Marketing mix:</b> 7 P's & 7 C's of Marketing, 4 A's of Marketing, customer quality, value and satisfaction, Michael E. Porters chain analysis model
<b>Unit-4</b>	<b>Marketing environment:</b> 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
<b>Unit-5</b>	<b>Consumer behaviour:</b> 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
<b>Unit-6</b>	<b>Segmentation decisions:</b> market segmentation, characteristics of a segment, bases for segmenting a consumer market, levels of market segmentation, factors influencing selection of market segments
<b>Unit-7</b>	<b>Targeting and positioning:</b> Benefits of market segmentation; Criteria for effective market segmentation; Target market selection and strategies; Positioning – concept, bases and process
<b>Unit-8</b>	<b>Product decisions:</b> 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
<b>Unit-9</b>	<b>Pricing decisions:</b> pricing – objectives, price sensitivity, factors affecting price of a product, pricing methods and strategies, ethical issues in product and pricing decisions
<b>Unit-10</b>	<b>Distribution planning:</b> channels of distribution – concept and importance, different types of distribution middlemen and their functions, selection, motivation and performance appraisal of distribution middlemen
<b>Unit-11</b>	<b>Distribution decisions:</b> 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

<b>Unit-12</b>	<b>Distribution decisions:</b> 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
<b>Unit-13</b>	<b>Promotion decisions:</b> 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
<b>Unit-14</b>	<b>Trends in marketing:</b> 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

<b>Course Code</b>	<b>DEFIN542</b>	<b>Course Title</b>	<b>CORPORATE FINANCE</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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.

<b>Unit No.</b>	<b>Content</b>
<b>Unit-1</b>	<b>Financial Management:</b> An Overview, evolution of finance, the basic goal: creating shareholder value, agency issues, business ethics and social responsibility
<b>Unit-2</b>	<b>Sources of Finance:</b> Long term and Short-term sources of finance- Ordinary shares, Preferences shares, redeemable irredeemable debentures, Debt vs. Equity.
<b>Unit-3</b>	<b>Money Market Instruments:</b> Treasury Bills, Commercial Papers, Certificate of Deposits, Treasury Management and Treasury Operations in corporate. External Commercial Borrowings, Financing for MSMEs
<b>Unit-4</b>	<b>Time Value of Money concept:</b> Compounding and discounting, Future value and Present value, Annuities, Effective interest rates
<b>Unit-5</b>	<b>Investment Decisions:</b> Capital Budgeting Decisions, Rationale of Capital Budgeting, Non-Discounting Capital Budgeting Techniques - Payback period, Profitability Index, Accounting Rate of Return
<b>Unit-6</b>	<b>Investment Decisions:</b> 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
<b>Unit-7</b>	<b>Cost of Capital:</b> Meaning and Concept, Cost of Debt, Cost of Equity, Cost of Retained Earnings, Calculation of WACC, International Dimensions in Cost of Capital
<b>Unit-8</b>	<b>Financing Decisions:</b> 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.
<b>Unit-9</b>	<b>EBIT-EPS Analysis:</b> Concept of Leverage, Types of Leverage: Operating Leverage, Financial Leverage, Combined Leverage.
<b>Unit-10</b>	<b>Dividend Decisions:</b> Factors determining Dividend Policy, Theories of Dividend Gordon Model, Walter Model, MM Hypothesis
<b>Unit-11</b>	<b>Forms of Dividend:</b> Cash Dividend, Bonus Shares, Stock Split, Stock Repurchase, Dividend Policies in practice.
<b>Unit-12</b>	<b>Working Capital Management:</b> Working Capital Policies, Risk-Return trade-off, Cash management, Receivables management
<b>Unit-13</b>	<b>Corporate Governance:</b> 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

<b>Unit-14</b>	<b>Economic outlook and Business Valuation:</b> 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
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**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

<b>Course Code</b>	<b>DEMGN578</b>	<b>Course Title</b>	<b>INTERNATIONAL BUSINESS ENVIRONMENT</b>	
			<b>WEIGHTAGE</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

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

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

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

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

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

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

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

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

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

**READINGS:**

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

<b>Course Code</b>	<b>DEMKT509</b>	<b>Course Title</b>	<b>CONSUMER BEHAVIOR</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

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

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

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

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

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

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

<b>Unit No.</b>	<b>Content</b>
<b>Unit 1</b>	<b>Consumer Behaviour and Marketing strategy:</b> consumer behaviour, market strategy and applications of consumer behaviour.
<b>Unit 2</b>	<b>Market Analysis and Consumer Decisions:</b> market analysis components, segmentation strategy and consumer decisions and consumer behaviour models.
<b>Unit 3</b>	<b>Culture and Group influence:</b> cultural and group influence on consumer behaviour, concept of culture, cross cultural marketing strategy, the household life cycle and marketing strategy.
<b>Unit 4</b>	<b>Groups, Reference Group and Diffusion of Innovation:</b> groups, types of groups, reference group influence on consumption process & marketing strategies and diffusion of innovation.
<b>Unit 5</b>	<b>Perception:</b> perception, exposure, attention and interpretation, perception and marketing strategy.
<b>Unit 6</b>	<b>Learning and Personality:</b> memory's role in learning, learning theories, brand image and product positioning, brand equity and brand leverage motivation, personality and emotion.
<b>Unit 7</b>	<b>Motivation and Emotion:</b> motivation theory and marketing strategy use of personality in marketing practice, emotions and marketing strategy.
<b>Unit 8</b>	<b>Attitude and Market Segmentation:</b> attitude, influencing attitude, attitude components and change strategies, market segmentation and product development strategies based on attitudes.
<b>Unit 9</b>	<b>Self-Concept and Consumer Decisions:</b> nature of lifestyle, the VALS system consumer decision process and types of consumer decisions.
<b>Unit 10</b>	<b>Consumer Decision Making Process:</b> 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.
<b>Unit 11</b>	<b>Decision Rules and Attributes of consumers:</b> 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.
<b>Unit 12</b>	<b>Post purchase Processes and Dissonance:</b> post purchase processes, post purchase dissonance, product use and non-use, disposition.

<b>Unit 13</b>	<b>Purchase Evaluation and Customer Satisfaction:</b> purchase evaluation, customer satisfaction, dissatisfaction responses, repeat purchase and customer commitment.
<b>Unit 14</b>	<b>Consumer Behaviour and Marketing Regulation:</b> 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 LMOOTHERSBAUGH, & 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.

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

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

**C01:** understand the critical financial issues of international firms and international investors in present scenario.

**C02:** analyze the framework of exchange rates and foreign exchange exposures and forces affecting exchange rates.

**C03:** evaluate the international capital structure and international capital budgeting mechanism of multinational corporations.

**C04:** analyze the different modes of raising finance in international market and significance of international finance in MNCs.

<b>Unit No.</b>	<b>Content</b>
<b>Unit-1</b>	<b>Introduction to International Financial management:</b> domestic vs. international finance, International financial market integration, currency crisis, and global recession and risk spill over.
<b>Unit-2</b>	<b>Balance of Payments</b> - 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.
<b>Unit-3</b>	<b>Foreign Exchange Markets and Exchange Rate Mathematics:</b> nature, functions, transactions, participants, forex markets in India, forex dealing, foreign exchange regimes, foreign exchange rate determination, factors affecting foreign exchange.
<b>Unit-4</b>	<b>Forecasting Foreign Exchange Rate:</b> 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.
<b>Unit-5</b>	<b>Foreign Exchange Spot and Derivative Market:</b> 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.
<b>Unit-6</b>	<b>Management of Foreign Exchange Risk:</b> 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.
<b>Unit-7</b>	<b>International Capital Markets</b> - sources of international finance - debt and equity markets – international equity diversification, short-term vs long-term finance – export import finance.

<b>Unit-8</b>	<b>Capital Structure of the Multinational Firm:</b> 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.
<b>Unit-9</b>	<b>Capital Budgeting of the Multinational Firm:</b> international capital budgeting – key issues – unique cashflows – adjusted present value approach. foreign direct investment – motives – determinants – international portfolio diversification.
<b>Unit-10</b>	<b>Working Capital Management of the Multinational Firm:</b> international working capital management – international cash management – decentralized vs centralized cash management – bilateral vs multilateral netting – central cash pool.
<b>Unit-11</b>	<b>Option Contracts</b> 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.
<b>Unit-12</b>	<b>Managing Foreign Operations:</b> 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.
<b>Unit-13</b>	<b>Foreign Direct Investment and Cross Border Acquisitions:</b> global trends in FDI, benefits of investing overseas, political risk and FDI., cross border mergers and acquisitions.
<b>Unit-14</b>	<b>Country Risk Analysis-</b> 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.

<b>Course Code</b>	<b>DEMGN801</b>	<b>Course Title</b>	<b>BUSINESS ANALYTICS</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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

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

<b>Unit 12</b>	<b>Design fundamentals and visual analytics:</b> Filters, sorting, groups and sets, interactive filters, forecasting, use of tooltip, reference line, parameter, drill down and hierarchies
<b>Unit 13</b>	<b>Decision analytics and calculations:</b> Types of calculations, logic calculations (including if comment, nested if command etc.), data calculations, string calculations
<b>Unit 14</b>	<b>Mapping:</b> Role of maps in business intelligence and visualization, editing unrecognized locations

**READINGS:**

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

<b>Course Code</b>	<b>DEMKT505</b>	<b>Course Title</b>	<b>DIGITAL AND SOCIAL MEDIA MARKETING</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

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

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

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

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

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

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

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

	media marketing ethics, global perspective
<b>Unit 13</b>	<b>Social networks:</b> marketing with social networks, white label social networks, the future of social networks
<b>Unit 14</b>	<b>Publishing blogs:</b> 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.

**REFERENCES:**

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)

<b>Course Code</b>	<b>DEFIN508</b>	<b>Course Title</b>	<b>INTERNATIONAL BANKING AND FOREX MANAGEMENT</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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

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

#### **READINGS:**

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

<b>Course Code</b>	<b>DEOPR639</b>	<b>Course Title</b>	<b>OPERATIONS MANAGEMENT AND RESEARCH</b>
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<b>WEIGHTAGES</b>	
<b>CA</b>	<b>ETE(Th.)</b>
<b>30</b>	<b>70</b>

**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.

<b>Unit No.</b>	<b>Contents</b>
<b>Unit- 1</b>	<b>Introduction to Operations Management:</b> introduction and scope of operation management, production of goods versus delivery of services, product-process matrix
<b>Unit- 2</b>	<b>Forecasting:</b> 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
<b>Unit- 3</b>	<b>Product and service design:</b> design process, product design, service design
<b>Unit- 4</b>	<b>Process selection and facility layout:</b> introduction, process types, product and service profiling, automation, facility layout, line balancing
<b>Unit- 5</b>	<b>Location planning and analysis:</b> need and nature of location decisions, factors that affect location decisions, evaluating location alternatives
<b>Unit- 6</b>	<b>Management of quality:</b> defining quality-dimensions of quality, determinants of quality, the cost of quality, quality tools, total quality management
<b>Unit- 7</b>	<b>Quality control:</b> inspection, control charts for variables (mean and range chart), control charts for attributes (p-chart, c-chart), run test
<b>Unit- 8</b>	<b>Inventory management:</b> nature and importance of inventories, inventory counting systems and inventory costs, economic production quantity, quantity discounts, EOQ model
<b>Unit- 9</b>	<b>Buying and sourcing in e-commerce:</b> 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
<b>Unit- 10</b>	<b>Planning:</b> Aggregate Production Planning; Master Production Schedule and MRP, MRP-II, ERP
<b>Unit- 11</b>	<b>Maintenance:</b> Preventive maintenance, Breakdown maintenance, Replacement
<b>Unit- 12</b>	<b>Supply chain management:</b> 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
<b>Unit- 13</b>	<b>JIT and lean operations:</b> goals and building blocks of lean systems
<b>Unit- 14</b>	<b>Emerging issues in operations management:</b> 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

<b>Course Code</b>	<b>DEMKT517</b>	<b>Course Title</b>	<b>CUSTOMER RELATIONSHIP MANAGEMENT</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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.

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

<b>Course Code</b>	<b>DEFIN576</b>	<b>Course Title</b>	<b>SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT</b>	
			<b>WEIGHTAGES</b>	
			<b>CA</b>	<b>ETE(Th.)</b>
			<b>30</b>	<b>70</b>

**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

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