



R.M.D. ENGINEERING COLLEGE

(An Autonomous Institution)

B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

CURRICULUM – 2024 & SEMESTER I - VII SYLLABI

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To ensure graduates are proficient in utilizing the fundamental knowledge of basic sciences, mathematics, Computer Science and Business Systems for the applications relevant to various streams of engineering and technology.
2. To enrich knowledge of common business principles and enable graduates with the core competencies necessary for understanding contemporary technology.
3. To enable graduates to gain employment in organizations by applying their technical skills to solve real world problems.
4. To enable graduates to enrich knowledge in the management and establish themselves as a professional with ethical, social responsibility by enriching the human values.

PROGRAM OUTCOMES (POs)

After the successful completion of the program, the graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Engineering Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling — recognizing their limitations — to solve complex engineering problems.

6. **The Engineer and the World:** Analyse and evaluate societal and environmental aspects while solving complex engineering problems, considering their impact on sustainability with reference to economy, health, safety, legal frameworks, culture, and the environment.
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; and adhere to relevant national and international laws.
8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse and multi-disciplinary teams.
9. **Communication:** Communicate effectively and inclusively within the engineering community and with society at large — comprehending and writing effective reports and design documentation, and making effective presentations — considering cultural, language, and learning differences.
10. **Project management and finance:** Apply knowledge and understanding of engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects in multi-disciplinary environments.
11. **Life-long learning:** Recognise the need for, and have the preparation and ability for, independent and life-long learning, adaptability to new and emerging technologies, and critical thinking in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After the successful completion of the program, the graduates will be able to:

1. To create appropriate modern engineering and business tools of cutting edge technologies and develop solutions for the betterment of the society.
2. To provide state of technological tools and soft skills that helps in delivering global business solutions with ethical values.
3. To set their career path applying all the technologies and business skills as an unique individual.

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(An Autonomous Institution)

B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

REGULATIONS – 2024

CHOICE BASED CREDIT SYSTEM

I - VIII SEMESTER CURRICULUM AND I - VII SEMESTER SYLLABI

SEMESTER – I								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24MA102	Introduction to Calculus, Probability and Statistics	BSC	4	3	1	0	4
2	24GE101	Heritage of Tamils	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
3	24CS101	Programming in C++	ESC	6	3	0	3	4.5
4	24CS102	Software Development Practices	ESC	6	3	0	3	4.5
5	24EE102	Principles of Electrical Engineering	ESC	5	3	0	2	4
6	24PH102	Fundamentals of Physics	BSC	5	3	0	2	4
LABORATORY COURSE								
7	24ME111	Idea Lab I (Non Credit)	EEC	1	0	0	1	0
EMPLOYABILITY ENHANCEMENT COURSES								
8	24HS111	Interpersonal skills, Psychometric Analysis and Career Development	EEC	1	1	0	0	1
MANDATORY COURSE								
9	24MC101	Student Induction Program (Non Credit)	MC	3 Weeks				
10	24MC102	Programming in C (Non Credit)	MC	40 Periods				
11	24CH102	Environmental Science and Sustainability (Non Credit)	MC	2	2	0	0	0
TOTAL				31	19	1	11	23

SEMESTER – II								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSE								
1	24MA203	Linear Algebra	BSC	4	3	1	0	4
2	24GE201	Tamils and Technology	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
3	24CS201	Data Structures	ESC	6	3	0	3	4.5
4	24CS202	Java Programming	ESC	6	3	0	3	4.5
5	24AI201	Introduction to Artificial Intelligence	PCC	4	2	0	2	3
6	24EC201	Principles of Electronics Engineering	ESC	5	3	0	2	4
LABORATORY COURSE								
7	24ME211	Idea Lab II	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	24HS211	Innovation and Creativity Skills Development	EEC	1	1	0	0	1
AUDIT COURSE								
9	24MC201	Yoga for Stress Management	AC	1	0	0	1	0
TOTAL				30	16	1	13	23

SEMESTER –III								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24GE301	Universal Human Values 2: Understanding Harmony	HSMC	3	2	1	0	3
2	24MA303	Discrete Mathematics and its Applications	BSC	4	3	1	0	4
3	24CS301	Computer Organization and Architecture	PCC	3	3	0	0	3
4	24CB301	Fundamentals of Economics	PCC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5	24CS302	Advanced Java Programming	PCC	6	3	0	3	4.5
6	24CS303	Database Management Systems	PCC	6	3	0	3	4.5
LABORATORY COURSE								
7	24GE311	Product Development Lab - 1	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	24CS311	Aptitude and Coding Skills I	EEC	3	0	0	3	1.5
9	24CB311	Internship/Seminar (1 Week)	EEC	1	0	0	1	0.5
MANDATORY COURSE								
10	24MC301	Indian Constitution (Non Credit)	MC	1	1	0	0	0
TOTAL				32	18	2	12	25

SEMESTER –IV								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24CB401	Marketing Research and Marketing Management	PCC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
2	24CB402	Operating Systems	PCC	5	3	0	2	4
3	24CS402	Design And Analysis of Algorithms	PCC	5	3	0	2	4
4	24IT402	Web Development Frameworks	PCC	6	3	0	3	4.5
5	24MA403	Statistical Methods	BSC	5	3	0	2	4
LABORATORY COURSE								
6	24GE411	Product Development Lab - 2	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
7	24CS411	Aptitude and Coding Skills II	EEC	3	0	0	3	1.5
AUDIT COURSE								
8	24AC401	Value Education (Non Credit)	AC	1	1	0	0	0
TOTAL				30	16	0	14	22
FOR HONOURS DEGREE								
1	24CB951	Capstone Design Project – Level I	EEC	12	0	0	12	6
OR								
1		Honours Elective I	PEC	3	3	0	0	3
2		Honours Elective II	PEC	3	3	0	0	3
OR								
1		Honours Elective I	PEC	3	3	0	0	3
FOR MINOR DEGREE								
1		Minor Elective I	OEC	3	3	0	0	3

SEMESTER –V								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24CB503	Fundamentals of Management and Business Strategy	PCC	3	3	0	0	3
2		Professional Elective II	PEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
3	24CB501	Software Design with UML	PCC	4	2	0	2	3
4	24CB502	Computer Networks	PCC	5	3	0	2	4
5	24MA501	Computational Statistics	BSC	5	3	0	2	4
6		Professional Elective I	PEC	4	2	0	2	3
LABORATORY COURSE								
7	24HS511	Professional Communication – I (TOEFL)	HSMC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8	24CS511	Advanced Aptitude and Coding Skills I	EEC	3	0	0	3	1.5
9	24CB511	Internship/Seminar	EEC	2 Weeks				1
10	24GE511	Product Development Lab - 3	EEC	2	0	0	2	1
MANDATORY COURSE								
11	24MC501	Essence of Indian Traditional Knowledge (Non Credit)	MC	1	1	0	0	0
TOTAL				34	17	0	19	25.5
FOR HONOURS DEGREE								
1	24CB952	Capstone Design Project – Level II	EEC	12	0	0	12	6
OR								
1		Honours Elective III	PEC	3	3	0	0	3
2		Honours Elective IV	PEC	3	3	0	0	3
OR								
1		Honours Elective II	PEC	3	3	0	0	3
FOR MINOR DEGREE								
1		Minor Elective II	OEC	3	3	0	0	3

SEMESTER –VI								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1		Professional Elective IV	PEC	3	3	0	0	3
2		Open Elective I	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
3	24CB601	CLOUD & MICROSERVICES	PCC	5	3	0	2	4
4	24CB602	Information Security	PCC	5	3	0	2	4
5		Professional Elective III	PEC	4	2	0	2	3
LABORATORY COURSE								
6	24HS611	Professional Communication – II (TOEFL)	HSMC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
7	24CS611	Advanced Aptitude and Coding Skills II	EEC	3	0	0	3	1.5
8	24GE611	Product Development Lab - 4	EEC	2	0	0	2	1
AUDIT COURSE								
9	24AC601	Personality Development (Non Credit)	AC	2	2	0	0	0
TOTAL				29	16	0	13	20.5
FOR HONOURS DEGREE								
1	24CB953	Capstone Design Project – Level III	EEC	12	0	0	12	6
OR								
1		Honours Elective V	PEC	3	3	0	0	3
2		Honours Elective VI	PEC	3	3	0	0	3
OR								
1		Honours Elective III	PEC	3	3	0	0	3
FOR MINOR DEGREE								
1		Minor Elective III	OEC	3	3	0	0	3

SEMESTER –VII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24CB701	Human Resource Management	PCC	2	2	0	0	2
2		Professional Elective VI	PEC	3	3	0	0	3
3		Open Elective II	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4	24CB702	IT Project Management	PCC	4	2	0	2	3
5		Professional Elective V	PEC	4	2	0	2	3
AUDIT COURSE								
6	24CB711	Internship/Seminar (4 weeks)	EEC	4	0	0	4	2
TOTAL				19	12	0	8	16
FOR HONOURS DEGREE								
1		Honours Elective IV	OEC	3	3	0	0	3
2		Capstone Design Project	EEC	12	0	0	12	6
FOR MINOR DEGREE								
1		Minor Elective IV	OEC	3	3	0	0	3
2		Capstone Design Project	EEC	12	0	0	12	6

SEMESTER –VIII								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
EMPLOYABILITY ENHANCEMENT COURSE								
1	24CB811	Project Work	EEC	16	0	0	16	8
TOTAL				16	0	0	16	8

SUMMARY OF CREDIT DISTRIBUTION

Sl. No.	Category	Credits Per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	1	1	3		2	1			5+3
2	BSC	8	4	4	4	4				24
3	ESC	13	13							26
4	PCC		3	15	15.5	10	8	5		56.5
5	PEC					6	6	6		18
6	OEC						3	3		6
7	EEC	1	2	3	2.5	3.5	2.5	2	8	24.5
8	MC/AC	√	√	√	√	√	√			
	Total	23	23	25	22	25.5	20.5	16	8	160+3

HSMC - Humanities and Social Sciences including Management Course; BSC – Basic Science Course; ESC – Engineering Science Course; PCC – Professional Core Course; PEC – Professional Elective Course; OEC – Open Elective Course; EEC – Employability Enhancement Course; MC – Mandatory Course; AC – Audit Course

PROFESSIONAL ELECTIVE I								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB901	Conversational Systems	PEC	4	2	0	2	3
2.	24CB902	Robotics and Embedded Systems	PEC	4	2	0	2	3
3.	24CB903	Machine Learning	PEC	4	2	0	2	3

PROFESSIONAL ELECTIVE II								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB911	Industrial Psychology	PEC	3	3	0	0	3
2.	24CB905	Computational Finance and Modeling	PEC	3	3	0	0	3
3.	24CB906	Design Thinking	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE III								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB907	Data Mining and Analytics	PEC	4	2	0	2	3
2.	24CB908	Compiler Design	PEC	4	2	0	2	3
3.	24CB909	Enterprise Systems	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE IV								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB910	Introduction to Fintech	PEC	3	3	0	0	3
2.	24CB904	Organizational Behaviour	PEC	3	3	0	0	3
3.	24CB912	Services Science and Service Operational Management	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE V								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB913	Usability Design of Software Applications	PEC	4	2	0	2	3
2.	24CB914	Image Processing and Pattern Recognition	PEC	3	3	0	0	3
3.	24CB915	Business Intelligence	PEC	4	2	0	2	3

PROFESSIONAL ELECTIVE VI								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB916	Cognitive Science and Analytics	PEC	3	3	0	0	3
2.	24CB917	Financial Management	PEC	3	3	0	0	3
3.	24CB918	Introduction to Innovation, IP Management & Entrepreneurship	PEC	3	3	0	0	3

OPEN ELECTIVE								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES								
1	24CB001	Fundamentals of Management	OE	3	3	0	0	3
2	24CB002	Business Strategy	OE	3	3	0	0	3
3	24CB003	Design Thinking	OE	3	2	1	0	3
4	24CB004	Marketing Research and Marketing Management	OE	3	3	0	0	3
5	24CB005	Fundamentals of Economics	OE	3	3	0	0	3
6	24CB006	Industrial Psychology	OE	3	3	0	0	3

HONOURS VERTICALS								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
Business Analytics								
1.	24CB931	Python for Business Analytics	PEC	3	3	0	0	3
2.	24CB932	Big Data Analytics	PEC	3	3	0	0	3
3.	24CB932	Business Intelligence	PEC	3	3	0	0	3
4.	24CB934	Cognitive Science and Analytics	PEC	3	3	0	0	3
5.	24CB942	Capstone Project	EEC	12	0	0	12	6
Fintech and Blockchain								
1.	24CB911	Introduction to Fintech	PEC	3	3	0	0	3
2.	24CB935	Advance Finance	PEC	3	3	0	0	3
3.	24CB936	Financial Cost and Accounting	PEC	3	3	0	0	3
4.	24CB937	Introduction to Blockchain and its Applications	PEC	3	3	0	0	3
5.	24CB942	Capstone Project	EEC	12	0	0	12	6
Digital Marketing								

HONOURS VERTICALS								
Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB938	Social Media Marketing	PEC	3	3	0	0	3
2.	24CB939	Web Analytics	PEC	3	3	0	0	3
3.	24CB940	Digital Marketing Analytics	PEC	3	3	0	0	3
4.	24CB941	Recommender Systems	PEC	3	3	0	0	3
5.	24CB942	Capstone Project	EEC	12	0	0	12	6

R2024 B.TECH. COMPUTER SCIENCE AND BUSINESS SYSTEMS WITH MINOR DEGREE

S. No.	Minor Degree	Offering Department
1	Internet of Things	Electronics and Communication Engineering
2	Full Stack Engineering	Information Technology

**R2024
MINOR DEGREE – ADVANCED WEB DEVELOPMENT CURRICULUM OFFERED BY
DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS
(FOR OTHER B.E. / B.TECH PROGRAMMES)**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	24CB916	Usability Design of Software Applications	PEC	5	3	0	2	4
2.	24CB943	Front-end development using React	PEC	5	3	0	2	4
3.	24CB944	Server side programming with Ruby on Rails	PEC	5	3	0	2	4
4.	24CB945	Capstone Project	EEC	12	0	0	12	6
TOTAL				27	9	0	18	18

SEMESTER – I

Course Code	INTRODUCTION TO CALCULUS, PROBABILITY AND STATISTICS	L	T	P	C
24MA102		3	1	0	4

OBJECTIVES:

The course will enable the learners to:

- develop a comprehensive understanding concepts of differential and integral calculus.
- implement the fundamental probability concepts.
- identify discrete and continuous probability distributions.
- understand fundamental statistical concepts, including data collection, descriptive statistics and bivariate data analysis.

UNIT I CALCULUS 12

Basic concepts of differential calculus: Derivatives – product rule – quotient rule -chain rule, Basic concepts of integral calculus: Definition of definite and indefinite integrals – substitution method – Integration by parts.

UNIT II PROBABILITY 12

Concept of experiments – Sample space – Event – Definition of Probability (Probability problems using combinatorics) – Conditional Probability– Baye's Theorem – Expected values and moments – Mathematical expectation and its properties – Moments (including variance) and their properties – Interpretation – Moment generating function.

UNIT III DISCRETE PROBABILITY DISTRIBUTIONS 12

Binomial – Poisson – Geometric distributions: Moment Generating Function, Mean, Variance and its properties.

UNIT IV CONTINUOUS PROBABILITY DISTRIBUTIONS 12

Uniform – Exponential - Normal distributions: Moment generating function, Mean, Variance and its properties. Chi-square, student - t and F distributions (Definition and properties without proof).

UNIT V INTRODUCTION TO STATISTICS 12

Definition of Statistics – Basic objectives – Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data – Population and sample, Representative sample – Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves – Central tendency (Mean, Median and Mode) and dispersion (Standard Deviation, Quartile Deviation and Range) – Bivariate data – Summarization, marginal and conditional frequency distribution.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: evaluate the differentiation and integration problems using concepts of calculus.
CO2: compute the expected values, moments, variance and interpret their significance.
CO3: analyze the discrete probability distributions for countable outcomes.
CO4: analyze the continuous probability distributions to continuous variables.
CO5: develop proficiency in gathering, analyzing, and interpreting data from diverse sources.
CO6: apply probability concepts to solve problems involving uncertainty.

TEXT BOOKS:

1. S.M. Ross, "Introduction of Probability Models", 10th Edition, Academic Press, New York, 2010.
2. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", volume I & II, 1st Edition, World Press, 2013.
3. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publication, New Delhi, 2021.

REFERENCES:

1. S.M. Ross, "A first course in Probability", 8th Edition, Prentice Hall, 2010.
2. I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", 9th Edition, PHI, 2017.
3. A.M. Mood, F.A. Graybill and, D.C. Boos, "Introduction to the Theory of Statistics", 3rd Edition McGraw Hill Education, 1973.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Thomson Learning, 2011.
5. M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 2002.
6. NPTEL course on "Probability and Statistics" by Prof. Somesh Kumar, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/noc21_ma74/preview

24CS101	PROGRAMMING IN C++ (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

UNIT I PROGRAMMING FUNDAMENTALS

9+9

Procedural Languages vs Object Oriented Languages - Types of computer programming languages - Genesis of C++ - Program Life Cycle -Structure of C++ program - Identifiers - Variables - Keywords - Number System -Binary Number System -Octal Number System- Decimal Number System -Hexadecimal Number System - Data types - Constants - Errors – Operators- Expressions - Type Conversions - Control-Flow Statements - Conditional Statements - Iterative Statements - Unconditional Control Statements - Arrays - One-Dimensional Arrays - Two-Dimensional Arrays - Multi -Dimensional Arrays - Strings - String Manipulation Functions - Array of Strings.

List of Exercise/Experiments:

1. Write C++ programs for the following:
 - a. Find the sum of individual digits of a positive integer.
 - b. Compute the GCD of two numbers.
 - c. Find the roots of a number (Newton 's method)
2. Write C++ programs using arrays:
 - a. Find the maximum of an array of numbers.
 - b. Remove duplicates from an array of numbers.
 - c. Print the numbers in an array after removing even numbers.
3. Write C++ programs using strings:
 - a. Checking for palindrome.
 - b. Count the occurrences of each character in a given word.

UNIT II POINTERS AND FUNCTIONS

9+9

Pointers - Pointer Variables - Pointer Operators & Expressions -Pointers with Arrays -Functions - Scope Rules -Function Arguments -return Statement - Function Variables - Storage Classes - Types of storage classes - Create Header Files - User-Defined Functions - Inline Functions - Function Overloading -Recursion - Namespaces.

List of Exercise/Experiments:

1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members: EID, Ename, Designation, DOB, DOJ, Basic pay
Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

UNIT III CLASSES AND OBJECTS

9+9

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

List of Exercise/Experiments:

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

Practice Questions & Scenario Based Questions:

1. Imagine you are working as a software engineer at a tech company. Your team is developing a mathematical software library that will be used in various applications across the company. One of the features that your team lead has asked you to implement is a function that calculates the number of trailing zeros in the factorial of a number.
The team lead has emphasized the importance of encapsulation in your implementation.

2. Create a C++ class Calculator representing a simple calculator. The class should have the following attributes and methods:

Attributes: Two operands and an operation (+, -, *, /)

Methods: Perform the operation and return the result

Implement constructors to initialize the calculator with default values (0,0) and with specified values. Also, implement a destructor to perform any necessary cleanup.

UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM

9+9

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.

Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

List of Exercise/Experiments:

1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:
a) Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchical inheritance.

Practice Questions & Scenario Based Questions:

1. Joy is a software developer at a 3D modeling company. The company is developing a new software tool that will be used by architects and engineers to design and analyze 3D models of various structures. One of the features that her project manager has asked is to implement a function that calculates the volume of basic 3D shapes like cylinders and cuboids. The project manager has emphasized the importance of using function overloading in her implementation.
2. Imagine you are a software developer tasked with creating a utility program for a school that handles student scores. The school wants a simple program where teachers can enter the scores of students for a particular test, and the program will then provide the highest and lowest scores among them. This will help the teachers quickly identify the top performer and the student who might need extra help.

Your task is to write program that satisfies the above scenario using **inline function**

3. Develop a software system to manage part-time worker students at a university. These students have unique attributes such as their name, student ID, hourly wage, and hours worked per week.

Your goal is to create a C++ program that models this system.

Ramu is a software developer at a company specializing in developing software solutions for geometric shapes. Recently, a client approached with a request to create a program to calculate the areas of rectangles and triangles.

UNIT V I/O, FILES AND EXCEPTIONS

9+9

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

List of Exercise/Experiments:

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.

Practice Questions & Scenario Based Questions:

1. Develop a simple library management system. Create a base class Book representing a book in the library. The class should have attributes such as title, author, and ISBN (International Standard Book Number). Implement a virtual function displayDetails() to display information about the book.
2. A software developer working on a banking application. One of the requirements is to analyze account holders' balances based on a minimum balance threshold. The application should read account information from a sequential access file, where each line represents an account record in the format: account_holder_name, balance.
3. The financial company is developing a new software tool that will be used by financial analysts to perform various calculations. One of the features of that project is to implement a function that performs division of two numbers.
Write a program that takes two integer inputs, numerator and denominator, from the user. Implement error handling to check if the denominator is zero. If the denominator is zero, display the message "Division by zero is not allowed!" using an exception. If the denominator is not zero, calculate the result of the division and display it.
4. Mini project.

TOTAL: 45 (L) + 45 (P) = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Solve problems using basic constructs in C++.

CO2: Implement C++ programs using pointers and functions.

CO3: Apply object-oriented concepts and solve real world problems.

CO4: Develop C++ programs using operator overloading and polymorphism.

CO5: Implement C++ programs using Files and exceptions.

CO6: Develop applications using C++ concepts

TEXT BOOKS:

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015.
2. E Balagurusamy, "Object Oriented Programming with C++", 4th Edition, Tata McGraw-Hill Education, 2008.

REFERENCES:

1. Karl Beecher, "Computational Thinking: A beginner's guide to problem-solving and programming", BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, "Programming and Problem Solving with C++", 5th Edition, Jones and Bartlett Publishers, 2010.
3. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
4. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
5. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
7. Paul Deitel, Harvey Deitel, "C++ How to Program", 10th Edition, Pearson Education Inc. 2017.
8. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01297200240671948837_shared/overview

LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

24CS102	SOFTWARE DEVELOPMENT PRACTICES (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:**The Course will enable learners to:**

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I AGILE SOFTWARE DEVELOPMENT AND Git and GitHub 9+9

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

List of Exercise/Experiments:

1. Form a Team, Decide on a project:
 - a) Create a repository in GitHub for the team.
 - b) Choose and follow a Git workflow
 - Each team member can create a StudentName.txt file with contents about themselves and the team project
 - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
 - Team members can now create a Pull request to merge the branch to master branch or main development branch.
 - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
 - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II HTML 9+9

Introduction – Web Basics – Multitier Application Architecture – Client-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

List of Exercise/Experiments:

1. Create web pages using the following:

- Tables and Lists
- Image map
- Forms and Form elements
- Frames

UNIT III CSS**15**

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

List of Exercise/Experiments:

1. Apply Cascading style sheets for the web pages created.

UNIT IV JAVASCRIPT BASICS**9+9**

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:

1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

UNIT V JAVASCRIPT OBJECTS**9+9**

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:

Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.

- a. Online assessment system
- b. Ticket reservation system
- c. Online shopping
- d. Student management system
- e. Student result management system
 - f. Library management
 - g. Hospital management
- h. Attendance management system
- i. Examination automation system
- j. Web based chat application

TOTAL: 45 (L) + 45 (P) = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand basic software engineering practices effectively.

CO2: Apply version control using Git and GitHub, and manage code repositories proficiently.

CO3: Design web applications using HTML, CSS, and JavaScript.

CO4: Analyze problems and create solutions using CSS for better web page presentation and usability.

CO5: Develop interactive web pages using JavaScript with an event-handling mechanism.

CO6: Apply the technological changes and improve skills continuously.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Ninth Edition, 2020.
2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.

REFERENCES:

1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944214274703362099_shared/overview

LIST OF EQUIPMENTS:

1. Systems with either Netbeans or Eclipse
2. Java/JSP/ISP Webserver/Apache
3. Tomcat / MySQL / Dreamweaver or
4. Equivalent/ Eclipse, WAMP/XAMP

24EE102	PRINCIPLES OF ELECTRICAL ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

The Course will enable learners to:

- Study the basic concepts of electrical engineering.
- Analyse the basic DC and AC networks.
- Explain the concepts of electrostatics and electromagnetics
- Acquaint the knowledge about the measurement of electrical quantities.
- Demonstrate the concepts of electrical wiring and safety.

UNIT I INTRODUCTION 15

Basics of electric circuits- terminology and symbols - passive and active elements, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff's laws and applications to network solutions using mesh and nodal analysis.

1. Familiarization of electrical Elements and sources related to electrical circuits
2. Verification of Kirchhoff's laws

UNIT II DC CIRCUITS 15

Current-voltage relations of the electric network by mathematical equations to analyze the network - simplifications of networks using series- parallel, star/delta transformation. Thevenin's theorem, Norton's theorem, maximum power transfer theorem, super position theorem, Verification of Thevenin's and Norton's Theorem

1. Verification of Maximum Power Transfer Theorem

UNIT III AC CIRCUITS 15

AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase balanced AC circuits (Y- Δ & Y-Y).

1. Simulation of R-L-C series circuits and time response of RC circuit
2. Verification of relation in between voltage and current in three phase balanced star and delta connected loads

UNIT IV ELECTROMAGNETISM 15

Electricity and magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, magnetic circuit. Single phase transformer - Principle of operation - EMF equation - Voltage ratio - current ratio - KVA rating - Efficiency and regulation. Electromechanical energy conversion.

1. Load test on single phase transformer
2. Study of magnetic field along a current carrying conductor

UNIT V MEASUREMENTS AND SENSORS 15

Introduction to measuring devices/sensors and transducers - piezoelectric and thermocouple, elementary methods for the measurement of electrical quantities in DC and AC systems - current and single-phase power, electrical wiring: basic layout of the distribution system, types of wiring system and wiring accessories, necessity of earthing, Types of earthing, safety devices and system.

1. Measurement of power in a given DC Circuit.
2. Measurement of power in a given AC Circuit.

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Summarize the behavior electrical circuits

CO2: Solve the DC circuits using network theorems

CO3: Interpret the concepts of AC circuits

CO4: Discuss the electrostatic and magnetic fields with circuit laws and analyze the performance of transformers

CO5: Explain the various sensors and demonstrate electric wiring

TEXT BOOKS:

1. A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Electric Machinery, sixth edition, Tata McGraw Hill, 2014.
2. B. L. Theraja, A Textbook of Electrical Technology, (vol. I), Chand And Company Ltd., New Delhi, 2017.
3. V. K. Mehta, Basic Electrical Engineering, S. Chand and Company Ltd., New Delhi, 2016.
4. I.J. Nagrath and Kothari, Theory and Problems of Basic Electrical Engineering, second edition, Prentice Hall of India Pvt. Ltd, 2018.

Course Code	FUNDAMENTALS OF PHYSICS	L	T	P	C
24PH102		3	0	2	4

OBJECTIVES:

The course will enable the learners to:

- impart the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.
- illustrate the fundamentals of oscillatory systems and the analogy of mechanical and electrical systems.
- explain various light concepts like interference, diffraction and polarization.
- relate the EM waves with the concepts of quantum mechanics
- get introduced to the concepts of crystallography, band structure
- identify lasing action in various types of lasers and find its applications in optical fibers

UNIT I WAVES AND OSCILLATIONS**12**

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring-mass system - Resonance- definition, damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor - forced oscillation - resonance in mechanical and electrical oscillators.

(Theory -9)

1. Determination of rigidity modulus of wire and moment of inertia of the disc by torsional Pendulum

(Laboratory-3)

UNIT II OPTICS

15

Interference - principle of superposition - Young's experiment: Theory of interference fringes - types of interference - Fresnel's prism - Newton's ring – Diffraction: Two kinds of diffraction - Difference between interference and diffraction - Fraunhofer diffraction at single slit- plane diffraction grating - Temporal and Spatial Coherence.

Polarization of light - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light - Brewster's law - double refraction.

(Theory -9)

1. Determination of wave length of light by Newton's Ring method
2. Determination of thickness of a wire by Air wedge method

(Laboratory -6)

UNIT III ELECTROMAGNETISM AND QUANTUM MECHANICS

18

Basic Idea of Electromagnetism: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium - Quantum Mechanics: Introduction, Planck's quantum theory- Matter waves, de-Broglie wavelength - Heisenberg's Uncertainty principle- time independent and time dependent Schrödinger's wave equation - Physical significance of wave function - Particle in a one-dimensional potential box.

(Theory -12)

1. Determination of Planck's constant
2. Magnetic field along the axis of current carrying coil – Stewart and Gee

(Laboratory -6)

UNIT IV CRYSTALLOGRAPHY AND THERMODYNAMICS

15

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction - Semiconductor Physics: Conductor, Semiconductor and Insulator; Origin of Band Theory, Basic concept of Band theory - Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law and second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

(Theory -9)

1. Determination of Hall coefficient of semiconductor
2. Crystal growth by slow evaporation

(Laboratory -9)

UNIT V LASER

15

Laser and Fiber optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby

Laser, CO₂ and Neodymium YAG (Neodymium - doped Yttrium Aluminum Garnet) lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering, Fiber optics and applications, types of optical fibers.

(Theory -9)

1. Determination of wavelength of light by Laser diffraction method
2. Determination of laser and optical fiber parameters

(Laboratory -6)

TOTAL: 75 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: obtain solution of the forced and damped oscillator using differential equation.
CO2: apply the concept of interference to form Newton's rings and calculate the wavelength of light
CO3: derive the Schrodinger wave equation and determine the solution for a particle in a one-dimensional box.
CO4: calculate the atomic packing factor and d spacing of crystals
CO5: analyze and determine the properties of laser and optical fiber and its applications.
CO6: calculate the packing factor for various crystal structure.

TEXT BOOKS

1. A Beiser, Concepts of Modern Physics, (Fifth Edition), McGraw Hill International.
2. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
3. Sears and Zemansky -University Physics- (Addison-Wesley)
4. Jenkins and White, Fundamentals of Optics, (Third Edition), McGraw-Hill.
5. M.N. Avadhanulu and P.G. Kshirsagar, "A text book of Engineering Physics", S. Chand and Company, New Delhi, 2014.
6. R.K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai Publications (P) Ltd., Eighth Edition, New Delhi, 2001.

REFERENCES

1. Halliday, Resnick and Walker, Fundamentals of Physics, 9th Ed., John Wiley & Sons (2011).
2. Richard P. Feynman, The Feynman Lectures on Physics - Vol. I, II and III: The New Millennium Edition (2012).
3. Neil W Ashcroft and N David Mermin, "Solid State Physics", Harcourt College Publishers, 1976
4. S. O. Pillai, "Solid state physics", New Age International, 2015.
5. M A Wahab, "Solid State Physics", 3rd Edition, Narosa Publishing House Pvt. Ltd., 2015

6. Garcia, N. and Damask, A. "Physics for Computer Science Students" Springer-Verlag, 2012.
7. Rogers, B., Adams, J and Pennathur, S., "Nanotechnology: Understanding Small System", CRC Press, 2014.
8. Wilson J.D. and Hernandez C.A., Physics Laboratory Experiments, Houghton Mifflin Company, New York 2005.
9. NPTEL course on "Introduction to LASER" by Prof. M. R. Shenoy, IIT Delhi : https://onlinecourses.nptel.ac.in/noc24_ph45/preview
10. NPTEL course on "Nature and Properties of Materials - An Introductory Course" by Prof. Ashish Garg, IIT Kanpur : https://onlinecourses.nptel.ac.in/noc24_mm32/preview
11. Fundamentals of Physics - Laboratory Manual, R.M.K. Engineering College, 2022.

S. No.	Description of Equipment	Quantity
1.	Newton's Ring apparatus	6 Nos.
2.	Planck's constant apparatus	6 Nos.
3.	Magnetic field along the axis of current carrying coil – Stewart and Gee	6 Nos.
4.	Semiconductor Laser	6 Nos.
5.	Determination of optical fiber parameters	6 Nos.
6.	Hall effect set-up	2 Nos.
7.	Torsional pendulum	6 Nos.
8.	Slow evaporation crystal growth	6 Nos.
9.	Air wedge set-up	6 Nos.

24GE101	HERITAGE OF TAMILS (Common to All Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES:

The Course will enable learners to:

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thina in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

UNIT I LANGUAGE AND LITERATURE

3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism &

Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -- Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: State the role of Tamil literature in shaping Tamil Cultural roots.

CO2: Express the cultural and religious significance of Tamil art and sculptures.

CO3: Identify and describe the techniques of folk and martial arts.

CO4: Classify the role of Thinai concept in Tamil culture and literature.

CO5: Compare the idea of cultural and intellectual contributions of Tamils.

TEXT BOOKS & REFERENCES:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – டாக்டர். பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கண்ணித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
கழிடி – வைகை நதிககரையில சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3. பொருதை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
5. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies).
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services)

- Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay)
(Published by: The Author)
 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu
Text Book and Educational Services Corporation, Tamil Nadu)
 12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) –
Reference Book

24MC101	STUDENT INDUCTION PROGRAM (SIP) (Common to all branches of First Year B.E./ B.Tech)	L	T	P	C
		3 Weeks			

OBJECTIVES:

The Course will enable learners to:

- Facilitate the adjustment of new students to the new environment, ensuring they feel comfortable and supported.
- Inculcate the institution's ethos and culture in new students, helping them internalize these values.
- Encourage the building of bonds among students and between students and faculty members.
- Expose students to a sense of larger purpose and guide them in their journey of self-exploration.

The various modules or core areas recommended for the 3-week SIP are

Module 1	Universal Human Values I	18
Welcome and Introductions - Aspirations and Concerns - Self- Management - Health - Relationships - Society - Natural Environment - Sum Up - Self-evaluation and Closure.		
Module 2	Physical Health and Related Activities	6
Special Lecturers: Happy and Healthy lifestyle - Physical Health -Mental Health - Health and Fitness.		
Module 3	Familiarization of Department/ Branch and Innovation	8
Principal Address - Address by Head of Science and Humanities - Addresses by Respective Department HoDs – Campus Tour – CoE introduction – Introduction of Student Activity Cell (SAC).		
Module 4	Visit to a Local Area	4
Virtual tour: Government Museum - Theosophical Society - Fort St. George - Ripon Building - Kalakshetra Foundation - Anna Centenary Library - Marina Beach - St. Thomas Mount - Vivekananda House.		
Module 5	Lectures by Eminent People	10
Special Lecturers: Academics – industry – Careers – Art - Self-management.		

Module 6	Proficiency Modules	30
Basic Competencies: C Programming, Foundation in Mathematics, Interpersonal Communication.		
Module 7	Literature / Literary Activities	7
Literary Debate - Creative Writing Workshop - Literature Circle Discussions - Author Study and Presentation.		
Module 8	Creative Practices	10
Activity: Handicrafts (Painting / Drawing / Pottery / Knitting / Jewellery making, etc.)		
Module 9	Extra-Curricular Activities	10
Students Activity Cell: Activities from Coding Club – Math Club -- Language Club – Astronomy Club - ECO Club - Photography Club - Tedx Club -Yoga Club.		
Valedictory and Closing Ceremony		2
		TOTAL: 105 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1:** Achieve a smooth transition where students feel comfortable and confident in their new environment.
- CO2:** Demonstrate a strong understanding and practice of the institution's ethos and culture within the campus community.
- CO3:** Build meaningful and supportive relationships with peers and faculty members.
- CO4:** Develop a clear sense of purpose and engage in self-exploration, leading to a deeper understanding of personal goals and aspirations.

REFERENCES:

<https://www.aicte-india.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf>

24MC102	PROGRAMMING IN C (Common to All Branches)
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OBJECTIVES:

The Course will enable learners to:

- To learn problem solving and programming fundamentals in C.
- To gain knowledge on Arrays and Functions.
- To understand Pointers, Structures and File handling concepts.

UNIT I INTRODUCTION TO C PROGRAMMING

10

Introduction to C, Comments, Tokens, Character set, Identifiers- Variables, Keywords, Bits and Bytes representations- Data Types, Type Qualifiers- Symbolic Constants, One's and Two's Complement Forms, Expressions and Statements- Operators- Operator Precedence and Associativity- Pre-Processor Directives- I/O Functions- Control Structures: Decision Making Statements For Loop-While and do-while Loops

UNIT II ARRAYS AND FUNCTIONS

15

Array Operations-One dimensional array-Multi Dimensional Array - Practice Programs- Searching-Sorting-String Handling Functions- Function: Declaration, Definition, Function Call and Return Statements-Passing Parameters to Functions-Types of Functions-Calling Functions from Another Function and Recursive Functions. Variable Scope, Lifetime and Storage Classes-Storage Classes-Problem Solving using Recursion- Towers of Hanoi Problem, Advantages and Disadvantages of Recursion.

UNIT III POINTERS, STRUCTURES AND FILE HANDLING CONEPTS

15

Introduction to Pointers-Dynamic Memory Allocation-Pointers of Arrays and Strings-Pointer Arithmetic - Pointers to Functions-Introduction to User Defined Data Types-Structures, Functions and Nested Structures-Bit Fields in Structure and Union Enumerated Data Types- Introduction to File Handling-Advanced File Operations-Command Line Arguments & Error Handling.

TOTAL HOURS: 40

OUTCOMES:

Upon completion of the course, the students will be able to develop a C program, control the sequence of the program and give logical outputs, implement strings in C program, store different data types in the memory, write functions in C and also handle files

REFERENCES:

1. Programming in C. E. Balagurusamy. 9th Edition, Tata McGraw-Hill Publishing, 2020. ISBN
2. The C programming language. BW Kernighan, DM Ritchie. Prentice Hall, Englewood Cliffs 2015

24MC105	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to all Branches)	L	T	P	C
		2	0	0	MC

OBJECTIVES:

The Course will enable learners to:

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and Waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

UNIT I NATURAL RESOURCES

7

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - types - forest resources: use and over-exploitation, deforestation and its impacts, food resources: effects of modern agriculture, organic farming, renewable energy sources - solar, wind, geothermal, tidal, OTE and biomass. field activity -tree plantation

UNIT II POLLUTION AND WASTE MANAGEMENT

7

Pollution - definition –causes, effects and control measures of (a) air pollution (b) water pollution(c) soil pollution (d) noise pollution (e) nuclear hazards - nuclear accidents and holocaust - role of an individual in prevention of pollution –case studies.

Waste management- municipal solid wastes, E- waste, plastic waste.

Field study – Solid waste management of the institution

UNIT III BIODIVERSITY AND ITS CONSERVATION

6

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: in-situ and ex-situ method.

Field study – Biodiversity of the institution

UNIT IV SUSTAINABILITY AND MANAGEMENT

5

Sustainability-concept, needs and challenges- circular economy - sustainable development goals- concept of carbon footprint, environmental impact assessment, clean development mechanism, solutions.

Field study – Alternate energy sources and its impacts

UNIT V HUMAN POPULATION

5

Introduction - population growth, variation among nations, population explosion, environment and human health – endemic/epidemic/pandemic – role of information technology in environment and

human health.

Case Study – Pandemics of 21st century

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: To investigate and use conservational practices to protect natural resources.

CO2: To identify the causes of pollutants and illustrate suitable methods for pollution abatement.

CO3: To analyze the values of biodiversity and its conservational methods.

CO4: To classify suitable sustainable development practices and apply it in day-to-day life.

CO5: To assess the impacts of human population and suggest suitable solutions.

CO6: To develop innovative solutions and strategies to address sustainability challenges.

TEXTBOOKS:

1. Anubha Kaushik and C.P. Kaushik, “Perspectives in environmental studies”, New Age International Publishers, 8th edition, 2024.
2. Benny Joseph, Environmental Science and Engineering, McGraw-Hill, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., 3rd edition, 2021.

REFERENCES:

1. William P. Cunningham and Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, —Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O. and Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

24ME111	IDEA LAB - I (Common to all Branches)	L	T	P	C
		0	0	1	0

The students may be grouped into 3 to 4. The device/Machine/system/component are studied by the students and a final presentation to be done by the students about the study of various devices or machinery at the end of the semester.

OBJECTIVES:

The Course will enable learners to:

- Understand the functionalities and limitation of various machines/equipment
- Demonstrate various operations that can be performed using various Machines

LIST OF EXPERIMENTS

1. Study of fundamental operations of 3D Printer and Scanner with Software.
2. Study of Laser cutting machine.
3. Study of CNC Router machine.
4. Study of Fundamentals of basic circuit design, Soldering and Desoldering.
5. Study of PCB Milling Machine.

TOTAL: 15 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1:** Describe the working of the 3D Printer.
- CO2:** Explain the operation of the CNC router and laser cutting machines.
- CO3:** Explain the basic parts and PCB fabrication process.
- CO4:** Develop the ability to handle delicate electronic components carefully, minimizing damage during the soldering process.
- CO5:** Describe the process for converting ideas into prototypes.

LIST OF EQUIPMENT FOR A BATCH OF 33 STUDENTS

S.No.	Description of Equipment	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Multimeter	5 Nos.
6	Solder Stations	5 Sets
7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No
9	Variable Power Supply	1 No
10	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	5 Sets

Course Code	INTERPERSONAL SKILLS, PSYCHOMETRIC ANALYSIS AND CAREER DEVELOPMENT (Common to all the branches)	L	T	P	C
24HS111		1	0	0	1

OBJECTIVES

The course will enable the learners to:

- Evaluate and enhance language proficiency by using SMART Vox to assess communication skills and linguistic abilities.
- Explore future technologies, solve real-time problems, and prepare students for campus recruitment.
- Assess and develop work style, cognitive abilities, emotional intelligence, and work competencies
- Explore placements, internships, higher education options, GATE and CAT exams, and

career development.

- Understand career milestones, assess personal skills and personality, and develop effective goal-setting strategies for successful career planning

UNIT I LANGUAGE PROFICIENCY EVALUATION 3

Identification of Strengths and Weaknesses - Assessing Language Skills (Diagnostic tests and interactive exercises) - Measuring Language Competence (Proficiency Levels) - Identifying Support Needs - Developing Individual Learning Plans - Enhancing Student Experience (Building Confidence) – Evaluation using SMART Vox

UNIT II CAREER GUIDANCE 3

Future of Engineering- Various aspects of Technology and its Applications - Future of Technologies – Branch Specific emerging technologies - Problems solving through open source - Campus recruitment process.

UNIT III PSYCHOMETRIC EVALUATION 3

Understanding Behavioural work style (Personality)- Testing of numerical, logical, and verbal reasoning skills (Cognitive Abilities / Aptitude) – Measure of emotional intelligence and interpersonal skills – Determination of Culture Preferences in various workplace scenarios – Evaluation of Work Competencies through targeted games and simulations

UNIT IV CAREER PREPARATION 3

Present Scenario of Engineering - Placement Opportunities - Internship Opportunities - Types of Internships- Higher Education opportunities in India and Abroad - Understanding GATE and CAT Exams - Other Opportunities - Career path development plans.

UNIT V CAREER VISION AND PLANNING 3

Introduction to career milestones - Overview of the Vision Assessment and its benefits - Psychometric evaluation - Numeracy, Literacy, Visual Reasoning, Algorithmic Thinking - Introduction to a goal-setting model - Identification career pathways aligned with personality profiles - Evaluate personal skills and abilities in various areas.

COURSE OUTCOMES

TOTAL: 15 PERIODS

Upon completion of the course, the students will be able to:

CO1: Assess and improve their English language proficiency using SMART Vox, gaining insights into their communication skills and linguistic competence

CO2: Understand future engineering trends, emerging technologies, importance of solving real-time problems, and the process of campus recruitment.

CO3: Evaluate their behavioral work style, cognitive abilities, emotional intelligence, cultural preferences, and work competencies.

CO 4: Understand the current engineering landscape, placement opportunities, and higher education prospects to develop effective career path plans

CO5: Develop a clear and actionable vision for their future career path.

SEMESTER II

Course Code	LINEAR ALGEBRA	L	T	P	C
24MA203		3	1	0	4

OBJECTIVES:

The course will enable the learners to:

- ensure the fundamental concepts of matrix operations.
- impart the knowledge of vectors and linear combinations.
- illustrate the basic notions associated with vector spaces and its properties.
- utilize the Gram-Schmidt ortho normalization process.
- implement the concept of linear combinations in image processing and Machinelearning.

UNIT I MATRICES AND DETERMINANTS 12

Introduction to Matrices and Determinants – Solution of Linear Equations – Cramer's rule – Inverse of a Matrix.

UNIT II VECTORS AND LINEAR COMBINATIONS 12

Vectors and linear combinations – Rank of a matrix – Gaussian elimination – LU Decomposition – Solving Systems of Linear Equations using LU Decomposition method.

UNIT III VECTOR SPACE 12

Vector space – Dimension – Basis – Orthogonality – Projections – Gram-Schmidt orthogonalization and QR decomposition.

UNIT IV LINEAR TRANSFORMATIONS 12

Linear transformations – Eigen values and Eigen vectors – Positive definite matrices – Hermitianand unitary matrices.

UNIT V APPLICATIONS OF MATRICES 12

Singular value decomposition and Principal component analysis – Introduction to their applications in Image Processing and Machine Learning.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Apply Cramer's rule for solving the system of linear equations.
CO2: Utilize the LU Decomposition technique to solve the system of equations.
CO3: Execute the QR decomposition for a given matrix.
CO4: Develop problem-solving abilities through the application of linear algebra techniques.
CO5: Determine the eigenvalues and eigenvectors.
CO6: Apply matrix techniques in Image Processing and Machine Learning.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi 2021.
2. H. Friedberg, A. J. Insel and L. Spence, "Linear Algebra", Prentice Hall of India, 4th Edition, New Delhi, 2004.

REFERENCES:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, 7th Edition.
2. Michael. D. Greenberg, "Advanced Engineering Mathematics", Pearson, 2nd Edition.
3. Gilbert Strang, "Introduction to linear algebra", Wellesley - Cambridge Press, 5th Edition.
4. P. N. Wartikar & J.N. Wartikar, "Applied Mathematics", Volume I & II, Pune Vidyarthi Griha Prakashan, 7th Edition, 1994.
5. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson Education International, 3rd Edition.
6. Steven J. Leon, Linear Algebra with Applications, Pearson Education International, 9th Edition.
7. NPTEL course on "Linear Algebra", by Prof. K. C. Sivakumar, IIT Madras:
<https://archive.nptel.ac.in/courses/111/106/111106051/##>.



24CS201	DATA STRUCTURES (Common to CSE, CSD, ADS, CSBS and IT)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- To understand and apply Tree data structures.
- To understand and apply Graph structures.
- To analyze sorting, searching and hashing algorithms.

UNIT I LINEAR DATA STRUCTURES – LIST

9+9

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

List of Exercise/Experiments:

- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES

9+9

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

List of Exercise/Experiments:

- Array implementation of Stack and Queue ADTs.
- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
- Applications of Stack – Infix to postfix conversion and expression evaluation.

UNIT III NON LINEAR DATA STRUCTURES – TREES

9+9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT– AVL Tree.

List of Exercise/Experiments:

- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
- Implementation of Heaps using Priority Queues.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS

9+9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

List of Exercise/Experiments:

- Graph representation and Traversal algorithms.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES

9+9

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertion sort – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

List of Exercise/Experiments:

- Implement searching and sorting algorithms.

TOTAL: 45(L) + 45(P) = 90 PERIODS**OUTCOMES:****Upon completion of the course, the students will be able to:****CO1:** Analyze algorithms and abstract data types (ADTs).**CO2:** Evaluate fundamental data structures.**CO3:** Implement linked data structures and its application.**CO4:** Apply advanced tree data structures.**CO5:** Understand basic graph theory concepts.**CO6:** Evaluate various searching and sorting algorithms.**TEXTBOOKS:**

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson Education, 2014.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon paper publications, 2004.

REFERENCES:

1. Rajesh K. Shukla, "Data Structures using C and C++", Wiley India Publications, 2009.
2. Narasimha Karumanchi, "Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles", CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2017.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, "Fundamentals of Data Structures in C++", Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01350157816505139210584/overview

LIST OF EQUIPMENTS:

1. Systems with Linux/Ubuntu Operating System with gnu C++ compiler

24CS202	JAVA PROGRAMMING (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:**The Course will enable learners to:**

- To explain object oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

UNIT I JAVA FUNDAMENTALS**9+9**

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword –

Overloading methods - Overloading constructors - Access Control – Static – Final

List of Exercise/Experiments:

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff

If the type of the EB connection is domestic, calculate the amount to be paid as follows: First 100 units - Rs. 1 per unit

101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit

> 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

First 100 units - Rs. 2 per unit

101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit

> 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)
- Find kth smallest element in an unsorted array
 - Find the sub array with given sum
 - Matrix manipulations – Addition, Subtraction, Multiplication
 - Remove duplicate elements in an Array
- e. Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

Example: The 11th digit in the sequence 12345678910111213.... is 0.

UNIT II INHERITANCE, INTERFACES AND EXCEPTION HANDLING 9+9

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

List of Exercise/Experiments:

1. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.

2. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

3. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.

4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Numberofsides() that prints the

number of sides of the given shape.

5. Write a Java program to apply built-in and user defined exceptions.

UNIT III MULTITHREADING, I/O AND GENERIC PROGRAMMING 9+9

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

List of Exercise/Experiments:

1. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

UNIT IV STRING HANDLING AND COLLECTIONS 9+9

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

List of Exercise/Experiments:

1. String Manipulation:

- a. Reversing a set of words and count the frequency of each letter in the string.
- b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
- c. Remove all the occurrences of string S2 in string S1 and print the remaining.
- d. Find the longest repeating sequence in a string
- e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

2. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

3. Collections:

- a. Write a program to perform string operations using ArrayList. Write functions for the following
 - i. Append - add at end
 - ii. Insert – add at particular index
 - iii. Search
 - iv. List all string starts with given letter
- b. Find the frequency of words in a given text.

UNIT V JDBC CONNECTIVITY 9+9

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

List of Exercise/Experiments:

- Mini Project (using JDBC)

TOTAL: 45(L) + 45(P) = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Solve core Java programming concepts.

CO2: Utilize object-oriented programming (OOP) principles.

CO3: Demonstrate competency in handling exceptions and implementing multithreading.

CO4: Develop expertise in input/output (I/O) operations and file handling.

CO5: Apply advanced Java programming concepts with generics and lambda expressions.

CO6: Implement database connectivity using JDBC.

TEXTBOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2019.

REFERENCES:

1. Cay S. Horstmann, Gary Cornell, "Core Java Volume – I Fundamentals", 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

LIST OF EQUIPMENTS:

1. Java and Eclipse / NetBeans IDE or Equivalent

24EC201	PRINCIPLES OF ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

COURSEOBJECTIVES:

The Course will enable learners to:

- Studythe operation of semiconductor diodes and their characteristics
- Acquire knowledge about the operation and characteristics of BJT under various configurations
- Introduce the structure and terminal characteristics of FET and MOSFET
- Understand the concepts of feedback and operational amplifiers with its applications
- Gain knowledge about digital logic circuits.

UNIT I

SEMI CONDUCTOR DIODES AND CIRCUITS

9

Semiconductors: P&N-type semiconductors, intrinsic & extrinsic - Diodes and Diode Circuits: Formation of P-N junction, built-in potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener break down and its reverse characteristics - Rectifier circuits: half wave, full wave

List of Experiments:

1. Characteristics of PN junction diode
2. Zener diode characteristics

UNIT II**BIPOLAR JUNCTION TRANSISTORS****9**

Formation of PNP & NPN junctions and principle of transistors - CE, CB, CC configurations - transistor characteristics: cut-off active and saturation mode, transistor action, current amplification factors for CB and CE modes

List of Experiments:

3. Common Emitter Input Output characteristics

UNIT III**FIELD EFFECT TRANSISTORS****9**

Concept of Field Effect Transistors (channel width modulation), JFET Structure and characteristics - MOSFET Structure and characteristics : depletion and enhancement type **List of Experiments:**

4. FET characteristics

UNIT IV**FEEDBACK AMPLIFIER AND OPERATIONAL AMPLIFIERS****9**

Positive and negative feedback amplifier: Concept (Block diagram), open loop gain, loop gain, feedback factors – condition of oscillation: Barkhausen criteria - Operational amplifier and its terminal properties - Application of operational amplifier: inverting and non-inverting mode of operation.

List of Experiments:

5. Design of an inverting operational amplifier using Simulation Spice
6. Design of a non-inverting operational amplifier using Simulation Spice

UNIT V**DIGITAL ELECTRONICS FUNDAMENTALS****9**

Difference between analog and digital signals, Logic ICs, half and full adder, half and full subtractor, multiplexers, demultiplexers

List of Experiments:

7. Simplification, realization of Boolean expressions using logic gates / Universal gates
8. Realization of Half and Full adders using logic gates
9. Realization of Half/Full Subtractors using logic gates
10. Construction of Multiplexer and Demultiplexer circuits using logic gates

TOTAL: 45 PERIODS (THEORY) + 30 PERIODS (LAB) = 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: Examine the performance of electronic circuits using PN junction diode and Zener diode.

CO2: Construct electronic circuits using BJT and to sketch the input and output characteristics.

CO3: Examine the terminal characteristics of FET and MOSFET

CO4: Acquire the knowledge on feedback amplifiers and operational amplifiers.

CO5: Design of simple Digital Logic Circuits.

CO6: Perform practical exercises as an individual and / or team member to manage the task in time.

TEXTBOOKS:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar , Microelectronic Circuits: Theory And Applications, 7th Edition, Oxford University Press ,2017
2. Jacob Millman, Christos Halkias, Chetan Parikh, Millman's Integrated Electronics, 2nd Edition, McGraw Hill Education,2017
3. M.Morris Mano, Digital Logic & Computer Design, 1st Edition, Pearson,2016

REFERENCES:

1. RobertL. Boylestad, Louis Nashelsky Electronic Devices and Circuit Theory, 11th Edition, Pearson,2017.
2. Ben Streetman, Sanjay Banerjee, Solid State Electronic Devices,6th Edition, Pearson,2015.
3. Albert Paul Malvino, Electronic Principle,8th Edition, McGraw Hill, 2015.
4. D Schilling C Belove T Apelewicz R Saccardi Electronics Circuits: Discrete & Integrated, 3rd Edition, McGraw Hill, 2002.
5. Jacob Millman, Arvin Grabel, Micro electronics,2nd Edition, McGraw Hill, 2017.
6. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, Electronics Devices & Circuits, 4th Edition, McGraw Hill, 2017

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. BC 107, BC 148, 2N2646, BFW10 - 25 each
2. 1N4007, Zener diodes - 25 each
3. Bread Boards -15 Nos
4. CRO (30MHz) - 10 Nos
5. Signal Generator /Function Generators (3 MHz) - 15 Nos
6. Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) - 50 Nos
7. Dual power supply/ single mode power supply - 15 Nos
8. IC Trainer Kit -15 Nos
9. Seven segment display -15 Nos
10. Digital LCR Meter - 2 Nos
11. Multimeter -15 Nos
12. IC tester -2Nos
13. Standalone desktop PCs - 15 Nos.
14. SPICE Circuit Simulation Software: (any public domain or commercial software)
15. ICs each 50 Nos
7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/
555 / 7494 / 7447 / 74180 / 7485 / 7473 74138 / 7411 / 7474/Op-Amps

24AI201	INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Common to all Branches)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Understand the basics and applications of Artificial Intelligence.
- Apply the basics of Python programming.
- Use python libraries to solve simple problems.
- Understand the different types of Machine Learning algorithms.
- Solve real world problems using AI/ML.
- Explore the various applications in the field of Artificial Intelligence and Machine Learning.

UNIT I **ARTIFICIAL INTELLIGENCE**

6+6

Introduction – Types of AI – ANI, AGI, ASI – Narrow, General, Super AI, Examples - AI problems – Production Systems – State space Representation – Applications of AI in various industries.

List of Exercise:

1. Build a simple AI model using python.

UNIT II BASICS OF PYTHON

6+6

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion – Iteration.

Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods - Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Comparing and Sorting.

List of Exercises:

1. Compute the GCD of two numbers.
2. Operations on Tuples: a) finding repeated elements, b) slice a tuple c) reverse a tuple d) replace last value of a tuple.

UNIT III PYTHON LIBRARIES

6+6

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Narray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins-Pivot Tables - String operations – Working with time series – High performance Pandas.

List of Exercises:

1. Download, install and explore the features of R/Python for data analytics
 - Installing Anaconda
 - Basic Operations in Jupyter Notebook
 - Basic Data Handling
2. Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create two arrays and perform the concatenation among the arrays.
3. Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection Operations, Data indexing operations like: loc, iloc, and ix, operations of handling the missing data like None, Nan, Manipulate on the operation of Null Vaues (is null(), not null(), dropna(), fillna()).
4. Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).
5. Use any data set compute the mean ,standard deviation, Percentile.

UNIT IV MACHINE LEARNING

6+6

Introduction – ML Algorithms Overview – Types – Supervised – Unsupervised – Reinforcement Learning – Introduction to Neural Networks – Working of Deep Learning – Applications of DL – Ethical consideration in AI and ML.

List of Exercise:

1. Apply any Machine Learning model to predict the sales in a store.

UNIT V CASE STUDIES

6+6

Disease Prediction – Share Price Forecasting – Weather Prediction – Domain Specific Case Studies.

List of Domain Specific Case Studies:

- For CSE & allied: Sentiment analysis of product reviews using machine learning.
- For ECE & allied: Smart homes using AI.
- For EEE: Forecasting of Renewable energy availability during a specified period using AI.
- Civil: Application of ML for crack detection on concrete structures.
- Mech: Predictive Maintenance for CNC Machines Using AI and Machine Learning.

List of Exercise:

1. Build a machine learning model to solve any real-world problem from your domain.

TOTAL: 30(L) + 30(P) = 60 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Elaborate the basics and applications of Artificial Intelligence.

CO2: Apply the basics of Python programming to solve problems.

CO3: Use python libraries to solve simple ML problems.

CO4: Outline the different types of Machine Learning algorithms.

CO5: Use Machine Learning Algorithms to solve real world problems.

CO6: Outline the recent developments in the field of Artificial Intelligence.

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Jake VanderPlas, "Python Data Science Handbook – Essential tools for working with data", O'Reilly, 2017.
3. Steve Abrams, "Artificial Intelligence and Machine Learning for Beginners: A simple guide to understanding and Applying AI and ML", Independently published, May 14, 2024.

REFERENCES:

1. Vinod Chandra S S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
2. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Ethem Alpaydm, Introduction to Machine Learning, Second Edition, the MIT Press, Cambridge, Massachusetts, London, England.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition, 2015, by Taylor & Francis Group, 2015.
5. Tom M. Mitchell, Machine Learning, McGraw-Hill Science, ISBN: 0070428077
6. Mayuri Mehta, Vasile Palade, Indranath Chatterjee, Explainable AI: Foundations, Methodologies and Applications, Springer, 2023.
7. Siddhartha Bhattacharyya, Indrajit Pan, Ashish Mani, Sourav De, Elizabeth Behrman, Susanta Chakraborti, "Quantum Machine Learning", De Gruyter Frontiers in Computational Intelligence, 2020.

LIST OF EQUIPMENTS:

1. Systems with Anaconda, Jupyter Notebook, Python.

24GE201	TAMILS AND TECHNOLOGY (Common to all branches of First Year B.E. / B. Tech)	L	T	P	C
		1	0	0	1

OBJECTIVES:

The Course will enable learners to:

- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangam age.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

UNIT I WEAVING AND CERAMIC TECHNOLOGY

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY

3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold - Coins as source of history - Minting of Coins – Beads making - industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY

3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea – Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING

3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Identify the role of weaving and ceramic technology in ancient Tamil Culture.

CO2: Assess the design and construction technology ideas in the current Tamil society.

CO3: Identify the different types of manufacturing technology used in Tamil society and their significance.

CO4: Classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

CO5: Discuss the fundamentals of scientific Tamil and Tamil computing.

REFERENCES:

தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

3.

பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL).

24ME211	IDEA LAB - II (Common to all Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Develop hands-on experience and practical application of theoretical knowledge.
- Develop their ability to explain the process involved.

LIST OF EXPERIMENTS

1. Printing of a 3D part.
2. Scanning of a 3D part.
3. Design and fabrication of press fit object using laser cutting machine.
4. Design and fabrication of 3D part using CNC Router.
5. Design and fabrication of simple PCB.
6. Soldering and desoldering of given electronic circuit.

TOTAL: 30 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1:** Analyze the latest manufacturing methods in advancements and technologies related to their field.
- CO2:** Understand the operations of a laser cutting machine and CNC Router.
- CO3:** Analyze the process of design and fabrication of PCB and Soldering operations
- CO4:** Develop technical proficiency and problem-solving abilities, making more competent and confident in their field.
- CO5:** Develop themselves with the skills needed to address industry-specific problems

LIST OF EQUIPMENT FOR A BATCH OF 33 STUDENTS

S.No.	Description of Equipment	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Multimeter	5 Nos.
6	Solder Stations	5 Sets
7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No
9	Variable Power Supply	1 No

10	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	5 Sets
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Course Code	INNOVATION AND CREATIVITY SKILLS AND DEVELOPMENT (Common to all the branches)	L	T	P	C
24HS211		1	0	0	1

OBJECTIVES

The course will enable the learners to:

- Understand study plans, co-curricular activities, programming skills, recruitment test patterns, and hiring strategies through national qualifiers and hackathons.
- Equip students with strategies for higher education, resume enhancement, project management, and securing internships
- understand entrepreneurship fundamentals, including key differences, global hubs, business ideas, and scalability.
- develop essential entrepreneurial skills such as opportunity recognition, patience, risk management, communication, persistence, and leadership
- Understand life, success, self-confidence, health, scientific heritage, personal counseling, and cybercrime awareness

UNIT I STEPPING STONE – ENGINEERING CAREERS AND SKILL DEVELOPMENT

3

Study Plans and Resources - Identification of key resources and job opportunities - career prospects and academic growth through co-curricular activities - importance of programming/coding skills - Overview of test patterns and essential skills for popular campus recruiters - Comparison of IT Services, Dream, and Super Dream offers and their recruitment processes - National Qualifier Tests and their impact on hiring processes – Overview of Corporate contests and hackathons (e.g., TCS Codevita, HackerRank)

UNIT II STEPPING STONE – HIGHER EDUCATION AND CAREER DEVELOPMENT

3

Overview of higher education opportunities: GATE, GRE, GMAT, XAT, CAT, MAT - Exam formats, preparation strategies, and timelines - Resume Enhancement Strategies - Project Management - Steps to develop projects from proposal to prototype - Internship Pathways - Strategies for maximizing internship experiences for career advancement

UNIT III FUNDAMENTALS OF ENTREPRENEURSHIP: FROM IDEAS TO VENTURES

3

Introduction to Entrepreneurship – Intrapreneur vs. entrepreneur - Roles and Contributions - Global Entrepreneurship Hubs - Overview of Key Global Locations - Idea vs. Commercial Value - Transforming Ideas into Viable Business Models - Characteristics of Successful Business Ideas -

Understanding Market Competition - Basics of Copyrights and Intellectual Property - Scalability in Business Ventures - Strategies for Scaling a Business

UNIT IV HUMAN SKILLS FOR ENTREPRENEURSHIP

3

Identifying and capitalizing on business opportunities - Case studies and anecdotes - Patience and Risk Management - The role of patience in entrepreneurial success and decision-making - Effective Communication - Techniques for clear and persuasive communication - Importance of communication in building and leading teams - Leadership qualities and their impact on entrepreneurial ventures - Analyzing success and failure stories

UNIT V FOUNDATIONS OF PERSONAL DEVELOPMENT AND WELL-BEING

3

Understanding Life and Success - Self-Confidence and Fear - Practical strategies for enhancing self-esteem - Adolescent Issues - Health Management - Basics of a balanced diet - Benefits of physical activity - Scientific Heritage of India - Overview of India's scientific achievements and contributions - Cyber Crime Awareness - Types and prevention strategies.

TOTAL: 15 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: Create study plans, value co-curricular activities, develop programming skills, and navigate for career advancement

CO2: Understand about higher education options, resume enhancement, project management, and securing internships

CO3: Learn entrepreneurship skills and strategies to develop successful business ideas.

CO4: Develop key entrepreneurial skills like opportunity recognition, risk management, and leadership through real-world examples

CO5: Explore personal development, health management, scientific heritage, and cybercrime awareness.

24MC201	Yoga for Stress Management (Common to all branches of First Year B.E. / B. Tech)	L	T	P	C
		0	0	1	0

OBJECTIVES:

The Course will enable learners to:

- Understanding the different types of stress and managing stress.
- Develop an understanding of practicing yoga
- Learning to do asanas, including sitting, standing and lying postures

UNIT I Stress Management

3

Definition of Stress - Stress in Daily Life - Impact of Stress on Life - Identifying the Causes of Stress - Symptoms of Stress - Managing Stress (Habits, Tools, Training, Professional Help) - Complications of Stress Mismanagement - The Importance of Sleep for Mental Wellness - Connection Between Sleep and Digestion.

UNIT II Introduction to Yoga 3

Meaning and Definition of Yoga - Aims and Objectives of Yoga - Guidelines for Practicing Asanas - Benefits of Yoga

UNIT III Different Asanas 3

Methods of Performing Asanas - Pranayama - Suryanamaskar Asanas - Sitting Postures: Uttanpadasana, Paschimottanasana, Janu Sirsasana, Baddha Konasana - Shishupal Asana – Vajrasana

UNIT IV Standing Postures 3

Uttanasana - Trikonasana - Vrikshasana - Tadasana - Superbrain asana

UNIT V Lying Postures 3

Pavana Muktasana - Pada Sanchalanasana – Jhulana Lurhakanasana -Dhanurasana – Marjaryasana. BitilasanaDictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Relieve stress and achieve mental wellness.

CO2: Experience the benefits of yoga

CO3: Keep self and body healthy

REFERENCES:

1. Iyengar, Bellur Krishnamukar Sundara. "Light on yoga." (1965).
2. Desikachar, Tirumalai Krishnamacharya Venkata. The heart of yoga: Developing a personal practice. Simon and Schuster, 1999.
3. Davis, Martha, Elizabeth Robbins Eshelman, and Matthew McKay. The relaxation and stress reduction workbook. New Harbinger Publications, 2008.
4. Krishnamacharya, Tirumalai, et al. "Yoga makaranda: The nectar of yoga." Swathi Soft (2013).

SEMESTER III

24GE301	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (Common to all branches of First Year B.E. / B. Tech)	L	T	P	C
		2	1	0	3

OBJECTIVES:

The Course will enable learners to:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION **9**

Purpose and motivation for the course - recapitulation from Universal Human Values-I -Self-Exploration-what is it? – It's content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A Look at Basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for the fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity Correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Practice sessions: To discuss natural acceptance in human beings as the innate acceptance of living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF! **9**

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Understanding the characteristics and activities of 'I' and harmony in 'I' - 'Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, the meaning of Prosperity in detail - Programs to ensure Sanyam and Health.

Practice sessions: To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with the disease.

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP **9**

Understanding values in a human-human relationship - the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure mutual happiness -Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in a relationship - Understanding the harmony in the society (society being an extension of the family) - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT IV UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - 9
WHOLE EXISTENCE AS COEXISTENCE

Practice sessions: To discuss human beings as the cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems - Case studies of typical holistic technologies, management models and production systems - Strategy for the transition from the present state to Universal Human Order: a. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers b. At the level of society: as mutually enriching institutions and organizations - Sum up.

TOTAL: 45 PERIODS

Upon completion of the course, the students will be able to:

CO2: identify and resolve inner conflicts based on natural acceptance.

CO4: enhance their critical thinking and analyzing skills.

CO6: apply what they have learnt in different day-to-day settings in real life, and take the initial steps towards integrating these values into daily life.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, First edition: New Delhi, 2010, ISBN: 978-81-7446-781-2 Reprint: 2010, 2011, 2013, 2016, 2018, 2019 (Second edition: New Delhi, 2019, ISBN: 978-93-87034-47-1)
2. A foundation course in Human Values and Professional Ethics RR Gaur, R Asthana, GP Bagaria, Third revised edition: New Delhi, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), ISBN: 978-81-957703-6-6 (e-book), UHV Publications

REFERENCES:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence - J C Kumarappa

Course Code		L	T	P	C
24MA303	DISCRETE MATHEMATICS AND ITS APPLICATIONS	3	1	0	4

OBJECTIVES**The course will enable the learners to:**

- describe the arguments using connectives and rules of inference.
- impart knowledge of the basics of counting and solving recurrence relations.
- understand the nomenclature of graphs, isomorphism of graphs, paths, cycles and circuits.
- explain group theory, rings and fields
- apply Boolean algebra, basic properties, and Karnaugh's maps.

UNIT I LOGIC**12**

Propositional calculus- propositions and connectives, syntax; Semantics– truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility-natural deduction system and axiom system; Soundness and completeness.

UNIT II COMBINATORICS**12**

Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, the principle of mathematical induction, pigeon hole principle.

UNIT III GRAPH THEORY**12**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments. (ore's theorem, Dirac theorem Statement only).

UNIT IV ABSTRACT ALGEBRA 12

Groups - Subgroups -Homomorphism - Normal subgroup and cosets - Lagrange's theorem -
Definitions and examples of Rings and Fields

UNIT V BOOLEAN ALGEBRA 12

Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, the principle of duality, canonical form, Karnaugh map.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: examine the validity of the arguments.
- CO2: demonstrate various proof techniques and application of principles.
- CO3: apply graph theory techniques to solve real life problems.
- CO4: identify algebraic techniques to formulate and solve group theoretic problems.
- CO5: utilize the significance of Boolean algebra in computer science and engineering.
- CO6: illustrate different types of recurrence relations and their role in problem-solving.

TEXTBOOKS:

1. J. P. Trembly & Manohar, "Discrete Mathematical Structures with applications to computer science", 1st Edition, McGraw Hill Education, 2017.
2. N. Herstein, "Topics in Algebra", 2nd Edition, John Wiley and Sons, Reprint 2022.
3. M. Morris Mano, "Digital Logic and Computer Design", 1st Edition, Pearson, Reprint 2017.
4. J.A. Bondy and U.S.R. Murty, "Graph Theory with Applications", 5th Edition, Macmillan Press, London, 1982.

REFERENCES:

1. Gilbert Strang, "Introduction to linear algebra", 6th Edition, Wellesley-Cambridge Press, 2023.
2. R. A. Brualdi, "Introductory Combinatorics", 5th Edition, Pearson, 2023.
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", 1st Edition, Prentice Hall, Englewood Cliffs, 2018.

24CS301	COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CSE, CSD, ADS, CSBS and IT)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Describe the basic principles and operations of digital computers.
- Design arithmetic and logic unit for various fixed and floating point operations
- Construct pipeline architectures for RISC processors.
- Explain various memory systems & I/O interfacing
- Discuss parallel processor and multi-processor architectures

UNIT I COMPUTER FUNDAMENTALS 9

Computer Types - Functional Units — Basic Operational Concepts - Number Representation and Arithmetic Operations - Performance Measurement - Instruction Set Architecture - Memory Locations and Addresses - Instructions and Instruction Sequencing - Addressing Modes.

UNIT II COMPUTER ARITHMETIC 9

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Unsigned Numbers - Multiplication of Signed Numbers - Fast Multiplication - Integer Division - Floating-Point Numbers – Representation and Operations.

Study Experiments: Ripple Carry Adder, Carry Look-a-head Adder, Booth's Multiplier

UNIT III BASIC PROCESSING UNIT AND PIPELINING 9

Basic Processing Unit: Concepts - Instruction Execution - Hardware Components - Instruction Fetch and Execution Steps -Control Signals - Hardwired Control.

Pipelining: Basic Concept - Pipeline Organization- Pipelining Issues - Data Dependencies - Memory Delays - Branch Delays - Resource Limitations - Performance Evaluation -Superscalar Operation.

Study Experiments: Arithmetic Logic Unit, CPU Design

UNIT IV I/O AND MEMORY 9

Input/Output Organization: Bus Structure - Bus Operation - Arbitration - The Memory System: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Memory Management Requirements - Secondary Storage.

Study Experiments: Memory Design, Associative Cache Design, Direct Mapped Cache Design.

UNIT V PARALLEL PROCESSING AND MULTICORE COMPUTERS 9

Parallel Processing: Use of Multiple Processors - Symmetric Multiprocessors - Multithreading and Chip Multiprocessors - Clusters - Nonuniform Memory Access Computers - Vector Computation - Multicore Organization.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Explain the basic principles and operations of digital computers.

CO2: Analyse the performance of computers by identifying factors that contribute to performance.

CO3: Compare various I/O methods and understand memory management principles.

CO4: Explain data flow in arithmetic algorithms.

CO5: Demonstrating the concept of parallelism in hardware and software.

CO6: Design hardware to solve computationally intensive problems.

TEXT BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata McGraw Hill,

Sixth edition, 2012.

2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 5th edition, Morgan Kaufmann, 2013.

REFERENCES:

1. John P.Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.
3. John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.

24CB301	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- To explain the fundamental principles of micro economics relevant to managing an organization.
- To describe the fundamental principles of macroeconomics to have the understanding of economic environment of business.
- To understand the various aspects of India's economy.

UNIT I INTRODUCTION

9

Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).

UNIT II CONSUMER ANALYSIS

9

Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve;

UNIT III PRODUCTION AND COSTING

9

Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect; Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT IV MACROECONOMIC REFORMS

9

National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector -Exports and Imports; Money - Definitions; Demand for Money -Transactionaryand Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model.

UNIT V POLICY GOVERNANCE

9

Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

CO1: Become familiar with both principles of micro and macroeconomics.

CO2: Understand the approaches to consumer behavior and relationbetween production and cost function.

CO3: Describe and discuss on interaction of product and factor market.

CO4: Get awareness about importance and development of Indian economyand economic reforms.

CO5: Have thorough knowledge in the areas of inflation, unemployment,monetary policy, fiscal policy and international trade.

TEXT BOOKS:

1. Pindyck, Robert S., and Daniel L. Rubinfeld, Microeconomics, Pearson Education, 9th edition 2022
2. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill Ltd., 12th edition, 2019
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Tata McGraw Hill, 19th edition, 2011

REFERENCES:

1. Hal R, Varian, W W Norton, Intermediate Microeconomics: A Modern Approach, 9th edition, 1987
2. N. Gregory Mankiw, Cengage Learning, Principles of Macroeconomics, 7th edition, 2021

24CS302	ADVANCED JAVA PROGRAMMING (Lab Integrated) (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- Gain a comprehensive understanding of the Java Collections Framework and its various interfaces and implementations.
- Learn the details of Java I/O streams and utility classes for managing dates, numbers, and currencies.
- Develop a thorough understanding of the Stream API introduced in Java 8 and its various operations.
- Explore advanced object serialization and string tokenizing techniques, including pattern matching with regular expressions.
- Understand advanced Stream API features and gain proficiency in using regular expressions for text processing.

UNIT I COLLECTIONS FRAMEWORK AND UTILITY CLASSES 9+9

Introduction to Collections Framework - Collection Interface- Methods in Collection Interface - Iterable and Iterator Interfaces - List Interface- ArrayList - LinkedList - Set Interface - HashSet- LinkedHashSet - TreeSet - Map Interface - HashMap -LinkedHashMap- TreeMap - Queue Interface -PriorityQueue - Deque Interface - Utility Classes.

List of Experiments

1. Write a program that measures the time taken for insertion, deletion, and search operations on ArrayList, LinkedList, HashSet, and TreeSet for varying sizes of input data.
2. Implement a custom data structure that combines features of a list and a set.
3. Write a Java program to create a HashMap where the keys are strings, and the values are integers Add five key-value pairs to the map. Print all the keys and values in the map. Remove an entry by key. Update the value associated with a specific key. Check if the map contains a specific key and a specific value.

UNIT II DATE HANDLING AND SERIALIZATION 9+9

Date – Calendar – Comparable interface – Observer Interface — Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies - Object Serialization - Serializable Interface - Writing and Reading Serializable Objects -Transient Keyword- serialVersionUID.

List of Experiments

1. Create a class representing a complex object with nested data structures. Serialize the object to a file, then deserialize it back and verify that the object remains intact.
2. Write a program that formats dates and currencies according to different locales.
3. Create a class hierarchy representing different types of objects (e.g., Person, Employee). Serialize instances of these classes to a file using object serialization.

UNIT III STREAM API AND FUNCTIONAL PROGRAMMING 9+9

PARADIGMS

Overview of Stream API - Importance of Stream API in Java 8 and Beyond – Functional Programming Concepts - Creating Streams - Stream Interface Methods - Stream Operations - Intermediate Filtering (filter)-Mapping (map, flatMap)-Sorting (sorted)-Distinct (distinct) - Limit and Skip (limit, skip) - Terminal Operations -Collecting Results (collect) - Reducing and Summarizing (reduce, summaryStatistics)-Iterating (forEach) - Matching and Finding (anyMatch, allMatch, noneMatch, findFirst, findAny) -Counting (count).

List of Experiments

1. Write a program that performs stream operations like filtering, mapping, and reducing.
2. Create an infinite stream generator that generates prime numbers. Implement methods to check for primality and generate the next prime number.
3. Write a program that reads a text file containing sentences. Tokenize each sentence into words, filter out stopwords, and print the remaining words.

UNIT IV ADVANCED STRING PROCESSING AND I/O TECHNIQUES 9+9

String Tokenizer – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing - Streams - Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class – the java.io. Console Class - Advanced I/O - Piped Streams (PipedInputStream and PipedOutputStream) – SequenceInputStream -PushbackInputStream and PushbackReader.

List of Experiments

1. Write a program that reads a text file and tokenizes it into sentences using the StringTokenizer class.
2. Implement a java program that allows users to open a text file, navigate through it using random access, insert, delete, and modify text at specific positions within the file.
3. Implement a program that uses advanced I/O techniques like PipedInputStream, PipedOutputStream, SequenceInputStream, and PushbackInputStream.

UNIT V ADVANCED STREAM FEATURES AND REGULAR EXPRESSIONS 9+9

Importance and Use Cases of Advanced Stream Features - Creating Custom Streams -Stream Generators (Stream.generate, Stream.iterate) - Infinite Streams - Using Spliterators – Advanced Stream Operations - FlatMapping - Chaining Stream Operations - Stream Peeking (peek) - Advanced Filtering Techniques - Introduction to Regular Expressions - Character Classes - Quantifiers - Pattern Matching - Groups and Capturing - Regex in Java - java.util.regex Package Pattern Class - Matcher Class - String Manipulation with Regex - Splitting Strings - Replacing Text (replaceAll, replaceFirst) - Replacing with Backreferences.

List of Experiments

1. Implement custom stream generators using Stream.generate and Stream.iterate methods.
2. Write a program that demonstrates advanced stream operations like flatMapping, chaining stream operations, and peeking.
3. Develop a program that utilizes regular expressions to perform string manipulation tasks such as splitting strings, replacing text, and extracting specific patterns.

TOTAL: 45+45 = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Implement various data structures by utilizing core Java features and libraries.

CO2: Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval.

CO3: Apply and Analyze the Stream API for functional programming and data processing.

CO4: Implement advanced object serialization for complex data structures.

CO5: Utilize regular expressions for text parsing and string manipulation.

CO6: Build applications using advanced Java programming techniques.

TEXT BOOK:

1. Cay S. Horstmann, "Core Java Volume I--Fundamentals," 12th Edition, 2019.
2. Joshua Bloch, "Effective Java," 3rd Edition, 2018.
3. Raoul-Gabriel Urma, "Java 8 in Action: Lambdas, Streams, and Functional-Style Programming," 1st Edition, 2014.
4. Herbert Schildt, "Java: The Complete Reference," 11th Edition, 2018.
5. Alan Mycroft and Martin Odersky, "Programming in Scala," 4th Edition, 2020.

REFERENCES:

1. Bruce Eckel, "Thinking in Java," 4th Edition, 2006.
2. Herbert Schildt, "Java: A Beginner's Guide," 8th Edition, 2019.
3. Richard Warburton, "Java 8 Lambdas: Pragmatic Functional Programming," 1st Edition, 2014.

LIST OF EQUIPMENTS:

JDK/Eclipse

24CS303	DATABASE MANAGEMENT SYSTEMS (Lab Integrated) (Common to CSE, CSD, ADS, CSBS, IT, EEE, ECE, ECA and EEV)	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand the basic concepts of Data Modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To learn relational algebra, calculus and normalization.
- To know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.
- To understand query processing, efficient data querying and advanced databases.

UNIT I DATABASE CONCEPTS

9+9

Concept of Database and Overview of DBMS - Characteristics of databases -Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces- Introductions to data models types- ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

- a) Inventory Management for a EMart Grocery Shop
 - b) Society Financial Management
 - c) Cop Friendly App – Eseva
 - d) Property Management – eMall
 - e) Star Small and Medium Banking and Finance
- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

UNIT II STRUCTURED QUERY LANGUAGE

9+9

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list and do the following exercises.

- a) Inventory Management for a EMart Grocery Shop
 - b) Society Financial Management
 - c) Cop Friendly App – Eseva
 - d) Property Management – eMall
 - e) Star Small and Medium Banking and Finance
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
 2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
 3. Views, Sequences, Synonyms
 4. Database Programming: Implicit and Explicit Cursors
 5. Procedures and Functions
 6. Triggers
 7. Exception Handling

UNIT III RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION

9+9

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) – Multivalued Dependency and 4NF –Joint Dependencies and 5NF - De-normalization.

List of Exercise/Experiments

1. Case Study using real life database applications anyone from the following list
 - a) Inventory Management for a EMart Grocery Shop

- b) Society Financial Management
- c) Cop Friendly App – Eseva
- d) Property Management – eMall
- e) Star Small and Medium Banking and Finance.

Apply Normalization rules in designing the tables in scope.

UNIT IV TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE

9+9

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery – Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

- a) Inventory Management for a EMart Grocery Shop
- b) Society Financial Management
- c) Cop Friendly App – Eseva
- d) Property Management – eMall
- e) Star Small and Medium Banking and Finance

Ability to showcase ACID Properties with sample queries with appropriate settings for the above scenario.

UNIT V QUERY OPTIMIZATION AND ADVANCED DATABASES

9+9

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.

Distributed Database Concepts – Design – Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

Explain Plan Statement – Parsing Output – Join Orders and Methods – Indexes - Standard Issues – Query Tuning - Explain Plan vs Explain Analyses.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

- a) Inventory Management for a EMart Grocery Shop
- b) Society Financial Management
- c) Cop Friendly App – Eseva
- d) Property Management – eMall
- e) Star Small and Medium Banking and Finance

Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

TOTAL: 45 + 45 = 90 PERIODS

OUTCOMES:

After completing the course, students will have the ability to

CO1: Map ER model to Relational model to perform database design effectively.
 CO2: Implement SQL and effective relational database design concepts.
 CO3: Apply relational algebra, calculus and normalization techniques in database design.
 CO4: Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.
 CO5: Evaluate and implement transaction processing, concurrency control mechanisms, and recovery procedures to maintain data integrity.
 CO6: Analyze and optimize database queries and understand the features and applications of advanced and distributed database systems, including NoSQL.

TEXTBOOKS:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014.
3. Roger Wattenhofer, "The Science of the Blockchain" Create Space Independent Publishing, 2016.
4. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.

24GE311	PRODUCT DEVELOPMENT LAB - 1 (Design Thinking) (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Identify any gaps in the literature, such as open questions or conflicts in previous studies.
- Identify the need for additional research and areas of prior research to prevent duplication of effort.
- encourage the rapid and creative generation of diverse ideas within a limited timeframe, promoting innovation, critical thinking, and problem-solving in relation to a defined problem or research area.

DESCRIPTION

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The students learn to observe, empathize and ideate innovative solutions to real-world

challenges. The student batches should identify a proposed work and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the Identified literature gap.

LIST OF ACTIVITIES:

1. Conduct a literature review on the identified research area.
2. Identify the research gap from the literature review conducted.
3. Brain storming to be done to generate a large number of ideas within a specific timeframe.
4. Present the literature review conducted and identified research gap in relation to the research problem being investigated.

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Identify, collect, and interpret relevant scholarly literature in the chosen research area.

CO2: Evaluate existing research to identify gaps and formulate precise research questions.

CO3: Apply brainstorming techniques to generate innovative and diverse research ideas.

CO4: Analyze reviewed literature and research gap to effectively present a research problem with clarity and rationale.

CO5: Develop skills in using evidence to create and present an engaging and critical argument.

24CS311	APTITUDE AND CODING SKILLS – I (Common to All Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:

- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

List of Exercises:

1. English – Phase I

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase I**
Logical, Compilation and Code reuse

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Develop vocabulary for effective communication skills.

CO2: Build the logical reasoning enhance critical thinking.

CO3: Develop error correction and debugging skills in programming.

CO4: Apply programming skills to develop programs efficiently.

CO5: Solve problems using quantitative skills.

CO6: Develop effective reading and listening skills.

24MC301	INDIAN CONSTITUTION (Non Credit)	L	T	P	C
		1	0	0	0

OBJECTIVES:

The Course will enable learners to:

- Have some knowledge about Indian Constitution.

UNIT I INTRODUCTION

3

Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution.

UNIT II FUNDAMENTAL RIGHTS

3

Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principles of State Policy.

UNIT III LOK SABHA AND RAJYA SABHA

3

Union Government – Lok Sabha and Rajya Sabha Composition, Powers and functions: The President, The Prime Minister and Supreme Court: Role Position and Powers/ functions.

UNIT IV LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL

3

State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: The Governor, Chief Minister and High Court: Role, Position and Powers/ functions.

UNIT V LOCAL SELF GOVERNMENT

3

Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions, Role, powers and function

TOTAL: 15 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Have the knowledge on Indian Constitution.

TEXT BOOK:

1. Introduction to the constitution of India – M V Pylee, Vikas publishing house Pvt Ltd.

REFERENCE:

1. Introduction to the constitution of India – Dr. Durga das Basu, 19th edition Reprint 2007.



SEMESTER IV

24CB401	MARKETING RESEARCH AND MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand basic marketing concepts
- Comprehend the dynamics of marketing.
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research
- Apply Internet marketing strategies.

UNIT I INTRODUCTION 9

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. **Marketing Planning & Environment:** Elements of Marketing Mix, analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social **Understanding the consumer:** Determinants of consumer behavior, Factors influencing consumer behavior

UNIT II MARKET SEGMENTATION AND PRODUCTION MANAGEMENT 9

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning **Product Management:** Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

UNIT III PRICING, PROMOTION AND DISTRIBUTION STRATEGY 9

Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

UNIT IV MARKETING RESEARCH 9

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research **Data Analysis:** Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis

UNIT V INTERNET MARKETING

9

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the marketing concepts and its evolution

CO2: Analyze the market based on segmentation, targeting and positioning

CO3: Leverage marketing concepts for decision making on product, price, promotion mix and distribution

CO4: Apply the concepts of market research and analyse data using statistical tools

CO5: Apply internet marketing strategies for businesses

TEXT BOOKS:

1. Philip Kotler, Marketing Management (Analysis, Planning, Implementation & Control) – 16th Ed. Pearson Education, 2022
2. V.S. Ramaswamy and S. Namakumari, Marketing Management, Macmillan, 2024
3. Rajendra Nargundkar, Marketing Research –4th Ed. McGraw Hill Limited, 2019
4. G.C. Beri, Market Research –6th Ed., McGraw Hill Limited, 2020
5. Cooper Schindler, Market Research, Concepts, & Cases –McGraw Hill LTD,2010

REFERENCES:

1. Rajan Saxena, Marketing Management –6th Ed., McGraw Hill Limited, 2020
2. S.A. Sherlekar, Marketing Management –Himalaya Publishing House, 2022
3. S.M. Zha, Service Marketing –Himalaya Publishing House, 2006
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull, Prentice Hall of India, 2005
6. David M Levine et al, Business Statistics, A First Course, Pearson Publication, 7th Ed., Pearson Education, 2021

Course Code	STATISTICAL METHODS (Theory course with Laboratory Component)	L	T	P	C
24MA403		3	0	2	4

OBJECTIVES

The course will enable the learners to:

- elucidate the fundamental concepts of random sampling and the Hypothesis test.
- foster comprehension of the principles of estimation theory.
- illustrate the fundamental principles of linear statistical models.
- illustrate the fundamental principles of non-parametric tests.
- impart knowledge of time series analysis & forecasting.

UNIT I SAMPLING DISTRIBUTION

15

Sampling Techniques – Random sampling – Sampling from finite and infinite populations – Estimates and standard error (sampling with replacement and sampling without replacement) – Sampling distribution of the sample mean

Experiments using R statistical programming language:

1. Introduction to R
2. Functions

UNIT II THEORY OF ESTIMATION

15

Estimation – Point estimation – criteria for good estimates (unbiasedness, consistency, Efficiency, Sufficiency)– Estimation methods including maximum likelihood estimation. Sufficient Statistic – Concept & examples Test of hypothesis – Concept & formulation – Type I and Type II errors – Neyman Pearson lemma (excluding proof) – Testing procedures.

Experiments using R statistical programming language:

1. Control flow and Loops
2. Working with Vectors and Matrices

UNIT III LINEAR STATISTICAL MODELS

15

Linear Statistical Models – Scatter diagram – Linear regression and correlation – Least Squares method – Rank correlation —Analysis of variance (one way two-way without interaction).

Experiments using R statistical programming language:

1. Reading in Data.
2. Writing Data.
3. Working with Data.

UNIT IV NON-PARAMETRIC TEST

15

Non-parametric Inference – Comparison with parametric inference – Use of order statistics –

Sign test – Wilcoxon signed rank test – Mann-Whitney test – Run test –Kolmogorov – Smirnov test – Spearman's and Kendall's test

Experiments using R statistical programming language:

1. Manipulating Data
2. Simulation.

UNIT V TIME SERIES ANALYSIS

15

Basics of Time Series Analysis & Forecasting – Stationary–Identification – Estimation and Forecasting.

Experiments using R statistical programming language:

1. Linear model
2. Data Frame
3. Graphics in R

TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: determine the sampling distribution's standard error and sample mean by applying the sampling distribution principles.

CO2: evaluate the properties of estimators.

CO3: generate regression and correlation curves.

CO4: implement hypothesis testing methodologies to solve real-life problems.

CO5: execute ARIMA models to identify and estimate time series data and apply them to real-life situations.

CO6: apply R programming to examine statistical information.

TEXTBOOKS:

1. I.R.Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", Prentice Hall India Learning Private Limited, 9th Edition, 2017.
2. A.Goon, M.Gupta, and B.Dasgupta, "Fundamentals of Statistics", Volume I and II, World Press, 9th Edition, Reprint 2016.
3. Chris Chatfield, "The Analysis of Time Series: An Introduction", Chapman and Hall / CRC Press, 7th Edition, 2019.

REFERENCES:

1. D.C. Montgomery, E. A. Peck, and G. Geoffrey Vining, "Introduction to Linear Regression Analysis", Wiley –Inter science, 6th Edition, 2021.
2. A.M. Mood, F.A. Graybill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill, 3rd Edition, Reprint 2017.

3. N. R. Draper and H. Smith, “Applied Regression Analysis”, Wiley-Inter science, 3rd Edition, 2014.
4. Garrett Grolmund, “Hands-on Programming with R”, O'Reilly Media, 1st Edition, 2014.
5. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Professional, 2nd Edition, 2017.

S. No.	Software Requirement	Remarks
1	www.rbi.org.in	Open Source

24CB402	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the basic concepts of operating systems.
- Understand Processes and Threads
- Analyse various CPU Scheduling algorithms.
- Understand the concept of Deadlocks.
- Analyse various memory management schemes.
- Understand I/O management and File systems.

UNIT I INTRODUCTION TO OPERATING SYSTEMS AND PROCESS 9

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

UNIT II PROCESS MANAGEMENT AND THREADS 9

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

UNIT III PROCESS SYNCHRONISATION AND DEADLOCKS 9

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's

Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT IV MEMORY MANAGEMENT

9

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

UNIT V FILE MANAGEMENT

9

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

TOTAL: 45 PERIODS

LIST OF EXERCISE:

- Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
- UNIX Filters
- Shell programming
- Programming with the standard I/O
- UNIX system calls

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Implement the various System calls

CO2: Understand the concepts of Processes

CO3: Apply various processor scheduling algorithms and thread mechanism
process synchronization and deadlock problems

CO5: Apply various memory management techniques to given situation

CO6: Apply various file management techniques

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts Essentials. 10th Ed., Wiley Company Publishing, 2019
2. William Stallings, Operating Systems: Internals and Design Principles. 7th Ed., Pearson Education, 2014
3. Charles Patrick Crowley, Operating System: A Design-oriented Approach. McGraw Hill Limited., 2018

REFERENCES:

1. Gary J. Nutt, Operating Systems: A Modern Perspective. 3rd ed., Pearson Education, 2012
2. Maurice J. Bach, Design of the Unix Operating Systems. Prentice Hall Of India, 2008
3. Daniel Pierre Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Ed., Shroff Publishers & Distributors, 2011

24CS402	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, CSD, ADS, CSBS and IT)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Critically analyse the efficiency of alternative algorithmic solutions for the same problem
- Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization problems
- Examine the limitations of algorithmic power and handling it in different problems.

UNIT I INTRODUCTION

9+6

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and their properties. Analysis Framework – Mathematical analysis for Recursive and Non-recursive algorithms

List of Exercise/Experiments:

1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

UNIT II BRUTE FORCE AND DIVIDE AND CONQUER

9+6

Brute Force - String Matching - Exhaustive Search - Knapsack Problem - Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

List of Exercise/Experiments:

1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.

UNIT III DYNAMIC PROGRAMMING

9+6

Dynamic programming – Principle of optimality – Floyd's algorithm – Multi stage graph - Optimal

Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

List of Exercise/Experiments:

1. Solve Floyd's algorithm
2. Write a program to find the longest common subsequence

UNIT IV GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT 9+6

Greedy Technique – Prim's algorithm and Kruskal's Algorithm – Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - The Stable marriage Problem

List of Exercise/Experiments:

1. Write a program to find minimum spanning tree using Prim's algorithm
2. Implement Kruskal's algorithm to find minimum spanning tree

UNIT V BACKTRACKING AND BRANCH AND BOUND 9+6

P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem

List of Exercise/Experiments:

1. Write a program to implement sum of subset problem.
2. Solve knapsack problem using branch and bound technique

TOTAL: 45+30=75 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the different algorithm design paradigms.

CO2: Design algorithms for real world problems using algorithmic design techniques.

CO3: Analyse the efficiency of simple recursive and non-recursive algorithms.

CO4: Analyse the algorithm's worst, best and average case behaviour in terms of time and space.

CO5: Understand the approximation algorithms for solving NP Hard problems

CO6: Solve the problems by selecting suitable algorithmic design techniques.

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
3. <http://nptel.ac.in/>

LIST OF EQUIPMENTS:

1. Standalone PC with C/C++/Java

24IT402	WEB DEVELOPMENT FRAMEWORKS (Lab Integrated)	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand web semantics and related tools and framework
- To get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I ADVANCED TYPESCRIPT 9+9

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring
Introduction, Advantage of Using TS over JS, and where to Use and not to use TS - Understanding the Compiler (Transpiler), and its options, Scope of TS - Variable Scopes, Static Data Types - String, Number, Interface, Date - Union, Tuple, Undefined Data Types, Unknown vs any vs Never - Object Oriented , Arrow Functions - Types, KeyOf, TypeOf, InstanceOf ,Narrowing, Conditional Types - Generics, Enum ,Required / Partial / Optional - Arrays, Modules ,Async Processing w Call backs ,Type Inference, Type Compatibility, Utility Type - Unit Testing, TSLint

List of Exercise/Experiments

- 1) Create a TS Object for Bank Account (with attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
 - List down all the entries of the bank object
 - Check the existence of a key
 - If key found, get the value for the key
- 2) Spread Operator
 - Merge Customer and Account Arrays
 - Update the Customer Object with the new values
 - Develop a function that takes an Spread Argument and calculates total balance.

UNIT II INTRODUCTION TO REACTJS 9+9

Introduction to React - ES6 Features, What is React?, React Features - Setting up React Development Environment:- Node.js and npm installation, Create React App, Project structure - JSX (JavaScript XML):- What is JSX?,JSX Syntax and Rules,JSX Expressions - Components in React:- Functional Components, Class Components, Props and PropTypes - State and Lifecycle :- State and setState, Lifecycle Methods, Mounting, Updating, and Unmounting, Handling Events in React - Event Handling in React :- Synthetic Events, Event Binding, - Conditional Rendering:-If-else Statements, Ternary Operator, Logical && Operator
Lists and Keys:- Rendering Lists, Keys and Reconciliation, Extracting Components.

List of Exercise/Experiments

- 1) A leading bank from APAC wants to modernize their banking services and decided to build a online multi channel mobile ecommerce platform. As part of the drive, starting building following feature set in a staggered model emplying ReactJS as front end library and associated libs from React eco system. Feature to be implemented are
 - a. User Login Page
 - b. Account Summary

TOTAL: 45+45=90 PERIODS

COURSE OUTCOMES:

After completing the course, students will have the ability to

CO1. Understand and apply modern web technologies including HTML5, CSS3, JavaScript, and advanced TypeScript concepts to build dynamic web components.

CO2. Develop responsive and modular front-end applications using ReactJS, including component creation, state management, and routing.

CO3. Implement advanced React features like hooks (useState, useEffect, useRef), React Router, and REST API integration using Axios for dynamic content handling.

CO4. Utilize higher-order components (HOCs), lazy loading, and server-side rendering to optimize and abstract React applications.

CO5. Perform unit testing using Jest and RTL, and manage global application state efficiently using Context API and Redux.

CO6. Design and deliver scalable and real-world enterprise web applications with complete user interface flow, security, and error handling.

TEXTBOOKS:

- 1) **David Flanagan**, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
- 2) David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020.
- 3) Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020.

E-RESOURCES:

1. Parental Website - <https://reactjs.org/>
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. <https://www.edureka.co/reactjs-redux-certification-training>
7. CodePen
8. CodeSandbox (Preferred)
9. Stackblitz

LIST OF EQUIPMENTS:

- NodeJS (v22.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FireFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps

24GE411	PRODUCT DEVELOPMENT LAB - 2 (Functional Design) (Common to All Branches)	L	T	P	C
		0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- To accurately capture the expectations, needs, and constraints of stakeholders to ensure that the system being developed aligns with user goals and real-world usage scenarios.
- To visually represent the system's structure and functional relationships, enabling clearer communication, easier analysis, and better planning of system architecture and workflow.
- To create a precise and comprehensive reference document that guides development, ensures clarity, and serves as a basis for verification, validation, and future system enhancements.

DESCRIPTION

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. Further at the end of the semester they will make a final presentation to exhibit the functional design and the process to develop a product.

LIST OF ACTIVITIES:

1. Understand and document functional requirements based on stakeholder needs.
2. Map out how functions interact and relate to each other using functional block diagrams or flowcharts.
3. Write detailed specification describing each function's role, behavior, constraints, and expected outcomes.
4. Check if defined functions meet the intended requirements and can be validated/tested.
5. Present the design concepts carried out for the identified research gap in relation to the research problem being investigated.

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Interpret stakeholder needs and document comprehensive functional requirements for the proposed system.

CO2: Develop functional block diagrams or flowcharts to represent system interactions and functional relationships.

CO3: Analyze functional specifications that define roles, behaviors, constraints, and performance expectations for each function.

CO4: Evaluate the defined functional model through verification and validation techniques to ensure alignment with original requirements.

CO5: Analyze and present functional design solutions aligned with the identified research problem and gap.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Multimeter	5 Nos
6	Solder Stations	5 Sets

7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No
9	Variable Power Supply	1 No
10	Modelling Software(open source)	30 Nos

24CS411	APTITUDE AND CODING SKILLS – II (Common to All Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

List of Exercises:

1. English – Phase II

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase II

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase II

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase II

Logical, Compilation and Code reuse

5. Automata - Phase II

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication skills.

CO2: Build an enhanced level of logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

CO4: Apply data structures and algorithms in problem solving.

CO5: Develop advanced vocabulary for effective reading skills

CO6: Apply advanced algorithm design techniques to develop programs

HONOURS VERTICALS – BUSINESS ANALYTICS

24CB931	PYTHON FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Learn the fundamentals of Data Analytics
- Acquire skills in data preparatory and preprocessing steps
- Learn the tools and packages in Python for Data Analytics
- Understand the various Excel Function to solve Data Analytics Problem
- Acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION TO PYTHON AND DATA ANALYTICS 9

Introduction to Python programming language, Basics of data types, variables, and operators, Introduction to libraries like NumPy and Pandas for data manipulation, Data visualization with Matplotlib and Sea born.

UNIT II DATA CLEANING AND PREPROCESSING 9

Understanding data cleaning and preprocessing techniques, Handling missing values and outliers, Data transformation and normalization, Feature engineering for business analytics.

UNIT III EXPLORATORY DATA ANALYSIS (EDA) 9

Introduction to EDA techniques, Descriptive statistics and data summarization, Visualization techniques for exploring data, Correlation and relationship analysis.

UNIT IV PREDICTIVE ANALYTICS WITH MACHINE LEARNING 9

Overview of machine learning algorithms for business analytics, Supervised and unsupervised learning techniques, Model evaluation and validation, Building predictive models for business applications.

UNIT V BUSINESS ANALYTICS APPLICATIONS AND CASE STUDIES 9

Real-world applications of Python for business analytics, Case studies demonstrating the use of Python in different industries, project work and presentations.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

- CO1: Apply the skillset in data Processing, Data Transformations and Normalization
- CO2: Interpreting the various uses of libraries
- CO3: Understand the real-world data and information.
- CO4: Understand Descriptive analytics and predictive analytics
- CO5: Interpret real world applications

TEXTBOOKS:

1. Data Science for Business by Foster Provost and Tom Fawcett ,2013
2. Python for Data Science Handbook by Jake Vander Plas, 2017
3. Hands-On Exploratory Data Analysis with Python by Suresh Kumar Mukhiya and Usman Ahmed.

REFERENCES:

1. Feature Engineering for Machine Learning by Alice Zheng and Amanda Casari
2. Practical Data Science with Python by Phuong Vo.T.H and Martin Czygan

24CB932	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:**The Course will enable learners to:**

- Learn the fundamentals of Big Data Analytics
- Acquire skills in various data models
- Understand various Big Data generation and storage systems
- Understand the Big Data Analysis and Applications

UNIT I INTRODUCTION**9**

INTRODUCTION: Dawn of the Big Data Era, Definition and Features of Big Data, Big Data Value, The Development of Big Data, Challenges of Big Data.

RELATED TECHNOLOGIES: Cloud Computing - Cloud Computing Preliminaries, Relationship Between Cloud Computing and Big Data, IoT - IoT Preliminaries, Relationship Between IoT and Big Data, Data Center, Hadoop - Hadoop Preliminaries, Relationship between Hadoop and Big Data

1.

UNIT II INTRODUCTION TO VARIOUS MODELS**9**

INTRODUCTION TO HADOOP: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode and DataNode. **HADOOP ECOSYSTEM:** Hadoop ecosystem components - Schedulers - Fair and Capacity.

PIG : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

HIVE : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases.

UNIT III BIG DATA GENERATION AND STORAGE**9**

Big Data Generation-Enterprise Data, IoT Data, Internet Data, Bio medical Data, Data Generation from Other Fields, Big Data Acquisition Data Collection, Data Transportation, Data Pre-processing.

BIG DATA STORAGE: Storage System for Massive Data, Distributed Storage System, Storage Mechanism for Big Data- Database Technology, Design Factors, Database

Programming Model.

UNIT IV BIG DATA ANALYSIS

9

Traditional Data Analysis, Big Data Analytic Methods, Architecture for Big Data Analysis - Real-Time vs. Offline Analysis, Analysis at Different Levels, Analysis with Different Complexity, Tools for Big Data Mining and Analysis.

UNIT V BIG DATA APPLICATIONS

9

Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis, Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Relate Big data with Cloud Computing, Hadoop and IoT.

CO2: Interpret Hadoop Architecture and utilize Hadoop Ecosystem components.

CO3: Understand several mechanisms for Big Data generation, acquisition and storage.

CO4: Understand and Compare various Big Data Analytic Methods.

CO5: Outline Big Data Analysis in various Fields.

TEXTBOOKS:

1. Min Chen, Shiwen Mao, Yin Zhang, Victor C.M. Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer; 2014.
2. Tom White, Hadoop- The Definitive Guide, 4th Edition, O'reilly, 2015.

REFERENCES:

1. Eric Sammer, Hadoop Operations, 2nd Edition., O'Reilley, 2012.
2. Vignesh Prajapati, Big Data Analytics with R and Hadoop, PACKT Publishing, 2013.

WEB REFERENCES:

1. http://www.jbonneau.com/doc/2012-04-27-big_data_lecture_1.pdf
2. <https://www.ibm.com/developerworks/community/blogs/SusanVisserEditionntry/flashbookunderstandingbigdataanalyticsforenterpriseclasshadoopandstreamingdata?lang=en>

SEMESTER V

24CB503	FUNDAMENTALS OF MANAGEMENT & BUSINESS STRATEGY	L	T	P	C
		3	0	0	3
OBJECTIVES					
- To provide a comprehensive understanding of management theories and principles. - To develop knowledge of managerial functions and leadership skills. - To introduce organizational behavior concepts and workplace dynamics. - To familiarize students with organizational design and structures. - To impart knowledge on strategic management and competitive advantage.					
UNIT-I	MANAGEMENT THEORIES & STRATEGIC FOUNDATIONS	9			
Concept and foundations of management; evolution of management thoughts – Pre-scientific, Classical, Neo-classical, and Modern eras. Contributions of thinkers like Taylor, Fayol, and Elton Mayo. Introduction to strategic management – importance, vision, mission, and objectives. Schools of thought in strategic management; strategy content, process, and practice. Fit concept and configuration perspective.					
UNIT-II	FUNCTIONS OF MANAGEMENT & INTERNAL ENVIRONMENT	9			
Functions of management – planning, organizing, staffing, directing, and controlling. Leadership – concept, nature, importance, attributes, leadership development, and Leadership Grid. Internal environment of the firm – core competencies, competitive advantage, intellectual assets, business processes, and capability-based strategy.					
UNIT-III	ORGANIZATIONAL BEHAVIOUR & COMPETITIVE STRATEGY	9			
Introduction to organizational behaviour-personality, perception, learning, motivation, group dynamics, power and influence, stress management, decision-making, organizational culture, and cultural diversity. External environment-industry analysis using Five Forces, strategic groups, industry life cycle. Competitive strategies and value chain analysis.					
UNIT-IV	ORGANIZATIONAL DESIGN & CORPORATE STRATEGY	9			
Organizational design-classical, neoclassical, and contingency approaches. Organizational structures-simple, functional, divisional, and matrix. Corporate strategy-diversification (related and unrelated), business portfolio analysis, expansion, integration strategies. Strategic alliances, joint ventures, mergers, and acquisitions.					
UNIT-V	MANAGERIAL ETHICS & STRATEGY IMPLEMENTATION	9			
Managerial ethics-ethics in business, marketing, finance, and accounting. Decision-making frameworks, corporate governance, corporate citizenship, CSR, and international standards. Strategy implementation-McKinsey 7S framework, strategic control, performance evaluation, and governance.					
TOTAL: 45 PERIODS					
OUTCOMES: Upon completion of the course, the students will be able to:					
CO1	Explain the concepts, evolution of management theories, and fundamentals of strategic management including vision, mission, and objectives.				
CO2	Apply the functions of management and leadership principles in analysing organizational internal environment and core competencies.				
CO3	Analyze organizational behaviour factors and evaluate external business environment using competitive strategy frameworks.				

CO4	Examine organizational design structures and formulate appropriate corporate strategies including diversification and alliances.
CO5	Evaluate ethical issues in management and assess strategy implementation frameworks such as 7Smodel and strategic control mechanisms.
TEXT BOOKS:	
1. Richard L. Daft, Understanding the Theory and Design of Organization, Cengage Learning India Private Limited, Eleventh Edition, 2020. 2. Robert M. Grant, Contemporary Strategic Management, Blackwell, 7th Edition, 2012. 3. D N Dwivedi, Managerial Economics, 8th Edition, Vikas Publishing House, 2018.	
REFERENCES:	
1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior, Eighteenth Edition, Pearson India, 2019. 2. Richard Rumelt, Competitive Advantage, 2011. 3. Kazmi, Azhar, Business Policy and Strategic Management, Third Edition, Tata McGrawhill, New Delhi, 2008.	

24CB501	SOFTWARE DESIGN WITH UML	L	T	P	C
		2	0	2	3
OBJECTIVES					
The Course will enable learners to: • Understand the different models and milestones in a software project • Understand fundamental concepts of software project management • Understand the various software design methodologies • Learn various testing and maintenance measures					
UNIT-I	INTRODUCTION	6			
Software Characteristics, Software Crisis, Introduction to Software Engineering: Software Process - Water fall, prototyping, Incremental, RAD, Spiral, Unified modelling, Object oriented analysis process Models. Introduction to Agility-Agile Process-Extreme programming-XP Process. Software Quality and Reliability: Internal and external quality attributes, quality models - McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126;					
UNIT-II	REQUIREMENTS ANALYSIS SPECIFICATION	6			
Software requirements: Software Requirements Specifications (SRS), Requirement Elicitation techniques, OO Concepts - the principles of class, objects, abstraction, modularity, specification, polymorphism, inheritance, encapsulation and information hiding.					
UNIT-III	SOFTWARE DESIGN	6			

Introduction to the UML Language, Behavioural Diagrams: Use Case Diagram, Interaction Diagram, State Transition Diagram, Activity Diagram. Static Structure Diagrams: Class Diagram, Component Diagram, Package Diagram, Deployment Diagram.		
UNIT-IV	TESTING	6
Software testing fundamentals-Internal and external views of Testing-white box testing-basis path testing-control structure testing-black box testing-code coverage, condition coverage, branch coverage; Transaction testing, Use Case Testing, Regression Testing –Unit Testing –Integration Testing – Validation Testing –System Testing and Debugging.		
UNIT-V	PROJECT MANAGEMENT	6
Estimation –FP Based, LOC Based, Make/Buy Decision, COCOMO, Risk Management, EVA, Project Metrics, Product Metrics, Object oriented Metrics. Capability Maturity Models (CMM and CMMI).		
LIST OF EXERCISES: Draw standard UML diagrams using an UML modelling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied 1. Identify a software system that needs to be developed. 2. Document the Software Requirements Specification (SRS) for the identified system. 3. Identify use cases and develop the Use Case model. 4. Identify the conceptual classes and develop Class Diagram 5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence Diagrams 6. Draw relevant State Chart and Activity Diagrams for the same system. 7. Implement the system as per the detailed design 8. Test the software system for all the scenarios identified as per the use case diagram		
TOTAL: 30 + 30 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to:		
CO1	Understand engineering approach to software development, software quality and reliability.	
CO2	Summarize the concepts of software requirement analysis.	
CO3	Apply the concepts of object-oriented principles.	
CO4	Understand the need for software design and modelling techniques.	
CO5	Compare and contrast various software testing methodologies.	
CO6	Explore various project and risk management techniques.	

TEXT BOOKS:
1. Software Engineering, Ian Sommerville, Addison Welsey Publishers, 9th edition. 2. Roger S. Pressman, “Software Engineering: A Practitioner’s Approach” , McGraw Hill International Edition, Ninth Edition, 2020. 3. Fundamentals of Software Engineering, Rajib Mall, PHI Learning Private Limited, September 2018. 4. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2000
REFERENCES:
1. Shari Lawrence Pfleeger, Joanne M. Atlee - Software Engineering_ Theory and Practice- Prentice Hall 2009. 2. Craig Larman, —Applying UML and Patterns: An Introduction to Object- Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.

24CB502	COMPUTER NETWORKS (Lab Integrated)	L	T	P	C
		3	0	2	4
OBJECTIVES					
The Course will enable learners to: - Understand the concepts of data communications and networking. - Understand data link layer and its various services. - Learn the functions of network layer and various routing protocols. - Familiarize the functions and protocols of the transport layer. - Understand various application layer services.					
UNIT-I	INTRODUCTION	15			
Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures, Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, Wired LAN, Wireless LAN, Virtual LAN, Switching. List of Exercise/Experiments 1. Learn to use basic networking commands 2. Setting up of bus, mesh, star and ring topology using Cisco Packet Tracer.					
UNIT-II	DATA LINK LAYER AND MEDIUM ACCESS SUBLAYER	15			
Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Multiple access protocols- Random Access - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA. List of Exercise/Experiments 1. Simulation of Error correction code. (CRC) 2. Implementation of flow control protocols.					
UNIT-III	NETWORK LAYER	15			
Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. List of Exercise/Experiments					

1.Simulation of ARP using Cisco Packet Tracer		
2. Simulation of Distance Vector/ Link State Routing algorithm.		
UNIT-IV	TRANSPORT LAYER	15
Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.		
List of Exercise/Experiments		
1. Creation of Applications using TCP sockets like:		
a. Echo client and Echo Server		
b. Chat		
c. File Transfer		
2. Multi-client chatting in TCP/UDP Socket programming		
UNIT-V	APPLICATION LAYER	15
DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls.		
List of Exercise/Experiments		
1. Write a HTTP web client program to download a web page using TCP sockets.		
2. Simulation of DNS using Cisco Packet Tracer.		
TOTAL: 75 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to:		
CO1	Understand the classification of computer networks, basic layers and its functions, protocols and transmission media in computer networks	
CO2	Inspect the functionalities of data link and media access control protocols.	
CO3	Examine different routing algorithms.	
CO4	Identify appropriate protocol to be used at the transport layer.	
CO5	Explain the working of various application layer protocols.	
TEXT BOOKS:		
1. Behrouz A. Forouzan, Data Communications and Networking, The McGrawHill Companies, Inc. 5th Edition, 2013.		
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers Inc., 5th Edition 2012.		
REFERENCES:		
1. William Stallings, Data and Computer Communications, Pearson Education, 10th Edition, 2014.		
2. Andrew S. Tanenbaum, Computer Networks, Prentice Hall, 5th Edition, 2011		

24MA501	COMPUTATIONAL STATISTICS (B.Tech. CSBS) (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4
OBJECTIVES					

The course will enable the learners to:

- extend the knowledge of univariate normal distribution to the multivariate normal distributions.
- introduce multivariate regression models.
- impart knowledge about the core principles of Linear Discriminant Function Analysis.
- understand the concepts of principal component, and factor analysis.
- illustrate the concept of clustering and its various types.

UNIT-I	MULTIVARIATE NORMAL DISTRIBUTION	15
Bivariate Normal and Multivariate Normal Distribution Functions - Problems based on Properties - Conditional Distribution and its relation to regression model - Estimation of parameters. List of Exercises/Experiments using Python/Minitab: 1. To generate the mean and covariance matrix for a sample data. 2. To find the probability density function at a given point for a sample in a multivariate normal distribution.		
UNIT-II	MULTIPLE LINEAR AND MULTIVARIATE REGRESSION MODELS	15
Multiple linear (Classical linear) regression models - Assumptions - Estimation of Parameters - Sum of squares decomposition - Detection of outliers. Multivariate regression models - Assumptions - Parameter estimation - Multivariate Analysis of variance and covariance. List of Exercises/Experiments using Python/Minitab: 1. To generate a multiple linear regression model for a sample data. 2. To generate a multivariate regression model for a sample data.		
UNIT-III	DISCRIMINANT ANALYSIS	15
Statistical background - linear discriminant function analysis - Estimating linear discriminant functions for two and several populations - linear discriminant projection. List of Exercises/Experiments using Python/Minitab: 1. To generate a linear discriminant function for a sample data. 2. To generate a linear discriminant projection for a sample data.		
UNIT-IV	PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS	15
Principal Components - Algorithm for conducting principal component analysis - deciding on how many principal components to retain - Scree plot. Factor analysis model - Extracting common factors - determining number of factors - factor scores. List of Exercises/Experiments using Python/Minitab:		

1. To generate a principal component for a sample data. 2. To generate a factor analysis model for a sample data		
UNIT-V	CLUSTER ANALYSIS	15
Introduction - Types of clustering - correlations and distances - clustering by partitioning methods - hierarchical clustering - linkage methods - overlapping clustering - K-means clustering - non-hierarchical clustering. List of Exercises/Experiments using Python/Minitab: 1. To generate a hierarchical clustering - single linkage for a sample data. 2. To generate a K-means clustering for a sample data.		
TOTAL: 75 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to:		
CO1	estimate the statistical measures of multivariate normal distribution.	
CO2	evaluate the variance and covariance using multivariate analysis.	
CO3	estimate linear discriminant functions for two and several populations.	
CO4	determine the principal components and factor analysis of the given data.	
CO5	recognize factor and cluster analysis.	
CO6	generate multiple and multivariate linear regression models using Python.	
TEXT BOOKS:		
1. R. A Johnson, D. W Wichern, “Applied Multivariate Statistical Analysis”, 6th Edition. Pearson Prentice hall of India, Reprint 2015. 2. H. Kris, “Statistical Tests for Multivariate Analysis”, Springer, New York, 2011.		
REFERENCES:		
1. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, 3rd Edition, John Wiley and sons, New Jersy, 2009. 2. J. D. Jobson, “Applied Multivariate Data Analysis”, Vol I and II, 1st Edition, Springer-Verlag, New York, 2012. 3. M. Lutz, “Programming Python”, 4th Edition, O'Reilly Media, 2011. 4. Tim Hall and J.P Stacey, “Python 3 for Absolute Beginners”, 1st Edition, Apress, Reprint 2022.		

24CB903	MACHINE LEARNING	L	T	P	C
		3	0	2	4
OBJECTIVES: - To discuss the basics of Machine Learning and model evaluation. - To study dimensionality reduction techniques. - To understand the various classification algorithms. - To elaborate on unsupervised learning techniques. - To discuss the basics of neural networks and various types of learning.					
UNIT I	INTRODUCTION	9+6			
Machine Learning – Types – Applications – Preparing to Model – Activities – Data – Exploring structure of Data – Data Quality and Remediation – Data Pre-processing – Modelling and Evaluation: Selecting a Model -Training a Model – Model representation and Interpretability – Evaluating Performance of a Model – Improving Performance.					
Lab Programs: - Implementation of Candidate Elimination algorithm - Implementation of ML model evaluation techniques (R-Squared/Adjusted R-Squared/Mean Absolute Error/Mean Squared Error) - Implementation of ML model evaluation techniques (Confusion Matrix/F1 Score/AUC-ROC Curve)					
UNIT II	FEATURE ENGINEERING AND DIMENSIONALITY REDUCTION	9+6			
Feature Engineering – Feature Transformation – Feature Subset Selection - Principle Component Analysis – Feature Embedding – Factor Analysis – Singular value decomposition and Matrix Factorization – Multidimensional scaling – Linear Discriminant Analysis – Canonical Correlation Analysis – Isomap – Locally linear Embedding – Laplacian Eigenmaps.					
Lab Programs: - Write python code to identify feature co-relations (PCA) - Interpret Canonical Covariates with Heatmap - Feature Engineering is the way of extracting features from data and transforming them into formats that are suitable for Machine Learning algorithms. Implement python code for Feature Selection/ Feature Transformation/ Feature Extraction. - Mini Project – Feature Subset Selection					
UNIT III	SUPERVISED LEARNING	9+6			
Linear Regression -Relation between two variables – Steps – Evaluation – Logistic Regression – Decision Tree – Algorithms – Construction – Classification using Decision Tree – Issues – Rule - based Classification – Pruning the Rule Set – Support Vector Machines – Linear SVM – Optimal Hyperplane – Radial Basis Functions – Naïve Bayes Classifier – Bayesian Belief Networks.					
Lab Programs: - Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select the appropriate data set for your experiment and draw graphs. - Implement and demonstrate the working of the decision tree-based ID3 algorithm - Build a Simple Support Vector Machines using a data set					
UNIT IV	UNSUPERVISED LEARNING	9+6			
Clustering – Types – Applications - Partitioning Methods – K-means Algorithm – K-Medoids – Hierarchical methods – Density based methods DBSCAN – Finding patterns using Association Rules – Hidden Markov Model.					
Lab Programs: - Implement a k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions - Implement market basket analysis using association rules - Mini Project using Clustering analysis.					
UNIT V	NEURAL NETWORKS AND TYPES OF LEARNING	9+6			
Biological Neuron – Artificial Neuron – Types of Activation function – Implementations of ANN – Architectures of Neural Networks – Learning Process in ANN – Back propagation – Deep Learning					

Representation Learning – Active Learning – Instance based Learning – Association Rule Learning – Ensemble Learning Algorithm – Regularization Algorithm- Reinforcement Learning – Elements- Model-based- Temporal Difference Learning.

Lab Programs:

1. Build an ANN by implementing the Single-layer Perceptron. Test it using appropriate data sets.
2. Implement Multi-layer Perceptron and test the same using appropriate data sets.
3. Build a RBF Network to calculate the fitness function with five neurons.
4. Mini Project – Face recognition,

TOTAL: 45(L) + 30(P) = 75 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the basics of Machine Learning and model evaluation.

CO2: Study dimensionality reduction techniques.

CO3: Understand and implement various classification algorithms.

CO4: Understand and implement various unsupervised learning techniques.

CO5: Build Neural Networks and understand the different types of learning.

TEXT BOOKS:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson, 2019. (Unit 1 – chap 1,2,3/ Unit 2 – Chap 4 / Unit 4 – 9 / Unit 5 – Chap 10, 11)
2. Ethem Alpaydin, “Introduction to Machine Learning, Adaptive Computation and Machine Learning Series”, Third Edition, MIT Press, 2014. (Unit 2 – Chap 6 / Unit 4 – chap 8.2.3/ Unit 5 – Chap 18)

REFERENCES:

1. Anuradha Srinivasaraghavan, Vincy Joseph, “Machine Learning”, First Edition, Wiley, 2019. (Unit 3 – Chap 7,8,9,10,11 / Unit 4 – 13, 11.4, 11.5,12)
2. Peter Harrington, “Machine Learning in Action”, Manning Publications, 2012.
3. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition,
4. Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
5. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013.
6. Christoph Molnar, “Interpretable Machine Learning - A Guide for Making Black Box Models Explainable”, Creative Commons License, 2020.
7. NPTEL Courses:
 - a. Introduction to Machine Learning - https://onlinecourses.nptel.ac.in/noc23_cs18/preview

LIST OF EQUIPMENTS:

Systems with Anaconda, Jupyter Notebook, Python, Pytorch, scikit-learn, Tensorflow, Colab

24HS511	PROFESSIONAL COMMUNICATION-I (TOEFL)	L	T	P	C
		0	0	4	2
OBJECTIVES: The Course will enable learners to: • Develop learners’ ability to use TOEFL-specific reading strategies to comprehend academic texts and answer test-based questions. • Enable learners to produce organized and grammatically accurate TOEFL-style writing for both integrated and independent tasks. • Enhance learners’ listening comprehension of academic lectures and conversations typical of the TOEFL iBT test. Build learners’ speaking skills for TOEFL tasks, including clear organization of ideas, fluency, and intelligible pronunciation. • Familiarize learners with integrated TOEFL tasks requiring the combined					

use of listening, reading, speaking, and writing under time constraints.		
UNIT I	Introduction to TOEFL and LSRW	12
Purpose of the TOEFL - Types of TOEFL Exams - TOEFL Sections - Scoring and Grading - Test Administration -Test-Taking Tips- Overview of Listening, Speaking, Reading and Writing		
UNIT II	Reading Skills – Part 1	12
TOEFL Reading Comprehension -Fast Reading Techniques and Skills-Increasing eye-span and other speed-reading techniques; Skimming, scanning, searching for gist; Understanding context and theme of passages - Understanding the author's tone- Reading Question Types - Question Types Identification Quiz - Detail Question Strategy Application- Purpose Question Strategy Application- Purpose Question Quiz - Inference Question Strategy Application- Inference Question Strategy Introduction- Inference Quiz Questions - Except/Not Question Strategy Introduction and Application - Except Question Quiz		
UNIT III	Writing Skills – Part 1	12
TOEFL Knowledge Guide and TOEFL Writing - Pitfalls of poor writing skills – Impact discussed in professional as well as recruitment contexts - Essentials of good writing skills - Clear ideation Simple sentences Coherent structure Correct punctuations - Ability to make a write-up understandable from a point of no context - Creative writing - Integrated Essay: Reading Note-Taking Introduction - Reading Note -Taking: Finding Author's POV Reading, Note-Taking: Finding Author's 3 Controlling Ideas - Listening Note-Taking: Academic Lecture Listening Note-Taking: Applying the Strategy - Integrated Essay: Writing Introductions Integrated Essay: Writing Body Paragraphs		
UNIT IV	Listening Skills – Part 1	12
TOEFL Knowledge Guide and TOEFL Listening -Note Making Strategy – Introduction, General TOEFL Note-taking Strategies and Benefits- Top Ten Challenges Taking Lecture Notes, Rubric Analysis - Discourse Marker: Usage and Impact, Discourse Marker and Signposting; Listening Note-Making Section (Conversations), Conversations Note-Making Strategies - Application of Note-Making Strategies (Conversations) - Conversation Question Answering Strategy, Application of Answering Strategy (Conversations)		
UNIT V	Speaking Skills – Part 1	12
TOEFL Speaking Course Introduction Speaking Course– Phonetics - Understanding right pronunciations and sounds - Word stress; Pitfalls of mispronounced words in professional contexts – case studies		
TOTAL: 60 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to: CO1: Apply TOEFL reading strategies (skimming, scanning, inference, vocabulary recognition) to answer academic reading questions with appropriate accuracy under test conditions. CO2: Produce TOEFL-style integrated and independent essays that meet task requirements, demonstrating coherence, grammatical accuracy, and academic vocabulary within the allotted time. CO3: Identify the main ideas, supporting details, and the speaker's attitudes in		

TOEFL-type academic listening passages, and respond correctly to comprehension questions.

CO4: Deliver organized spoken responses to TOEFL speaking prompts with intelligible pronunciation, adequate fluency, and relevant content within the prescribed time.

CO5: Complete TOEFL integrated tasks by synthesizing information from reading and listening inputs into coherent spoken or written responses using appropriate time-management strategies.

TEXT BOOKS:

1. Educational Testing Service. (2024). The Official Guide to the TOEFL® Test (7th ed.). Princeton,NJ:ETS.
2. Educational Testing Service. (2024). Official TOEFL iBT® Tests, Volume 1 (5th ed.). Princeton,NJ:ETS.
3. Educational Testing Service. (2024). Official TOEFL iBT® Tests, Volume 2 (4th ed.). Princeton, NJ: ETS.

Reference Books & Online Resources Books

1. **Pamela J. Sharpe.**Barron's TOEFL iBT. 17th ed., Barron's Educational Series, 2023.
2. **Kaplan Test Prep.**Kaplan's TOEFL iBT Prep Plus. 2024–2025 ed., Kaplan Publishing, 2024.
3. **Educational Testing Service (ETS).**The Official Guide to the TOEFL® Test. 7th ed., Princeton, NJ: ETS, 2024.
4. **Educational Testing Service (ETS).**Official TOEFL iBT® Tests, Volume 1. 5th ed., Princeton, NJ: ETS, 2024.
5. **Educational Testing Service (ETS).**Official TOEFL iBT® Tests, Volume 2. 4th ed., Princeton, NJ: ETS, 2024.

Online Resources

1. **Coursera.**TOEFL Preparation Specialization. Available at :
<https://www.coursera.org/specializations/toefl-preparation>
2. **Coursera.**TOEFL Test-Taking Strategies. Available at:
<https://www.coursera.org/learn/toefl-test-taking-strategies>
3. Complete TOEFL Prep Course (Free Online). Available at:
<https://coursesity.com/course-detail/complete-toefl-prep-course>
4. **Preply.**TOEFL Preparation Course. Available at:
<https://preply.com/en/courses/english/toefl-preparation-course>

24CS511	ADVANCED APTITUDE AND CODING SKILLS - I	L	T	P	C
		0	0	3	1.5
OBJECTIVES: • To develop vocabulary for effective communication and reading skills. • To build the logical reasoning and quantitative skills. • To develop error correction and debugging skills in programming.					
LIST OF EXERCISES: 1. English – Phase I Advanced					

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. Logical Reasoning – Phase I Advanced

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. Quantitative Ability - Phase I Advanced

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. Automata Fix – Phase I

Logical, Compilation and Code reuse

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Develop error correction and debugging skills in programming.

SEMESTER VI

24CB601	CLOUD, MICROSERVICES (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	3
OBJECTIVES: The Course will enable learners to: • Know basic components and fundamentals of cloud computing • Develop an application using various services in cloud • Understand how to design the web application development in cloud • Learn the basic and important concepts of python to implement in an application • Understand the issues and solutions for cloud security and cloud monitoring					
UNIT I	INTRODUCTION				9
Cloud Fundamentals-Cloud Service Components-Cloud Service, Deployment Models-Cloud components-Guiding principle with respect to utilization, Security, Pricing-Application of Cloud Computing. Case Study: Design and Implementation of Public and Private Cloud Environments – Open Stack and AWS.					
UNIT II	CLOUD BASED APPLICATIONS DEVELOPMENT				9
Application Architectures-Monolithic & Distributed, Microservice Fundamental and Design Approach-Cloud Native Applications-12 Factors App-Application Integration Process and APIfication Process-API Fundamental-Microservice and API Management- Spring Boot Fundamental and Design of Microservice - API Tools - Developer Portal Applications of Microservice and APIfication.					
UNIT III	WEB DEVELOPMENT TECHNIQUES				9
Devops fundamentals - Devops Role and Responsibility-Tools and Applications-Containerization Process and Application-Evolution of APP Deployment- Docker Fundamentals - Docker Architecture-Docker Commands. Case study Orchestration, Kubernetes, Docker Container.					
UNIT IV	CLOUD SECURITY AND MONITORING TOOL				9
Cloud Security-Cloud Security Shared Responsibility Architecture-Security By Design Principles-Identity And Access Management-Cloud Security Layers Illustration-Cloud Network, Host And Data Security Concepts-Security Operations and Major Cloud Service Provider Tools-Security Compliance and Regulations-Cloud Monitoring-Benefits of Cloud Monitoring-Overview of Cloud Monitoring Tools.					
UNIT V	BUILDING AN APPLICATION USING PYTHON				9
Developing and Deploying an Application in the Cloud- Building a python project based on Design-Development Testing-Deployment of an application in the cloud using a development framework and deployment platform. Case Study: Python Use case and Python Framework.					
TOTAL: 45 PERIODS					
LIST OF EXPERIMENTS: 1. Find procedure to run the virtual machine of different configuration using virtual-manager. 2. Virtualize a machine and check how many virtual machines can be utilized at a particular time. 3. Create a VM Clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine. 4. Create a Snapshot of a VM at a given point in time and test the snapshot by restoring the VM to that time. (Note: Testing can be done by installing an application and then restore it.) 5. Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix and launch it. 6. Test how a SaaS applications scales in response to demand.					

7. Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP. 8 Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.
8. Find the procedure to develop a DevSecOps – Cloud (AWS, GCP, Azure).
9. Find the procedure to develop a DevSecOps – Cluster (Kubernetes).
10. Find the procedure to develop a Container (Docker).
11. To Build and Test Your Docker Images in the Cloud with Docker commands.
12. Perform the installation steps and configure Google App Engine.
13. Find the Procedure to develop a Salesforce application in cloud.
14. Create an Application in Salesforce.com using Apex programming Language.

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Demonstrate the main concepts of cloud, its characteristics, advantages, key technologies and its various delivery and deployment models.

CO2: Develop and design an application using various tools in cloud environment CO3: Acquire the basic and important design concepts and issues of web application development techniques in cloud.

CO4: Structure simple python program for developing an application in cloud

CO5: Analyze the issue of cloud such as security, energy efficiency and interoperability, and provide an insight into future prospects of computing in the cloud monitoring.

TEXT BOOKS:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, “Cloud Computing Concepts, Technology & Architecture”, Prentice Hall, 2023.
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press, 2022.

REFERENCES:

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, “Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet”, First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing: Principles and Paradigms”, Wiley, 2011.

24CB602	INFORMATION SECURITY (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4
OBJECTIVES: The Course will enable learners to: • Understand the role of information security and its parameters. • Understand various access control models and security policies. • Understand importance of system design. • Understand logic-based system design. • Understand Unix system interface. • Understand Unix programming methods.					
UNIT I	OVERVIEW OF SECURITY PARAMETERS				9
Confidentiality, integrity and availability; Security violation and threats; Security policy and procedure;					

Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.		
UNIT II	ACCESS CONTROL MODELS AND SECURITY POLICIES	9
Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.		
UNIT III	SYSTEMS DESIGN	9
Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.		
UNIT IV	LOGIC-BASED SYSTEM	9
Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.		
UNIT V	UNIX SYSTEM INTERFACE AND PROGRAMMING METHOD	9
Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing.		
TOTAL: 45 PERIODS		
LIST OF EXPERIMENTS: 1. Analysis of security in Unix/Linux. 2. Administration of users, password policies, privileges and roles		
TOTAL: 30 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to: CO1: Implement of information security and its parameters. CO2: Implement various access control models and security policies. CO3: Implement the system design effectively. CO4: Implement logic-based system design effectively. CO5: Capable to work with UNIX system calls. CO6: Student will be able to work with UNIX programming by various methods.		
TEXT BOOKS: 1. M. Bishop, "Computer Security: Art and Science", 2nd Edition, Pearson Education, 2019. 2. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Third Edition, Wiley, 2021.		
REFERENCES: 1. C.P. Pfleeger, S.L. Pfleeger, J. Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2015. 2. M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, 2011.		

24HS611	PROFESSIONAL COMMUNICATION- II (TOEFL)	L	T	P	C
		0	0	2	1

OBJECTIVES: The Course will enable learners to: • Develop effective reading strategies, with a primary focus on TOEFL-oriented tasks, to enhance comprehension. • Strengthen note-taking skills and organize written responses coherently with TOEFL-related writing tasks. • Enhance active listening skills to effectively comprehend academic lectures and campus conversations, in alignment with TOEFL iBT. • Demonstrate confidence, fluency, and clarity while presenting ideas, in alignment with TOEFL-integrated speaking tasks. • Apply Listening, Speaking, Reading, and Writing (LSRW) skills effectively to achieve overall communicative competence, with TOEFL- integrated task requirements.					
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UNIT I	READING SKILLS – PART 2	6
Paraphrase Question Strategy Application, Paraphrase Question Strategy and Tactics Process, Question Quiz-Sentence, Addition Question Type Strategy, Sentence Addition Quiz-Vocabulary Question Strategy Application, Vocabulary Through Context-Reference Question Strategy Intro and Application, Reference, Vocabulary, How Organized Strategy-Non-Category Questions Strategy, Summary and Category (table) Question Strategy, Summary Question Answer Explanation-TOEFL Reading Comprehension Rubrics Analysis.		

UNIT II	WRITING SKILLS – PART 2	6
Listening Note-Taking: Academic Lecture Listening Note-Taking: Applying the Strategy-Integrated Essay: Writing Introductions Integrated Essay: Writing Body Paragraphs-Writing Thesis Statements-Writing Introductions: Writing Topic Sentences: Topic Sentences-Writing Body Paragraphs-Eliminate Weak Sentence-Full Essay writing: Agree – Disagree, Support – Oppose, If - Imaginary Questions, Compare and Contrast, Advantage and Disadvantage , Standard Opinion Question , Discuss and Choose Side to Agree -Rubric Analysis.		

UNIT III	LISTENING SKILLS – PART 2	6
Application of Note-Taking Strategy 2 (Conversations)-Application of Answering Strategy 2 (Conversations)-Application of Note-Taking Strategy 3 (Conversations)-Application of Answering Strategy 3 (Conversations)-Application of Note-Taking Strategy 4 (Conversations)-Application of Answering Strategy 4 (Conversations)-Demonstration (Questions Go In-Order) Timed Strategy Application Quiz.		

UNIT IV	Speaking Skills – Part 2	6
Personal Opinion Questions- Introduction, Note-Taking: Personal Opinion Questions-Speaking Template, Useful Expressions, In-Class Practice-Campus Announcement Introduction Overview: Question Reading, Text Note-Taking, Teacher Sample Responses-Student Practice: Campus Announcement Question ,Speech-to-Text Teacher Demonstration Question, Speech-to-Text Student Opportunity-Academic Text-Lecture Question: Introduction Overview, Reading Text Note-Taking, Lecture- Listening Note-Taking Academic Text Lecture, Teacher Sample Response and Student Practice Opportunity, Transcription of Speaking Responses: Academic Text - Lecture Question, Speech-to-Text Teacher Demonstration, Speech-to-Text Student Opportunity.		

UNIT V	INTEGRATED LSRW APPROACH	6
Listening: Active listening strategies such as note-taking and paraphrasing-Listening to various audio materials to improve comprehension and retention-Focuses on identifying main ideas, supporting details, and speaker attitudes. Speaking: Discussion on strategies for improving pronunciation, intonation, and fluency-Speaking on different topics to enhance verbal communication skills-Reading: Review the strategies for active reading, including skimming, scanning, and annotating texts-Practice reading across various genres to improve comprehension and vocabulary acquisition-Emphasize understanding the author's purpose, tone, and argumentation in texts-Writing: Discussion on principles of effective writing, including organization, coherence, and clarity- Practice writing essays or responses to prompts to develop written communication skills- Feedback on grammar, punctuation, and sentence structure to improve writing proficiency.		
TOTAL: 30 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to: CO1: Apply effective reading strategies to read academic texts fluently and respond accurately to TOEFL-style contextual questions. CO2: Compose written responses with coherence, clarity, and logical flow in alignment with TOEFL-integrated writing tasks. CO3: Demonstrate active listening skills by comprehending academic lectures and campus conversations as required in the TOEFL Listening section, and respond appropriately. CO4: Engage confidently in spoken communication by effectively performing TOEFL-integrated Speaking tasks with clarity and fluency. CO5: Execute Listening, Speaking, Reading, and Writing (LSRW) skills, strategically to meet the standards of TOEFL iBT integrated tasks.		
TEXT BOOKS: 1. Gear, J., & Gear, R. (2014). Cambridge preparation for the TOEFL test (4th ed.). Cambridge University Press. 2. Sharpe, P. J. (2020). Barron's TOEFL iBT (17th ed.). Barron's Educational Series.		
Reference Books & Online Resources Books 1. Educational Testing Service. (2023). <i>The official guide to the TOEFL iBT test</i>. McGraw-Hill Education. 2. Brown, H. D., & Lee, H. (2015). <i>Teaching by principles: An interactive approach to language pedagogy</i> (4th ed.). Pearson Education. 3. Richards, J. C. (2008). <i>Teaching listening and speaking: From theory to practice</i>. Cambridge University Press. 4. Anderson, N. J. (2008). <i>Practical English language teaching: Reading</i>. McGraw-Hill. 5. Hedge, T. (2005). <i>Writing</i> (2nd ed.). Oxford University Press.		
Online Resources 1. Educational Testing Service. (n.d.). TOEFL iBT test content and structure. ETS. https://www.ets.org/india/toefl/test-takers/ibt/about/content.html 2. Exam Word. (n.d.). TOEFL test preparation resources. https://www.examword.com/d/toefl 3. Coursera. (n.d.). TOEFL reading and listening sections skills mastery.		

24CS611	ADVANCED APTITUDE AND CODING SKILLS - II	L	T	P	C
		0	0	3	1.5
OBJECTIVES: • To develop advanced vocabulary for effective communication and reading skills. • To build an enhanced level of logical reasoning and quantitative skills. • To develop error correction and debugging skills in programming. • To apply data structures and algorithms in problem solving.					
LIST OF EXERCISES: 1.English – Phase II Advanced Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering 2. Logical Reasoning – Phase II Advanced Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency 3. Quantitative Ability - Phase II Advanced Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability 4. Automata Fix – Phase II Logical, Compilation and Code reuse 5. Automata - Phase II Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry					
TOTAL: 45 PERIODS					
OUTCOMES: At the end of this course, the students will be able to: CO1: Develop advanced vocabulary for effective communication and reading skills. CO2: Build an enhanced level of logical reasoning and quantitative skills. CO3: Develop error correction and debugging skills in programming. CO4: Apply data structures and algorithms in problem solving.					

24CB701	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		2	0	0	2
OBJECTIVES: • To understand the basic concepts, functions and processes of human resource management • To enable students to learn the skills of talent acquisition practices • To describe corporate training & development methods • To develop conceptual understanding of compensation management system and career concepts. • To develop practical insights and problem solving capabilities for effectively managing the organisational appraisal and control practices • To integrate the knowledge of HR concepts to take correct business decisions					
UNIT I	HUMAN RESOURCE MANAGEMENT	6			
Concept and Challenges, HR Philosophy, Policies, Procedures and Practices.					
UNIT II	HUMAN RESOURCE SYSTEM DESIGN	6			
HR Profession, and HR Department, Line Management Responsibility in HRM, Measuring HR, Human resources accounting and audit; Human resource information system					
UNIT III	FUNCTIONAL AREAS OF HRM	6			
Recruitment and staffing, benefits, compensation, employee relations, HR compliance, organizational design, training and development, human resource information systems (H.R.I.S.) and payroll.					
UNIT IV	HUMAN RESOURCE PLANNING	6			
Demand Forecasting, Action Plans– Retention, Training, Redeployment & Staffing, Succession Planning					
UNIT V	STRATEGIC MANAGEMENT OF HUMAN RESOURCES	6			
SHRM, relationship between HR strategy and overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace					
TOTAL: 30 PERIODS					
OUTCOMES: At the end of this course, the students will be able to: CO1: Understand the object basic principles of Human Resource Management. CO2: Identify effective management of its human resources. CO3: Familiarize the basic concepts, roles, functional areas and activities of HR CO4: Demonstrate the knowledge of HR concepts to take appropriate business decisions. CO5: Understand organization’s employees, their interest, motivation and satisfaction and their belief of fair treatment.					
TEXT BOOK: 1. Gary Dessler, <i>Human Resource Management</i> , Pearson India, 2019					
REFERENCES: 1. Pravin Durai, <i>Human Resource Management</i> , Pearson India Education Services, 2016 2. Nipun Sharma, <i>Human Resource Management Theory and Practice</i> , R.C. Sharma, Sage Publications India PVT., Ltd., 2018					

24CB702	IT PROJECT MANAGEMENT	L	T	P	C
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	(Theory Course with Laboratory Component)	2	0	2	4
OBJECTIVES: • To gain knowledge on fundamental concepts of project and project scheduling. • To understand Project Cost Control, Scheduling and Management Features. • To obtain knowledge on Agile Project Management. • To know about the Scrum framework in detail. • To obtain knowledge on DevOps and its related concepts.					
UNIT I	PROJECT OVERVIEW AND PROJECT SCHEDULING				6
Project Overview and Feasibility Studies: Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal- Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.					
UNIT II	COST CONTROL, SCHEDULING AND MANAGEMENT FEATURES				6
Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling – Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.					
UNIT III	AGILE PROJECT MANAGEMENT				6
Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL). Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal.					
UNIT IV	SCRUM				6
Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum, Case Study.					
UNIT V	DEVOPS				6
DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring, Case Study.					
TOTAL: 30 PERIODS					
Lab Exercises A mini-project to be identified in the given domain (Crowd Source System, Day Book, Smart Transport System, Resume Builder, E-Commerce, Expert System, Puzzle Corner) to apply the IT Project Management Principles. 1. Estimation of project cost and control activity using open-source tools. 2. Scheduling of project with PERT and CPM techniques to estimate the completion time. 3. Assessment of IT Project Risk Analysis using open-source tools. 4. Perform IT Project Audit and generate a report using open-source tools. 5. Study of Agile project management tools. 6. Application of Scrum practices in the project. 7. Design and perform automated testing.					
TOTAL: 30 PERIODS					
OUTCOMES: At the end of this course, the students will be able to: CO1: Learn to effectively plan, and schedule projects within time and cost targets. CO2: Have Knowledge in Cost Control, Scheduling and Management Features. CO3: Be aware of different Agile Project Methodologies. CO4: Know in detail about Scrum. CO5: Obtain good knowledge in DevOps.					
TEXT BOOK:					

Mike Cohn, Succeeding with Agile: Software Development Using Scrum, Addison Wesley Signature Series, 2019

REFERENCE BOOKS:

1. Roman Pichler, Agile Product Management with Scrum, Addison-Wesley Signature Series, 2020
2. Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional)

PROFESSIONAL ELECTIVES

24CB901	CONVERSATIONAL SYSTEMS (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3
OBJECTIVES: The Course will enable learners to: • Acquire knowledge on fundamentals of conversational systems. • Understand the different techniques of Natural Language Processing. • Familiar with Chatbot frameworks & architecture. • Work with ML Concepts and different algorithms to build custom ML Model. • Enable students to understand on Conversational experiences and provide better customer experiences.					
UNIT I	FUNDAMENTALS OF CONVERSATIONAL SYSTEMS				12
Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, Natural Language Generation, Speech-To-Text, Text-To-Speech, Computer Vision etc., Introduction to Top players in Market – Google, MS, Amazon &Market trends. Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview. List of Exercise/Experiments 1. A python program to identify morphological features of a word by analysing it. 2. A python program to generate word forms from root and suffix information.					
UNIT II	NATURAL LANGUAGE PROCESSING				12
Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chat bots, General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation, Information Extraction, Sentiment Analysis. List of Exercise/Experiments 1. A python program to know the importance of context and size of training corpus in learning Parts of Speech and understand the concept of chunking and get familiar with the basic chunk tagset. 2. A python program to calculate the bigrams from a given corpus and calculate probability of a sentence. 3. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.					
UNIT III	BUILDING A CHAT BOT / CONVERSATIONAL AI SYSTEMS				12
Fundamentals of Conversational Systems (NLU, DM and NLG) - Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation. UX design, APIs and SDKs, Usage of Conversational Design Tools. Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. List of Exercise/Experiments 1. A python program to build a Neural Network to recognize handwritten digits using MNIST					

dataset.		
2. Project 1: Case Study to build a learning chatbot		
UNIT IV	ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES	12
Understanding on how Conversational Systems uses ML technologies in ASR, NLP-Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction etc., to effectively converse.		
List of Exercise/Experiments		
Case Study to build a ML Model using RNN and integrate with chatbot.		
UNIT V	CONVERSATIONAL ANALYTICS AND FUTURE	12
Conversation Analytics: The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems, XR-Commerce - What to expect next? – Future technologies and market innovations overview.		
List of Exercise/Experiments		
Case Study to build a ML Model using LSTM and integrate with chatbot.		
TOTAL: 60 PERIODS		
OUTCOMES:		
Upon completion of the course, the students will be able to:		
CO1: Familiarize with the basic technologies required for building a conversational system.		
CO2: Familiarize with the NLTK tool kit and the pre-processing techniques of natural language processing.		
CO3: Build a Chabot for any application and deploy it		
CO4: Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behaviour.		
CO5: Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.		
TEXT BOOK:		
1. Michael McTear, “Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots”, Moran and Claypool Publishers, Second Edition, 2020.		
REFERENCE BOOKS:		
1. Cathy Pearl, “Designing Voice User Interfaces: Principles of Conversational Experiences”, O'REILLY, 2016.		

	(Theory Course with Laboratory Component)	2	0	2	4
OBJECTIVES: The Course will enable learners to: - Understand the concept of Industry 4.0 and technologies for cognitive robotics - Understand the fundamentals of robotics operating systems - Understand the role of AI in cognitive robotics - Understand and demonstrate the role of Data Science and their working principles in robotics - Demonstrate the concepts of cloud computing with robot on various real time applications					
UNIT I	INTRODUCTION				6
Introduction to Modern Day Robotics and their industrial applications: Industry 4.0 Concept: Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies-Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications Technologies essential for Cognitive Robotics: Computer systems and Technologies relevant to modern day robotics-Robotic Process Automation: Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders-Introduction to Robotics: Analysis, Control, Applications					
UNIT II	ROBOTIC OPERATING SYSTEM				6
ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan Quality of Service and Cybersecurity Communication Protocols -Analysis for the Robot Operating System. Robotics systems communication- Threat modelling using ROS					
UNIT III	AI IN THE CONTEXT OF COGNITIVE ROBOTICS AND ROLE OF AI IN ROBOTICS				6
Foundation for Advanced Robotics and AI- A Concept for a Practical Robot Design Process-Demo to train A Robot Using AI - Deep learning core applications-Deep learning business applications					
UNIT IV	DATA SCIENCE AND BIG DATA IN THE CONTEXT OF COGNITIVE ROBOTICS				6
Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots - Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction					
UNIT V	CLOUD PLATFORMS AND IT APPLICATIONS IN ROBOTICS				6
Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms - Robot as a Service in Cloud Computing -Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud Robotics Architectures and Applications - Google's cloud robotics and high computing needs of industrial automation and systems-The role of cloud and opensource software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association					
TOTAL: 30 PERIODS					
LIST OF EXPERIMENTS: - Build a Self-Driving Robot that can automatically follow a line - Build a basic obstacle-avoiding robot and improve the design to help it avoid getting stuck - Build a Humanoid Robot					

4. Autonomous Robot Navigation using Computer Vision for exhaustive path-finding
5. A Mobile Autonomous Chemical Detecting Robot
6. Build a voice controlled robot
7. Web-Controlled Mobile Video-Enabled Robotic Litter Collection Device
8. Utilizing Artificial Neural Networks to Create a Learning Robot
9. Hospital Sanitizing Robot
10. Autonomous Robotic Vehicle: Saving lives, preventing accidents one at a time
11. Build a robot with Python and 3D Printed Robotic Arm
12. Build an Intelligent Irrigation Control System
13. AI-powered Hearing Aid
14. Fire Extinguishing Robot
15. Remote Operated Spy Robot Circuit

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries.

CO2: Understand the basics of Robotic operating systems and communication system.

CO3: Understand basic concepts and technological advancements in AI and robotics.

CO4: Understand and apply several statistical analysis techniques, business analytics for cognitive robotics and programming of robots using python and R languages.

CO5: Understand and apply the cloud computing concepts in robotics.

TEXT BOOK:

1. Saeed Benjamin Niku, "Introduction to Robotics: Analysis, Control, Applications", Wiley Publishers, 2nd edition, 2011.

2. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

REFERENCES:

1. Francis X. Govers, "Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques", Packt publishing, 2018.

2. Krishnendu Kar, "Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques", Packt publishing, 2020.

24CB903	MACHINE LEARNING (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	4
OBJECTIVES:					

The Course will enable learners to: • To discuss the basics of Machine Learning and model evaluation. • To study dimensionality reduction techniques. • To understand the various classification algorithms. • To elaborate on unsupervised learning techniques. • To discuss the basics of neural networks and various types of learning.		
UNIT I	INTRODUCTION	6+6
Machine Learning – Types – Applications – Preparing to Model – Activities – Data – Exploring structure of Data – Data Quality and Remediation – Data Pre-processing – Modelling and Evaluation: Selecting a Model -Training a Model – Model representation and Interpretability – Evaluating Performance of a Model – Improving Performance. Lab Programs: 1. Implementation of Candidate Elimination algorithm 2. Implementation of ML model evaluation techniques (R-Squared/Adjusted R-Squared/Mean Absolute Error/Mean Squared Error) 3. Implementation of ML model evaluation techniques (Confusion Matrix/F1 Score/AUC-ROC Curve)		
UNIT II	FEATURE ENGINEERING AND DIMENSIONALITY REDUCTION	6+6
Feature Engineering – Feature Transformation – Feature Subset Selection - Principle Component Analysis – Feature Embedding – Factor Analysis – Singular value decomposition and Matrix Factorization – Multidimensional scaling – Linear Discriminant Analysis – Canonical Correlation Analysis – Isomap – Locally linear Embedding – Laplacian Eigenmaps. Lab Programs: 1. Write python code to identify feature co-relations (PCA) 2. Interpret Canonical Covariates with Heatmap 3. Feature Engineering is the way of extracting features from data and transforming them into formats that are suitable for Machine Learning algorithms. Implement python code for Feature Selection/ Feature Transformation/ Feature Extraction. 4. Mini Project – Feature Subset Selection		
UNIT III	SUPERVISED LEARNING	6+6
Linear Regression -Relation between two variables – Steps – Evaluation – Logistic Regression – Decision Tree – Algorithms – Construction – Classification using Decision Tree – Issues – Rule-based Classification – Pruning the Rule Set – Support Vector Machines – Linear SVM – Optimal Hyperplane – Radial Basis Functions – Naïve Bayes Classifier – Bayesian Belief Networks. Lab Programs: 1. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select the appropriate data set for your experiment and draw graphs. 2. Implement and demonstrate the working of the decision tree-based ID3 algorithm 3. Build a Simple Support Vector Machines using a data set		
UNIT IV	UNSUPERVISED LEARNING	6+6
Clustering – Types – Applications - Partitioning Methods – K-means Algorithm – K-Medoids – Hierarchical methods – Density based methods DBSCAN – Finding patterns using Association Rules – Hidden Markov Model. Lab Programs: 1. Implement a k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions 2. Implement market basket analysis using association rules 3. Mini Project using Clustering analysis.		

UNIT V	NEURAL NETWORKS AND TYPES OF LEARNING	6+6
Biological Neuron – Artificial Neuron – Types of Activation function – Implementations of ANN – Architectures of Neural Networks – Learning Process in ANN – Back propagation – Deep Learning – Representation Learning – Active Learning – Instance based Learning – Association Rule Learning – Ensemble Learning Algorithm – Regularization Algorithm- Reinforcement Learning – Elements- Model-based- Temporal Difference Learning.		
Lab Programs:		
1. Build an ANN by implementing the Single-layer Perceptron. Test it using appropriate data sets. 2. Implement Multi-layer Perceptron and test the same using appropriate data sets. 3. Build a RBF Network to calculate the fitness function with five neurons. 4. Mini Project – Face recognition,		
TOTAL: 30 +30 =60 PERIODS		
OUTCOMES:		
At the end of this course, the students will be able to:		
CO1: Explain the basics of Machine Learning and model evaluation.		
CO2: Study dimensionality reduction techniques.		
CO3: Understand and implement various classification algorithms.		
CO4: Understand and implement various unsupervised learning techniques.		
CO5: Build Neural Networks and understand the different types of learning.		
TEXT BOOK:		
1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson,2019. (Unit 1 – chap 1,2,3/ Unit 2 – Chap 4 / Unit 4 – 9 / Unit 5 – Chap 10, 11) 2. Ethem Alpaydin, “Introduction to Machine Learning, Adaptive Computation and Machine Learning Series”, Third Edition, MIT Press, 2014. (Unit 2 – Chap 6 / Unit 4 – chap 8.2.3/ Unit 5 – Chap 18)		
REFERENCES:		
1. Anuradha Srinivasaraghavan,Vincy Joseph, “Machine Learning”, First Edition, Wiley, 2019.(Unit 3 – Chap 7,8,9,10,11 / Unit 4 – 13, 11.4, 11.5,12) 2. Peter Harrington, “Machine Learning in Action”, Manning Publications, 2012. 3. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, 4. Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014. 5. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013. 6. Christoph Molnar, “Interpretable Machine Learning - A Guide for Making Black Box Models Explainable”, Creative Commons License, 2020. 7. NPTEL Courses: Introduction to Machine Learning - https://onlinecourses.nptel.ac.in/noc23_cs18/preview		
LIST OF EQUIPMENTS:		
Systems with Anaconda, Jupyter Notebook, Python, Pytorch, scikit-learn, Tensorflow, Colab		

		3	0	0	3
OBJECTIVES: The Course will enable learners to: • Understand the concept and theory of economics. • Acquire knowledge on the choices and behavior of firms, households and other economics entities. • Learn the behavioral science perspective in economics. • Know the current ideas and concepts regarding decision making in economics. • Study the intertemporal choice in economics.					
UNIT I	INTRODUCTION				9
The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications – gains and losses, money illusion, charitable donation.					
UNIT II	BASICS OF CHOICE THEORY				9
Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis – consumption and addiction, environmental protection, retail therapy; applications – pricing, valuation, public goods, choice anomalies.					
UNIT III	BELIEFS, HEURISTICS AND BIASES				9
Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and selfprojection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade in memorabilia, policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design.					
UNIT IV	CHOICE UNDER UNCERTAINTY				9
Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications – ownership and trade, income and consumption, performance in sports. Strategic choice-Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signalling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry.					
UNIT V	INTERTEMPORAL CHOICE				9
Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings, clubs and membership, consumption planning. Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion					
TOTAL: 45 PERIODS					
OUTCOMES: Upon completion of the course, the students will be able to: CO1: Understand and apply various concepts in traditional and modern Microeconomics. CO2: Focus on decision making, and develop a holistic understanding of these concepts and their interconnections. CO3: Explore the knowledge on behavioural science perspective in Economics.					

CO4: Understand current ideas and concepts regarding decision making in Economics. CO5: Students will be able to understand the intertemporal choice in Economics.
TEXT BOOK: 1.N. Wilkinson and M. Klaes , “An Introduction to Behavioral Economics”, 2022. 2.Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, “Economics”, 19 th Edition, Tata McGraw Hill, 2010.
REFERENCES: 1.M.L.Trivedi, “Managerial Economics:Theory & Applications”, Tata McGraw-Hill Education, 4 th Edition, 2022. 2.Robert H. Frank, “Microeconomics and Behaviour”, McGraw-Hill, 9 th Edition, 2014.

24CB905	COMPUTATIONAL FINANCE AND MODELING	L	T	P	C
		3	0	0	3
OBJECTIVES: The Course will enable learners to: - Understand existing financial models in a quantitative and mathematical way. - Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering. - Explain the approaches required to calculate the price of options. - Identify the methods required to analyse information from financial data and trading systems.					
UNIT I	INTRODUCTION				9
Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance: examples of exact solutions including Black Scholes and its relatives, finite difference methods including algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, early exercise, and the corresponding free boundary problems, and a brief introduction to numerical methods for solving multi-factor models					
UNIT II	BLACK-SCHOLES FRAMEWORK				9
Black-Scholes framework: Black-Scholes PDE: simple European calls and puts; put-call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega&rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts;					
optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces. Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linear congruential generator, Mersenne twister RNG. The use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature. The technical topics addressed include importance sampling, Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the “Greeks. ”					
UNIT III	FINANCIAL PRODUCTS AND MARKETS				9
Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange, and commodities. Options contracts and strategies for speculation and hedging.					
UNIT IV	APPLICATION AREAS				9
Application areas include the pricing of American options, pricing interest rate dependent claims, and					

credit risk. The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options.		
UNIT V	STATISTICAL ANALYSIS OF FINANCIAL RETURNS	9
Statistical Analysis of Financial Returns: Fat-tailed and skewed distributions, outliers, stylized facts of volatility, implied volatility surface, and volatility estimation using high frequency data. Copulas, Hedging in incomplete markets, American Options, Exotic options, Electronic trading, Jump Diffusion Processes, High-dimensional covariance matrices, Extreme value theory, Statistical Arbitrage.		
TOTAL: 45 PERIODS		
OUTCOMES: Upon completion of the course, the students will be able to: CO1: Understand existing financial models in a quantitative and mathematical way. CO2: Apply these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering. CO3: Explain the approaches required to calculate the price of options. CO4: Identify the methods required to analyse information from financial data and trading systems. CO5: Understand the various statistical methods to analyse the financial data.		
TEXT BOOK: 1.R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2014. 2.P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York, 2020.		
REFERENCES: 1.W. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Art of Scientific Computing, 1997. Cambridge University Press, Cambridge, UK. Available on-line at: http://www.nr.com/ 2.A. Lewis: Option Valuation under Stochastic Volatility, Finance Press, Newport Beach, California, 2010.		

24CB906

DESIGN THINKING

L	T	P	C
3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Familiarize design thinking and its phases.
- Perform immersion activity in empathize phase of design thinking.
- Create problem statements in the define phase of design thinking.
- Ideate and find solutions to the problem defined.
- Develop a prototype and perform testing.

UNIT I INTRODUCTION 9

Introduction to design thinking - Importance of design thinking for business – Phases of design thinking – Experiential activity – Case study.

UNIT II EMPATHIZE PHASE 9

Empathize phase - Steps involved - Immersion activity- Questionnaire – Empathy map for case study

UNIT III DEFINE PHASE 9

Creation of personas in define phase – steps in problem statement creation - problem statement definition – Examples – Key problem statements.

UNIT IV IDEATION PHASE 9

Ideation phase steps – Ideation games – Ideate to find solutions – Doodling – Storytelling in presenting ideas and prototypes.

UNIT V PROTOTYPE AND TESTING 9

Importance of prototype in design thinking –Guidelines - Prototyping the idea – Value proposition statement – Testing in design thinking – Prototype testing – Documentation – Design thinking in functional work – Mapping design thinking to agile methodologies.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Understand the phases of design thinking process
- CO2: Conduct an immersion activity to create an empathy map
- CO3: Define the key problems of the personas created.
- CO4: Apply the ideation phase steps to present the prototype ideas
- CO5: Create a prototype with value propositions and test the prototype

TEXT BOOKS:

1. Christian Müller-Roterberg, “Handbook of Design Thinking”, Kindle Direct Publishing, November 2018.
2. Dan Senior and Saul Singer, “Start-Up Nation”, Grand Central Publishing, Twelfth Edition, 2009.

REFERENCES:

1. Nir Eyal and Ryan Hoover, “Hooked: How to Build Habit-Forming Products”, Library of Congress, 2014.
2. Corral, Luis & Fronza, Ilenia, “Design Thinking and Agile Practices for Software Engineering: An Opportunity for Innovation”, 2018.

24CB907	DATA MINING AND ANALYTICS (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Understand basic concepts and techniques of Data Mining
- Develop skills of using data mining software for solving practical problems
- Understand and apply several statistical analysis techniques: regression, ANOVA, data reduction

UNIT I INTRODUCTION TO DATA MINING 6

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications. Data mining knowledge representation: Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques

UNIT II DATA PREPROCESSING 6

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT III ASSOCIATION AND MINING 6

Data mining algorithms - Association rules: Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis

Data mining algorithms - Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules

Data mining algorithms – Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models

UNIT IV LINEAR AND NONLINEAR MODELS 6

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis
Forecasting models: Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models

Generalized Linear model: link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.

Non Linear Regression (NLS): Linearization transforms, their uses & limitations, examination of non-linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods

UNIT V TIME SERIES ANALYSIS

6

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing

Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARMA Processes, Forecasting using ARIMA models

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS:

1. Installing Weka and exploring a dataset.
2. Loading a dataset and visualizing the Data
3. Preprocessing a dataset from a real domain (Medical/Retail/Banking)
4. Building a classifier- Run Decision Tree, Naïve Bayesian Classifier, NN classifier and SVM.
5. Mining Association Rules- Run Apriori Algorithm.
6. Building a statistical model using a sample dataset – preprocessing, hypothesis building, model fitting, model validation and interpretation of results.
7. Implementation of linear regression technique for statistical model building.
8. Implementation of Non-linear regression technique for statistical model building

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the fundamentals of data mining and data representation.

CO2: Perform preprocessing tasks for the data set.

CO3: Apply association rules and predictive methods for data mining.

CO4: Build data models using linear and non-linear regression techniques.

CO5: Gain knowledge on time series analysis and prescriptive analysis.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 3rd ed, 2010.
2. Lior Rokach and Oded Maimon, “Data Mining and Knowledge Discovery Handbook”, Springer, 2nd edition, 2010

REFERENCES:

1. Box, G.E.P and Jenkins G.M. Time Series Analysis, Forecasting and Control, Holden-Day, 1970.
2. Draper, N. R. and Smith, H. Applied Regression Analysis (John Wiley) Third Edition, 1998.

24CB908	COMPILER DESIGN (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Design the front end of the compiler, scanner, parser, intermediate code generator, object code generator, and the parallel compilation strategies
- Be exposed to compiler writing tools.
- Learn to implement the different Phases of compiler
- Be familiar with control flow and data flow analysis
- Learn simple optimization techniques

UNIT I INTRODUCTION

6

Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

UNIT II SYNTAX ANALYSIS

6

(Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

UNIT III SEMANTIC ANALYSIS AND SYMBOL TABLE

6

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree

Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.

UNIT IV CODE GENERATION

6

Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT V ARCHITECTURE DEPENDENT CODE IMPROVEMENT

6

Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS:

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
2. Implementation of Lexical Analyzer using Lex Tool
3. Generate YACC specification for a few syntactic categories
 - a. Program to recognize a valid arithmetic expression that uses operator +, −, * and /.

- b. Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
4. Implementation of Calculator using LEX
5. implementation of Calculator using YACC

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand about the regular expressions and finite automata

CO2: Implement the different Phases of compiler using tools

CO3: Analyze the control flow and data flow of a typical program

CO4: Optimize a given program

CO5: Generate an assembly language program equivalent to a source language program

TEXT BOOKS:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, Compilers – Principles, Techniques and Tool, Pearson Education, Second Edition, 2013.
2. Levine R. John, Tony Mason and Doug Brown ,Lex &Yacc, O'Reilly Media, 1992.

REFERENCES:

1. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, , Morgan Kaufmann publishers, First Edition, 2003.

24CB909	ENTERPRISE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand the components of an ERP system.
- Know the implementation stages and processes of an ERP system.
- Understand the process of integrating legacy systems and other current IT systems with an ERP system.
- Understand the infrastructure of ERP systems.
- Understand and know the modern Enterprise Information Systems.

UNIT I INTRODUCTION

9

Introduction to Modern Enterprise Systems: Introduction to enterprise systems. Elements of enterprise systems – Business Information system, Decision support systems, Knowledge management systems, Financial and human resource systems. Kinds of Enterprise systems- B2C and B2B models.

Components of Enterprise systems: Channels (Mobile, web, desktop, partner integration), Data management, workflow, Controlling and Auditing, Accounting etc.

Key characteristics Enterprise systems: Distributivity, Managed redundancy, Exception processing, Collaboration, Data transformation.

Sample Enterprise systems: ERP, SCM, CRM, Product Life cycle management (PLM), HR Systems (HRM), GL systems.

UNIT II ENTERPRISE APPLICATION ARCHITECTURES AND PATTERNS

9

Enterprise System architectures: Importance of Enterprise Architecture, Enterprise architecture

models, Batch processing, Monolithic, client server, ecommerce, service oriented, microservice, and cloud architectures.

Introduction to Enterprise Application architectures: Layer Architecture, Event driven Architecture, Service oriented Architecture, Microservice architecture, Plug-in architecture.

Application architecture Patterns: Layering, Organizing domain logic, Mapping to database, Web Presentation, Concurrency.

UNIT III ENTERPRISE APPLICATION INTEGRATION 9

Enterprise Application Integration: Introduction to Enterprise Integration, different integration styles. Elements of messaging-based Integration.

Enterprise Integration patterns: Modern service integration techniques. Introduction to WSDL, SOAP. Introduction RESTful web services integration. Differences between SOAP and REST.

UNIT IV ENTERPRISE APPLICATION DEPLOYMENT 9

Deployment of Enterprise applications: Key requirements in deployment - Stability, capacity, Security, availability, Network, Availability, and Transparency

Concepts of Cloud computing, cloud platforms and their role in Enterprise systems: Core Concepts – Types of Cloud: Private, public, and Hybrid clouds. Advantage of cloud computing – Scaling, Availability, and cost. Disadvantages – Technology overload, Security, Monitoring and troubleshooting, Testing, Latency etc. Cloud service models: - Infrastructure, platform, Software as a Service in Cloud Computing. Major public clouds: Google cloud, AWS, Azure.

UNIT V ENTERPRISE APPLICATION DEPLOYMENT IN CLOUD AND CASESTUDY 9

Application development and deployment in cloud: Dockers, micro services, Kubernetes, Serverless. Continuous Integration/Continuous Delivery.

Enterprise Architecture Frameworks: Zachman Framework, TOGAF Framework.

Enterprise Architecture Case study: Implementing EA in secret service systems, Health care organization, Manufacturing Company, case study of University, case study of mid-sized municipal government

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

- CO1. Understand basic elements of Enterprise systems.
- CO2. Develop skills in understanding architecture and non-functional requirements in developing Enterprise system development and their deployment.
- CO3. Explain Enterprise integration patterns.
- CO4. Illustrate the methods of deploying enterprise systems in cloud.
- CO5. Outline future trends in Enterprise architectures.

TEXTBOOKS:

1. Martin Fowler et al, “Pattern of Enterprise Application Architecture”, Addison-Wesley, 2012
2. Mark Richards, “Software Architecture Patterns”, Second Edition, O'Reilly Media, August 2022
3. Gregor Hohpe, Bobby Woolf, “Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions”, Pearson Addison-Wesley Professional; First edition, October 2003

REFERENCES:

1. Sam Newman, “Building Microservices”, O'Reilly Media, Inc., February 2015, ISBN: 9781491950357

2. Jez Humble, David Farley, “Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation”, Pearson International; First Edition, August 2010
3. Brendan Burns, “Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services”, O'Reilly Media, Inc., First Edition, February 2018
4. Leonard J. Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Pearson Education, Third Edition, January 2013
5. Daljit Roy Banger, “Enterprise Systems Architecture: Aligning Business Operating Models to Technology Landscapes”, Apress, First Edition, October 2022
6. Eric Jager, “Getting Started with Enterprise Architecture: A Practical and Pragmatic Approach to Learning the Basics of Enterprise Architecture”, Apress, First Edition, December 2023

ONLINE LEARNING PLATFORMS:

- <https://www.oracle.com/in/erp/>
- <https://www.netsuite.com/portal/products/erp.shtml>
- <https://www.britannica.com/topic/information-system/Operational-support-and-enterprise-systems>

24CB910	INTRODUCTION TO FINTECH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how finance and technology have evolved and are transforming finance around the world
- Discuss major technological trends, including cryptocurrencies, Blockchain, AI and Big Data

UNIT I INTRODUCTION

9

FinTech: Introduction– FinTech Evolution: Infrastructure, Collaboration between Financial Institutions and Start-ups –FinTech Typology – Emerging Economics: Opportunities and Challenges – Introduction to Regulation Industry.

UNIT II PAYMENTS

9

Payments, Crypto currencies and Blockchain – Introduction – Individual Payments – Digital Financial Services – Mobile Money – Regulation of Mobile Money – SFMS – RTGS – NEFT –NDS Systems – Crypto currencies – Legal and Regulatory Implications of Crypto currencies –Blockchain – The Benefits from New Payment Stacks

UNIT III DIGITAL FINANCE

9

Digital Finance and Alternative Finance -Introduction – Brief History of Financial Innovation – Digitization of Financial Services – FinTech & Funds- Crowd funding– Regards, Charity and Equity – P2P and Marketplace Lending – New Models and New Products – ICO

UNIT IV FINTECH REGULATIONS

9

FinTech Regulation and RegTech -Introduction – FinTech Regulations Evolution of RegTech – RegTech Ecosystem: Financial Institutions – RegTech Ecosystem Ensuring Compliance from the Start: Suitability and Funds – RegTech Startups: Challenges –RegTech Ecosystem: Regulators

Industry –Use Redesigning Better Financial Infrastructure

UNIT V FUTURE OF FINTECH

9

Data & Tech – Introduction– Data in Financial Services –Application of Data Analytics in Finance – Methods of Data Protection – How AI is Transforming the Future of FinTech –Digital Identity – Change in mindset: Regulation 1.0 to 2.0 (KYC to KYD) – AI & Governance – New Challenges of AI and Machine Learning – Challenges of Data Regulation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student will be able to

CO1: Understand the challenges and opportunities in FinTech industry

CO2: Describe how Artificial Intelligence, Big Data, Crypto currencies and Block chain is changing the Financial World.

CO3: Explain the recent developments in digital financial services.

CO4: Analyse the progress of FinTech Regulations.

CO5: Study the future of FinTech Industry

TEXTBOOKS:

1. Susanne Chishti and Janos Barberis, “The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries”, John Wiley, 1st Edition, 2016
2. Theo Lynn, John G. Mooney, Pierangelo Rosati, Mark Cummins, “Disrupting Finance: FinTech and Strategy in the 21st Century”, Palgrave, 1st edition, 2018

REFERENCES:

1. Abdul Rafay, “FinTech as a Disruptive Technology for Financial Institutions”, IGI Global, January, 2019

24CB911	INDUSTRIAL PSYCHOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues.
- Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety.
- Using an applied approach, this course will help prepare students for their roles as employees and managers.

UNIT I INTRODUCTION

9

Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment.

UNIT II TEST AND MEASTURES

9

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods.

UNIT III PERFORMANCE

9

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance.

UNIT IV EMPLOYEE MOTIVATION	9
Employee Motivation, Satisfaction and Commitment, Fairness and Diversity.	
UNIT V LEADERSHIP	9
Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior, Stress Management: Demands of Life and Work.	
TOTAL: 45 PERIODS	

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Become conversant about the major content areas of Industrial Psychology.
- CO2: Gain further comfort with statistical concepts in the context of making personnel decisions.
- CO3: Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.
- CO4: Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.
- CO5: Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

TEXT BOOKS:

- Elmes, D., Kantowitz, B., & Roediger, H, "Research methods in psychology", Cengage Learning, 9th Edition, 2011.
- Landy, F. J. and Conte, J. M, "Work in the 21st Century", Oxford: Blackwell Publishing, 4th Edition, 2013.

REFERENCES:

- TV.Rao, "Performance Management towards Organizational Excellence", Sage, 2nd Edition, 2016.
- Stephen Robbins, Tim Judge, Neharika Vohra, "Organizational Behaviour", Pearson, 18th Edition, 2019.

24CB912	SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understanding the nature of services.
- Aligning service strategy and competitiveness.
- Service design, development & automation.
- Managing human resources in services.
- Service Quality.
- Service facility design and facility location.
- Demand Management in services.
- Capacity Management or Supply Management in Services.

UNIT I UNDERSTANDING THE NATURE OF SERVICES

9

Introduction and imperatives of services, Nature and characteristics of services, Classification of services and analysing service operations, Introduction to Service Strategy, Competitive Service Strategies, Strategic Service Vision

UNIT II SERVICE DESIGN, DEVELOPMENT AND AUTOMATION 9

New service design and development, Service system design and delivery process, - Technology & automation in services, Service encounter, Human resource planning & employee selection, managing people in Services organization, Work measurement in Services, Defining Service Quality

UNIT III SERVICE FACILITY DESIGN AND FACILITY LOCATION 9

Quality Service by Design, Service process control, Total quality management tools, Quality philosophy and performance excellence, Service recovery and Service guarantee, Service facility design, Process analysis of facility layouts, Facility location decision factors.

UNIT IV DEMAND MANAGEMENT IN SERVICES 9

Forecasting Demand In Services, Smoothing Customer Demand In Services, Service Capacity Management, Yield management, Resource and Workforce Scheduling in Services, Introduction to Queuing System, Characteristics of Queuing system.

UNIT V QUANTITATIVE MODELS IN MANAGING SERVICE OPERATIONS 9

Service Inventory Management, Service Supply Chains, Processes in Service Supply Chain, - Data Envelopment Analysis, Application of simulation in service operations management, Case Study Vehicle routing and scheduling.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Understanding the nature of services.
- CO2: Understand Capacity management or supply management in services.
- CO3: Apply Managing waiting lines & queuing models.
- CO4: Analyse Service facility design and facility location.
- CO5: Apply Quantitative models in managing service operations.
- CO6: Apply Service inventory and supply chain management.

TEXTBOOKS:

2. 1. Service And Operations Management, 9 February 2018 by Cengiz Haksever and Barry Render
3. 2. B. Fitzsimmons, James A., and Mona J. Fitzsimmons, Service Management: Operations, Strategy, and Information Technology, 6th Ed., Irwin/McGraw-Hill, 2017.
4. C. Haksever, Render B., Russel S. R. and Murdick R. G., Service Management and Operations, 2nd Ed., Prentice Hall, 2017.
5. 4. Daskin, M. S., 2018, Service Science, John Wiley, New York, NY

REFERENCES:

1. Chang, C. M., 2010, Service Systems Management and Engineering: Creating Strategic Differentiation and Operational Excellence, John Wiley, New York, NY.
2. Davis, M. M. and J. Heineke, 2003, Managing Services: Using Technology to Create Value, McGraw Hill Irwin, Boston, MA.
3. Fitzsimmons, J. A. and M. J. Fitzsimmons, 2004, Service Management: Operations, Strategy and Information Technology, Irwin/McGraw Hill, Boston.
4. Johnson, R. and G. Clark, 2008, Service Operations Management: Improving Service

- Delivery, Prentice Hall Financial Times, Harlow, England.
5. Katzan, J., 2008, Service Science: Concepts, Technology and Management, iUniverse, Inc., New York.
 6. Metters, R., K. King-Metters, M. Pullman, 2003, Successful Service Operations Management, 2003, Thomson South-Western, Australia.

24CB913	USABILITY DESIGN OF SOFTWARE APPLICATIONS (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Providing management students with a comprehensive understanding of the importance of innovation and creative thinking in today's business environment.
- Equipping students with the necessary skills and knowledge to navigate the challenges of starting new ventures.
- Educating students on the significance of intellectual Property Rights (IPR) and how to effectively protect their innovations and intangible assets.
- Fostering a culture of entrepreneurial thinking and problem-solving among management students.
- Empowering students to apply their learning to real-world scenarios and develop practical strategies for innovation and business growth.

UNIT I INTRODUCTION TO USER CENTRED DESIGN 6

Basics of User Centred Design - Aspects of User Centred Design: Product Appreciation Assignment – Evaluating the product from user centered design aspects: functionality, ease of use, ergonomics, and aesthetics.

UNIT II HEURISTIC EVALUATION 6

10 Heuristic Principles, Examples- Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.

UNIT III PROJECT DESIGN LIFECYCLE 6

Redesign project through the design lifecycle – Discovery - Define – Design - Implement (Design Prototype) - Usability Testing. Understanding users, their goals, context of use, and environment of use.

UNIT IV UX RESEARCH 6

Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX. Personas and Scenarios: Scenarios and Persona Technique – Overview of Design Thinking Technique - Discovery and brainstorming.

UNIT V ITERATIVE PRODUCT DEVELOPMENT 6

Concept Development - Task flow detailing for the Project - Prototyping Techniques - Paper, Electronic, and Prototyping Tools. Project Prototyping Iteration 1- Project Prototyping Iteration 2- Review and feedback.

TOTAL: 30 PERIODS

Lab Exercises

1. Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
2. Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key

tasks of the app or website for heuristic principles, severity, recommendations.

3. Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle:

Discovery

Define

Design

Implement (Design Prototype)

Usability Testing

The below design methods and techniques will be imparted w.r.t. the group project selected by the students.

4. Presentation of Persona for the group project.

5. Task flow detailing for the project.

6. Project Prototyping Iteration 1.

7. Project Prototyping Iteration 2.

8. Final presentation of solution (Mobile or Web Application).

TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals and importance of User-Centred design.

CO2: Perform design evaluation by applying the heuristic principles.

CO3: Develop an application focusing on the design aspects.

CO4: Do research on understanding user requirement.

CO5: Perform iterative product development using prototyping technique.

TEXT BOOK:

1. Jenny Preece, Helen Sharp and Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 6th Edition, 2023.

2. Alan Cooper and Robert Reimann. About Face, 4th Edition, 2022.

REFERENCES:

1. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, Observing the User Experience, Second Edition: A Practitioner's Guide to User Research. 2019

2. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond. 2nd Edition, 2019

3. Lean, and Agile - Jonny Schneider, Understanding Design Thinking, 2020.

24CB914	IMAGE PROCESSING AND PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Learn the fundamentals of image formation and formats.
- Understand the intensity transformations and filtering techniques.
- Acquire knowledge on image segmentation operations.
- Learn the feature extraction and image registration process.
- Understand the components of colour image processing.

UNIT I INTRODUCTION AND IMAGE FORMATION

9

Introduction - Image processing systems and its applications - Basic image file formats. Image formation: Geometric and photometric models; Digitization - sampling, quantization; Image definition and its representation, neighborhood metrics.

UNIT III INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING 9

Enhancement, contrast stretching, histogram specification, local contrast enhancement; Smoothing, linear and order statistic filtering, sharpening, spatial convolution, Gaussian smoothing, DoG, LoG. Morphological Filtering Basics - Dilation and Erosion Operators, Top Hat Filters.

UNIT III IMAGE SEGMENTATION 9

Pixel classification; Grey level thresholding, global/local thresholding; Optimum thresholding - Bayes analysis, Otsu method; Derivative based edge detection operators, edge detection/linking, Canny edge detector; Region growing, split/merge techniques, line detection, Hough transform.

UNIT IV FEATURE EXTRACTION AND IMAGE REGISTRATION 9

Textural features - gray level co-occurrence matrix; Moments; Connected component analysis; Convex hull; Distance transform, medial axis transform, skeletonization/thinning, shape properties. Mono-modal/multimodal image registration; Global/local registration; Transform and similarity measures for registration; Intensity/pixel interpolation.

UNIT V COLOUR IMAGE PROCESSING 9

Fundamentals of different Colour models - RGB, CMY, HSI, YCbCr, Lab; False Colour; Pseudo Colour; Enhancement.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Be familiar with the fundamentals of image formation and formats.
- CO2: Perform image transformation functions and filtering operations.
- CO3: Apply the segmentation techniques on the images.
- CO4: Extract the features of an image and perform image registration.
- CO5: Able to do colour image processing and conversion operations.

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson, 4 th Edition, 2018.
2. Maria Petrou and Panagiota Bosdogianni, "Image Processing: The Fundamentals", John Wiley & Sons, Ltd, 2 nd Edition , 2010.

REFERENCES:

1. K. R. Castleman, "Digital Image Processing", Prentice Hall, Englewood Cliffs, 1 st Edition, 1995.
2. A. N. Netravali and B. G. Haskell, "Digital Pictures", Plenum Press, 2nd Edition, 1995

24CB915	BUSINESS INTELLIGENCE (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To understand the business intelligence (BI) methodology and concepts.

-
- To learn about descriptive, inferential statistics and data warehousing operations.
 - To analyze wide range of applications of data mining.
 - To analyze the various prescriptive analytics methods.
 - To develop and deploy Business Analytic Models.

UNIT I OVERVIEW OF BUSINESS INTELLIGENCE

6+6

Evolution of Computerized Decision Support to Analytics- A Framework for Business Intelligence - Analytics Overview - Analytics Examples- Introduction to Big Data Analytics- Overview of the Analytics Ecosystem.

List of Exercise/Experiments

1. Perform Customer Segmentation Classification using customer data of a certain organization. Analyze the data from the standpoint of paying capacity and purchasing pattern similarities among the company's clients.
2. Build a data model by taking an available data for a certain company and create a series of analysis and visualizations on various metrics related to the products of that company.

UNIT II DESCRIPTIVE ANALYTICS

6+6

The Nature of Data- Data Preprocessing- Statistical Modeling for Business Analytics- Regression Modeling for Inferential Statistics- Business Reporting- Data Visualization- Types of charts and graphs- The Emergence of Visual Analytics- Information Dashboards- Business Intelligence and Data Warehousing- Data Warehousing Process - Data Warehousing architecture - Data Integration and the Extraction, Transformation, and Load (ETL) Processes- Data Warehouse Development.

List of Exercise/Experiments

1. Consider Groceries dataset for Market Basket Analysis and investigate customer's historical transactions. Focus on descriptive analytics of customer's purchase behavior, revealing interesting combinations of products that are frequently bought together, and creating valuable suggestions for the company.
2. Given Life Expectancy (WHO) dataset that provides information on both life expectancy and GDP per capita by year for different countries and regions, Explore and visualize the data using appropriate plots, and develop meaningful insights.

UNIT III PREDICTIVE ANALYTICS

6+6

Text Analytics and Text Mining – NLP – Applications – Process – Sentiment Analysis – Web Mining – Search Engines – Web Analytics – Social Analytics

List of Exercise/Experiments

1. Perform Customer Review Sentiment Analysis with text data extracted from customer reviews of a certain company and explore it using specialized statistical and linguistic tools to identify positive, negative, and neutral experiences and their strength and subjectivity.
2. Using Microsoft Stock Data/Amazon Stock Data or INTEL Stock Data, Explore the company's historical stock performance and find insights about the future.

UNIT IV PRESCRIPTIVE ANALYTICS

6+6

Model-based Decision Making – Structure of Mathematical Models for Decision Support – Certainty, Uncertainty and Risk – Decision Modelling – Multiple Goals, Sensitivity Analysis, WhatIf Analysis and Goal Seeking – Decision Analysis – Introduction to Simulation – Location-based Analytics for Organizations – Impacts of Analytics in

Organization. Case study: prepare a detailed report on applications of analytics in different industries.

List of Exercise/Experiments

1. Perform Retail Price Optimization using dataset of price data for a retail company containing information such as product names, historical prices, product categories and characteristics, volume of sales, and time and geographic notations. Calculate the optimal selling prices for the products to create efficient, data-driven recommendations for the company.
2. Perform Credit Card Fraud Detection using online transactions dataset and analyze it for suspicious operations using statistical methods.

UNIT V BUSINESS ANALYTICS MODEL

6+6

Overview of Business Analytics Model – Deployment of BA Model – Business Analytics at the Strategy Level – Link between Strategy and Deployment – Strategy and BA – Priority – Development and Deployment- Case Study: Specification of Requirements, Technical support - Establishing Business Processes – New Business Processes – Optimizing Existing Business Processes.

List of Exercise/Experiments

1. Consider Sales Product Dataset and analyze sales data from various aspects. Extract key performance indicators (KPIs) that will enable you to make data-driven decisions and improve company's business.
2. Perform Customer Churn Prediction and analyze a company's data to identify customers who are likely to churn based on a variety of factors, such as the number of calls to customer service and the total charge for calls.

TOTAL:30+30 = 60 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Understand the business intelligence (BI) methodology and concepts.
- CO2: Learn about descriptive, inferential statistics and data warehousing operations.
- CO3: Analyze wide range of applications of data mining.
- CO4: Analyze the various prescriptive analytics methods.
- CO5: Develop and deploy Business Analytic Models.

TEXTBOOKS:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson, 4th Edition, 2018.
2. Jesper Thorlund & Gert H.N. Laursen, "Business Analytics for Managers: Taking Business Intelligence beyond Reporting, Wiley, 2010.

REFERENCES:

1. Shmueli, Patel, and Bruce: Wiley, Data Mining for Business Intelligence, Concepts, Techniques and Applications, Wiley, 2010
2. R.N.Prasad and Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2016.

LIST OF EQUIPMENTS:

1. Jupyter Notebook
2. Tableau / Power BI

22CB916	COGNITIVE SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain cognitive computing
- To know about design principles and Natural Language Processing.
- To distinguish between Big Data and Cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

UNIT I FOUNDATIONS OF COGNITIVE SCIENCE 9

Foundation of Cognitive Computing: cognitive computing as a new generation- the uses of cognitive systems- system cognitive- gaining insights from data- Artificial Intelligence as the foundation of cognitive computing- understanding cognition.

UNIT II DESIGN PRINCIPLES FOR COGNITIVE SYSTEMS AND NLP IN COGNITIVE SYSTEMS 9

Components of a cognitive system- building the corpus- bringing data into cognitive system- machine learning- hypotheses generation and scoring- presentation and visualization services.

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system- semantic web- Applying Natural language technologies to Business problems.

UNIT III BIG DATA Vs COGNITIVE COMPUTING 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data- defining big data- architectural foundation- analytical data warehouses- Hadoop- data in motion and streaming data- integration of big data with traditional data.

UNIT IV THE BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING 9

Preparing for change- advantages of new disruptive models- knowledge meaning to business- difference with a cognitive systems approach- meshing data together differently- using business knowledge to plan for the future- answering business questions in new ways- building business specific solutions- making cognitive computing a reality- cognitive application changing the market- IBM Watson as a cognitive system.

UNIT V APPLICATIONS OF COGNITIVE COMPUTING 9

Build a cognitive health care application- Build a cognitive application on Smarter cities- Apply Cognitive Computing principle in building an Government related application.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain cognitive computing.

CO2: Understand the design principles and learn about NLP in cognitive computing

CO3: Apply advanced analytics to cognitive computing.

CO4: Discuss application of cognitive computing in business

CO5: Illustrate various applications of cognitive computing.

TEXT BOOKS:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics", Wiley, 2015.

REFERENCES:

1. Vijay Raghvan, Venu Govindaraju, C.R. Rao, "Cognitive Computing: Theory and Applications", Elsevier publications, North Holland Publication, 1st Edition, 2016.

2. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

24CB917	FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Understand the fundamental concepts of financial management
- Understand valuation of securities.
- Analyse operating and financial leverages.
- Comprehend and apply the concepts of capital budgeting.
- Understand cash management.

UNIT I INTRODUCTION 9

Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments. **Time Value of Money:** Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT II VALUATION OF SECURITIES 9

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. **Risk & Return:** Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

UNIT III OPERATING & FINANCIAL LEVERAGE 9

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study. **Cost of Capital:** Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L

UNIT IV CAPITAL BUDGETING 9

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods. **Working Capital Management:** Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

UNIT V CASH MANAGEMENT 9

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring. **Accounts Receivable Management:** Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- CO1: Understand the fundamental concepts of financial management
- CO2: Apply valuation of securities and calculate the risk & return in portfolio

CO3: Analyse the cost structure of a company using operating and financial leverages.
CO4: Develop capital budgets and to estimate working capital.
CO5: Apply cash management in business.

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGrawHill, 2007.
2. Srivastava, Misra: Financial Management, OUP, 2011

1. Van Horne and Wachowicz : Fundamentals of Financial Management, PrenticeHall/ Pearson Education.
2. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14th edition, Cengage, 2015
3. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases TataMcGraw Hill, 6th edition, 2011.
4. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012

OBJECTIVES:

- ☐ Develop mindsets to pursue entrepreneurship.
- ☐ Understand the basics of Innovation and Entrepreneurship
- ☐ Create, protect, assetize and commercialize intellectual property?
- ☐ Identify and discover market needs
- ☐ Manage an innovation program
- ☐ Understand opportunities and challenges for entrepreneurs through StartupModels

UNIT I	INNOVATION	9
Innovation Types of Innovation Incremental, disruptive, Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.) , Challenges in Innovation (time, cost, data, infrastructure, etc.)		
UNIT II	IPR	9
Types of IPR (patents, copyrights, trademarks, GI, etc.) Lifecycle of IP (creation, protection, assetization, commercialization), Balancing IP Risks and Rewards (Right Access and Right		

Use of Open Source and 3rd party products, technology transfer and licensing)

UNIT III ENTREPRENEURSHIP 9

Opportunity Identification in Technology Entrepreneurship (customer pain points, competitive context) Market Research, Segmentation and Sizing Product Positioning, Pricing, and Go-To-Market Strategy IP Valuation (methods, examples, limitations)

UNIT IV TYPES OF STARTUP BUSINESS MODEL 9

Startup Business Models (fund raising, market segments, channels, etc.) Co- innovation and Open Innovation (academia, startups, corporates) Technology Innovation: Two Case Studies

UNIT V PROCESSES IN STARTUP BUSINESS MODEL 9

Innovation, Incubation and Entrepreneurship in Corporate Context Technology-driven Social Innovation and Entrepreneurship Manage Innovation, IP and Entrepreneurship Programs – Processes, Governance and Tools

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the basics of Innovation and Entrepreneurship

CO2: Manage an innovation program

CO3: Create, protect, assetize and commercialize intellectual property

CO4: Understand opportunities and challenges for entrepreneurs

CO5: Developing mindsets to pursue entrepreneurship.

CO6: Identify and discover market needs

TEXT BOOKS:

1. Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough GrowthNavi Radjou,Jaideep Prabhu, Simone Ahuja , John Wiley & Sons

REFERENCES:

1. Identifying Entrepreneurial Opportunities: Cognition and Categorization inNascent Entrepreneurs, Matthew J. Karlesky
2. <http://www.businessdictionary.com/definition/entrepreneurship>.
3. <https://www.infoentrepreneurs.org/en/guides/use-innovation-to-grow-your-business/>
4. <http://sourcesofinsight.com/innovation-life-cycle/>
5. <https://www.investottawa.ca/>
6. <https://www.Lead-innovation.com>

OPEN ELECTIVES
Offered to other Departments

24CB001	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the fundamental principles of micro economics relevant to managing an organization.
- To describe the fundamental principles of macroeconomics to have the understanding of economic environment of business.
- To understand the various aspects of India's economy.

UNIT I INTRODUCTION

9

Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).

UNIT II CONSUMER ANALYSIS

9

Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects - Derivation of a Demand Curve

UNIT III PRODUCTION AND COSTING

9

Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect; Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT IV MACROECONOMIC REFORMS

9

National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports; Money - Definitions; Demand for Money - Transactionary and Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model.

UNIT V POLICY GOVERNANCE

9

Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

CO1: Become familiar with both principles of micro and macroeconomics.

CO5: Have thorough knowledge in the areas of inflation, unemployment, monetary policy, fiscal policy and international trade.

1. Pindyck, Robert S., and Daniel L. Rubinfeld, Microeconomics, Pearson Education, 9th edition 2022
2. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill Ltd., 12th edition, 2019
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Tata McGraw Hill, 19th edition, 2011

1. Hal R. Varian, W W Norton, Intermediate Microeconomics: A Modern Approach, 9th edition, 1987
2. N. Gregory Mankiw, Cengage Learning, Principles of Macroeconomics, 7th edition, 2021

24CB002	MARKETING RESEARCH AND MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

- Understand basic marketing concepts
- Comprehend the dynamics of marketing.
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research
- Apply Internet marketing strategies.

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. Marketing Planning & Environment: Elements of Marketing Mix, analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

UNIT III PRICING, PROMOTION AND DISTRIBUTION STRATEGY 9

Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

UNIT IV MARKETING RESEARCH 9

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT V INTERNET MARKETING 9

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the marketing concepts and its evolution

CO2: Analyze the market based on segmentation, targeting and positioning

CO3: Leverage marketing concepts for decision making on product, price, promotion mix and distribution

CO4: Apply the concepts of market research and analyse data using statistical tools

CO5: Apply internet marketing strategies for businesses

TEXT BOOKS:

1. Philip Kotler, Marketing Management (Analysis, Planning, Implementation & Control) –16th Ed. Pearson Education, 2022
2. V.S. Ramaswamy and S. Namakumari, Marketing Management Macmillan, –2005
3. Rajendra Nargundkar, Marketing Research –4th Ed. McGraw Hill Limited, 2019
4. G.C. Beri, Market Research –6th Ed., McGraw Hill Limited, 2020
5. Cooper Schindler, Market Research, Concepts, & Cases –McGraw Hill LTD,2010

REFERENCES:

1. Rajan Saxena, Marketing Management –6th Ed., McGraw Hill Limited, 2020
2. S.A. Sherlekar, Marketing Management –Himalaya Publishing House, 2022
3. S.M. Zha, Service Marketing –Himalaya Publishing House, 2006

4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull, Prentice Hall Of India, 2005
6. David M Levine et al, Business Statistics, A First Course, Pearson Publication, 7th Ed., Pearson Education, 2021

24CB003	INDUSTRIAL PSYCHOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Introduces students to the content areas of industrial psychology and the application of psychological theory to organizational issues.
- Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety.
- Using an applied approach, this course will help prepare students for their roles as employees and managers.

UNIT I INTRODUCTION

9

Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modeling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment.

UNIT II TEST AND MEASURES

9

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods.

UNIT III PERFORMANCE

9

Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance.

UNIT IV EMPLOYEE MOTIVATION

9

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity.

UNIT V LEADERSHIP

9

Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, The Organization of Work Behavior, Stress Management: Demands of Life and Work.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Become conversant about the major content areas of Industrial Psychology.

CO2: Gain further comfort with statistical concepts in the context of making personnel decisions.

CO3: Gain practical experience by completing a series of hands-on projects involving job analysis, selection decisions, training programs, and employee well-being.

CO4: Deepen your understanding of tests and measurements so that you can collect accurate information and make sound data-based decisions.

CO5: Prepare for other focused seminar courses in Industrial/Organizational Psychology or Human Resource Management.

TEXT BOOKS:

1. Elmes, D., Kantowitz, B., & Roediger, H, "Research methods in psychology", Cengage Learning, 9th Edition, 2011.
2. Landy, F. J. and Conte, J. M, "Work in the 21st Century", Oxford: Blackwell Publishing, 4th Edition, 2013.

REFERENCES:

1. TV.Rao, "Performance Management towards Organizational Excellence", Sage, 2nd Edition, 2016.
2. Stephen Robbins, Tim Judge, Neharika Vohra, "Organizational Behaviour", Pearson, 18th Edition, 2019.

HONOURS VERTICALS – BUSINESS ANALYTICS

24CB919	PYTHON FOR BUSINESS ANALYTICS (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Learn the fundamentals of Data Analytics
- Acquire skills in data preparatory and preprocessing steps
- Learn the tools and packages in Python for Data Analytics
- Understand the various Excel Function to solve Data Analytics Problem
- Acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION TO PYTHON AND DATA ANALYTICS 6+6

Introduction to Python programming language, Basics of data types, variables, and operators, Introduction to libraries like NumPy and Pandas for data manipulation , Data visualization with Matplotlib and Seaborn.

List of Exercise/Experiments:

1. Download, install and explore the features of R/Python for data analytics
Installing Anaconda Basic Operations in Jupiter Notebook Basic Data Handling
2. Perform the fundamental Pandas data structures operations
3. Implement the three dimensional plotting

UNIT II DATA CLEANING AND PREPROCESSING 6+6

Understanding data cleaning and preprocessing techniques, Handling missing values and outliers, Data transformation and normalization, Feature engineering for business analytics.

List of Exercise/Experiments:

1. Implement the data processing operations like data cleansing, data preparation
2. Implement Data Transformation and Normalization

UNIT III EXPLORATORY DATA ANALYSIS (EDA) 6+6

Introduction to EDA techniques, Descriptive statistics and data summarization , Visualization techniques for exploring data, Correlation and relationship analysis.

List of Exercise/Experiments:

1. Implement descriptive statistics and correlation using any dataset

UNIT IV PREDICTIVE ANALYTICS WITH MACHINE LEARNING 6+6

Overview of machine learning algorithms for business analytics, Supervised and unsupervised learning techniques, Model evaluation and validation, Building predictive models for business applications.

List of Exercise/Experiments:

1. Implement predictive models for any real time applications

UNIT V BUSINESS ANALYTICS APPLICATIONS AND CASE STUDIES 6+6

Real-world applications of Python for business analytics, Case studies demonstrating the use of Python in different industries, project work and presentations.

List of Exercise/Experiments:

1. Implement any two case studies

TOTAL: 30+30 PERIODS**OUTCOMES:****At the end of this course, the students will be able to:**

CO1: Apply the skillset in data Processing, Data Transformations and Normalization

CO2: Interpreting the various uses of libraries

CO3: Understand the real-world data and information.

CO4: Understand Descriptive analytics and predictive analytics

CO5: Interpret real world applications

TEXTBOOKS:

1. Data Science for Business by Foster Provost and Tom Fawcett ,2013
2. Python for Data Science Handbook by Jake Vander Plas, 2017
3. Hands-On Exploratory Data Analysis with Python by Suresh Kumar Mukhiya and Usman Ahmed.

REFERENCES:

1. Feature Engineering for Machine Learning by Alice Zheng and Amanda Casari
2. Practical Data Science with Python by Phuong Vo.T.H and Martin Czygan

24CB920	BIG DATA ANALYTICS (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:**The Course will enable learners to:**

- Learn the fundamentals of Big Data Analytics
- Acquire skills in various data models
- Understand various Big Data generation and storage systems
- Understand the Big Data Analysis and Applications

UNIT I INTRODUCTION**6+6**

INTRODUCTION: Dawn of the Big Data Era, Definition and Features of Big Data, Big Data Value, The Development of Big Data, Challenges of Big Data.

RELATED TECHNOLOGIES: Cloud Computing - Cloud Computing Preliminaries, Relationship Between Cloud Computing and Big Data, IoT - IoT Preliminaries, Relationship Between IoT and Big Data, Data Center, Hadoop - Hadoop Preliminaries, Relationship between Hadoop and Big Data

List of Exercise/Experiments:

1. Case study on Big Data Challenges

UNIT II INTRODUCTION TO VARIOUS MODELS**6+6**

INTRODUCTION TO HADOOP: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode and DataNode. **HADOOP ECOSYSTEM:** Hadoop ecosystem components - Schedulers - Fair and Capacity.

PIG : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

HIVE : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases.

List of Exercise/Experiments:

1. Implement Hadoop
2. Implement PIG
3. Implement HIVE

UNIT III BIG DATA GENERATION AND STORAGE

6+6

Big Data Generation-Enterprise Data, IoT Data, Internet Data, Bio medical Data, Data Generation from Other Fields, Big Data Acquisition Data Collection, Data Transportation, Data Pre-processing.

BIG DATA STORAGE: Storage System for Massive Data, Distributed Storage System, Storage Mechanism for Big Data- Database Technology, Design Factors, Database Programming Model.

List of Exercise/Experiments:

1. Case study on various database programming models

UNIT IV BIG DATA ANALYSIS

6+6

Traditional Data Analysis, Big Data Analytic Methods, Architecture for Big Data Analysis - Real-Time vs. Offline Analysis, Analysis at Different Levels, Analysis with Different Complexity, Tools for Big Data Mining and Analysis.

List of Exercise/Experiments:

1. Case Study on Big Data Architecture

UNIT V BIG DATA APPLICATIONS

6+6

Application Evolution, Big Data Analysis Fields - Structured Data Analysis, Text Data Analysis, Web Data Analysis, Multimedia Data Analysis, Network Data Analysis, Mobile Traffic Analysis, Key Applications - Application of Big Data in Enterprises, Application of IoT Based Big Data, Application of Online Social Network Oriented Big Data, Applications of Healthcare and Medical Big Data, Collective Intelligence, Smart Grid.

List of Exercise/Experiments:

1. Implement any two case studies for Big Data Applications

TOTAL: 30+30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Relate Big data with Cloud Computing, Hadoop and IoT.

CO2: Interpret Hadoop Architecture and utilize Hadoop Ecosystem components.

CO3: Understand several mechanisms for Big Data generation, acquisition and storage.

CO4: Understand and Compare various Big Data Analytic Methods.

CO5: Outline Big Data Analysis in various Fields.

TEXTBOOKS:

1. Min Chen, Shiwen Mao, Yin Zhang, Victor C.M. Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer; 2014.
2. Tom White, Hadoop- The Definitive Guide, 4th Edition, O'reilly, 2015.

REFERENCES:

1. Eric Sammer, *Hadoop Operations*, 2nd Edition., O'Reilley, 2012.
2. VigneshPrajapati, *Big Data Analytics with R and Hadoop*, PACKT Publishing, 2013.

WEB REFERENCES:

1. http://www.jbonneau.com/doc/2012-04-27-big_data_lecture_1.pdf
2. https://www.ibm.com/developerworks/community/blogs/Susan_Visser
Editionntry/flashbook understanding big data analytics for enterprise class hadoop and streaming data? lang en

24CB915	BUSINESS INTELLIGENCE (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To understand the business intelligence (BI) methodology and concepts.
- To learn about descriptive, inferential statistics and data warehousing operations.
- To analyze wide range of applications of data mining.
- To analyze the various prescriptive analytics methods.
- To develop and deploy Business Analytic Models.

UNIT I OVERVIEW OF BUSINESS INTELLIGENCE 6+6

Evolution of Computerized Decision Support to Analytics- A Framework for Business Intelligence - Analytics Overview - Analytics Examples- Introduction to Big Data Analytics- Overview of the Analytics Ecosystem.

List of Exercise/Experiments

1. Perform Customer Segmentation Classification using customer data of a certain organization. Analyze the data from the standpoint of paying capacity and purchasing pattern similarities among the company's clients.
2. Build a data model by taking an available data for a certain company and create a series of analysis and visualizations on various metrics related to the products of that company.

UNIT II DESCRIPTIVE ANALYTICS 6+6

The Nature of Data- Data Preprocessing- Statistical Modeling for Business Analytics- Regression Modeling for Inferential Statistics- Business Reporting- Data Visualization- Types of charts and graphs- The Emergence of Visual Analytics- Information Dashboards- Business Intelligence and Data Warehousing- Data Warehousing Process - Data Warehousing architecture - Data Integration and the Extraction, Transformation, and Load

(ETL) Processes- Data Warehouse Development.

List of Exercise/Experiments

1. Consider Groceries dataset for Market Basket Analysis and investigate customer's historical transactions. Focus on descriptive analytics of customer's purchase behavior, revealing interesting combinations of products that are frequently bought together, and creating valuable suggestions for the company.
2. Given Life Expectancy (WHO) dataset that provides information on both life expectancy and GDP per capita by year for different countries and regions, Explore and visualize the data using appropriate plots, and develop meaningful insights.

UNIT III PREDICTIVE ANALYTICS

6+6

Text Analytics and Text Mining – NLP – Applications – Process – Sentiment Analysis – Web Mining – Search Engines – Web Analytics – Social Analytics

List of Exercise/Experiments

1. Perform Customer Review Sentiment Analysis with text data extracted from customer reviews of a certain company and explore it using specialized statistical and linguistic tools to identify positive, negative, and neutral experiences and their strength and subjectivity.
2. Using Microsoft Stock Data/Amazon Stock Data or INTEL Stock Data, Explore the company's historical stock performance and find insights about the future.

UNIT IV PRESCRIPTIVE ANALYTICS

6+6

Model-based Decision Making – Structure of Mathematical Models for Decision Support – Certainty, Uncertainty and Risk – Decision Modelling – Multiple Goals, Sensitivity Analysis, WhatIf Analysis and Goal Seeking – Decision Analysis – Introduction to Simulation – Location-based Analytics for Organizations – Impacts of Analytics in Organization. Case study: prepare a detailed report on applications of analytics in different industries.

List of Exercise/Experiments

1. Perform Retail Price Optimization using dataset of price data for a retail company containing information such as product names, historical prices, product categories and characteristics, volume of sales, and time and geographic notations. Calculate the optimal selling prices for the products to create efficient, data-driven recommendations for the company.
2. Perform Credit Card Fraud Detection using online transactions dataset and analyze it for suspicious operations using statistical methods.

UNIT V BUSINESS ANALYTICS MODEL

6+6

Overview of Business Analytics Model – Deployment of BA Model – Business Analytics at the Strategy Level – Link between Strategy and Deployment – Strategy and BA – Priority – Development and Deployment- Case Study: Specification of Requirements, Technical support - Establishing Business Processes – New Business Processes – Optimizing Existing Business Processes.

List of Exercise/Experiments

1. Consider Sales Product Dataset and analyze sales data from various aspects. Extract key performance indicators (KPIs) that will enable you to make data-driven decisions and

improve company's business.

2. Perform Customer Churn Prediction and analyze a company's data to identify customers who are likely to churn based on a variety of factors, such as the number of calls to customer service and the total charge for calls.

TOTAL:30+30 = 60 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand the business intelligence (BI) methodology and concepts.

CO2: Learn about descriptive, inferential statistics and data warehousing operations.

CO3: Analyze wide range of applications of data mining.

CO4: Analyze the various prescriptive analytics methods.

CO5: Develop and deploy Business Analytic Models.

TEXTBOOKS:

3. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Pearson, 4th Edition, 2018.

4. Jesper Thorlund & Gert H.N. Laursen, "Business Analytics for Managers: Taking Business Intelligence beyond Reporting, Wiley, 2010.

REFERENCES:

3. Shmueli, Patel, and Bruce: Wiley, Data Mining for Business Intelligence, Concepts, Techniques and Applications, Wiley, 2010

4. R.N.Prasad and Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2016.

LIST OF EQUIPMENTS:

3. Jupyter Notebook

4. Tableau / Power BI

24CB916	COGNITIVE SCIENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain cognitive computing
- To know about design principles and Natural Language Processing.
- To distinguish between Big Data and Cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

UNIT I FOUNDATIONS OF COGNITIVE SCIENCE

9

Foundation of Cognitive Computing: cognitive computing as a new generation- the uses of cognitive systems- system cognitive- gaining insights from data- Artificial Intelligence as the foundation of cognitive computing- understanding cognition.

UNIT II DESIGN PRINCIPLES FOR COGNITIVE SYSTEMS AND NLP IN COGNITIVE SYSTEMS

9

Components of a cognitive system- building the corpus- bringing data into cognitive system- machine learning- hypotheses generation and scoring- presentation and visualization services. Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system- semantic web- Applying Natural language technologies to Business problems.

UNIT III BIG DATA Vs COGNITIVE COMPUTING

9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data- defining big data- architectural foundation- analytical data warehouses- Hadoop- data in motion and streaming data- integration of big data with traditional data.

UNIT IV THE BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING 9

Preparing for change- advantages of new disruptive models- knowledge meaning to business- difference with a cognitive systems approach- meshing data together differently- using business knowledge to plan for the future- answering business questions in new ways- building business specific solutions- making cognitive computing a reality- cognitive application changing the market- IBM Watson as a cognitive system.

UNIT V APPLICATIONS OF COGNITIVE COMPUTING 9

Build a cognitive health care application- Build a cognitive application on Smarter cities-Apply Cognitive Computing principle in building an Government related application.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

- CO1: Explain cognitive computing.
- CO2: Understand the design principles and learn about NLP in cognitive computing
- CO3: Apply advanced analytics to cognitive computing.
- CO4: Discuss application of cognitive computing in business
- CO5: Illustrate various applications of cognitive computing.

TEXT BOOKS:

2. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics", Wiley, 2015.

REFERENCES:

3. Vijay Raghvan, Venu Govindaraju, C.R. Rao, "Cognitive Computing: Theory and Applications", Elsevier publications, North Holland Publication, 1st Edition, 2016.
4. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

MINOR VERTICALS – ADVANCED WEB DEVELOPMENT

24CB921	USABILITY DESIGN OF SOFTWARE APPLICATIONS (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES:

- Providing management students with a comprehensive understanding of the importance of innovation and creative thinking in today's business environment.
- Equipping students with the necessary skills and knowledge to navigate the challenges of starting new ventures.
- Educating students on the significance of intellectual Property Rights (IPR) and how to effectively protect their innovations and intangible assets.
- Fostering a culture of entrepreneurial thinking and problem-solving among management students.
- Empowering students to apply their learning to real-world scenarios and develop practical strategies for innovation and business growth.

UNIT I INTRODUCTION TO USER CENTRED DESIGN 9

Basics of User Centred Design - Aspects of User Centred Design: Product Appreciation Assignment – Evaluating the product from user centered design aspects: functionality, ease of use, ergonomics, and aesthetics.

UNIT II HEURISTIC EVALUATION 9

10 Heuristic Principles, Examples- Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.

UNIT III PROJECT DESIGN LIFECYCLE 9

Redesign project through the design lifecycle – Discovery - Define – Design - Implement (Design Prototype) - Usability Testing. Understanding users, their goals, context of use, and environment of use.

UNIT IV UX RESEARCH 9

Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX. Personas and Scenarios: Scenarios and Persona Technique – Overview of Design Thinking Technique - Discovery and brainstorming.

UNIT V ITERATIVE PRODUCT DEVELOPMENT 9

Concept Development - Task flow detailing for the Project - Prototyping Techniques - Paper, Electronic, and Prototyping Tools. Project Prototyping Iteration 1- Project Prototyping Iteration 2- Review and feedback.

TOTAL: 45 PERIODS

Lab Exercises

1. Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
2. Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.
3. Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle:
 Discovery
 Define

Design
Implement (Design Prototype)
Usability Testing

The below design methods and techniques will be imparted w.r.t. the group project selected by the students.

4. Presentation of Persona for the group project.
5. Task flow detailing for the project.
6. Project Prototyping Iteration 1.
7. Project Prototyping Iteration 2.
8. Final presentation of solution (Mobile or Web Application).

TOTAL: 30 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals and importance of User-Centred design.

CO2: Perform design evaluation by applying the heuristic principles.

CO3: Develop an application focusing on the design aspects.

CO4: Do research on understanding user requirement.

CO5: Perform iterative product development using prototyping technique.

TEXT BOOK:

1. Jenny Preece, Helen Sharp and Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 6th Edition, 2023.
2. Alan Cooper and Robert Reimann. About Face, 4th Edition, 2022.

REFERENCES:

1. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, Observing the User Experience, Second Edition: A Practitioner's Guide to User Research. 2019
2. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond. 2nd Edition, 2019
3. Lean, and Agile - Jonny Schneider, Understanding Design Thinking, 2020.

24CB922	FRONT END DEVELOPMENT USING REACT (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- To understand web semantics and related tools and framework
- Able to get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I ADVANCED JAVASCRIPT

9+6

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

List of Exercise/Experiments

- 1) Create a JS Object for Bank Account (w attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
 - List down all the entries of the bank object

- Check the existence of a key
 - If key found, get the value for the key
- 2) Spread Operator
- Merge Customer and Account Arrays
 - Update the Customer Object with the new values
 - Develop a function that takes an Spread Argument and calculates total balance.

UNIT II INTRODUCTION TO REACTJS

9+6

Class-Inheritance, Methods, Extended Class-Map, filter and Reduce Functions, Functions - Arrow Functions, Lambda Expressions , REST - Introduction, Why JSX, Hello World Apps, Project Structure

List of Exercise/Experiments

- 1) Create a list of Bank Objects (same kind of object you used in above lab, but in a array format)
 - Display the banks where balance is greater than 200
 - deduct 10% of the Bank account balance, as part of monthly service fees
 - Display the banks where balance is greater than 200 and branch code is “Chennai”
 - Add a new Bank to the given array
 - Delete a bank from the array (use splice operator)
 - Calculate the total balance of all bank accounts
- 2) Develop a Scientific calculator that does following operations
 - Rounded Value
 - Area of Circle
 - Calculating of Sin, Cos and Tan functions
 - Perimeter of an Rectangle
 - Employ Arrow functions
 - Employ HOC

UNIT III REACT COMPONENTS

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Class vs Functional Components, React Class Based Components – component DidMount, WillUpdate, shouldupdate, didcatchetc - State - useState, useRef, useEffect, useHistory Usage and Props(difference, when to use what, mutable or immutability, direction of flow), PropTypes, Auxillary Components, Controlled and Uncontrolled Components, Component Interaction (Parent to Child and Child to Parent), Iteration & Conditional Response

List of Exercise/Experiments

- 1) Create a collection of Customer by using
 - Weak Map and Map Collection in JS
 - Show Case the different feature set of the same.
- 2) Add Login Page, Dash Board Page, Admin Page
 - Enable React Routing
 - Add React Protected Route, for authorization

UNIT IV REACT LIBRARY – I

9+6

Event Bubbleup - Component Wrapper - Integration of CSS Modules - Forms Validations(YUP, Formik, Standard), Events Handling, Data Binding

List of Exercise/Experiments

- 1) Develop a React application that has User Registration Form w field level validations, data submission to a rest api end point, boot strap for responsive.
 - Use YUP or Formik to implement the same

UNIT V REACT HOOKS

9+6

Custom Hooks, HTTP - Fetch, Axios, Services, Behaviour Subjects - StateLess, StateFull and Container Components, Error Handling - Build, Env, CORS, Unit Testing w React Testing Library - Introduction to react-native - Introduction to StoryBook

List of Exercise/Experiments

- 1) Employ back end api for Login Page functionality (authentication). Post login, store the user context (received from the back end server) in browser's session storage as objects. And use the same as creds during protected route verification
 - On the dashboard page, have a grid of Students. The data has to be bought from back end api
 - Employ useRef, useeffect & usestate, and useHistory
 - Enable Exception Handling
 - Enable HOC and Aux Components
 - Implement React-Testing Library

Business Use Case Implementations

- 1) Student Management System
- 2) Retail Bank System
- 3) eCommerce System
- 4) Student LMS Management System

TOTAL:45+30=75 PERIODS

OUTCOMES:

At the end of the course, the students will be able to:

CO1: Personalize web pages using text formatting, graphics, audio, and video.

CO2: Hands on knowledge on Rest API , propTypes

CO3: Able to develop a web application using latest React Framework

CO4: Apply various React features including functions, components, and services.

CO5: Able to develop application using ReactJshooks .

TEXTBOOKS:

1. JAVASCRIPT THE DEFINITIVE GUIDE 7/ED Paperback – 15 June 2020
2. Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020
3. Advanced Web Development with React Paperback – 1 January 2020

REFERENCES:

1. PARENTAL WEBSITE - <https://reactjs.org/>

2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. <https://www.edureka.co/reactjs-redux-certification-training>

ONLINE LEARNING PLATFORMS :

- CodePen,
- CodeSandbox (β Preferred)
- Stackblitz.

LIST OF EQUIPMENTS:

- NodeJS (v9.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FireFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps

24CB923	SERVER SIDE PROGRAMMING WITH RUBY ON RAILS (Theory Course with Laboratory Component)	L	T	P	C
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OBJECTIVES:

The Course will enable learners to:

- To build web applications using the Ruby on Rails framework
- To manipulate data using both imperative and functional programming techniques.
- To develop web applications using object oriented design
- To store and retrieve data from database using ActiveRecord

UNIT I

INTRODUCTION TO RUBY

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Introduction to Ruby – The Ruby Ecosystem - Comments - Variables - Datatypes - Operators - Control Statements - Looping - Arrays - Key value pairs - Functions

List of Exercise/Experiments

- 1) You have a certain number of 100 rupee notes, 10 rupee notes and 1 rupee notes with you. There is an item you want to buy whose price is given to you. Write a program in Ruby to find if the item is affordable, that is the price of the item is less than or equal to the current money you have. Get the number of notes and price as input from the user.
- 2) Create an application in Ruby which gets number inputs until the input is -1. Store the input in the array and check for duplicate values. Remove the duplicate values and display the elements of the array in descending order.

Object Oriented Programming - Classes - Objects - Methods - Instance Variables - Constructor - Access Control - Inheritance - Method Overriding - Operator Overloading - Exceptions - Multithreading - Modules - Libraries - Files - Ruby Tools

- 1) Create a Hospital class which acts as a super class for In_Patient. There is another one class Bill which is a sub class of In_Patient. Get necessary inputs about the patients and on analyzing their medical record generate a bill using Ruby.
- 2) For the above example expand the code to generate the bill and save the bill details along with the patient detail and medical report in a text file.

Ruby ERB - Layout building using HTML and CSS - Designing with CSS - Classes and Specifiers in CSS - Box Layout - Flex Box Layout - HTML Forms - ERB Templates - **User Authentication** - Token Verification - Authenticity - Cross Site Request Forgery (CSRF) - CSRF attacks

- 1) Create a web application for student management. It should get the details of the students using forms and generate a printable resume for them using the obtained details.
- 2) Create a web application for conducting online quiz. The user will be answering the multiple choice questions by clicking the radio button. Generate the score after submission.

Ruby on Rails - Introduction - Framework - MVC - Active Records - Rails Migration - Rails
 Controllers - Rails View - Asset Pipeline - ActiveRecord Migration - ActiveRecord Association -
 Cookies - Session - ActionDispatch - ActiveRecord Validation

- 1) Create a to-do list web application using Ruby on Rails.
- 2) Create a simple calculator using Ruby on Rails.

Database Connectivity - Ruby DBI - Architecture of DBI application - Database Connection - Manipulation Operations - Transactions - RubyGems - PostgreSQL - Create database and table using PostgreSQL - Connect PostgreSQL to Rails application - **Back End Development** - AJAX - File Uploader - Action Mailer

- 1) Create a web application using Ruby on Rails to manage comments for the post from the users.
- 2) Create an online ecommerce marketplace web application using Ruby on Rails.

TEXTBOOKS:

1. John Elder, “Intro To Ruby Programming: Beginners Guide Series”, Paperback – Import, 10 May 2016
2. John Elder, “Learn Ruby On Rails For Web Development: Learn Rails The Fast And Easy Way!”, Paperback – Import, 19 January 2015
3. Simon St. Laurent, Edd Dumbill, “Learning Rails”, O'Reilly Media, Inc., November 2008, ISBN: 9780596554217

REFERENCES:

1. Yukihiro Matsumoto, David Flanagan, “The Ruby Programming Language: Everything You Need to Know”, O'Reilly Media, Inc., January 2008
2. Dave Thomas, David Heinemeier Hansson, and Sam Ruby, “ Agile Web Development with Rails 5”,
3. Sandi Metz, Obie Fernandez, “Practical Object Oriented Design in Ruby - An Agile Primer”, Addison-Wesley Professional Ruby, 1st Edition
4. Akshat Paul, Peter Philips, Dániel Szabó, “The Ruby Workshop”, Packt Publishing, October 2019
5. Peter Cooper, “Beginning Ruby from Novice to Professional”, Third Edition, Apress
6. Kevin C. Baird, “Ruby By Example - Concepts and Code”, No Starch Press, 2007

ONLINE LEARNING PLATFORMS :

- <https://www.learnrubyonline.org>
- <https://www.udemy.com/course/ruby-for-absolute-beginners/>
- <https://gorails.com>

LIST OF EQUIPMENTS:

- Visual studio code as IDE
- Ruby LSP extension in VS Code