R.M.D. ENGINEERING COLLEGE
(An Autonomous Institution)
REGULATIONS 2022
CHOICE BASED CREDIT SYSTEM

B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

I.PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

PEO 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.

PEO 2: To enrich knowledge of common business principles and enable graduates with the core competencies necessary for understanding contemporary technology..

PEO 3: To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills to solve real world problems and meet the diversified needs of industry, academia and research.

PEO 4: To enable graduates to enrich knowledge in the management and establish themselves as an entrepreneur by applying their leadership and management qualities.

PEO 5: To be a professional with ethical, social responsibility by enriching the human values.

II. PROGRAM OUTCOMES (POs)

PO 1. Engineering Knowledge (K3):
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Problem Analysis (K4): Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. Design/Development of solutions (K5):
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.

PO 4. Conduct investigations of complex problems (K5):
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.

PO 5. Modern Tool Usage (K3):
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. The Engineer and Society (A3):
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. Environment and Sustainability (A2):
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics (A3):
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and Team Work (A3):
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. Communication (A3):
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 11. Project Management and Finance (A3):
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12. Life-long Learning (A2):
Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

II. PROGRAM SPECIFIC OUTCOMES (PSOs)

The Students will be able to

PSO 1: To create appropriate modern engineering and business tools of cutting edge technologies and develop solutions for the betterment of the society.

PSO 2: To identify, understand and communicate economic, legal, global, and ethical aspects of business.

PSO 3: To set their career path applying all the technologies and business skills as an unique individual.

R.M.D. ENGINEERING COLLEGE
(An Autonomous Institution)
REGULATIONS 2022
B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER –I								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22MA102	Discrete Mathematics	BSC	4	3	1	0	4
2	22MA103	Introduction to Statistics, Probability and Calculus	BSC	3	3	0	0	3
3	22GE101	Heritage of Tamils	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
4	22CS101	Problem Solving using C++	ESC	5	3	0	2	4
5	22CS102	Software Development Practices	ESC	5	3	0	2	4
6	22EE102	Principles of Electrical Engineering	ESC	4	2	0	2	3
7	22PH104	Fundamentals of Physics	BSC	5	3	0	2	4
LABORATORY COURSE								
8	22GE112	Product Development Lab – I	EEC	2	0	0	2	1
MANDATORY COURSE								
9	22MC101	Induction Program (Non Credit)	MC	3Weeks				
TOTAL				**29**	**18**	**1**	**10**	**24**

SEMESTER –II								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSE								
1.	22MA202	Linear Algebra	BSC	3	3	0	0	3
2.	22GE201	Tamils and Technology	HSMC	1	1	0	0	1
THEORY COURSES WITH LABORATORY COMPONENT								
3	22MA203	Statistical Methods	BSC	5	3	0	2	4
4	22CB201	Data Structures and Algorithms	ESC	5	3	0	2	4
5	22CS202	Java Programming	ESC	5	3	0	2	4
6	22EC202	Principles of Electronics Engineering	ESC	4	2	0	2	3
7	22HS101	Professional Communication	HSMC	4	2	0	2	3
LABORATORY COURSE								
8	22GE211	Product Development Lab – II	EEC	2	0	0	2	1
MANDATORY COURSE								
9	22CH104	Environmental Sciences and Sustainability (Non Credit)	MC	2	2	0	0	0
AUDIT COURSE								
10	22AC201	Yoga for Stress Management	AC	1	1	0	0	0
TOTAL				**32**	**20**	**0**	**12**	**23**

SEMESTER –III								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22GE301	Universal Human Values II	HSMC	3	2	0	2	3
2	22CB301	Computer Organization and Architecture	PCC	3	3	0	0	3
3	22CB302	Fundamentals of Economics	PCC	2	2	0	0	2
THEORY COURSES WITH LABORATORY COMPONENT								
4	22MA304	Computational Statistics	BSC	5	3	0	2	4
5	22CB303	Software Design with UML	PCC	5	3	0	2	4
6	22CB304	Database Management Systems	PCC	5	3	0	2	4
LABORATORY COURSES								
7	22GE311	Product Development Lab - III	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	22CS311	Aptitude and Coding Skills I	EEC	2	0	0	2	1
9	22CB311	Mini Project - Design	EEC	2	0	0	2	1
MANDATORY COURSE								
10		Indian Constitution (Non Credit)	MC	1	1	0	0	0
TOTAL				**30**	**18**	**0**	**12**	**23**

SEMESTER –IV								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB401	Introduction to Innovation, IP Management and Entrepreneurship	PCC	3	3	0	0	3
2	22CB402	Marketing Research and Marketing Management	PCC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
3	22IT403	Web Development Framework	PCC	5	3	0	2	4
4	22CB403	Operating Systems	PCC	5	3	0	2	4
5	22CB404	Design And Analysis of Algorithms	PCC	5	3	0	2	4
6	22MA404	Operations Research	PCC	5	3	0	2	4
LABORATORY COURSES								
7	22GE411	Product Development Lab - IV	EEC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	22CS411	Aptitude and Coding Skills II	EEC	2	0	0	2	1
9	22CB411	Mini Project	EEC	2	0	0	2	1
AUDIT COURSE								
10		Value Education (Non Credit	AC	1	1	0	0	0
TOTAL				**33**	**19**	**0**	**14**	**25**

SEMESTER –V								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB501	Fundamentals of Management	PCC	3	3	0	0	3
2	22CB502	Business Strategy	PCC	3	3	0	0	3
3		Professional Elective II	PEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4	22CB503	Computer Networks	PCC	5	3	0	2	4
5		Professional Elective I	PEC	4	2	0	2	3
6	22CB504	Design Thinking	HSMC	3	2	1	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	22CS511	Advanced Aptitude and Coding Skills I	EEC	2	0	0	2	1
8	22CB511	Internship/Seminar	EEC	2	0	0	2	1
MANDATORY COURSE								
9		Essence of Indian Traditional Knowledge (Non Credit)	MC	1	1	0	0	0
TOTAL				**26**	**17**	**1**	**8**	**21**

SEMESTER –VI								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB601	Financial Management	PCC	3	3	0	0	3
2		Professional Elective III	PEC	3	3	0	0	3
3		Open Elective I	OEC	3	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4	22CB602	Information Security	PCC	5	3	0	2	4
5	22CB603	Artificial Intelligence	PCC	5	3	0	2	4
6		Professional Elective IV	PEC	4	2	0	2	3
LABORATORY COURSE WITH THEORY COMPONENT								
7	22CB604	IT Workshop using Scilab/Matlab	PCC	3	1	0	2	2
EMPLOYABILITY ENHANCEMENT COURSES								
8	22CS611	Advanced Aptitude and CodingSkills II	EEC	2	0	0	2	1
TOTAL				**28**	**18**	**0**	**10**	**23**

SEMESTER –VII								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB701	Human Resource Management	PCC	3	3	0	0	3
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	22CB702	IT Project Management	PCC	5	3	0	2	4
5		Professional Elective V	PEC	4	2	0	2	3
AUDIT COURSE								
6		Personality Development (Non Credit)	AC	3	3	0	0	0
TOTAL				**21**	**17**	**0**	**4**	**16**

SEMESTER –VIII								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
PRACTICAL COURSE								
1	22CB811	Project Work	EEC	16	0	0	16	8
TOTAL				**16**	**0**	**0**	**16**	**8**

SUMMARY OF CREDIT DISTRIBUTION

Sl. No.	Category	Credits Per Semester								As per AICTE	As per AU	Total Credits
		I	II	III	IV	V	VI	VII	VIII			
1	HSMC	1	4	3	3	3				12+3	12	11+3
2	BSC	11	7	4						25	29	22
3	ESC	11	11							24	18	22
4	PCC			13	19	10	13	7		53	58	62
5	PEC					6	6	6		18	18	18
6	OEC						3	3		12	12	6
7	EEC	1	1	3	3	2	1		8	16	16	19
8	MC/AC	✓	✓	✓		✓		✓				
	Total	24	23	23	25	21	23	16	8	160+3	163	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 – AuditCourse

PROFESSIONAL ELECTIVE I								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22CB901	Conversational Systems	PEC	4	2	0	2	3
2	22CB902	Robotics and Embedded Systems	PEC	4	2	0	2	3
3	22CB903	Machine Learning	PEC	4	2	0	2	3

PROFESSIONAL ELECTIVE II								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB904	Organizational Behaviour	PEC	3	3	0	0	3
2	22CB905	Computational Finance and Modeling	PEC	3	3	0	0	3
3	22CB906	Industrial Psychology	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE III								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22CB907	Cloud, Microservices & Application	PEC	4	2	0	2	3
2	22CB908	Data Mining and Analytics	PEC	4	2	0	2	3
3	22CB909	Compiler Design	PEC	4	2	0	2	3

PROFESSIONAL ELECTIVE IV								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB910	Enterprise Systems	PEC	3	3	0	0	3
2	22CB911	Introduction to Fintech	PEC	3	3	0	0	3
3	22CB912	Image Processing and Pattern Recognition	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE V								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22CB913	Cognitive Science & Analytics	PEC	4	2	0	2	3
2	22CB915	Cryptology	PEC	4	2	0	2	3
3	22CB916	Usability Design of Software Applications	PEC	4	2	0	2	3

PROFESSIONAL ELECTIVE VI								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB917	Advanced Social, Text and Media Analytics	PEC	3	3	0	0	3
2	22CB918	Introduction to IoT	PEC	3	3	0	0	3
3	22CB919	Mobile Computing	PEC	3	3	0	0	3
4	22CB920	Services Science& Service Operational Management	PEC	3	3	0	0	3

OPEN ELECTIVE								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1	22CB001	Fundamentals of Management	OE	3	3	0	0	3
2	22CB002	Business Strategy	OE	3	3	0	0	3
3	22CB003	Design Thinking	OE	3	2	1	0	3
4	22CB004	Marketing Research and Marketing Management	OE	3	3	0	0	3
5	22CB005	IT Project Management	OE	3	3	0	0	3

PROFESSIONAL ELECTIVE VERTICALS								
BUSINESS ANALYTICS								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22IT201	Python Programming	PEC	4	2	0	2	3
2	22CB902	Python for Business Analytics	PEC	4	2	0	2	3
3	22CB921	Big Data Analytics	PEC	4	2	0	2	3
4	22CB922	Business Intelligence	PEC	4	2	0	2	3
5	22CB914	Cognitive Science and Analytics	PEC	4	2	0	2	3
6	22CB932	Capstone Project	EEC	12	0	0	12	6

PROFESSIONAL ELECTIVE VERTICALS								
FINTECH AND BLOCKCHAIN								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22CB924	Financial Cost and Accounting	PEC	4	2	0	2	3
3	22CB926	Advance Finance	PEC	4	2	0	2	3
4	22CB927	Introduction to Blockchain and its Applications	PEC	4	2	0	2	3
5	22CB911	Introduction to Fintech	PEC	4	2	0	2	3
7	22CB932	Capstone Project	EEC	12	0	0	12	6

PROFESSIONAL ELECTIVE VERTICALS								
DIGITAL MARKETING								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
3	22CB928	Social Media Marketing	PEC	4	2	0	2	3
4	22CB929	Web Analytics	PEC	4	2	0	2	3
5	22CB930	Digital Marketing Analytics	PEC	4	2	0	2	3
6	22CB931	Recommender Systems	PEC	4	2	0	2	3
7	22CB932	Capstone Project	EEC	12	0	0	12	6

ADVANCED WEB DEVELOPMENT								
Sl. No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES AND LAB INTEGRATED COURSES								
1	22CB933	Usability Design of Software Applications + Lab	PEC	5	3	0	2	4
2	22CB934	Front-end development using React	PEC	5	3	0	2	4
3	22CB935	Server side programming withRuby on Rails	PEC	5	3	0	2	4
4	22CB932	Capstone Project	EEC	12	0	0	12	6

SEMESTER I

		L	T	P	C
22MA102	**DISCRETE MATHEMATICS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The Syllabus designed to:

- Check the validity of arguments by using basic connective and valid rules of inference
- Impart knowledge of the basics of counting and solving recurrence relations.
- Apply Boolean algebra, basic properties, and Karnaugh's maps.
- Explain functions, relations, and group theory.
- Know the nomenclature of graphs, isomorphism of graphs, paths, and cyclescircuits.
- Enumerate the concept of trees, tree traversals, information storage, and retrieval.

UNIT I LOGIC **12**

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

UNIT II 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.

UNIT III ABSTRACT ALGEBRA **12**

Set, relation, group, ring, field.

UNIT IV COMBINATORICS **12**

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

UNIT V 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, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number,statement of Four-color theorem.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to:

CO1: examine the validity of the arguments.
CO2: utilize the significance of Boolean algebra in computer science and engineering.
CO3: identify algebraic techniques to formulate and solve group theoretic problems.
CO4: demonstrate various proof techniques and application of principles.
CO5: apply graph theorytechniques to solve real life problems.

TEXTBOOKS:

1. J.P. Trembly & Manohar, "Discrete Mathematical Structures with applications to computer science", 1s Edition, McGraw Hill Education,2017.
2. N. Herstein, "Topics in Algebra", 2nd Edition, John Wiley and Sons, 1975
3. M. Morris Mano, "Digital Logic & Computer Design", 1st Edition, Pearson, 2004.
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", 4th Edition, Wellesley-CambridgePress, 2009.
2. R.A. Brualdi, "Introductory Combinatorics", 1st Edition, North-Holland, New York, 1977.
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science",1st Edition, Prentice Hall, Englewood Cliffs, 2016.

		L	T	P	C
22MA103	**INTRODUCTION TO STATISTICS, PROBABILITY& CALCULUS**	**3**	**0**	**0**	**3**

OBJECTIVES:

The syllabus is designed to:

- Acquaint the students with the fundamental concept of statistics, probability and distributions.
- Impart the knowledge on basic concepts of differential calculus and integral calculus.

UNIT I INTRODUCTION TO STATISTICS **9**

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, Frequencycurves. Central tendency (Mean, Median and Mode) and dispersion (S.D, M.D, Q.D and Range). Bivariate data. Summarization, marginal and conditional frequency distribution.

UNIT II PROBABILITY 9

Concept of experiments – sample space – event – Definition of Combinatorial Probability – 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 9

Binomial – Poisson – Geometric distributions.

UNIT IV CONTINUOUS PROBABILTY DISTRIBUTIONS 9

Uniform, exponential, normal, chi-square, student - t and F distributions (Definition and properties without proof).

UNIT V CALCULUS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to:

CO1: implement the concepts of basic statistics, find mean, median, mode, standarddeviation, mean deviation, quartile deviation and range for a given data.

CO2: make use of probability concepts in problems of uncertainty.

CO3: identify and apply the discrete distributions concepts in real life problems. CO4: apply the continuous distributions concepts by identifying in real life problems.CO5: evaluate the problems using differentiation and integration.

TEXT BOOKS:

1. S.M. Ross, "Introduction of Probability Models", 10th Edition, Academic Press,New York, 2010.
2. A. 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, Delhi,1965.

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.

		L	T	P	C
22CS101	**PROBLEM SOLVING USING C++** **(Theory Course with Laboratory Component)** **(Common to All Branches)**	3	0	2	4

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 PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS 15

Computational thinking for Problem solving – Algorithmic thinking for Problem solving - Building Blocks - Problem Solving and Decomposition - Dealing with Error – Evaluation.

Overview of C – Data types – Identifiers – Variables – Storage Class Specifiers – Constants – Operators - Expressions – Statements – Arrays and Strings – Single-Dimensional – Two-Dimensional Arrays – Arrays of Strings – Multidimensional Arrays.

List of Exercise/Experiments:

1. Write C/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/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/C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

UNIT II POINTERS AND FUNCTIONS 15

Pointers -Variables – Operators – Expressions – Pointers and Arrays – Functions - Scope Rules – Function Arguments – return Statement – Recursion – Structures – Unions – Enumerations.

List of Exercise/Experiments:

1. Generate salary slip of employees using structures and pointers. Create a structureEmployee with the following members: Note that DOB and DOJ should be implemented using structure within structure.

2. Compute internal marks of students for five different subjects using structures andfunctions.

UNIT III CLASSES AND OBJECTS **15**

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program -Classes and Objects - Member functions - Nesting of member functions - Private memberfunctions - 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 copyconstructors.

UNIT IV OPERATOR OVERLOADING, INHERITANCE ANDPOLYMORPHISM **15**

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) FunctionOverloading.
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.

UNIT V I/O, FILES AND EXCEPTIONS **15**

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 minimumbalance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.
4. Mini project.

TOTAL: 45+30 = 75 PERIODS

OUTCOMES:

At the end of this 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.

TEXT BOOKS:

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015.
2. E Balagurusamy,"Object Oriented Programming with C++", 4th Edition, TataMcGraw-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 Barklett 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++", TataMcGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
7. 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.

		L	T	P	C
	SOFTWARE DEVELOPMENT PRACTICES				
22CS102	**(Theory Course with Laboratory Component)**	**3**	**0**	**2**	**4**
	(Common to All Branches)				

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 **15**

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 - BranchManagement - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaininga 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 contentsabout 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 webpages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.
3. Form a Team, Decide on a project:
   c) Create a repository in GitHub for the team.
   d) Choose and follow a Git workflow
   - Each team member can create a StudentName.txt file with contentsabout themselves and the team project
   - Eachteam 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 branchto 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 updation.

- Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

4. Create a web page with at least three links to different web pages. Each of the webpages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II HTML 15

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – metaElements – Forminput 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 andText 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 15

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 15

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

List of Exercise/Experiments:

1. Implement Event Handling in the web pages.

Mini Projects-Develop anyone ofthe following web applications (not limited to one) usingabove 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: 75 PERIODS

OUTCOMES:

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

CO1: Apply agile development methods in software development practices.
CO2: Set up and create a GitHub repository.
CO3: Develop static and dynamic webpages using HTML.
CO4: Design interactive personal or professional webpages using CSS.
CO5: Develop web pages using Java script with event-handling mechanism.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGrawHill International Edition, Nineth 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, 2ndEdition, 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, PrenticeHall 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_013094421427470336209 9_shared/overview

LIST OF EQUIPMENTS:

Systems with either Netbeans or Eclipse
Java/JSP/ISP Webserver/Apache Tomcat /
MySQL / Dreamweaver or
Equivalent/ Eclipse, WAMP/XAMP

22EE102	PRINCIPLES OF ELECTRICAL ENGINEERING (Theory Course with Laboratory Component)	L 2	T 0	P 2	C 3

COURSE OBJECTIVES:

The Course will enable learners to:

- Studythe basic concepts of electrical engineering.
- Study the basic DC and AC networks used in electrical circuits.
- Demonstrate the concepts of electrical statics and electro-mechanics.
- Acquaint the knowledge about the measurement of electrical quantities.
- Demonstrate the concepts of electrical wiring and safety.

UNIT I INTRODUCTION **12**

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.

(Theory – 6)

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

(Laboratory– 6)

UNIT II DC CIRCUITS **12**

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

(Theory – 6)

1. Verification of Thevenin's and Norton's Theorem
2. Verification of Maximum Power Transfer Theorem

(Laboratory – 6)

UNIT III AC CIRCUITS **12**

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 ofimpedance, admittance, active, reactive, apparent and complex power, power factor,3 phase balanced AC circuits (Y-Δ & Y-Y).

(Theory – 6)

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 balancedstar and deltaconnected loads

(Laboratory – 6)

UNIT IV ELECTRO-MECHANICS **12**

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.

(Theory – 6)

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

(Laboratory – 6)

UNIT V MEASUREMENTS AND SENSORS **12**

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.

(Theory – 6)

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

(Laboratory – 6)

TOTAL PERIODS 60 PERIODS

COURSE 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 performanceof 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, 2012.
2. B. L. Theraja, A Textbook of Electrical Technology, (vol. I), ChandandCompany Ltd., NewDelhi, 2010.
3. V. K. Mehta, Basic Electrical Engineering, S. Chand and Company Ltd., NewDelhi, 2006.
4. I.J.Nagrath and Kothari, Theory and Problems of Basic Electrical Engineering, second edition,Prentice Hall of India Pvt. Ltd, 2005.

22PH104	FUNDAMENTALS OF PHYSICS (Theory Course with Laboratory Component)	L	T	P	C
		3	0	2	4

OBJECTIVES

The course will enable the learners to:

- Impart the fundamental concepts of physics and apply this knowledge toboth 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.
- Impart knowledge related to the importance of EM waves and quantum mechanics
- Introduce concepts of crystallography, band structure and thermodynamics
- Give idea of basic lasing action, various types of lasers and fiber optics

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 and resonance in mechanical and electrical oscillators.

(Theory-12)

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: Polarization - 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-12)

1. Determination of wave length of light by Newton's Ring method

(Laboratory -3)

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 -9)

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

(Laboratory -9)

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 ofthermodynamics, first law of thermodynamics, brief discussion on application of 1st law,second law of thermodynamics andconcept of Engine, entropy, change in entropy in reversible and irreversible processes.

(Theory -12)

1. Determination of Hall coefficient of semi-conductor

(Laboratory -3)

UNIT V LASER AND FIBER OPTICS 15

Laser and Fiber optics: Einstein's theory of matter radiation interaction and Aand B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO_2 and Neodymium YAG (Neodymium-doped Yttrium Aluminum Garnet); Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering, Fiber optics and applications, types of optical fibers.

1. Determination of wave length of light by Laser diffraction method (Theory -9)
2. Determination of laser and optical fiber parameters (Laboratory -6)

TOTAL: 75 PERIODS

OUTCOMES

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

CO1: Obtain solution of the oscillator using differential equation.
CO2: Analyze the intensity variation of light due to Polarization and interference
CO3:Explain fundamentals of electromagnetism and quantum mechanics and apply it in engineering problems
CO4: Find solution to thermal and electrical problems faced in computer devices.
CO5:Analyze working principle of lasers and to summarize its applications

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: TheNew Millennium Edition (2012).
3. Neil W Aschroft and N David Mermin, "Solid State Physics", Harcourt College Publishers, 1976
4. S. O. Pillai, "Solid state physics", New Age International, 2015.
5. M AWahab, "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, HoughtonMifflin Company, New York 2005.
9. Department of Physics, Physics laboratory manual, R.M.K. Group of Institutions,2021.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1.	Newton's Ring apparatus	6 Nos.
2.	Plank 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 fibre parameters	6 Nos.
6.	Hall effect set-up	2 Nos.

		L	T	P	C
22GE111	**PRODUCT DEVELOPMENT LAB –1 (Common to all Branches)**	**0**	**0**	**2**	**1**

The students may be grouped into 3 to 4 and work under a project supervisor. The device/system/component/prototype Idea to be developed by the students and a final presentation to be done by the students about the idea generated at the end of the semester.

OBJECTIVES:

- Students completing this course are expected to
- Understand the functionalities and limitation of various machine/equipment
- Demonstrate various operations that can be performed to machines
- Summarize the basic principles of machines to convert their ideas into products

LIST OF EXPERIMENTS

I 1. Study of Manufacturing Processes (Carpentry, Plumbing, Machines andWelding).
2. Studyof fundamental operations of 3D Printer and Scanner with Software.
3. Study of Smart Machining (CNC and Laser cutting) and Engraving Techniques.

II 1.Study of Fundamental of Circuit Design.
2. Studyof PCB Milling Machine.
3. Study of Soldering and Desoldering.

III 1. Study of Computer Peripheral Devices (Processing Information Devices)

IV 1.Present the Product Idea Presentation - Phase – I.

TOTAL: 30 PERIODS

Note:

The students can select the prototype to be made of their choice after learning theabove exercises.

OUTCOMES

After successful completion of the course the students will be able to do

CO1Understand the concept of manufacturing processes.

CO2 Describe the working of the machine element.

CO3 Discuss the various applications of engineering materials

CO4Summarize the basics of core engineering concepts.

CO5 Describe the process for converting ideas into products

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Equipment Name	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Centre lathe	2 Nos
6	Arc welding transformer with cables and holders	2 Nos
7	Plumbing tools	2 Sets
8	Carpentry tools	2 Sets
9	Multimeter	10 Nos
10	Drilling Machine	1 No
11	Solder Stations	5 Sets
12	Desoldering Machine	1 No
13	PCB Milling Machine	1 No

14	Variable Power Supply	1 No
15	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets
16	Personal Desktop Computers	30 Nos

REFERENCES:

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press.2011.
2. D. J. Griffiths, Introduction to Electrodynamics, fourth edition, Pearson, 2019.
3. William H. Hayt& Jack E. Kemmerly, Engineering Circuit Analysis, McGraw Hill Book CompanyInc, 2018.
4. Smarjith Ghosh, Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh,Prentice Hall (India) Pvt. Ltd, 2007.

SEMESTER - II

		L	T	P	C
22MA202	**LINEAR ALGEBRA**	**3**	**0**	**0**	**3**

OBJECTIVES:

The syllabus is designed to

- Introduce the concepts of matrices and determinants.
- Impart the knowledge of vectors, linear combinations, vector space andlinear transformations.
- Implement the concept of linear combinations in image processing and Machine learning.

UNIT I MATRICES AND DETERMINANTS **9**

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

UNIT II VECTORS AND LINEAR COMBINATIONS **9**

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 **9**

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

UNIT IV LINEAR TRANSFORMATIONS **9**

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

UNIT V APPLICATIONS OF MATRICES **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to:

CO1: solve the system of linear equations using Cramer’s rule.

CO2: solve the system of equations using LU Decomposition method.

CO3: compute QR decomposition for a given matrix.

CO4: represent the linear transformations in matrix and to find Eigenvalues and

Eigenvectors.

CO5: apply the concept of linear combinations in image processing and Machinelearning.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, New Delhi 2014.
2. A. H. Friedberg, A. J. Insel and L. Spence, "Linear Algebra", Prentice Hall ofIndia, 4th Edition New Delhi, 2004.

REFERENCE BOOKS:

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 GrihaPrakashan, 7th Edition, 1994.
5. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Pearson Education International, 3rd Edition.

		L	T	P	C
22MA203	**STATISTICAL METHODS (Theory Course with Laboratory Component)**	**3**	**0**	**2**	**4**

OBJECTIVES:

The Syllabus designed to

- Explain the fundamental concepts of random sampling and Test of hypothesis.
- Develop an understanding of the principles of estimation theory.
- Introduce the concepts of linear statistical models and non- parametric tests.
- Impart the knowledge of time series analysis & forecasting.

UNIT I SAMPLING DISTRIBUTION 12

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 –stratified random sampling.

UNIT II THEORY OF ESTIMATION 12

Estimation – Point estimation – criteria for good estimates (unbiasedness, consistency) – Methods of estimation including maximum likelihood estimation. Sufficient Statistic – Concept & examples – complete sufficiency and their application in estimation. Test of hypothesis – Concept & formulation – Type I and Type II errors

–Neyman Pearson lemma – Procedures of testing.

UNIT III LINEAR STATISTICAL MODELS 12

Linear Statistical Models – Scatter diagram – Linear regression and correlation – Least Squares method – Rank correlation – Multiple regression & multiple correlations – Analysis of variance (one way two way with as well as without interaction).

UNIT IV NON-PARAMETRIC TEST 12

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–Tolerance region.

UNIT V TIME SERIES ANALYSIS 12

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

TOTAL: 60 PERIODS

LIST OF EXPERIMENTS:

R statistical programming language – Introduction to R – Functions – Control flow and Loops, Working with Vectors and Matrices – Reading in Data – Writing Data – Workingwith Data – Manipulating Data – Simulation – Linear model – Data Frame – Graphicsin R.

TOTAL: 15 PERIODS

Data Source:

- www.rbi.org.in

COURSE OUTCOMES:

After the successful completion of the course, the student will be able to: CO1: find the standard error and sample mean of the sampling distributions.CO2: identify and evaluate the unbiased estimators.

CO3: compute correlation and regression curve.

CO4: apply testing of hypotheses to real-life problems.

CO5: analyze the ARIMA model and apply it to real-life situations.

TEXTBOOKS:

1. I.R.Miller, J.E. Freund andR. Johnson, "Probability and Statistics for Engineers", Prentice Hall India Learning Private Limited, 4th Edition, 2012.
2. A.Goon, M.Gupta and B.Das Gupta, "Fundamentals of Statistics", Volume I & II, World Press.
3. Chris Chat field, "The Analysis of Time Series: An Introduction", Chapman & Hall/CRC, 6th Edition, 2004.

REFERENCES:

1. D.C. Montgomery and E.Peck, "Introduction to Linear Regression Analysis", Wiley –Inter science.
2. A.M. Mood, F.A. Gray bill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill.
3. N. Draper and H. Smith, "Applied Regression Analysis", Wiley-Inter science.
4. R. Garrett Grolemund, "Hands-on Programming with R", O'Reilly.
5. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Professional, 2nd Edition.

22CB201	**DATA STRUCTURES AND ALGORITHM (Theory Course with Laboratory Component)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

COURSE OBJECTIVES:

The Course will enable learners to:

- Explore algorithm performance analysis.
- Learn linear data structures like lists, stacks, and queues.
- Understand and apply tree data structures.
- Understand and apply graph and file structures.
- Able to incorporate various searching and sorting techniques in real timescenarios.

UNIT IINTRODUCTION TO ALGORITHM & DATA ORGANISATION 15

Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

UNIT II LINEAR DATA STRUCTURE 15

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

List of Exercise/Experiments:

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.

UNIT III NON LINEAR DATA STRUCTURES 15

Trees (Binary Tree, Binary Search Tree, AVL Tree, B & B+ Tree), Operations and Applications of Non-Linear Data Structures

List of Exercise/Experiments:

3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.

UNIT IV GRAPHS AND FILES 15

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms. File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

List of Exercise/Experiments:

5. Breadth First Search
6. Depth First Search

UNIT V SEARCHING AND SORTING 5

Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, MergeSort, Quick Sort, Heapsort, Introduction to Hashing

List of Exercise/Experiments:

7. Merge Sort
8. Quick Sort

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:CO1:
Analyse the various data structure concepts.
CO2: Apply the different linear data structures to problem solutions.CO3:
Apply the tree non-linear data structures to problem solutions.
CO4: Apply the graph and file non-linear data structures to problem solutionsCO5:
Critically analyse the various sorting algorithms.

TEXT BOOKS:

1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed,Universities Press, 2018.
2. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. UIlman, Pearson, 2021.

REFERENCES:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth, 2016.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press, 2018.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning),(Thirty First Edition), Pat Morin, UBC Press, 2019.

		L	T	P	C
22CS202	**JAVA PROGRAMMING**	3	0	2	4

(Theory Course with Laboratory Component) (Common to CSE, CSD, EEE, ECE, ME, IT, ADS and CSBS)

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 **15**

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 asfollows:
   First 100 units - Rs. 1 per unit 101-
   200 units - Rs 2.50 per unit201 -
   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 asfollows:
   First 100 units - Rs. 2 per unit 101-
   200 units - Rs 4.50 per unit201 -
   500 units - Rs. 6 per unit
   > 501 units - Rs. 7 per unit
2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   a. Find k^{th} smallest element in an unsorted array
   b. Find the sub array with given sum
   c. Matrix manipulations – Addition, Subtraction, Multiplication
   d. Remove duplicate elements in an Array
   e. Accept an integer value N and print the N^{th} 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.....s 0.

UNIT II INHERITANCE, INTERFACES AND EXCEPTION HANDLING 15

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

List of Exercise/Experiments:

1. 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 asHRA, 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.
2. Design a Java interface for ADT Stack. Implement this interface using array and built- in classes. Provide necessary exception handling in both the implementations.
3. 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 areaof the given shape and Numberofsides() that prints the number of sides of the given shape.
4. Write a Java program to apply built-in and user defined exceptions.

UNIT III MULTITHREADING, I/O AND GENERIC PROGRAMMING 15

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, BoundedTypes, Generic Methods, Generic Interfaces, Generic Restrictions.

List of Exercise/Experiments:

1. Write a Java program that correctly implements producer consumer problem usingthe concept of inters thread communication.
2. 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 15

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. 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 **15**

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:

1. Mini Project (using JDBC)

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand the object oriented programming concepts and fundamentals of Java.CO2: Develop Java programs with the packages, interfaces and exceptions.
CO3: Build Java applications with I/O streams, threads and generics programming.CO4: Apply strings and collections in developing applications.
CO5: Implement the concepts of JDBC.

TEXT BOOK:

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. Systems with either Netbeans or Eclipse, JDK 1.7 and above, Linux and MySQL

22EC202	**PRINCIPLES OF ELECTRONICS ENGINEERING (Theory Course with Laboratory Component)**	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Studythe operation of semiconductor diodes and their characteristics
- Acquire knowledge about the operation and characteristics of BJT undervarious 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 ANDCIRCUITS 6

Semiconductors: Introduction to Semiconductors: intrinsic & extrinsic, P&N-type semiconductors. 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 breakdownand its reverse characteristics. Rectifier circuits: halfwave, full wave.

UNIT II BIPOLAR JUNCTION TRANSISTORS 6

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

UNITIII FIELD EFFECT TRANSISTORS 6

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type.

UNITIV FEEDBACKAMPLIFER ANDOPERATIONALAMPLIFIERS 6

Concept (Block diagram), positive and negative feedback, loop gain, open loop gain, feedback factors, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits: operational amplifier and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation.

UNITV DIGITAL ELECTRONICS FUNDAMENTALS 6

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

30 PERIODS

LIST OF EXPERIMENTS:

1. Semiconductor Diodes and application,
   a. Characteristics of PN junction diode
   b. Zener diode characteristics
2. Transistor circuits
   a. Common Emitter Input Output characteristics
3. JFET, oscillators and amplifiers.
   a. FET characteristics
4. Opamp based experiments (Analysis using Simulation Spice)
   a. Opamp as inverting amplifier, non-inverting amplifier
5. Digital experiments
   a. Simplification, realization of Boole an expressions using logic gates / Universal gates.
   b. Realization of Half/Full adders and Half/Full Subtractors using logic gates.
   c. Construction of Multiplexer and Demultiplexer circuits using logic gates.

30 PERIODS

TOTAL: 60 PERIODS

OUTCOMES:

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

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

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 managethe task in time.

CO7: Express the experimental results with effective presentation and report.

TEXTBOOKS:

1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar , MicroelectronicCircuits: 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.

NPTEL LINK: https://nptel.ac.in/courses/108/105/108105132/ NPTEL LINK:https://onlinecourses.nptel.ac.in/noc21_ee07/preview

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

BC 107, BC 148, 2N2646, BFW10	- 25 each
1N4007, Zener diodes	- 25 each
Bread Boards	-15 Nos
CRO (30MHz)	- 10 Nos
Signal Generator /Function Generators (3 MHz)	- 15 Nos
Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	- 50 Nos
Dual power supply/ single mode power supply	- 15 Nos
IC Trainer Kit	-15 Nos
Seven segment display	-15 Nos
Digital LCR Meter	- 2 Nos
Multimeter	-15 Nos
IC tester	-2Nos
Standalone desktop PCs	- 15 Nos.

SPICE Circuit Simulation Software: (any public domain or commercial software)

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-AmpsuA741 /LM555

22HS101	PROFESSIONAL COMMUNICATION (Theory Course with Laboratory Component)	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Strengthen basic reading and writing skills.
- Comprehend listening contexts competently.
- Inculcate reading habit and develop effective reading skills.
- Improve active and passive vocabulary.
- Acquire speech clarity with right pronunciation.
- Develop vocabulary of a general kind and enhance grammatical accuracy.
- Imbibe Content and Language Integrated Learning (CLIL).

UNIT IFORMAL AND INFORMAL COMMUNICATION **12**

Listening: Short Texts, Short Formal and Informal Conversations
Speaking: Self Introduction, Exchanging Personal Information

Reading: Practice in Skimming, Scanning and Predicting, Reading Comprehension

Writing: Free Writing, Hints Development

Grammar: Parts of Speech, Prepositions.

Vocabulary: Compound Nouns, Technical Words.

(Theory 6)

1. Familiarization of Vowel Sounds-Monophthongs, Diphthongs and Consonant Sounds
2. Listening to Formal Conversations in British and American Accents
3. Guided Writing

(Laboratory 6)

UNIT II GRAMMAR AND LANGUAGE DEVELOPMENT **12**

Listening: Telephonic Conversations.

Speaking: Sharing information of a personal kind - Greetings – Takingleave.

Reading: Short comprehension passages - Pre-reading and Post-reading(multiple choice questions shortquestions / open and close ended questions)

Writing: Instructions, Recommendations, Checklists
Grammar: Tenses, Framing 'Wh' & 'Yes' or 'No' questions
Vocabulary: Numerical Adjectives, Collocations.

(Theory 6)

1. Communication Etiquettes
2. Self -Introduction using SWOT Analysis
   (Laboratory 6)

UNIT III BASIC TECHNICAL WRITING AND STUDY SKILLS **12**

Listening: Listening to longer texts and filling up the tables **Speaking:**

Asking about routine actions and expressing opinions**Reading:** Short texts

(Cloze Test)

Writing: Formal letters, E-mail writing, Interpretation of Charts and Graphs

Grammar: Cause and Effect expressions**,** Conditional Clauses

Vocabulary: Often misspelled and confusing words

(Theory 6)

1. Mechanics of Reading Skills
2. News Reading–Cloze Tests
   (Laboratory 6)

UNIT IV GROUP DISCUSSION AND JOB APPLICATIONS **12**

Listening: Listening to recorded dialogues of conversations and completing exercises based on them

Speaking: Discussion on Social issues.

Reading: Reading text from magazines

Writing: Purpose Expressions, Letter of Application, Minutes of Meeting.

Grammar: Modal Verbs, Subject-Verb agreement

Vocabulary : Sequence Words

(Theory 6)

1. Group Presentation, Group Discussion:Do's and Don'ts of GroupDiscussion
2. Discussions on failure and success in interviews of famous personalities
3. Spotting Errors

(Laboratory 6)

UNIT V ART OF REPORTING **12**

Listening: Listening to TED talks

Speaking: Debate & Presentations

Reading: Biographies

Writing: Definitions (Single line & Extended), Report Writing (Industrial visit, Accident and Feasibilityreports)

Grammar: Reported speech

Vocabulary: Verbal Analogies

(Theory 6)

1. Writing based on listening to academic lectures and discussions
2. Leadership skills, Negotiation skills
3. Mechanics of Report Writing

(Laboratory 6)

LIST OF PROJECTS

1. Create a podcast on a topic that will be interesting to college students
2. Read and Review (Movie/Book/Technical Article)
3. Presentation on Social Issues
4. Submit a report on "Global English: A study"

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Comprehend conversations and short talks delivered in English

CO2: Participate efficiently in informal conversations and develop an awareness ofthe self and apply well-defined techniques

CO3: Read articles of a general kind in magazines and newspapers efficientlyCO4: Write short general essays, personal letters and E-mails in English CO5: Develop vocabulary of a general kind by enriching reading skills

TEXTBOOKS:

1. Kumar, Suresh E, & Sreehari, P. Communicative English. Orient Black Swan,2007.
2. Richards, Jack C. Interchange Students' Book-2 New Delhi: CUP,2015.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Dhanavel, S P. English and Soft Skills, Volume Two, Orient Black Swan.
3. Elbow, Peter. Writing Without Teachers. London: Oxford University Press, 1973.
4. Larsen, Kristine. Stephen Hawking: A Biography, Greenwood: Publishing Group,2005.

5. Redston, Chris & Gillies Cunningham. Face2Face (Pre- intermediate Students'Book &Workbook) Cambridge University Press, New Delhi: 2005.
6. Lewis, Norman. Word Power Made Easy, Latest Edition: Penguin Random HouseIndia: 2015

WEB REFERENCES:

1. Basics of Business Communication
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012688768083632128308_shared/overview
2. communicating to Succeed
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012686653619175424640_shared/overview
3. Business English
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683227498151936279_shared/overview
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013267708367904768573/overview (lab support)
4. Business Writing
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012689477601 00966433_shared/overview
5. Email Etiquettes
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013294623865 56108817682_shared/overview
6. Email Writing Skills
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012689543630135 29666_shared/overview
7. Time Management
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012985921210736640721_shared/overview
8. Understanding Body Language
   https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012979737651445760246 89_shared/overview

ONLINE RESOURCES:

1. https://infyspringboard.onwingspan.com/web/en/page/home

22GE211 **PRODUCT DEVELOPMENT LAB –2**

L	T	P	C
0	0	2	1

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The student batches should study the device/system/component and will do literature review to develop prototype idea. Further at the end of the semester theywill make a final presentation to exhibit the conceptual design skills and the process to develop a product.

OBJECTIVES:

Students completing this course are expected to

- Use the innovative design methodology to articulate the product concepts.
- Summarize the requisite Engineering Principles for transforming concepts into products.
- Conduct basic tests to extract the qualitative and quantitative performancefactors.

EXERCISES:

1. Studyof Basic Engineering Design Concepts.
2. Conduct a literature survey on the implementation of the design concepts.
3. Prepare the design concepts for an identified literature gap.
4. Present the Product Idea Presentation – Phase II.

TOTAL: 30 PERIODS

OUTCOMES:

After successful completion of the course, the students will be able to

CO1: Understand the working and capacity of various engineering systems.CO2: Infer the outcomes in the product development process.
CO3: Perform basic engineering and material characterization tests.
CO4: Demonstrate the ability to provide conceptual design strategies for a product. CO5: Implement the Science, Engineering, Technology and Mathematics (STEM) forproduct design.

		L	T	P	C
22CH104	**ENVIRONMENTAL SCIENCE AND SUSTAINABILITY**	**2**	**0**	**0**	**0**

OBJECTIVES:

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues andwaste 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-spotsof 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 IVSUSTAINABILITY 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 – Carbon footprint of the institution

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

COURSE OUTCOMES:

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

CO1: Investigate and use conservational practices to protect natural resources.

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

CO3: Adapt the values of biodiversity and its conservation methods.

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

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

TEXTBOOKS:

1. Anubha Kaushik and C.P. Kaushik, "Perspectives in environmental studies", NewAge International Publishers,2nd edition, 2021.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, NewDelhi, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 3rd edition, Pearson Education, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses,Third Edition, Universities Press(I) Pvt. Ltd., Hyderabad, 2021.

REFERENCES:

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

22GE101	Heritage of Tamils	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course is designed 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 toTamil Nadu.
- Acquaint the concept of Thinai 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 andSangam 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 MOVEMENTAND INDIAN CULTURE **3**

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence ofTamils 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

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

- State the role of Tamil literature in shaping Tamil Cultural roots.
- Express the cultural and religious significance of Tamil art and sculptures.
- Identify and describe the techniques of folk and martial arts.
- Classify the role of Thinai concept in Tamil culture and literature.
- Compare the idea of cultural and intellectual contributions of Tamils.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – 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) – Reference Book

SEMESTER III

UNIVERSAL HUMAN VALUES II

L	T	P	C
2	0	2	3

22GE301

OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), 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.
- Implications of Harmony on Professional Ethics.

COURSE TOPICS:

The course has 28 lectures (2 lecture hours) and 14 practice sessions (2 Tutorial hour) in 5 Units:

UNIT I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its 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 fulfillment 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.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for 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!

- Understanding human being 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, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

  Include 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 disease

UNIT III **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment 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 relationship
- Understanding the harmony in the society (society being an extension of 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.

Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV **Understanding Harmony in the Nature and Existence - Whole existence as coexistence**

- Understanding the harmony in nature
- Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.
- Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V Implications of the above Holistic Understanding of Harmony on Professional Ethics

- 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 the 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 above production systems.
- Case studies of typical holistic technologies, management models and production systems.
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

Include practice exercises and case studies will be taken up in practice (tutorial) sessions eg. To discuss the conduct as an engineer or scientist etc.

OUTCOMES:

At the end of this course, the students would:

CO1: Become more aware of themselves, and their surroundings (family, society, nature).

CO2: Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: Have better critical ability.

CO4: Become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).

CO5: Be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

TEXT BOOK:

1. R R Gaur, R Sangal, G P Bagaria, “Human Values and Professional Ethics”, Excel Books, New Delhi, Second Edition 2019.

REFERENCES:

A Nagaraj, “Jeevan Vidya: Ek Parichaya”, Jeevan Vidya Prakashan, Amarkantak, 1999.

E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.

A.N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, Third Edition 2020.

Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited,Hyderabad, 2020.

Mahatma Gandhi, “Hind Swaraj or Indian Home Rule”, Maheswari Publications, Delhi 2020.

Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house ofRamakrishna Math, Kolkata, Thirty second edition 2018.

Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being “, Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.

Heaton, Dennis P. "The story of stuff." (2010): 553-556.

Gandhi, Mohandas Karamchand, “The storyof my experiments with truth: An autobiography”,Om Books International, 2018.

Andrews, Cecile, “Slow is beautiful: new visions of community, leisure, and joie de vivre”,New society publishers, 2006.

Kumarappa, Joseph Cornelius, “The economyofpermanence. CP”, All India Village IndustriesAssn., 1946.

22CB301	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Know the basic principles and operations of digital computers.
- Design Arithmetic and Logic Unit for various fixed- and floating-point operations.
- Develop pipeline architectures for RISC Processors.
- Understand Parallel Processor and Various Memory systems.
- Understand the peripheral devices and their characteristics.

UNIT I BASIC STRUCTURE OF COMPUTERS & MACHINE INSTRUCTIONS 9

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

UNIT II DATA REPRESENTATION & COMPUTER ARITHMETIC 9

Data representation: Signed number representation, fixed and floating-point representations, character representation. Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

UNIT III BASIC PROCESSING & CONTROL UNIT 9

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

UNIT IV PARALLEL PROCESSING & MEMORY 9

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency. Memory system design: Semiconductor memory technologies, memory organization. Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

UNIT V I/O SYSTEMS **9**

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

OUTCOMES: **TOTAL: 45 PERIODS**

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

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

CO2: Design Arithmetic and Logic Unit.

CO3: Perform fixed- and floating-point operations

CO4: Develop pipeline architectures for RISC Processors.

CO5: Understand Parallel Processor Architectures

CO6: Understand Various Memory systems & I/O interfacings.

TEXT BOOKS:

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 2017.
2. Computer Organization and Design: The Hardware/Software Interface,David A. Patterson and John L. Hennessy, 6th Edition, Elsevier / Morgan 2021
3. Computer Organization and Embedded Systems, Carl Hamacher, 6th Edition, McGraw Hill Ltd.,2012.

REFERENCES:

1. Computer Architecture and Organization, John P. Hayes,.3 rd Edition. McGraw Hill Education, 2017
2. Computer Organization and Architecture: Designing for Performance, William Stallings. 10th Edition, Pearson Education, 2017
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan. . 2nd Edition, Pearson Education, 2008

22CB302	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

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

UNIT I INTRODUCTION **6**

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 **6**

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 **6**

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

UNIT IV MACROECONOMIC REFORMS **6**

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.

UNITV POLICYGOVERANCE 6

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: 30 PERIODS

OUTCOMES:

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

- Become familiar with both principles of micro and macroeconomics.
- Understand about approaches to consumer behaviour and relationbetween production and cost function.
- Describe and discuss on interaction of product and factor market.
- Get awareness about importance and development of Indian economy and economic reforms.
- Have thorough knowledge in the areas of inflation, unemployment, monetary policy, fiscal policyand international trade.

TEXT BOOKS:

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

REFERENCES:

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

22GE201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course is designed 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 SangamAge - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas andother 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 beats - Archeological evidences - Gem stonetypes described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, AnimalHusbandry- 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

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

- Identify the role of weaving and ceramic technology in ancient Tamil Culture.
- Assess the design and construction technology ideas in the current Tamil society.
- Identify the different types of manufacturing technology used in Tamil society and their significance.
- Classify agricultural and irrigation technologies in ancient Tamil society and its currentrelevance.
- Discuss the fundamentals of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (inprint)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. 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)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

		L	T	P	C
22MA304	**COMPUTATIONAL STATISTICS**				
	(Computer Science and Business Systems)	3	0	2	4
	(Theory Course with Laboratory Component)				

OBJECTIVES:

The course is designed to:

- Extend the knowledge of univariate Normal distribution to the multivariate normal distributions.
- Introduce multivariate regression models.
- Understand the concepts of discriminant analysis
- Understand the concepts of principal component analysis,
- Discuss the concepts of factor and cluster analysis.

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 Exercise/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 Exercise/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 Exercise/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 Exercise/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 Exercise/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: Compute the variance and covariance using multivariate analysis.

CO3: Apply Discriminant analysis in data analytics.

CO4: Find the Principal components and factor analysis of the given data.

CO5: Implement the concepts of cluster analysis in data analytics.

TEXTBOOK:

1. Richard A Johnson, Dean W Wichern, “Applied Multivariate Statistical Analysis”, 6th Edition. Pearson Prentice hall of India 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 & sons, New Jersy, 2009.

2. J.D. Jobson, “Applied Multivariate Data Analysis”, Vol I & II, 1st Edition, Springer Science + Business Media, LLC, New York, 1992.

3 .M. Lutz, “Programming Python”, 4th Edition, O'Reilly Media, 2010.

Tim Hall and J.P Stacey, “Python 3 for Absolute Beginners”, 1st Edition, A press, 2009

		L	T	P	C
22CB303	**SOFTWARE DESIGN WITH UML**	**3**	**0**	**2**	**4**

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 **9**

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 **9**

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 **9**

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 **9**

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 **9**

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).

TOTAL:45 PERIODS

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 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.

TEXTBOOKS:

1. Software Engineering, Ian Sommerville, Addison Welsey Publishers, 9th edition.

2. Roger S. Pressman, "Software Engineering: A Practitioner's Approach" , McGraw Hill International Edition, Nineth 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.

22CB304 DATABASE MANAGEMENT SYSTEMS + LAB

L	T	P	C
3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the basic concepts of Database, why its required and what its benefits & advantage
- Applyeffective relational database design concepts.
- Know the fundamental concepts of transaction processing, concurrency controltechniques and recovery procedure.
- Howto efficiently model and design various database objects and entities
- Implement efficient data querying and updates, with needed configuration

UNIT I INTRODUCTION **9**

Introduction: Introduction to Database. Hierarchical, Network and Relational Models. **Database system architecture**: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models**: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT II RELATIONAL QUERY LANGUAGE **9**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS MYSQL, ORACLE, DB2, SQL server. **Relational database design**: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependencypreservation, Lossless design.

UNIT III QUERY PROCESSING AND STORAGE **9**

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. **Storage strategies**: Indices, B-trees, Hashing.

UNIT IV TRANSACTION PROCESSING **9**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT V DATA BASE SECURITY AND ADVANCED DATABASES 9

Database Security: Authentication, Authorization and access control, DAC, MAC andRBAC models, Intrusion detection, SQL injection. Object oriented and object relational, databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

TOTAL: 45 PERIODS

LIST OF EXERCISES:

Case Studyusing real life database applications, Perform the following task.

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), and functions for enabling enterprise grade features.
- Build PLSQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to show case ACID Properties with sample queries with appropriate settings

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Able to design and deploy an efficient & scalable data storage node for varied kind of application requirements

CO2: Map ER model to Relational model to perform database design effectively

CO3: Write queries using normalization criteria and optimize queries

CO4: Compare and contrast various indexing strategies in different database systems

CO5: Appraise how advanced databases differ from traditional databases

TEXT BOOKS:

1. Abraham Silberschatz, Henry F.Korth, S. System 7th Edition, McGraw Hill,2021.
2. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, 6th Edition, Pearson Education, 2017.

REFERENCES:

1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman, Computer Science Press,1988
2. Foundations of Databases. Serge Abiteboul, Richard Hull, Victor Vianu.

SEMESTER IV

22CB401	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND \ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- 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 Startup Models

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 SocialInnovation 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 ableto:

CO1: Understand the basics of Innovation andEntrepreneurship

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 Growth Navi Radjou,Jaideep Prabhu, Simone Ahuja , John Wiley & Sons , 2017

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/u se-innovation-to-grow-your- business/
4. http://sourcesofinsight.com/innovation-life-cycle/
5. https://www.investottawa.ca/
6. https://www.Lead-innovation.com

22CB402	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 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: Applythe concepts of market research and analyse data using statistical tools

CO5: Apply internet marketing strategies for businesses

TEXT BOOKS:

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler , 16th Ed. Pearson Education, 2022
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Management – V.S. Ramaswamy and S. Namakumari, Macmillan,2005
4. Marketing Research – Rajendra Nargundkar, 4th Ed. McGraw Hill Limited, 2019
5. Market Research – G.C. Beri, 6th Ed., McGraw Hill Limited, 2020
6. Market Research, Concepts, & Cases – Cooper Schindler, McGraw Hill LTD,2010

REFERENCES:

1. Marketing Management – Rajan Saxena, 6th Ed., McGraw Hill Limited, 2020
2. Marketing Management – S.A. Sherlekar, Himalaya Publishing House, 2022
3. Service Marketing – S.M. Zha, 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. Business Statistics, A First Course, David M Levine at al, Pearson Publication , 7thEd., Pearson Education, 2021

22IT403 WEB DEVELOPMENT FRAMEWORKS 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
   - Permiter of an Rectangle
   - Employ Arrow functions
   - Employ HOC

UNIT III REACT COMPONENTS 9+6

Class vs Functional Components, React Class Based Components – component Did Mount, Will Update, shouldupate, didcatchetc - State - Use State, Use Ref, USe Effect ,Use History Usage and Props(difference, when to use what, mutable or immutabilty, direction of flow), Prop Types, 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 - State Less, State Full and Container Components, Error Handling - Build, Env, CORS, Unit Testing w React Testing Library - Introduction to react-native - Introduction to Story Book

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 use ref, use effect &use state, and use History

1) Enable Exception Handling
2) Enable HOC and Aux Components
3) Implement React-Testing Library

Business Use Case Implementations

1) Student Management System
2) Retail Bank System
3) e Commerce 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 , prop Types

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) David Flanagan, Java script The Definitive Guide, Paperback, 7th Edition, 2020

2) David Choi ,Full-Stack React, Type Script, 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

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 Kirupa Chinnathambi

5. "React Up & Running" by StoyanStefanov

6. https://www.edureka.co/reactjs-redux-certification-training

ONLINE LEARNING PLATFORMS:

- CodePen,
- CodeSandbo

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

L	T	P	C
3	0	2	4

OPERATING SYSTEMS + LAB

22CB403

OBJECTIVES:
The Coursewillenable 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, Dinning 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

CO4: Analyse process synchronization and deadlock problems

CO5: Apply various memory management techniques to given situation

CO6: Apply various file management techniques

TEXT BOOKS:

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

REFERENCES:

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

22CB404	DESIGNAND ANALYSIS OF ALGORITHMS	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 and greedy technique for solving various problems.
- Apply iterative improvement technique to solve optimization problems.
- Examine the limitations of algorithmic power and handling it in different problems.

UNIT I INTRODUCTION 9+6

Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

UNIT II FUNDAMENTAL ALGORITHMIC STRATEGIES 9+6

Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

UNIT III GRAPH AND TREE ALGORITHMS 9+6

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT IV TRACTABLE AND INTRACTABLE PROBLEMS 9+6

Computability of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques

UNIT V ADVANCED TOPICS 9+6

Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Analyse the efficiency of recursive and non-recursive algorithms mathematically

CO2: Analyse the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques.

CO3: Implement and analyse the problems using dynamic programming and greedy technique algorithmic techniques.

CO4: Solve the problems using iterative improvement technique for optimization.

CO5: Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound technique.

TEXT BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2021.
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. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, 2012

		L	T	P	C
22MA404	**OPERATIONS RESEARCH** (Computer Science and Business Systems) **(Theory Course with Laboratory Component)**	3	0	2	4

OBJECTIVES:

The course is designed to:

- Introduce the concept of operation research.
- Provide knowledge in using optimization techniques under limited resources.
- Handled balanced and unbalanced transportation problems.
- Impart the basic knowledge of inventory control.
- Impart the basic knowledge of queueing theory.

UNIT I INTRODUCTION 15

Introduction to OR: Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs Stochastic optimization, Phases of OR problem approach - problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution. LINEAR PROGRAMMING: Linear programming - Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Geometric method: 2-variable case, Special cases - infeasibility unboundedness, redundancy & degeneracy.

List of Exercise/Experiments using TORA:

1. Find the basic feasible solution for Linear equation using Graphical method.
2. Find the degenerate solution for Linear equation using Graphical method.

UNIT II SIMPLEX METHODS 15

Simplex Algorithm - slack, surplus & artificial variables, computational details, big-M method, identification, and resolution of special cases through simplex iterations. Duality - formulation, results, fundamental theorem of duality, dual simplex and primal-dual algorithms

List of Exercise/Experiments using TORA:

1. Finding solution for Linear Programming Problem using Simplex method.
2. Finding solution for Linear Programming Problem using Penalty method.
3. Using Duality method, find the solution for LPP.

UNIT III TRANSPORTATION AND ASSIGNMENT PROBLEMS 15

TP - Examples, Definitions - decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods - NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.AP - Examples, Definitions - decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method - Hungarian, test for optimality (MODI method), degeneracy & its resolution. PERT - CPM: Project definition, Project scheduling techniques - PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles.

List of Exercise/Experiments using TORA:

1. Finding the minimum total cost using Transportation.
2. Finding the minimum total cost for Allocating a Job to Machine using Assignment.
3. Estimation a project time and its variance using PERT.
4. Finding critical path,latest finish, earliest start, total float, free float.

UNIT IV INVENTORY CONTROL 15

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models -EOQ, POQ. EOQ models for discrete units, Special cases of EOQ models for safety stock with known / unknown stock out situations.

UNIT V QUEUEING THEORY 15

Definitions - queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples- M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

List of Exercise/Experiments using TORA:

1. Finding queue length, queue system, waiting time in queue and waiting time in system in 4 models.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand the decision-making environments and formulate LPP .

CO2: Use the optimization techniques for solving LPP.

CO3: Solve the Transportation Models and Assignment Models.

CO4: Manage inventory for known / unknown stock.

CO5: Compute performance measure of queues,

TEXTBOOKS:

1.Handy A. Taha, "Operations Research: An Introduction", 10th Edition. University of Arkansas. 2019, Pearson

2.K.G. Murthy, "Linear Programming". 1st Edition January 16, 1991, Wiley

REFERENCES:

1. G. Hadley, "Linear Programming", 1 January 2002, Narosa publishers.
2. H.M. Wagner, "Principles of OR with Application to Managerial Decisions".
3. F.S. Hiller and G.J. Lieberman, "Introduction to Operations Research". 11th Edition 2021, MC Graw Hill.
4. Thomas L. Saaty, "Elements of Queuing Theory",1961, New York, McGraw-Hill.
5. A. Ravi Ravindran (Edited) "Operations Research and Management Science", Handbook, Dec 5, 2007, Taylor and Francis.
6. Wiest and Levy Management, "Guide to PERT/CPM", 2nd Edition, Prentice -Hall.
7. J.W. Prichard and R.H. Eagle, "Modern Inventory Management", New York, Wiley.

22CB925	MANAGEMENT INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course is designed to:

- Management Information Systems (IS) enables new approaches to
- Improve efficiency and efficacy of business models.
- This course will equip the students with understanding of role, advantages and components of an Information System.
- help students integrate their learning from functional areas, decision making process in an organization and
- Understand role of Information Systems to have a vintage point in this competitive world.

UNIT I **Basic Concepts of MIS** **9**

Role of data and information, Organization structures, Business Process, Systems Approach and introduction to Information Systems.

UNIT II **Types of MIS** **9**

Resources and components of Information System, integration and automation of business functions and developing business models. Role and advantages of Transaction Processing System, Management Information System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems.

UNIT III **Architecture & Design of MIS** **9**

Architecture, development and maintenance of Information Systems, Centralized and Decentralized Information Systems, Factors of success and failure, value and risk of IS.

UNIT IV **Decision Making Process in MIS** **9**

Programmed and non-programmed decisions, Decision Support Systems, Models and approaches to DSS

UNIT V **QUEUEING THEORY** **15**

Definitions - queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples- M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

List of Exercise/Experiments using TORA:

1. Finding queue length, queue system, waiting time in queue and waiting time in system in 4 models.

TOTAL: 75 PERIODS

OUTCOMES:

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

CO1: Understand the decision-making environments and formulate LPP .

CO2: Use the optimization techniques for solving LPP.

CO3: Solve the Transportation Models and Assignment Models.

CO4: Manage inventory for known / unknown stock.

CO5: Compute performance measure of queues,

TEXTBOOKS:

1.Handy A. Taha, "Operations Research: An Introduction", 10th Edition. University of Arkansas. 2019, Pearson

2.K.G. Murthy, "Linear Programming". 1st Edition January 16, 1991, Wiley

REFERENCES:

8. G. Hadley, "Linear Programming", 1 January 2002, Narosa publishers.
9. H.M. Wagner, "Principles of OR with Application to Managerial Decisions".
10. F.S. Hiller and G.J. Lieberman, "Introduction to Operations Research". 11th Edition 2021, MC Graw Hill.
11. Thomas L. Saaty, "Elements of Queuing Theory",1961, New York, McGraw-Hill.
12. A. Ravi Ravindran (Edited) "Operations Research and Management Science", Handbook, Dec 5, 2007, Taylor and Francis.
13. Wiest and Levy Management, "Guide to PERT/CPM", 2nd Edition, Prentice -Hall.
14. J.W. Prichard and R.H. Eagle, "Modern Inventory Management", New York, Wiley.

SEMESTER V

		L	T	P	C
22CB501	**FUNDAMENTALS OF MANAGEMENT**	3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- The course will cover the management theories, evolution of management over the years and few basic concepts without going into the details.
- To expose the students to know the functions of management, the organizational design, leadership and ethics in management.

UNIT I MANAGEMENT THEORIES 9

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880- 1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-onward). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

UNIT II FUNCTIONS OF MANAGEMENT & LEADERSHIP 9

Planning, Organizing, Staffing, Directing, Controlling, Leadership - Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

UNIT III ORGANIZATION BEHAVIOR 9

Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity.

UNIT IV ORGANIZATIONAL DESIGN 9

Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure).

UNIT V MANAGERIAL ETHICS 9

Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the theories, concept, and evolution of management.
CO2: Demonstrate the ability to employ 'the management wayof thinking'.
CO3: Understand how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc.
CO4: Understand the qualities of a leader in the managerial aspect in future terms. CO5: Understand the managerial ethics and CSR and its importance.

TEXT BOOKS:

1.Richard L. Daft, Understanding the Theory and Design of Organization, Cengage Learning India Private Limited, Eleventh Edition, 2020.

REFERENCES:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior, Eighteenth Edition, Pearson India, 2019.

		L	T	P	C
22CB502	**BUSINESS STRATEGY**	3	0	0	3

OBJECTIVES:

The Course will enable learners to:

- Determine the concept and process ofstrategic management.
- Analyze the internal and external environment.
- Formulation of strategies, implementation and evaluation of strategies.
- The course will cover case studies and latest business events.

UNIT I INTRODUCTION TO STRATEGIC MANAGEMENT 9

Importance of Strategic Management - Vision and Objectives - Schools of thought inStrategic Management - Strategy Content, Process, and Practice - Fit Concept and Configuration Perspective in Strategic Management

UNIT II INTERNAL ENVIRONMENT OF FIRM- RECOGNIZING A FIRM'S INTELLECTUAL ASSETS 9

Core Competence as the Root of Competitive Advantage - Sources of Sustained Competitive Advantage - Business Processes and Capabilities-based Approach to Strategy

UNIT III EXTERNAL ENVIRONMENTS OF FIRM- COMPETITIVE STRATEGY 9

Five Forces of Industry Attractiveness that Shape Strategy - The concept of Strategic Groups, and Industry Life Cycle - Generic Strategies - Generic Strategies and the Value Chain

UNIT IV CORPORATE STRATEGY, AND GROWTH STRATEGIES 9

The Motive for Diversification - Related and Unrelated Diversification – Business ortfolio Analysis - Expansion, Integration and Diversification - Strategic Alliances, Joint Ventures, and Mergers & Acquisitions.

UNIT V STRATEGY IMPLEMENTATION: STRUCTURE AND SYSTEMS 9

The 7S Framework - Strategic Control and Corporate Governance

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Become familiar with both internal and external environment. Theywould also become familiar with corporate and growth strategies, appreciate implementation of such strategies

CO2: Learn the fundamentalconcepts of strategic management to analyse business situations and apply these concepts to solve business problems.

CO3: Understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, and HR and information technology.

CO4: Apply the inter-relationships of business to individuals, other organizations, government and society.

CO5: Analyze complex, unstructured qualitative and quantitative problems, using appropriate tools.

TEXT BOOKS:

1. Robert M. Grant, Contemporary Strategic Management, Blackwell, 7th Edition, 2012.
2. D N Dwivedi, Managerial Economics, 8th Edition, Vikas Publishing House, 2018.

REFERENCES :

1. Richard Rumelt, Competitive Advantage, 2011
2.Kazmi, Azhar, Business Policy and Strategic Management, Third Edition, TataMcGrawhill, New Delhi, 2008.

22CB503	COMPUTER NETWORKS + LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the concepts ofdata communications and networking.
- Understand data link layer and its various services.
- Learnthe functions of network layer and various routing protocols.
- Familiarize the functions and protocols ofthe transport layer.
- Understand various application layer services and the network security

UNIT I INTRODUCTION 9

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 9

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 9

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 9

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 9

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:

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

22CB504	DESIGN THINKING	L	T	P	C
		2	1	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: 60 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 Senor 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.
Corral, Luis & Fronza, Ilenia, "Design Thinking and Agile Practices for Software Engineering: An Opportunity for Innovation", 2018.

SEMESTER –VI

22CB601	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 that once a year, Annuity Factor.

UNIT II VALUATION OF SECURITIES 9

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common StockValuation, 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:

Uponcompletion 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 management.
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.

TEXT BOOKS:

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGrawHill, 2017. 2. Srivastava, Misra: Financial Management, OUP, 2021

REFERENCES:

1. Van Horne and Wachowicz : Fundamentals of Financial Management, PrenticeHall/ Pearson Education, 2022
2. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14thedition, 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., 10thedition, 2012.

22CB602	INFORMATION SECURITY	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 PRORAMMING 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:

Uponcompletion of the course, the students will be able to:

CO1: Implement of information securityand its parameters.
CO2: Implement various access control models and securitypolicies.
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.

.

22CB603	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand the main approaches to artificial intelligence.
- Explore areas of application such as knowledge representation, natural language processing and expert systems.
- Develop abilities to apply, build and modify decision models to solve real problems.
- Design good evaluation functions and strategies for game playing
- Discuss the core concepts and algorithms of searching

UNIT I INTRODUCTION 9

Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT II SEARCH TECHNIQUES 9

Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT III CONSTRAINT SATISFACTION PROBLEMS 9

Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT IV KNOWLEDGE & REASONING 9

Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge

UNIT V PROBABILISTIC REASONING 9

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS:

1. Implement heuristics, optimal search, and graph heuristics.

2. Constraint satisfaction problems
3. k-nearest neighbors
4. Decision trees.

TOTAL: 30 PERIODS

OUTCOMES:

Uponcompletion of the course, the students will be able to:

CO1: Demonstrate fundamental understanding of artificial intelligence (AI) and its problem solving techniques
CO2:Explain how Artificial Intelligence enables capabilities that are beyond conventional technology
CO3:Implement and execute searching in AI
CO4:Understand how to represent the knowledge and its approaches
CO5:Acquaint the Artificial Intelligence techniques for building well-engineered and efficient intelligent systems.

TEXT BOOKS:

1. Stuart J. Russell, Peter Norwig , "Artificial Intelligence –A Modern approach", 3rd Pearson Education, 2016
2. Ritch & Knight, "Artificial Intelligence", Third Edition, Tata McGraw Hill, 2009

REFERENCES:

1. . Patterson, "Introduction to Artificial Intelligence & Expert Systems", First Edition, Pearson, 2015
2. Saroj Kaushik, "Logic & Prolog Programming", First Edition, New Age International, 2008.

		L	T	P	C
22CB604	**IT WORKSHOP USING SCILAB/Matlab**	1	0	2	2

OBJECTIVES:

- To introduce the students with the basic features of MATLAB for problem solving.
- To introduce the students about the Mathematical functions like matrix generation.
- To introduce the students about the Mathematical functions like Plotting with multiple data sets, line styles and colors.
- To introduce the students about the Array operations and solving Linear equations in MATLAB.
- To introduce the students about the control flow and operators using ifend structures and loops.

UNIT I INTRODUCTION TO MATLAB 3+6

Introduction to MATLAB: History, basic features, strengths and weaknesses, good programming practices and plan your code.

Working with variables, workspace and miscellaneous commands: Creating MATLAB variables, overwriting variable, error messages, making corrections, controlling the hierarchy of operations or precedence, controlling the appearance of floating point number, managing the workspace, keeping track of your work session, entering multiple statements per line, miscellaneous commands.

LIST OF EXPERIMENTS:

1. Programs using mathematical, relational expressions and the operators.

2. Programs on input and output of values.

UNIT II MATRIX, ARRAY AND BASIC MATHEMATICAL FUNCTIONS 3+6

Matrix generation, entering a vector, entering a matrix, matrix indexing, colon operator, linear spacing,

creating a sub-matrix, dimension, matrix operations and functions matrix generators, special matrices, array and array operations, solving linear equations, other mathematical functions.

LIST OF EXPERIMENTS:

1. Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
2. Programs based on two main data structures: cell arrays and structures.
3. Programs based on Data Transfer.

UNIT III BASIC PLOTTING 3+6

Overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours.

LIST OF EXPERIMENTS:

1. Programs based on Advanced Functions.
2. Introduction to Object-Oriented Programming and Graphics.
3. Programs based on Advanced Plotting Techniques.

UNIT IV INTRODUCTION TO PROGRAMMING 3+6

Introduction to programming: Introduction, M-File Scripts, script side-effects, M-File functions, anatomy of a M-File function, input and output arguments, input to a script file, output commands.

Control flow and operators: "if ... end" structure, relational and logical operators, "for ... end" loop, "while ... end" loop, other flow structures, operator precedence, saving output to a file.

LIST OF EXPERIMENTS:

1. Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
2. Loop Statements and Vectorizing Code: Programs based on the concepts of counted (for) and conditional (while) loops.
3. Programs based on scripts and user-defined functions.
4. Programs on Built-in text manipulation functions and conversion between string and number types.

UNIT V DEBUGGING M-FILES 3+6

Debugging process, preparing for debugging, setting breakpoints, running with breakpoints, examining values, correcting and ending debugging, correcting an M-file.

LIST OF EXPERIMENTS:

1. Programs based on sound files and image processing.
2. Programs based on Advanced Mathematics. Perform all the experiments by Implementing the various Image Processing Algorithms

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Write fundamental programs in MATLAB, creating variables and mathematical functions.
CO2: Understand how to program matrix operations, array operations and how to solve the system of linear equations.
CO3: Program the fundamentals concepts of basic Plotting consisting of simple and multiple data sets in

one plot.
CO4: Understand how to program M-file scripts, M- file functions, Input –output Arguments and program control flow operators, loops, flow structures.
CO5: Use the debugging process and debugging M-files.

TEXT BOOKS:

1. Digital Image Processing using MATLAB. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2020.
2. MATLAB: A Practical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann, 2019

REFERENCES:

1. https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/moler/exm/book.pdf
2. https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart. pdf

22CB701	**HUMAN RESOURCE MANAGEMENT**	**L**	**T**	**P**	**C**
		3	0	0	3

OBJECTIVES:

- Tounderstand 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 9

Concept and Challenges, HR Philosophy, Policies, Procedures and Practices.

UNIT II HUMAN RESOURCE SYSTEM DESIGN 9

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 9

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 9

Demand Forecasting, Action Plans– Retention, Training, Redeployment & Staffing,

Succession Planning

UNIT V STRATEGIC MANAGEMENT OF HUMAN RESOURCES 9

SHRM, relationship between HR strategyand overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace

TOTAL: 45 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 BOOKS:

1. . Gary Dessler, Human Resource Management, PearsonIndia, 2019

REFERENCES:

1. . Pravin Durai, Human Resource Management, Pearson India Education Services, 2016

2. Nipun Sharma, Human Resource Management Theory and Practice, R.C.Sharma, Sage Publications India PVT., Ltd., 2018

22CB702	IT PROJECT MANAGEMENT	L	T	P	C
		3	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 9

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 9

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 9

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 9

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 9

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: 45 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 BOOKS:

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

REFERENCES:

1. Roman Pichler, Agile Product Management with Scrum, Addison-Wesley Signature Series, 2020

2. Ken Schwaber, Agile Project Management with Scrum(Microsoft Professional)

PROFESSIONAL ELECTIVE I

22CB901	CONVERSATIONAL SYSTEMS	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 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 programto calculate the bigrams from a given corpus and calculate probability of a sentence.
3. A python program to do sentiment ana

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 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

1. 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

1. 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 BOOKS:

1. Michael McTear, "Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Moran and Claypool Publishers, Second Edition, 2020.
2. MATLAB: A Practical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann, 2019

REFERENCES:

1. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY, 2016.

22CB902	ROBOTICS AND EMBEDDED SYSTEMS	L	T	P	C
		2	0	2	3

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 roboticsCognitive 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 maturerobots 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:

1. Build a Self-Driving Robot that can automatically follow a line
2. Build a basic obstacle-avoiding robot and improve the design to help it avoid getting stuck
3. 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 BOOKS:

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.

22CB903	MACHINE LEARNING	L	T	P	C
		2	0	2	3

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 6+6

Machine Learning – Types – Applications – Preparing to Model – Activities – Data – Exploringstructure 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 – OptimalHyperplane – 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 correctand 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 datasets.
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 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", SecondEdition,
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

22CB904 ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	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.
- Studythe 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 andknowledge, 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 andinconsistencies; 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 BOOKS:

1. N. Wilkinson and M. Klaes , "An Introduction to Behavioral Economics", 2022.

2. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and AnindyaSen, "Economics",19th Edition, Tata McGraw Hill, 2010.

REFERENCES:

1. M.L.Trivedi, "Managerial Economics:Theory & Applications", Tata McGraw-Hill Education,4th Edition, 2022.

2. Robert H. Frank, "Microeconomics and Behaviour", McGraw-Hill, 9th Edition, 2014.

22CB905	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 BOOKS:

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.

22CB906	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, EvaluatingEmployee 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, TheOrganization 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 personneldecisions.

CO3:Gain practical experience by completing a series of hands-on projects involving jobanalysis, selection decisions, training programs, and employee well-being.

CO4:Deepen your understanding of tests and measurements so that you can collectaccurate information and make sound data-based decisions.

CO5:Prepare for other focused seminar courses in Industrial/OrganizationalPsychology 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.

22CB907	CLOUD, MICROSERVICES & APPLICATION	L	T	P	C
		2	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 6

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 6

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 6

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 6

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 6

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: 30 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. Performthe 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.

22CB908 DATA MINING AND ANALYTICS	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. LiorRokach 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.

22CB909 COMPILER DESIGN	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 SYTNAX 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.

22CB910	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. **Sample**

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

UNIT II ENTERPRISE SYSTEMS ARCHITECTURE,KEY CHARACTERISTICS, APPLICATIONS **9**

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

UNIT III ARCHITECTURE PATTERNS, INTEGRATION TECHNIQUES **9**

Application architecture Patterns: Layering, Organizing domain logic, Mapping to database, Web Presentation, Concurrency.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 RESTFulwebservices integration.Differences between SOAP and REST.

UNIT IV CLOUD COMPUTING IN ENTERPRISE SYSTEMS **9**

Deployment of Enterprise applications: Key requirements in deployment - Stability, capacity, Security, availability, Network, Availability, and Transparency (Basic Introduction only).**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 CLOUD APPLICATION DEVELOPMENT AND DEPLOYMENT **9**

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

to Enterprise Architecture: Importance of Enterprise Architecture. Enterprise architecture models.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 midsized municipal government

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion 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: Understand Enterprise Patterns CO4:To Develop enterprise applications

CO5: Understand future trends in Enterprise architectures.

TEXT BOOKS:

1. Martin Fowler et al, "Pattern of Enterprise Application Architecture", Addison-Wesley, 2012
2. Mark Richards, Software Architecture patterns, 2015, O'Reilly.

REFERENCES:

1. Ravi Shankar & S. Jaiswal, Galgotia, "Enterprise Resource Planning", 1 st Edition, 1999.
2. Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3rd Edition, 2017.

22CB911	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

22CB912	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, 2ndEdition, 1995

22CB920	Services Science & 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 & 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

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:

1.Service And Operations Management, 9 February 2018 by Cengiz Haksever and Barry Render
2.B. Fitzsimmons, James A., and Mona J. Fitzsimmons,Service Management: Operations,Strategy, and Information

Technology, 6th Ed., Irwin/McGraw-Hill, 2017.
3. C. Haksever, Render B., Russel S. R. and Murdick R. G.,Service Management and Operations, 2nd Ed.,Prentice Hall, 2017.
4.Daskin, M. S., 2018, Service Science, John Wiley, New York, NY

References:

Chang, C. M., 2010, Service Systems Management and Engineering: Creating Strategic Differentiation and Operational Excellence, John Wiley, New York, NY.

Davis, M. M. and J. Heineke, 2003, Managing Services: Using Technology to Create Value, McGraw Hill Irwin, Boston, MA.

Fitzsimmons, J. A. and M. J. Fitzsimmons, 2004, Service Management: Operations, Strategy and Information Technology, Irwin/McGraw Hill, Boston.

Johnson, R. and G. Clark, 2008, Service Operations Management: Improving Service Delivery, Prentice Hall Financial Times, Harlow, England.

Katzan, J., 2008, Service Science: Concepts, Technology and Management, iUniverse, Inc., New York.

Metters, R., K. King-Metters, M. Pullman, 2003, Successful Service Operations Management, 2003, Thomson South-Western, Australia.

HONOURS BUSINESS ANALYTICS

Python for Business Analytics

L	T	P	C
2	0	2	3

22CB902

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 AnacondaBasic 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

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:

"Data Science for Business" by Foster Provost and Tom Fawcett
"Python for Data Science Handbook" by Jake VanderPlas
"Hands-On Exploratory Data Analysis with Python" by Suresh Kumar Mukhiya and Usman Ahmed.

References:

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

22CB921 **BIG DATA ANALYTICS**

L	T	P	C
2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Learnthe 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 DataValue, 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, Architecturefor Big Data Analysis - Real- Time vs. Offline Analysis, Analysis at Different Levels, Analysiswith 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 anytwo case studies for Big Data Applications

TOTAL: 30+30 PERIODS

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: RelatedTechnologies,Challenges and Future Prospects,* Springer; 2014.
2. Tom White, *Hadoop- The Definitive Guide,* 4th Edition, O'reilly, 2015.

REFERENCES:

1. Eric Sammer, *Hadoop Operations,* 2 nd 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/flash bookunderstanding big data analytics for enterprise class hadoop and streaming data? lang en

		L	T	P	C
22CB922	**BUSINESS INTELLIGENCE**	**2**	**0**	**2**	**3**

OBJECTIVES:

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. Analyse 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

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, What If Analysis and Goal Seeking – Decision Analysis

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 Business Analytics Model – Business Analytics at the Strategy Level – Link between Strategy and Deployment – Strategy and Business Analytics – Priority – Developmentand Deployment

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 97 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, DursunDelen, Efraim Turban, "Business Intelligence, Analytics,and DataScience: AManagerial Perspective", Pearson, 4th Edition, 2018.
2. JesperThorlund&Gert H.N. Laursen, "Business Analytics for Managers:TakingBusiness Intelligencebeyond Reporting, Wiley, 2010.

REFERENCES:

1. Shmueli, Patel, and Bruce: Wiley, Data Mining for Business Intelligence,Concepts,Techniques andApplications, Wiley, 2010
2. R.N.Prasad and Seema Acharya, "Fundamentals of Business Analytics", 2ndEdition, Wiley, 2016.

		L	T	P	C
22CB914	**COGNITIVE SCIENCE AND ANALYTICS**	2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To study the basic concepts and approaches in the field of cognitive science
- Toapply the concepts of planning, reasoning and learning models in cognitiveapplications
- Toanalyzelanguage and semantic models of cognitive process.

UNIT I **Introduction to Cognitive Science** **6+6**

Fundamental Concepts of cognitive science Computers in Cognitive Science Applied Cognitive Science-The Interdisciplinary Nature of Cognitive Science Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology-Understanding, Common Sense Reasoning.

List of Exercise/Experiments:

1. Implement a case study for ontology

UNIT II **Planning and Learning Methods** **6+6**

Planning Situation Logic- Learning in Cognitive Systems- Rote Learning Learning by Examples - Incremental Concept Learning Inductive Learning - Classification Techniques Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.

List of Exercise/Experiments:

1. Implement Bayesian Classification

UNIT III **Reasoning methods** **6+6**

Reasoning by analogy Explanation based reasoning Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning Temporal Constraint Networks- Spatial reasoning- Visual Spatial reasoning- Meta reasoning Learning by correcting mistakes- AI ethics

List of Exercise/Experiments:

1. Implement Constraint Satisfaction Problem
2. Implement Spatial Reasoning

UNIT IV **Cognitive Modeling** **6+6**

Declarative/ logic-based computational cognitive modelling - connectionist models of cognition - Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory -modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning. Distributed Cognition and Learning- Simple and Complex Decision Making - Reasoning Under Uncertainty -Natural Language: Understanding Natural Language Processing -Automated Natural Language Generation

List of Exercise/Experiments:

1. Implement a cognitive modeling for anyreal time problem.
2. Implement Natural Language Processing and generate an automated natural language for statements given

UNIT V **Modeling Paradigm** **6+6**

Modelling Select Aspects of Cognition Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis. Knowledge Acquisition Semantics in Cognitive Science-Meaning and Entailment Cognitive and Computational Models of Semantic Processing Information Processing Models of the Mind- Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes- Dynamical systems and situated cognition

List of Exercise/Experiments:

1. Implement a neural network model

TOTAL: 30+30 PERIODS

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

CO1: Understand the basic concept of cognitive science
CO2: Learn and understand the learning model and apply the same to appropriate real world applications
CO3: Applyreasoning methodology to real world applications
CO4: Envisage the concept of cognitive learning
CO5: Acquireknowledgein language processing and understanding

Text Books:

1. Jose Luis Bermudez " Cognitive Science: An Introduction to the Science of the Mind" ,Cambridge University Press, New York, 2014.
2. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.
3. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence" , Third Edition, Tata McGraw-Hill Education, 2012.

References:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Publishers, 2015
2. Paul Miller, "An Introduction Course in Computational Neuroscience", MIT Press,2018
3. Jerome R.Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed), "The Oxford Handbook of Computational and Mathematical Pshycology" ,Oxford University Press , 2015.
4. Neil Stillings, Steven E. Weisler, Christopher H. Chase "Cognitive Science " An Introduction", Second Edition MIT Press, 1995/

HONOURS
FINTECH AND BLOCKCHAIN

22CB924	FINANCIAL AND COST ACCOUNTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Create an awareness about the importance and usefulness of the accounting concepts and their managerial implications
- Develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements
- Create an awareness about cost accounting, different types of costing and cost management

UNIT I ACCOUNTING CONCEPT **6+6**

Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements.

List of Exercise/ Experiments:

1. Prepare a Financial Statement for any concern and interpret the statements.

UNIT II ACCOUNTING PROCESS **6+6**

Book Keeping and Record Maintenance, Fundamental Principles and Double Entry Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts, Cash Book and Subsidiary Books, Rectification of Errors

List of Exercise/ Experiments:

2. Prepare balance sheet for the above financial statement prepared

UNIT III FINANCIAL STATEMENT **6+6**

Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud

List of Exercise/ Experiments:

3. A Case Study of Satyam.

UNIT IV CASH FLOW AND FUND FLOW TECHNIQUES **6+6**

Introduction, How to prepare cash flow and fund flow, Difference between them. Costing , Systems: Elements of Cos Cost Behavior, Cost Allocation, OH Allocation Unit Costing, Process Costing, Job Costing, Absorption Costing, Mar Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis, Class Discussion: Application of costing concepts in the Service Sector.

List of Exercise/ Experiments:

4. Implement various Cost Analysis

UNIT V COMPANY ACCOUNTS AND ANNUAL REPORTS **6+6**

Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.

List of Exercise/ Experiments:

5. Prepare audit report and identify the pitfalls.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Understand the theories, concept, and evolution of management.

CO2: Demonstrate the ability to employ the management way of thinking.

CO3: Understand how organizations work and find it easier to grasp the intricacies of other management areas such as finance, marketing, strategy etc.

CO4: Understand the qualities of a leader in the managerial aspect in future terms.

CO5: Understand the managerial ethics and CSR and its importance.

TEXTBOOKS:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, "Accounting: Texts and Cases", Thirteenth Edition, McGraw-Hill, 2017.
2. M.Y.Khan & P.K.Jain, "Management Accounting", Tata McGraw Hill, 2011.

References:

1. R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi, 2011.
2. Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", Fifteenth Edition, Tata McGraw Hill Publishers, 2010.

22CB926	ADVANCE FINANCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Imbibe knowledge about the decisions and decision variables involved with financial activities of the firm.
- Develop skills for interpretation business information and application of financial theory in corporate investment decisions, with special emphasis on working capital management.
- Familiarizing the students with the corporate and financial restructuring.

UNIT I SOURCE OF FUNDS 9

Sources of Funds (including regulatory framework) Types of securities- Issuing the capital in market- Pricing of issue - Valuation of Stocks and bonds Dividend Decisions: Traditional Approach, Dividend Relevance Model, Miller and Modigliani
Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split.

UNIT II EVALUATION OF LEASE CONTRACTS 9

Evaluation of Lease Contracts- Corporate Restructuring -Mergers and Acquisitions- Types of Mergers, Evaluation of Merger Proposal-Take-over-Amalgamation- Leverage buy-out-Management buy-out-Corporate Failure and Liquidation.

UNIT III FINANCIAL RESTRUCTURING 9

Share Split – Consolidation -Cancellation of Paid-up Capital -Other Mechanisms

UNIT IV WORKING CAPITAL MANAGEMENT 9

Working Capital Planning- Monitoring and Control of Working Capital-Working Capital Financing -Managing the Components of Working Capital- Cash Management- Receivable Management -Inventory Management.

UNIT V INTRODUCTION TO DERIVATIVES 9

Basics of Futures, Forwards, Options, Swaps -Interest rate Payoff Diagrams, Pricing of Futures, Put Call Parity, Option Pricing using Binomial Model and Black Scholes Model -Use of Derivatives for Risk-Return Management- Credit Default Swaps

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the sources of funds including regulatory framework. CO2: Understand the Corporate Restructuring.

CO3: Develop skills for the interpretation of business information and application of financial theory in corporate investment decisions.

CO4: Predict the working capital requirements of a concern.

CO5: Understand Basics of Derivatives

TEXT BOOKS:

1. John.C.Hull, Options, "Futures and other Derivative Securities", PHI Learning, 9th Edition, 2012.
2. Fred Weston, Kwang S Chung, Susan E Hoag Mergers, "Restructuring And Corporate Control", Pearson Education, 4th Edition.

REFERENCES:

1. I.M.Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 9th Edition, 2014.
2. Stulz, "Risk Management and Derivatives", Cengage Learning, 2nd Edition,2011

22CB927	INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- Understand working of Block chain Technology.
- List the advantages of block chain technology over other distributes techniques and discuss various cryptocurrency and their application.
- Identify challenges associated with Block chain and cryptocurrency.
- Support their project by integrating block chain technology concept.
- Design, build, and deploy applications based on Block chain Technology.

UNIT I INTRODUCTION TO BLOCKCHAIN 9

The growth of blockchain technology - Progress toward maturity Increasing interest, Distributed systems, the history of blockchain and Bitcoin - The events that led to blockchain , Electronic cash ,Blockchain - Blockchain defined, Blockchain architecture, Generic elements of a blockchain, Benefits, features, and limitations of blockchain, Types of blockchain. Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in blockchain, CAP theorem and blockchain.

List of Exercise/ Experiments:

Case study on the different block chain technology

UNIT II DECENTRALIZATION 9

Decentralization using blockchain, Methods of decentralization - Disintermediation, Contest-driven decentralization, Routes to decentralization - How to decentralize, Decentralization framework example, Blockchain and full ecosystem decentralization - Storage, Communication, Computing power and decentralization, Pertinent terminology- Smart contracts, Autonomous agents, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications. Cryptographic constructs and blockchain technology: Homomorphic encryption, Signcryption, Secret sharing, Commitment schemes, Zero-knowledge proofs, Different types of digital signatures, Encoding schemes ,Applications of cryptographic hash functions.

List of Exercise/ Experiments:

1. Implement Digital signature algorithm
2. Implement Homomorphic encryption

UNIT III INTRODUCING THE CONSENSUS PROBLEM 9

The Byzantine generals problem, Fault tolerance, State machine replication, FLP impossibility, Lower bounds on the number of processors to solve consensus, Analysis and design - Model, Processes, Timing assumptions, Classification, Algorithms - CFT algorithms, BFT algorithms, Choosing an algorithm - Finality, Speed, performance, and scalability.

List of Exercise/ Experiments:

1. Perform study on CFT and BFT algorithms

UNIT IV ETHEREUM 9

An overview, The yellow paper, Ethereum – a user's perspective, The Ethereum network - The mainnet ,Testnets ,Private nets ,Components of the Ethereum ecosystem - Keys and addresses ,Accounts ,Transactions and messages ,Ether cryptocurrency/tokens (ETC and ETH) ,The Ethereum Virtual Machine (EVM) - ,Execution environment ,The machine state ,The iterator function ,Smart contracts - Native contracts.

List of Exercise/ Experiments:

Implement few transactions using Ethereum

UNIT V HYPERLEDGER 9

Projects under Hyperledger - Distributed ledgers, Libraries ,Tools ,Domain-specific , Hyperledger reference architecture - Hyperledger design principles ,Hyperledger Fabric - Membership services,Blockchain services ,Smart

contract services ,APIs and CLIs ,Components ,Applications on blockchain, Consensus in Hyperledger Fabric ,The transaction lifecycle in Hyperledger Fabric ,Fabric 2.0 , Hyperledger Sawtooth - Core features ,Consensus in Sawtooth, Transaction lifecycle ,Components.

List of Exercise/ Experiments:

Perform case study in Hyperledger

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Describe the basics of Blockchain.

CO2: Explain decentralization and cryptographic primitives in the block chain.

CO3: Examine the consensus mechanisms of blockchain.

CO4: Illustrate blockchain using Ethereum platform.

CO5: Use the libraries and tools of the Hyperledger blockchain.

TEXTBOOKS:

1. Imran Bashir, "Mastering Blockchain", 3rd Edition, Packt Publishing, 2020.

References:

1. Daniel Drescher, "Blockchain Basics", 1st Edition, Apress, 2017

2. Vikram Dhillon & David Metcalf & Max Hooper, "Blockchain Enabled Applications: Understand the Blockchain Ecosystem and How to Make it Work for You", 1st Edition, Apress, 2017 3. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O′Reilly, 2015.

INTRODUCTION TO FINTECH

L	T	P	C
2	0	2	3

22CB911

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 **6+6**

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 **6+6**

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 **6+6**

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 **6+6**

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 **6+6**

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: Studythe future of FinTech Industry

TEXTBOOKS:

3. Susanne Chishti and Janos Barberis, "The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries", John Wiley, 1st Edition, 2016

4. 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

HONOURS
DIGITAL MARKETING

		L	T	P	C
22CB928	**SOCIAL MEDIA MARKETING**	2	0	2	3

OBJECTIVES:

Provides knowledge regarding social media advertising including strategy development usingvarious social media management tools and platforms.

UNIT I Why is social media marketing important 6+6

Introduction to social media advertising Developing Social Media strategy- Social Media Management Tools: How to Cut Posting Time in Half-Different types of Social Media Platforms

List of Exercise / Experiments

Case study on different social media platforms

UNIT II Facebook Marketing 6+6

Introduction to Facebook Marketing- Create Facebook Page and Cover Pages-Page Settings, Description and About Page- Post Formulas Guaranteed to Drive Engagement-Facebook Ads and Campaign- Types of Facebook Ads – In Depth Analysis- Facebook Engagement, Reporting and Insights- Facebook Analytics- How to Start a Facebook Ads Business/Agency

List of Exercise / Experiments

Perform Facebook analytics

UNIT III Twitter and LinkedIn 6+6

Introduction to Twitter Marketing- How Twitter Works- What Not to Do on Twitter- Ways to Get More Re Tweet- Steps to Optimize Your Profile- Hashtags to Increase Discoverability- Twitter Advertisement- Introduction to LinkedIn Marketing- Optimize Your LinkedIn Profile-LinkedIn for Advertisement- Reach Your Target Audience with LinkedIn-How to Get 500+ Connections and Why you Should- How to Make Sales on LinkedIn-Advanced LinkedIn Strategies for B2B Marketing

List of Exercise / Experiments

Case study on Twitter and Linkedln

UNIT IV YouTube- 6+6

Introduction to YouTube Marketing- YouTube Marketing Strategy-The Subscriber Advantage- Account Set Up, Optimization, Keyword Research and Video Structure- YouTube SEO, Thumbnails, Annotations and Cards- YouTube Promotion and Analytics- YouTube Monetarization

List of Exercise / Experiments

Case study on Youtube

UNIT V Instagram 6+6

How to Create an Instagram Business Profile- Optimize your Instagram Bio & Profile Image- Instagram Captions &Hashtags -Reposting Instagram Content- How to Increase your Instagram Followers & Exposure- Ways to Convert Instagram Followers to Sales & Leads- Sponsored Posts -Instagram Ads via Facebook -Instagram Analytics -Instagram Profile + Instagram Post Captions- Instagram Ads-Engagement + Instagram Algorithm- Instagram Stories+ Instagram Reels + IGTV-Shopping on Instagram

List of Exercise / Experiments

Case study on Instagram

TOTAL: 60 PERIODS

OUTCOMES:

CO1: Employ the important concepts of social media marketing
CO2: Practice the various theoretical aspects in Facebook marketing
CO3: Discuss the different ways of marketing using Twitter and LinkedIn

CO4: Illustrate YouTube marketing and optimization
CO5: Create Instagram business profile and promote business

Textbook & References:

- Crittenden, V., & Crittenden, W. (2015). Digital and social media marketing in business education: Implications for the marketing curriculum.
- Evans, L. (2010). Social media marketing: strategies for engaging in Facebook, Twitter &other social media. Pearson Education.
- Geho, P. R., &Dangelo, J. (2012).The evolution of social media as a marketing tool for entrepreneurs. The Entrepreneurial Executive, 17, 61.
- Heinze, A., Fletcher, G., Rashid, T., & Cruz, A. (Eds.). (2020). Digital and social media marketing: a results-driven approach. Routledge.
- Shen, C. W., Luong, T. H., Ho, J. T., &Djailani, I. (2019). Social media marketing of IT service companies: Analysis using a concept-linking mining approach. Industrial Marketing Management.
- Tuten, T. L., & Solomon, M. R. (2017). Social media marketing.Sage.

		L	T	P	C
22CB929	**WEB ANALYTICS**	2	0	2	3

UNIT I Introduction to Web Analytics: 6+6

Introduction to Web Analytics: core analytic concepts-why understanding your web traffic is important to your business - a brief history of web analytics-web analytic fundamentals and framework- types of website-techniques and technologies used in web analytic- what web analytics should be-different web traffic data sources- web analytic terminology- customer funnel and life cycle

List of Exercise / Experiments

Case study on the different web analytics framework

UNIT II Web Analytics 2.0 6+6

Web Analytics 2.0: rethinking web analytics: meet web analytics 2.0-the optimal strategy for choosing your web analytics soul mate-the awesome world of click stream analysis: metrics/practical solutions-the key to glory: measuring success- solving the "why" puzzle- web site tracking & tools: data sources- web logs Vs javascript tags

List of Exercise / Experiments

Perform website tracking for any one website.

UNIT III Google analytics 6+6

Google analytics: different analytical tools - key features and capabilities of Google analytics- how Google analytics works - implementing Google analytics - getting up and running with Google analytics -navigating Google analytics - using Google analytics reports -Google metrics - using visitor data to drive website improvement- focusing on key performance indicators- integrating Google analytics with third-party applications

List of Exercise / Experiments

Implement Google Analytics

UNIT IV Overview of Qualitative Analysis 6+6

Overview of Qualitative Analysis: Lab Usability Testing- Heuristic Evaluations- Site Visits- Surveys (Questionnaires)

Social Media Analytics: Facebook/Twitter

Testing and Experimentation: A/B Testing and Multivariate Testing-Competitive Intelligence Analysis

Search Analytics: Performing Internal Site Search Analytics, Search Engine Optimization(SEO) and Pay per Click (PPC)-Website Optimization against KPIs- Content optimization- Funnel/Goal optimization

Text Analytics: Natural Language Processing (NLP)- Supervised Machine Learning (ML) Algorithms-API and Web data scarping using R and Python

List of Exercise / Experiments

Implement web data scrapping

UNIT V Visual Analytics 6+6

Visual Analytics: Drill down and hierarchies-Sorting-Grouping- Additional Ways to Group- Creating Sets-Analysis with Cubes and MDX- Filtering for Top and Top N- Using the Filter Shelf- The Formatting Pane--Trend Lines- Forecasting- Formatting- Parameters

Social Network Analysis: Types of social network-Graph visualization-Network relationships-Network structures: equivalence-Network evolution-Diffusion in networks- Descriptive modeling-Predictive modeling-Customer profiling-Network targeting

List of Exercise / Experiments

Perform predictive modeling

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Understand the role of Web analytic in collecting, analyzing and reporting website traffic

CO2: Understand the importance of web analytic as a tool for e-Commerce, business research, and market research

CO3: Use ready-made web analytics tools (Google Analytics)

CO4: Understand and apply statistical programming language (R) and use its graphical development environment for data exploration and analysis

CO5: Develop proficiency in visual analytics

Textbooks & Reference Books:

1. AvinashKaushik, (2009), Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, Sybex.
2. Sostre P, LeClaire J, (2007), Web Analytics for dummies, John Wiley & Sons.
3. Burby J, Atchison S, (2007), Actionable web analytics: using data to make smart business decisions, John Wiley & Sons.
4. Avinash Kaushik,(2007), Web Analytics 1.0 An Hour a Day, Sybex.
5. Dykes B, (2011), Web analytics action hero: Using analysis to gain insight and optimize your business, Adobe Press.

Valente T. W, (2010), Social networks and health: Models, methods, and applications, Oxford.

		L	T	P	C
22CB930	**DIGITAL MARKETING ANALYTICS**	2	0	2	3

OBJECTIVES:

The course is aimed at

- Familiarizing the students on use and deployment of Digital marketing tools and web/social/mobile analytics platforms
- Gaining a grounded understanding of web analytics and business implication.
- Preparing the students with growth potentials for Web Analysts professionals

UNIT I Digital Marketing Strategy **6+6**

Digital Vs. Traditional marketing- Significance - Online marketing mix - E-product, STP, E- price, E-Promotion. Affiliate marketing Online tools for Content Marketing market influence analytics in Digital Eco system

List of Exercise/ Experiments:

Study on various online tools for content marketing

UNIT II Social media Marketing and Search analytics **6+6**

Social Media Channels, Social Media Strategy, Web PR and Online reputation management

Search Engine marketing - Search Engine Optimization and Adwords - PPC Advertising - Video SEO-Conversion Optimization .Monitoring, trends analysis, dashboards, segmentation - Navigation analysis (funnel reports, heat maps, etc) - Experimentation A/B and multivariate testing - Search analytics Current trends & challenges: web analytics & Web 2.0, multi-channel marketing management, web mining & predictive analytic

List of Exercise/ Experiments:

Implement SEO

UNIT III Web Analytics **6+6**

Understanding the key fabric of the Web - Sources of data: clickstream data, online surveys, usability research - Clickstream data collection techniques compared: web server log analysis, page tagging - Web metrics and Key Performance Indicators (KPIs): simple views, visitor counts, measuring content, engagement, conversions, etc. Framework for mapping business needs to web analytics tasks - Web Analytics at e-Business scale - Data collection architecture- Introduction to OLAP, Web data exploration and reporting - Introduction to Splunk

List of Exercise/ Experiments:

Perform online surveys

UNIT IV Text and Visual Analytics **6+6**

Natural Language Processing (NLP)- Supervised Machine Learning (ML) Algorithms-API and Web data scarping using simple R / Python

Visual Analytics: Drill down and hierarchies-Sorting-Grouping- Additional Ways to Group-Creating Sets- Analysis with Cubes and MDX- Filtering for Top and Top N- Using the Filter Shelf- The Formatting Pane-- Trend Lines- Forecasting- Formatting- Parameters

List of Exercise/ Experiments:

Implement NLP and ML algorithms

UNIT V Google Analytics **6+6**

Key features and capabilities of Google analytics- how Google analytics works - implementing Google analytics -getting up and running with Google analytics -navigating Google analytics - using Google analytics reports -Google metrics - using visitor data to drive website improvement- focusing onkeyperformance indicators- integrating Google analytics with third-partyapplications

List of Exercise/ Experiments:

Implement Google Anlaytics

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the student should be able to

CO1: Comprehend the significance of Online Marketing, Online Promotion, and Content Marketing.

CO2: Enhance their analytic capabilities especially with regard to Google Ad words and Google Analytics, SEO - Search Engine Optimization

CO3: Anticipate the market requirements fromdigital marketing and web analysts

CO4: Prepare for career development and growth in technological agile field in analytics

Text Book(s)

1. Rob Stokes, (2014), eMarketing: The EssentialGuide to Digital Marketing, 5thedition, Quirk Education.

2. Dave Chaffey, Fiona Ellis-Chadwick, Richard Mayer, Kevin Johnston, (2012), Internet Marketing: Strategy, Implementation and Practice, Prentice Hall.

References Books

1. Liana Evans, (2010), SocialMedia Marketing: Strategies for Engaging in Facebook, Twitter & Other Social Media, Que Publishing.

2. Vandana Ahuja, (2015), Digital Marketing, 1stedition, Oxford UniversityPress.

3. Avinash Kaushik, (2009), Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity,

		L	T	P	C
22CB931	**RECOMMENDER SYSTEMS**	2	0	2	3

OBJECTIVES:

The Course will enable learners to:

- To Compare different types of Recommender Systems.
- Understand various issues related to Recommender System development.
- Design a recommender system for a given problem.
- Relate data collected from a Recommender System to understand user preferences and/or behavior.

UNIT I INTRODUCTION TO RECOMMENDER SYSTEMS 6+6

What is Recommendation engine, Need for recommender systems, Framework of recommendation systems, Domain, Purpose, Context, Personalization, how will you target your users?, Personalized vs. Non-Personalized, Semi/Segment - Personalized, Privacy, users data and trustworthiness. Recommender Systems Function, Techniques, Recommender Systems and Human Computer Interaction, Conversational Systems, Visualization, Issues working with RSs data sets: The cold-start problem.

List of Exercise/ Experiments:

1. Build a Recommendation Engine with Item-Based Collaborative Filtering.
2. Build Content-based recommendation engine on different datasets.

UNIT II COLLABORATIVE FILTERING-BASED RECOMMENDER SYSTEM 6+6

Understanding ratings and rating data, User-based nearest-neighbor recommendation: Similarity Function, User-Based Algorithms Item-based nearest neighbor recommendation: Similarity Function, Item-Based Algorithms, Further model-based and preprocessing-based approaches, Comparing User-Based and Item-Based recommendations, data drift and concept drift.

List of Exercise/ Experiments:

3. Build Recommender System using association rule mining.
4. Implement Recommendation System using K-Nearest Neighbors

UNIT III CONTENT-BASED RECOMMENDATION 6+6

Architecture of Content-based Systems, Advantages and Drawbacks of Content-based Filtering, Content representation and content similarity, Item profiles, discovering features of data, obtaining item features from tags, representing item profiles, Learning User Profiles and Filtering, Similarity-based retrieval, Classification algorithms, Knowledge base recommendation: Knowledge representation and reasoning, constraint-based recommenders, Case based recommenders.

List of Exercise/ Experiments:

5. Build Context-Aware Recommender Systems.
6. Build Constraint-based Recommenders.
7. Implement knowledge-based recommender system.

UNIT IV NEIGHBORHOOD-BASED RECOMMENDATION METHODS 6+6

Advantages of Neighborhood Approaches, Neighborhood-based Recommendation, User-based Rating Prediction, User-based Classification Regression Vs Classification, Item-based Recommendation, User-based Vs Item based Recommendation, Rating Normalization, Similarity Weight Computation, Neighborhood Selection

List of Exercise/ Experiments:

8. Evaluate the recommendation system with evaluation matrix.
9. Compare the performance of different recommender systems

UNIT V **EVALUATING RECOMMENDER SYSTEM** **6+6**

Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Case Study of the Netflix Prize Data Set, Segmenting the Ratings for Training and Testing, Hold-Out, Cross-Validation. Accuracy Metrics Evaluation: RMSE versus MAE, Impact of the Long Tail, Evaluating Ranking via Correlation, Evaluating Ranking via Utility, Evaluating Ranking via Receiver Operating Characteristic

List of Exercise/ Experiments:

Evaluate the recommender system implemented and study the impact

TOTAL PERIODS: 60

OUTCOMES:

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

CO1: Understand the basics techniques and problems in the field of recommender systems
CO2: Implement Recommendation System.
CO3: Evaluate the Recommendation System
CO4: Compare the performance of different Recommender Systems

Text Book(s)

1. C.C. Aggarwal, "Recommender Systems: The Textbook", Springer, 1st Edition, 2016.
2. Jannach D., Zanker M. and FelFering A., "Recommender Systems: An Introduction", Cambridge University Press, 1st Edition, 2011.
3. Kim Falk, "Practical Recommender Systems", Manning, 1st Edition, 2019 4. Rounak Banik, "Hands-On Recommendation Systems with Python: Start building powerful and personalized, recommendation engines with Python", 2018.

References Books

1. M.D. Ekstrand, J.T. Riedl, J.A. Konstan, "Collaborative filtering recommender systems", Now publishers, 1st Edition, 2011.
2. J. Leskovec, A. Rajaraman and J. Ullman, "Mining of massive datasets", Cambridge, 2nd Edition, 2012.
3. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, "Recommender Systems: Algorithms and Applications", CRC Press, 1st Edition, 2021.

MINOR
ADVANCED WEB DEVELOPMENT

	USABILITY DESIGN OF SOFTWARE APPLICATIONS + LAB	L	T	P	C
22CB933		3	0	2	4

OBJECTIVES:

- To learn the fundamentals of User Centered Design, their relevance and contribution to businesses.
- To study the principles of heuristic evaluation for interactive design
- To understand the appreciation of user research, solution conceptualization and validation as interwoven activities in the design and development lifecycle.
- To familiarize the facets of User Experience (UX) Design, particularly as applied to the digital artefacts
- To implement complex mobile/web applications.

UNIT I **INTRODUCTION TO USER CENTRED DESIGN** **9**

Basics of User Centred Design-Elements-Models and approaches-User Centred Design Principles-Usability-UCD Process-Analysis tools: personas, scenarios, and essential use cases with examples-User-Centred Design and Agile aspects of User Centred Design.

UNIT II **INTERACTIVE DESIGN EVALUATION** **9**

Introduction to Interactive Design process – Interactive design in practice – Introducing evaluation – Evaluation: Inspection, Analysis and Models – Inspection: Heuristic Evaluation: 10 Heuristic Principles, Examples.

UNIT III **DEVELOPMENT OF APPLICATION** **9**

Case Study: Development of any application like mobile or web based on User Centred Design – Design lifecyle: Establishing Requirements, Design, Prototyping and Construction.

UNIT IV **UX RESEARCH** **9**

Understanding users, their goals, context of use, environment of use. Research Techniques: Contextual Enquiry, User Interviews, Competitive Analysis for UX.

UNIT V **ITERATIVE PRODUCT DEVELOPMENT** **9**

.

The Problem with Complexity - Iterative Product Development - Scenarios and Persona Technique, Design Thinking Technique: Discovery and brainstorming - Concept Development –
Prototyping Techniques : Paper, Electronic, Prototyping Tools – Review and feedback.

TOTAL: 45 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

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).

TEXTBOOKS:

1. Jenny Preece, Helen Sharp and Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, 4th Edition, 2019
2. Alan Cooper and Robert Reimann. About Face, 4th Edition, 2022

References:

1. Elizabeth Goodman, Mike Kuniavsky, Andra 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

22CB934 FRONT-END DEVELOPMENT USING REACT	L	T	P	C
	3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Understand web semantics and related tools and framework
- Work with the latest JS based web frameworks
- Develop a scalable and responsive web application
- Create an industryready 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
   - Permiter of an Rectangle
   - Employ Arrow functions
   - Employ HOC

UNIT III REACT COMPONENTS AND HOOKS 9+6

Class vs Functional Components, React Class Based Components – component DidMount, WillUpdate, shouldupate, didcatchetc - State - UseState, UseRef, USeEffect,UseHistory

Usage and Props(difference, when to use what, mutable or immutabilty,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 LIBRARY - II 9+6

Custom Hooks, HTTP - Fetch, Axios, Services, Behaviour Subjects - StateLess, StateFulll and Container Components, Error Handling - Build, Env, CORS, Unit Testing with 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

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. Apply Rest API , propTypes for developing web applications.
CO3. Develop a web application using latest React Framework.
CO4. Utilize React features including functions, components, and services. CO5. Create application using ReactJshooks.

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

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 Banksand Eve Porcello

ONLINE LEARNING PLATFORMS :

- https://react.dev/learn
- https://react-tutorial.app
- https://www.w3schools.com/REACT/DEFAULT.ASP
- https://www.coursera.org/professional-certificates/meta-front-end-developer

22CB935	SERVER SIDE PROGRAMMING WITH RUBY ON RAILS (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES:

The Course will enable learners to:

- Build web applications using the Ruby on Rails framework
- Manipulate data using both imperative and functional programming techniques.
- Develop web applications using object oriented design
- Store and retrieve data from database using ActiveRecord

UNIT I INTRODUCTION TO RUBY 9+6

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.

UNIT II OBJECT ORIENTED PROGRAMMING WITH RUBY 9+6

Object Oriented Programming - Classes - Objects - Methods - Instance Variables - Constructor - Access Control - Inheritance - Method Overriding - Operator Overloading - Exceptions - Multithreading - Modules - Libraries - Files - Ruby Tools

List of Exercise/Experiments

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.

UNIT III RUBY ERB AND USER AUTHENTICATION 9+6

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

List of Exercise/Experiments

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.

UNIT IV INTRODUCTION TO RUBY ON RAILS 9+6

Ruby on Rails - Introduction - Framework - MVC - Active Records - Rails Migration - Rails Controllers - Rails View - Asset Pilpeline - ActiveRecord Migration - ActiveRecord Association - Cookies - Session - ActionDispatch - ActiveRecord Validation

List of Exercise/Experiments

1) Create a to-do list web application using Ruby on Rails.
2) Create a simple calculator using Ruby on Rails.

UNIT V DATABASE CONNECTIVITY AND BACK END DEVELOPMENT 9+6

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

List of Exercise/Experiments

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.

TOTAL:45+30=75 PERIODS

OUTCOMES:

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

CO1: Build web applications using Rails.

CO2: Model real-world systems using object-oriented design. CO3:

Write HTML & CSS to create elegant web pages.

CO4: Manipulate data using both imperative and functional programming techniques.

CO5: Use ActiveRecord to store and retrieve information from a database.

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