Sri
SAI RAM
ENGINEERING COLLEGE
An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF
COMPUTER SCIENCE & BUSINESS SYSTEMS

REGULATIONS
2020

Academic Year 2020-21 onwards

AUTONOMOUS
CURRICULUM AND
SYLLABUS
I - VIII
SEMESTERS

SRI SAIRAM ENGINEERING COLLEGE

VISION

To emerge as a "Centre of excellence" offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instil high levels of discipline and strive to set global standards, making our students technologically superior and ethically stronger, who in turn shall contribute to the advancement of society and humankind.

MISSION

We dedicate and commit ourselves to achieve, sustain and foster unmatched excellence in Technical Education. To this end, we will pursue continuous development of infra-structure and enhance state-of-the-art equipment to provide our students a technologically up-to date and intellectually inspiring environment of learning, research, creativity, innovation and professional activity and inculcate in them ethical and moral values.

QUALITY POLICY

We at Sri Sai Ram Engineering College are committed to build a better Nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Service to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF COMPUTER SCIENCE & BUSINESS SYSTEMS

VISION

To impart competent industry relevant education, skillful research and innovative computer science professionals with managerial skills, human and social values.

MISSION

Department of Computer Science & Business Systems, Sri Sairam Engineering College is committed to

M1 Produce highly proficient Computer Science Professionals with managerial knowledge of global standards and practices.

M2 Ascertain new technologies through ethical and innovative research and developments

M3 Impart knowledge through learning, creativity and inculcate in them critical thinking with moral values.

AUTONOMOUS CURRICULUM AND SYLLABI
Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20HSEN102	Business Communication and Value Science–I	3	3	0	0	3
2	20BSPH102	Fundamentals of Physics	3	3	0	0	3
3	20BSMA102	Discrete Mathematics	4	3	1	0	4
4	20BSMA103	Introductory Topics in Statistics, Probability and Calculus	3	3	0	0	3
5	20ESEE105	Principles of Electrical Engineering	3	3	0	0	3
6	20ESPC106	Fundamentals of Computer Science	3	3	0	0	3
PRACTICALS							
7	20BSPL102	Fundamentals of Physics Laboratory	2	0	0	2	1
8	20ESPL108	Electrical Engineering Laboratory	2	0	0	2	1
9	20ESPL109	Fundamentals of Computer Science Laboratory	3	0	0	3	1.5
VALUE ADDITIONS - I							
10	20TPHS101	Skill Enhancement	2	0	0	2	1
11	20HSMG101	Personal Values	2	2	0	0	0
		TOTAL	**30**	**20**	**1**	**9**	**23.5**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20HSEN202	Business Communication and Value Science–II	2	2	0	0	2
2	20BSPH205	Principles of Electronics	3	3	0	0	3
3	20BSMA202	Linear Algebra	4	3	1	0	4
4	20BSMA203	Statistical Methods with Laboratory	5	3	0	2	4
5	20CBPC201	Data Structures and Algorithms	3	3	0	0	3
6	20HSMG206	Fundamentals of Economics	2	2	0	0	2
7	20CYMC201	Environmental Science and Engineering	2	2	0	0	0
PRACTICALS							
8	20CBPL202	Data Structures and Algorithms Laboratory	3	0	0	3	1.5
9	20BSPL201	Principles of Electronics Laboratory	2	0	0	2	1
VALUE ADDITIONS - II							
10	20TPHS201	Skill Enhancement	2	0	0	2	1
11	20HSMG201	Interpersonal Values	2	2	0	0	0
		TOTAL	**30**	**20**	**1**	**9**	**21.5**

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20BSMA305	Computational Statistics	3	3	0	0	3
2	20CBPC301	Formal Language and Automata Theory	3	3	0	0	3
3	20CBPC302	Computer Organization and Architecture	3	3	0	0	3
4	20CSPC301	Object Oriented Programming	3	3	0	0	3
5	20CBPC303	Software Engineering	3	3	0	0	3
6	20CBMG301	Financial Management	2	2	0	0	2
7	20HSEN301	Business Communication and Value Science–III	2	2	0	0	2
PRACTICALS							
8	20CSPL301	Object Oriented Programming Laboratory	3	0	0	3	1.5
9	20CBPL301	Software Engineering Laboratory	3	0	0	3	1.5
10	20CBPL302	Computational Statistics Laboratory using Python	3	0	0	3	1.5
11	20CBTE301	Live-in-Lab - I	2	0	0	2	1
VALUE ADDITIONS - III							
12	20CBTP301	Skill Enhancement	2	0	0	2	1
13	20MGMC301	Constitution of India	2	2	0	0	0
TOTAL			**34**	**21**	**0**	**13**	**25.5**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20CBPC401	Database Management Systems	3	3	0	0	3
2	20CBPC402	Software Design with UML	3	3	0	0	3
3	20CBPC403	Operating Systems	3	3	0	0	3
4	20CBMG401	Introduction to Innovation, IP Management and Entrepreneurship	2	2	0	0	2
5	20BSMA405	Operations Research with Laboratory	5	3	0	2	4
6	20CBMG402	Marketing Management	2	2	0	0	2
PRACTICALS							
7	20CBPL401	Database Management Systems Laboratory	3	0	0	3	1.5
8	20CBPL402	Software Design with UML Laboratory	3	0	0	3	1.5
9	20CBPL403	Operating Systems Laboratory	3	0	0	3	1.5
10	20CBTE401	Live-in-Lab - II	2	0	0	2	1
VALUE ADDITIONS - IV							
11	20CBTP401	Skill Enhancement	2	0	0	2	1
12	20CBMC401	Essence of Indian Traditional Knowledge	1	1	0	0	0
TOTAL			**32**	**17**	**0**	**15**	**23.5**

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20CBPC501	Compiler Design	3	3	0	0	3
2	20CBPC502	Design and Analysis of Algorithms	3	3	0	0	3
3	20CBMG501	Fundamentals of Management	2	2	0	0	2
4	20CBMG502	Business Strategy	3	3	0	0	3
5	20CBPC503	Design Thinking	2	2	0	0	2
6	20CBELXXX	Professional Elective I + Lab	4	2	0	2	3
7	20CBELXXX	Professional Elective II	3	2	1	0	3
PRACTICALS							
8	20CBPL501	Compiler Design Laboratory	3	0	0	3	1.5
9	20CBPL502	Design and Analysis of Algorithms Laboratory	3	0	0	3	1.5
10	20CBTE501	Live-in-Lab - III	2	0	0	2	1
VALUE ADDITIONS - V							
11	20CBTP501	Skill Enhancement	2	0	0	2	1
		TOTAL	**30**	**17**	**1**	**12**	**24**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20HSEN601	Business Communication and Value Science–IV	3	2	1	0	3
2	20CBPC601	Computer Networks	3	3	0	0	3
3	20CBPC602	Information Security	3	3	0	0	3
4	20CBPC603	Artificial Intelligence	3	3	0	0	3
5	20CBELXXX	Professional Elective III + Lab	4	2	0	2	3
6	20CBELXXX	Professional Elective IV	3	2	1	0	3
PRACTICALS							
7	20CBPL601	Computer Networks Laboratory	3	0	0	3	1.5
8	20CBPL602	Information Security Laboratory	3	0	0	3	1.5
9	20CBPL603	Artificial Intelligence Laboratory	3	0	0	3	1.5
10	20CBPJ601	Innovative Design Project	2	0	0	2	1
VALUE ADDITIONS - VI							
10	20CBTP601	Skill Enhancement	2	0	0	2	1
		TOTAL	**32**	**15**	**2**	**15**	**24.5**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
		THEORY					
1	20CBPW701	Usability Design of Software Applications with Laboratory	4	2	0	2	3
2	20CBPW702	IT Workshop Sky Lab/Mat Lab	4	2	0	2	3
3	20CBPW703	IT Project Management with Laboratory	4	2	0	2	3
4	20CBMG701	Human Resource Management	2	2	0	0	2
5	20CBMG702	Financial and Cost Accounting	3	2	1	0	3
		PRACTICAL					
6	20CBPJ701	Project Phase-I	4	0	0	4	2
		VALUE ADDITIONS - VII					
7	20CBTP701	Skill Enhancement	2	0	0	2	1
		TOTAL	**23**	**10**	**1**	**12**	**17**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS
				L	T	P	C
1	20CBPJ801	Project Phase - II	8	0	0	8	4
		TOTAL	**8**	**0**	**0**	**8**	**4**

CREDIT DISTRIBUTION

Category	BS	ES	HS	EL	PC+PL	PW	OE	TE	PJ	TP	IS	MC	TOTAL
Credit	30	8.5	12	12	75	9	0	3	7	7	3	0	166.5
Percentage	18	5.1	7.2	7.2	45	5.4	0	1.8	4.2	4.2	1.8	0	

*IS-Internship

PROFESSIONAL ELECTIVE I

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS	STREAM
				L	T	P	C	
1.	20CBEL501	Conversational Systems with Laboratory	4	2	0	2	3	AI & ML
2.	20CBEL502	Cloud, Micro services and Application with Laboratory	4	2	0	2	3	Cloud Computing and Web Development
3.	20CBEL503	Machine Learning with Laboratory	4	2	0	2	3	AI & ML
4.	20CBEL504	Web Technology with Laboratory	4	2	0	2	3	Cloud Computing and Web Development
5.	20CBEL505	Mobile Application Development with Laboratory	4	2	0	2	3	Internet of Things
6.	20CBEL506	Soft Computing with Laboratory	4	2	0	2	3	Computing and Information Systems

PROFESSIONAL ELECTIVE II

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS	STREAM
				L	T	P	C	
1.	20CBEL507	Behavioral Economics	3	2	1	0	3	Business Studies
2.	20CBEL508	Computational Finance and Modeling	3	2	1	0	3	Business Studies
3.	20CBEL509	Psychology	3	2	1	0	3	Business Studies
4.	20CBEL510	Information Systems and Business Analytics	3	2	1	0	3	Data Analytics and Security
5.	20CBEL511	Software Testing	3	2	1	0	3	Computing and Information Systems
6.	20CBEL512	Graph Theory and Applications	3	2	1	0	3	Computing and Information Systems
7.	20HSMC501	Universal Human Values - II: Understanding Harmony	3	2	1	0	3	Intellectual domain for personality

PROFESSIONAL ELECTIVE III

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS	STREAM
				L	T	P	C	
1.	20CBEL601	Data Mining and Analytics with Laboratory	4	2	0	2	3	Data Analytics and Security
2.	20CBEL602	Robotics and Embedded Systems with Laboratory	4	2	0	2	3	Internet of Things
3.	20CBEL603	Modern Web Applications with Laboratory	4	2	0	2	3	Cloud Computing and Web Development
4.	20CBEL604	Computer Graphics and Multimedia with Laboratory	4	2	0	2	3	Computing and Information Systems
5.	20CBEL605	Cognitive Science and Analytics with Laboratory	4	2	0	2	3	Data Analytics and Security
6.	20CBEL606	Cryptology with Laboratory	4	2	0	2	3	Data Analytics and Security
7.	20CBEL607	Internet of Things with Laboratory	4	2	0	2	3	Internet of Things

PROFESSIONAL ELECTIVE IV

S. NO	COURSE CODE	COURSE TITLE	CONTACT HOURS	WEEK HOURS			CREDITS	STREAM
				L	T	P	C	
1.	20CBEL608	Enterprise Systems	3	2	1	0	3	Business Studies
2.	20CBEL609	Advance Finance	3	2	1	0	3	Business Studies
3.	20CBEL610	Image Processing and Pattern Recognition	3	2	1	0	3	AI & ML
4.	20CBEL611	Services Science and Service Operational Management	3	2	1	0	3	Business Studies
5.	20CBEL612	Advanced Social, Text and Media Analytics	3	2	1	0	3	Data Analytics and Security
6.	20CBEL613	Quantum Computation & Quantum Information	3	2	1	0	3	Computing and Information Systems
7.	20CBEL614	Mobile Computing	3	2	1	0	3	Computing and Information Systems

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 The Graduants will explore and excel in emerging domains such as Analytics, Machine Learning, Cloud Computing, and Internet of Things and apply the knowledge to design and develop solutions to business and societal needs.

PEO 2 Graduates will perform Research by designing & developing solutions using modern tools for complex problems in the field of IT by adapting to the rapid technological advancements.

PEO 3 The students graduating will have profound knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

PEO 4 The Graduants will be industry ready with required business skills in service orientated industries.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 Ability to create innovative software professionals with the emerging technologies and service orientations.

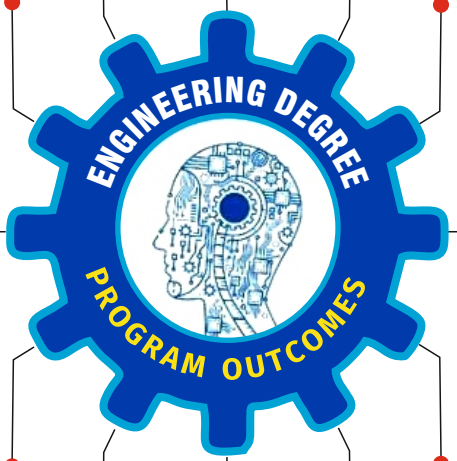
PSO 2 Ability to design and implement industry demand professionals with business principles aligned with equivalent knowledge in humanities and business systems.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences(BS)	18	34	30
Engineering Sciences(ES)	5.1	11	8.5
Humanities and Social Sciences (HS)	7.2	16	12
Professional Electives(EL)	7.2	14	12
Program Core+Program Lab (PC+PL)	45	95	75
Program theory with Lab (PW)	5.4	12	9
Open Electives (OE)	0	0	0
Talent Enhancement (TE)	1.8	6	3
Project (PJ)	4.2	14	7
Training & Placement (TP)	4.2	14	7
Internships/Seminars (IS)	1.8	0	3
Mandatory Courses (MC)	0	3	0
Total number of Credits		**219**	**166.5**

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



01 Engineering knowledge

Apply the basic principle and knowledge of mathematics, science and engineering principles to solve technical problems.

02 Problem Analysis

Identify and analyze complex engineering problems reaching logical conclusions using the basic principles of mathematics, science and engineering.

03 Development of solutions

Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs.

04 Investigate complex problems

Perform investigations, use research based knowledge and conduct experiments, analyze and interpret the results to provide valid conclusions.

05 Modern tool usage

Create, select and apply the latest techniques, resources and modern engineering / IT tools to develop appropriate solutions with an understanding of the limitations.

06 The Engineer and Society

Apply reasoning based on contextual knowledge to assess societal, legal and cultural issues with competency in professional engineering practices.

07 Environment & Sustainability

Demonstrate professional skills, knowledge and contextual reasoning to assess / environmental / societal issues for sustainable development.

08 Apply ethical principles

Apply ethical principles and commit to professional ethics and responsibilities based on the norms of professional engineering pratices.

09 Individual & Teamwork

Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary professional settings.

10 Communicate effectively

Communicate effectively amongst the engineering community, being able to comprehend & write effective reports, make presentations & give/receive clear instructions.

11 Project management

Demonstrate knowledge and apply the principles of engineering & management in their own / team projects in multidisciplinary environments.

12 Life-long learning

Recognize the need for, and have the preparation, ability to engage in independent and life-long learning in the context of technological change.

SEMESTER - I

20HSEN102 SDG NO. 4	BUSINESS COMMUNICATION AND VALUE SCIENCE – I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the basic LSRW skills of the learners
- To encourage the learners to actively participate through listening techniques and reflect spontaneously
- To understand and apply the key concepts of values of life skills and business communication
- To motivate the learners to look within and create a better version of self
- To learn career skills like working collaboratively, observing business etiquette and employing ethical tools

UNIT I INTRODUCTION **9**

Listening process – short texts – formal and informal conversations - basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve.

UNIT II LIFE SKILLS AND VALUES **9**

Overview of LOL (include activity on introducing self)- class activity – presentation on favorite cricket captain in IPL and the skills and values they demonstrate - self-work with immersion – mock interview – narration - overview of business communication- activity: write a newspaper report on an IPL match - record a conversation between a celebrity and an interviewer – quiz time- self awareness

UNIT III WRITING AND LANGUAGE DEVELOPMENT **9**

Listening – law of nature - importance of listening skills -difference between listening and hearing, types of listening - parts of speech- tense – quiz – sentence formation – writing – email writing – formal and informal Emails - common errors – voices - speaking – role plays – overview of communication skills – barriers of communication – effective communication - types of communication – verbal and non-verbal – role play based learning.

UNIT IV VOCABULARY BUILDING AND COMMUNICATION **9**

Listening - debates and discussions – practicing multiple tasks – verbal communication – pronunciation / clarity of speech – vocabulary enrichment – phrases – idioms – abbreviations – picture based and newspaper-based

activities – group discussion – writing – summary writing – story writing – resume writing – interpersonal skills – stress management – time management.

UNIT V LANGUAGE DEVELOPMENT AND INTERPERSONAL SKILL 9

Listening to selected speeches and presentations – understanding life skills – introduction to life skills – multiple intelligence embracing diversity – speaking – Life skills: community service work with an NGO and make a presentation – leadership – team work – managing stress – motivating people.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ashraf Rizvi. M, "Effective Technical Communication", Second Edition, McGraw Hill, New Delhi, 2018.
2. Dhanavel, S.P., "English and Communication Skills for Students of Science and Engineering", Orient Blackswan, Chennai, 2011.

REFERENCES:

1. English vocabulary in use – Alan Mc'carthy and O'dell
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication – Dr. Saroj Hiremath

WEB REFERENCES:

1. Train your mind to perform under pressure- Simon sinek
   https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs
   https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-beforenumbers.html
3. Will Smith's Top Ten rules for success
   https://www.youtube.com/watch?v=bBsT9omTeh0

ONLINE RESOURCES:

1. https://www.coursera.org/learn/learning-how-to-learn
2. https://www.coursera.org/specializations/effective-business-communication

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the basics of LSRW skills and will be able to participate effectively in conversations and to express opinions in English (K2)
2. Read, comprehend and interpret articles of a general kind in magazines and newspapers and also write reports in English employing grammatically correct sentences (K3)
3. Able to write on general and creative topics and to draft e-mails and resume in a convincing manner (K3)
4. Understand the basic tenets of communication and engage in group discussions and conversations by employing appropriate verbal and non-verbal communication (K2)
5. Recognize the need for life skills and values and enhance their career skills in business communication (K1)
6. Identify their own strengths and opportunities and apply the life skills to different situations (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	1	1	2	3	-	1
CO2	-	-	-	-	-	-	-	-	2	2	1	2
CO3	-	-	-	-	-	-	-	2	3	3	2	3
CO4	-	-	-	-	-	-	-	2	2	3	1	2
CO5	-	-	-	-	-	-	-	2	3	3	2	2
CO6	-	-	1	1	2	2	2	2	3	3	1	1

SEMESTER - I

20BSPH102 SDG NO. 4	FUNDAMENTALS OF PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the Fundamentals of Interference and Polarization properties of light
- To understand the Principles of crystallography and Oscillation
- To learn the basic ideas in Electromagnetism and Thermodynamics

- To learn the Principles and Applications of semiconductor and Quantum mechanics
- To understand the Fundamentals of Lasers and Fiber optics

UNIT I INTERFERENCE AND POLARIZATION OF LIGHT. 9

Principle of Superposition - Young's Experiment - Theory of Interference Fringes - Types of Interference - Fresnel's Prism - Newton's Rings - Diffraction-Two Kinds of Diffraction - Difference between Interference and Diffraction-Fresnel's Half Period Zone And Zone Plate-fraunhofer Diffraction at Single Slit-Plane Diffraction Grating - Temporal and Spatial Coherence - 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.

UNIT II CRYSTALLOGRAPHY AND OSCILLATION 9

Basic Terms-Types of Crystal Systems - Bravais Lattices - Miller Indices - D Spacing - Atomic Packing Factor for SC, BCC, FCC and HCP Structures - 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 Mechanical and Electrical Oscillators.

UNIT III BASIC IDEA OF ELECTROMAGNETISMS AND THERMODYNAMICS 9

Continuity Equation for Current Densities - Maxwell's Equation in Vacuum and Non-conducting Medium. Zeroth Law of Thermodynamics - First Law of Thermodynamics - Brief Discussion on Application of First Law - Second Law of Thermodynamics and Concept of Engine, Entropy, Change in Entropy in Reversible and Irreversible Processes.

UNIT IV SEMICONDUCTOR PHYSICS AND QUANTUM MECHANICS 9

Conductor, Semiconductor and Insulator - Basic Concept of Band Theory - 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 - Heisenberg Picture.

UNIT V LASER AND FIBER OPTICS. 9

Einstein's Theory of Matter Radiation Interaction and a And B Coefficients - Amplification of Light by Population Inversion - Different Types of Lasers: Ruby Laser, CO2 and Neodymium Lasers; 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.

TOTAL : 45 PERIODS.

TEXT BOOKS:

1. A Beiser, "Concepts of Modern Physics", McGraw Hill International, Fifth Edition, 2017.
2. Robert Resnick and Jearl Walker, "Fundamentals of Physics", David Halliday, Wileyplus, 2004.

REFERENCE BOOKS:

1. Optics, (Fifth Edition)AjoyGhatak, Tata McGraw Hill.
2. Sears &ZemanskyUniversity Physics, Addison-Wesley.
3. Fundamentals of Optics,(Third Edition)Jenkins and White, McGraw-Hill.

OUTCOMES:

At the end of studying this course work, the student should be able to

1. Understand the principles of interference and polarization of light. (K2)
2 Understand the principles lying behind crystallography and oscillations. (K1)
3 Understand the basics of electromagnetism and thermodynamics. (K1)
4 Learn the principles of semiconductor physics and quantum mechanics. (K2)
5 Learn the fundamentals of lasers and fiber optics principles. (K1)
6 Learn the concepts of Physics towards engineering applications.(K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	1	1	1	1	2	2
CO2	3	2	3	2	3	1	1	1	1	1	2	2
CO3	3	3	2	2	2	1	1	1	1	1	2	1
CO4	3	2	2	2	2	1	1	1	1	1	2	2
CO5	3	3	3	2	2	1	1	1	1	1	2	1
CO6	2	3	2	2	2	2	2	1	2	2	1	2

SEMESTER - I

20BSMA102 SDG NO. 4	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The aim of this course is to introduce abstraction, logical thinking and reasoning for developing algorithms and mathematical proofs related to Computer Science

UNIT I MATHEMATICAL LOGIC 12

Logic: Propositional Calculus - Propositions and Connectives - Syntax - Semantics - Truth Assignments and Truth Tables - Validity and Satisfiability, Tautology - Adequate Set of Connectives - Equivalence and Normal Forms - Compactness and Resolution - Formal Reducibility - Natural Deduction System and Axiom System - Soundness and Completeness.

UNIT II COMBINATORICS 12

Basic Counting, Balls and Bins Problems - Generating Functions - Recurrence Relations - Proof Techniques - Principle of Mathematical Induction - Pigeonhole Principle.

UNIT III BOOLEAN ALGEBRA 12

Introduction of Boolean Algebra - Truth Table - Basic Logic Gate - Basic Postulates of Boolean Algebra - Principle of Duality - Canonical Form - Karnaugh Map.

UNIT IV 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 Planar Graph - Independence Number and Clique Number - Chromatic Number - Statement of Four - Color Theorem.

UNIT V ABSTRACT ALGEBRA 12

Sets - Relations - Groups - Subgroups - Normal Subgroups and Quotient Groups - Homomorphisms - Cosets - Lagrange's Theorem - Rings and Fields (Definition and Examples only).

TOTAL: 60 PERIODS

TEXT BOOKS:

1. I. N. Herstein, "Topics in Algebra", John Wiley and Sons, Second Edition, 1975.
2. M. Morris Mano, "Digital Logic & Computer Design", Pearson Education India, 2017.
3. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill, New Delhi, Second Edition, 1985.
4. J. A. Bondy and U. S. R. Murty, "Graph Theory with Applications", Macmillan Press, London, First Edition, 1976.
5. L. Zhongwan, "Mathematical Logic for Computer Science", World Scientific, Singapore, Second Edition,1998.

REFERENCES:

1. Gilbert Strang, "Introduction to linear algebra", Wellesley Cambridge Press, Fifth Edition, 2016.
2. R. A. Brualdi, "Introductory Combinatorics", North-Holland, New York, Fifth Edition,2018.
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, Englewood Cliffs, 1974.
4. E. Mendelsohn, "Introduction to Mathematical Logic", Chapman & Hall, London, Second Edition, 1979.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106094/
2. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
3. http://home.iitk.ac.in/~arlal/book/mth202.pdf

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3517/discrete-mathematics-i
2. https://www.youtube.com/watch?v=rdXw7Ps9vxc&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=1
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply mathematical logic to understand logical arguments, construct logical proofs, solve problems and validate them. (K3)
2. Solve combinatorial problems using basic principles of counting. (K3)

3. Apply the principles of Boolean Algebra to design and simplify the circuits. (K3)
4. Solve real world problems using graphs and use it to develop algorithms in Computer Science. (K3)
5. Explain the concepts of algebraic structures such as groups, rings and fields . (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	-	-	-	-	-	1
CO2	3	3	3	2	2	2	-	-	-	-	-	1
CO3	3	3	3	2	2	2	-	-	-	-	-	1
CO4	3	3	3	2	2	2	-	-	-	-	-	1
CO5	3	3	3	2	2	2	-	-	-	-	-	1

SEMESTER - I

20BSMA103 SDG NO. 4	INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart basic knowledge in differential and integral calculus and apply it to solve a wide variety of Engineering problems.
- To introduce the fundamental concepts in the theory of probability and statistics for studying Engineering subjects.

UNIT I DIFFERENTIAL CALCULUS 9

Representation of Functions - Limit of a Function - Continuity - Derivatives - Differentiation Rules - Maxima and Minima of Functions of one Variable.

UNIT II INTEGRAL CALCULUS 9

Definite and Indefinite Integrals - Types of Integration-Integration by substitution - Integration by Parts - Bernouli's Formula - Double and Triple Integrals (Cartesian coordinates) - Applications of Double and Triple Integrals - Area and Volume.

UNIT III PROBABILITY AND RANDOM VARIABLES 9

Concept of Experiments - Sample Space - Event. Definition of Combinatorial Probability - Conditional Probability - Bayes Theorem - Expected Values and Moments - Mathematical Expectation and its Properties - Moments (including Variance) and their Properties - Interpretation - Moment Generating Function.

UNIT IV PROBABILITY DISTRIBUTIONS 9

Discrete & Continuous Distributions - Binomial - Poisson and Geometric Distributions - Uniform - Exponential - Normal - Chi-square, t & F Distributions.

UNIT V 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 - Frequency Curves - Descriptive Measures - Central Tendency and Dispersion - Bivariate Data - Summarization - Marginal and Conditional Frequency Distribution.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. M. Ross, "Introduction of Probability Models", Academic Press, N.Y.
2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", Vol. I, 2013 & Vol. II, 2016, Paper Back Edition, World Press.
3. B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publication, Delhi.

REFERENCES:

1. S. M. Ross, "A first course in Probability", Prentice Hall, Eleventh Edition, 2014.
2. Richard A. Johnson, "Miller & Freund's Probability and Statistics for Engineers, Eighth Edition, Pearson, 2013.
3. A. M. Mood, F.A. Graybill and D.C. Boes, "Introduction to the Theory of Statistics", McGraw Hill Education, Eighth Edition, 2001.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning, Seventh Edition, Cengage, 2011.
5. M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education, Second Edition, 2002.
6. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics", Vol. I & II, Vidyarthi Prakashan.

WEB RESOURCES:

1. https://ocw.mit.edu/courses/mathematics/18-600-probability-and-random-variables-fall-2019/lecture-notes/index.htm
2. https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/
3. https://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/textbook/

ONLINE RESOURCES

1. https://www.khanacademy.org/math/statistics-probability
2. https://www.khanacademy.org/math/differential-calculus
3. https://www.khanacademy.org/math/integral-calculus

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Evaluate the limit, examine the continuity and use derivatives to find extreme values of function. (K3)
2. Evaluate indefinite and definite integrals of algebraic, exponential, trigonometric and logarithmic functions and apply double and triple integrals for finding area of a region and volume of a surface. (K3)
3. Calculate the probability, conditional probability and statistical averages of events. (K3)
4. Apply standard discrete and continuous distributions in solving in real life problems. (K3)
5. Analyze statistical data using measures of central tendency, dispersion and location. (K3)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	3	2	1	-	-	-	-	-	-	1
CO3	3	3	3	2	1	-	-	-	-	-	-	1
CO4	3	3	3	2	1	-	-	-	-	-	-	1
CO5	3	3	3	2	1	-	-	-	-	-	-	1

SEMESTER - I

20ESEE105 SDG NO. 4&9	PRINCIPLES OF ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic electric circuits and its elements
- To impart knowledge on solving DC circuit equations using network theorems
- To educate on solving AC circuit and three phase circuits
- To introduce the concept of Electrostatics and Electro – Mechanics
- To impart the fundamentals of Measurement technique and various sensors

UNIT I INTRODUCTION 9

Concept Of Potential Difference - Voltage - Current - Fundamental Linear Passive and Active Elements to their Functional Current - Voltage Relation - Terminology and Symbols in Order to Describe Electric Networks - Voltage 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 - Concept of Work - Power - Energy - and Conversion of Energy.

UNIT II DC CIRCUITS 9

Current - Voltage Relations of the Electric Network by Mathematical Equations to Analyze the Network (Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem) Simplifications of Networks using Series - Parallel - Star/Delta Transformation - Superposition Theorem.

UNIT III AC CIRCUITS 9

AC Waveform Definitions - Form Factor - Peak Factor - Study of R-I, R-C, RLC Series Circuit - R-I-C Parallel Circuit - Phasor Representation in Polar and Rectangular Form - Concept of Impedance - Admittance - Active - Reactive - Apparent and Complex Power - Power Factor - 3 Phase Balanced AC Circuits (ʎ-Δ &ʎ-ʎ).

UNIT IV ELECTRO-STATIC AND ELECTRO-MECHANICS 9

Electrostatic Field - Electric Field Strength - Concept of Permitivity in Dielectrics - Capacitor Composite - Dielectric Capacitors - Capacitors in Series And Parallel - Energy Stored in Capacitors - Charging and Discharging of Capacitors - 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 - Electro-Mechanical Energy Conversion.

UNIT V MEASUREMENTS AND SENSORS 9

Introduction to Measuring Devices/Sensors and Transducers (Piezoelectric and Thermo-couple) Related to Electrical Signals - Elementary Methods for the Measurement of Electrical Quantities in DC and AC Systems (Current & Single-Phase Power) - Electrical Wiring and Illumination System - Basic Layout of the Distribution System - Types of Wiring System & Wiring Accessories - Necessity of Earthing - Types of Earthing - Safety Devices & System.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, "Electric Machinery", Sixth Edition, Tata McGraw Hill.
2. B. L. Theraja, "A Textbook of Electrical Technology", Vol. I, Chand and Company Ltd., New Delhi.
3. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi.
4. J. Nagrath and Kothari, "Theory and problems of Basic Electrical Engineering", Second Edition, Prentice Hall of India Pvt. Ltd.

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, Cambridge University Press.
3. William H. Hayt & Jack E. Kemmerly, "Engineering Circuit Analysis", McGraw-Hill Book Company Inc.
4. Smarjith Ghosh, "Fundamentals of Electrical and Electronics Engineering", Prentice Hall (India) Pvt. Ltd.

WEB REFERENCES:

1. www.electrical4u.net/useful-information/top-10-electrical-website-for-electrical-engineering-students/#2_Electrical4ucom
2. www.academia.edu/35125273/Engineering_Principles_and_Applications_of_Electrical_Engineering

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc19_ee35/preview
2. https://swayam.gov.in/nd1_noc19_ee35/preview
3. https://nptel.ac.in/courses/108105112

OUTCOMES:

Upon completion of the course, the student should be able to

1. Choose the concept of Basic Electric Circuits, Networks and measurements techniques. (K1)
2. Understand the working of electrical AC& DC circuits, electrostatics, electro-mechanics circuits and working of sensors. (K2)
3. Apply electrical laws to AC &DC Circuits and Solve for Single Phase and Three Phase Circuits. (K3)
4. Analyze the function of AC& DC Circuits, Electrostatic Field and Electromechanical Field and its Energy Conversion, sensors and also Single Phase Transformer . (K4)
5. Determine the electrical characteristics of AC& DC Circuits , Sensors for Various Applications and also Electrostatic Field and Electromechanical characteristic of circuits. (K5)
6. Creating a different applications using AC& DC Circuits, Electrostatic Field and Electromechanical Field, sensors and Single Phase Transformer. (K6)

CO- PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	1	-	-	2	3	3
CO2	3	3	3	3	3	2	-	-	1	-	-	2	3	3
CO3	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO4	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO5	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO6	3	3	3	2	3	2	-	-	1	-	-	2	3	3

SEMESTER - I

20ESPC106 SDG NO. 4 & 9	FUNDAMENTALS OF COMPUTER SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand simple algorithms for arithmetic and logical problems
- To design C Programs using basic programming constructs, arrays and strings
- To develop applications in C using functions , pointers and structures
- To do input/output and file handling in C
- To learn some basic Unix system interface

UNIT I GENERAL PROBLEM SOLVING CONCEPTS AND C LANGUAGE 9

Algorithm and Flowchart for Problem Solving with Sequential Logic Structure, Decisions and Loops - Introduction- C Structure - Syntax and Constructs of ANSI C - Variable Declarations, Data Type and Sizes (Little Endian Big Endian)- Constants - Hungarian Notation - Type Conversion - Standard I/O - Formatted Input and Output – Statements and Blocks - C Pre-processors - Operators : Arithmetic - Relational - Logical - Increment and Decrement - Bitwise and Assignment Operators - Expressions - Precedence and Order of Evaluation.

UNIT II CONTROL FLOW AND FUNCTIONS 9

Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch - Loops – while, do, for, break and continue - Goto Labels- Structured and un- Structured Programming - Basics of Functions - Parameter Passing and Returning Type - C main return as Integer - External - Auto - Local - Static - Register Variables - Scope Rules - Block Structure - Initialisation - Recursion - Preprocessor - Standard Library Functions and Return Types.

UNIT III POINTERS AND ARRAYS 9

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Initialisation of Pointer Arrays, Pointer to Pointer, Multi-dimensional arrays and Row/Column Major Formats, Command Line Arguments, Pointers to Functions, Complicated Declarations and Evaluations.

UNIT IV STRUCTURES AND UNIONS 9

Basic Structures, Structures and Functions, Array of structures, Pointer of

Structures, Self-referential Structures, Table look up, Typedef, Unions, Bit-fields.

UNIT V FILE SYSTEMS, UNIX SYSTEM INTERFACE AND PROGRAMMING METHOD 9

File Access using FILE Structure - fopen, stdin, stdout and stderr - Error Handling – exit - perror and error.h - Line I/O, Miscellaneous Functions - Unix System Interface: File Descriptor - Low Level I/O - Read and Write - Open - Create - Close and Unlink - Random Access – lseek - Discussions on Listing Directory -Storage Allocator.

Programming Method: Debugging Macro - User Defined Header - User Defined Library Function - makefile Utility.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Second Edition, PHI
2. Byron Gottfried, "Programming with C", Second Edition, Schaum Outline Series.

REFERENCES:

1. Herbert Schildt, "C: The Complete Reference", Fourth Edition, McGraw Hill.
2. YashavantKanetkar, "Let Us C", BPB Publications.

WEB REFERENCES:

1. https://codeforwin.org/
2. https://www.learn-c.org/
3. https://www.cprogramming.com/

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/
2. https://nptel.ac.in/courses/106105171/
3. https://www.coursera.org/specializations/c-programming

OUTCOMES:

Upon completion of the course, the student should be able to

1. Illustrate simple algorithms for arithmetic and logical problems (K2)
2. Implement conditional branching, iteration and recursion (K3)

3. Use operators and functions to formulate algorithms and programs (K3)
4. Understand the concepts of pointers and Arrays (K2)
5 Design and implement programs using structures and Unions (K3)
6 Illustrate programs using file systems and UNIX system interfaces (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO2	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO3	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO4	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO5	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO6	3	3	1	1	1	1	1	1	1	1	2	2	2	2

SEMESTER - I

20BSPL102 SDG NO. 4&9	FUNDAMENTALS OF PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Study the variation of magnetic field along the axis of the current carrying coil and finding out the Hall coefficient of a given semiconductor.
- To determine experimentally the value of Planck's constant and Stefan's constant.
- To find wavelength of a given light source by diffraction method.
- To find the wavelength of a light source by Newton's ring method.
- To determine the laser wavelength and fiber optic parameters of a cable.

LIST OF EXPERIMENTS :

1. Magnetic field along the axis of current carrying coil – Stewart and Gee
2. Determination of Hall coefficient of semiconductor
3. Determination of Planck constant
4. Determination of wavelength of light by Laser diffraction method
5. Determination of wavelength of light by Newton's Ring method

6. Determination of laser and optical fiber parameters
7. Determination of Stefan's Constant.

TOTAL : 30 PERIODS

LAB REQUIREMENTS

1.	Stewart and Gee experimental set up to determine magnetic field	5 sets
2.	Hall coefficient determination-experimental set-up	5 sets
3.	Planck's constant experimental set-up	5 sets
4.	Diffraction method -experimental set up to find wavelength of light source	5 sets
5.	Newton's ring method -experimental set-up to find out wavelength of light	5 sets
6.	Diode lasers(5to 10 mW)	5 nos
7.	OFC cables- various diameters -3 types	5 nos
8.	Accessories for electronic experiments- wires, cutters, magnets, etc.	5 sets
9.	Sodium Vapor lamp-	5 nos
10.	Stefan's constant experimental determination set-up	5 sets

OUTCOMES:

On completion of the lab course work, the student will be able to

1. Understand magnetic fields along a certain direction. (K2)
2. Determine the Hall coefficient of a semiconductor. (K4)
3. Determine the value of Planck's constant. (K4)
4. Determine the wavelength of light by diffraction method. (K2)
5. Determine the wavelength of a laser and find out OFC parameters. (K2)
6. Determine Stefan's constant and to establish Stefan's law.(K1)

CO- PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	1	1	2	1	2	2
CO2	3	2	3	2	3	1	1	1	2	1	2	2
CO3	3	3	2	2	2	1	1	1	2	1	2	1
CO4	3	2	2	2	2	1	1	1	2	1	2	2
CO5	3	3	3	2	2	1	1	1	2	1	2	1
CO6	3	3	3	2	2	1	1	2	1	2	2	1

SEMESTER - I

20ESPL108 SDG NO. 4&9	ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To simulate various electric circuits using Pspice/ Matlab/e-Sim /Scilab
- To gain practical experience on electric circuits and verification of theorems
- To gain practical Knowledge on electric circuits transients and resonance

LIST OF EXPERIMENTS :

1. Study of Electrical elements, sources, measuring devices and transducers.
2. Experimental solving of electrical circuit problems using Kirchhoff's voltage and current laws.
3. Experimental solving of electrical circuit problems using Thevenin's theorem.
4. Experimental solving of electrical circuit problems using Norton's theorem.
5. Experimental solving of electrical circuit problems using Superposition theorem.
6. Measurement of variation of resistance of a thermistor with temperature.
7. Experimental verification of Maximum Power transfer Theorem.
8. Simulation and Experimental validation of R-C electric circuit transients.
9. Simulation and Experimental validation of frequency response of RLC electric circuit.
10. Measurement of energy using single phase energy meter.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER BATCH:

S.No	EQUIPMENTS	
1.	Regulated Power Supply: 0 – 15 V D.C / Distributed Power Source.	10 Nos
2.	Function Generator (1 MHz)	10Nos
3.	Single Phase Energy Meter	1 No
4.	Oscilloscope (20MHz)	10 Nos
5.	Digital Storage Oscilloscope (20 MHz)	1 No
6.	Thermistor and RTD	each 1 No

7. 10 Nos of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / Matlab / other Equivalent software Package) and Printer (1No.)
8. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.) 8 Single Phase Wattmeter 3 Nos
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each 6 Nos
10. Circuit Connection Boards 10Nos

OUTCOMES :

On completion of this laboratory course, the student should be able to

1. Use laboratory equipment and techniques to measure electrical quantities using multi-meters, power supplies and oscilloscopes. (K1)
2. Understand DC and AC Network theorems and apply to them in laboratory measurements. (K2)
3. Analyze the transient response of series RL and RC electric circuits. (K4)
4. Simulate the frequency behavior of RLC electric circuits. (K6)
5. Design and simulate the resonance circuits. (K6)
6. Build applications using electrical AC & DC circuits. (K6)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	1	-	-	2	3	3
CO2	3	3	3	3	3	2	-	-	1	-	-	2	3	3
CO3	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO4	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO5	3	3	3	2	3	2	-	-	1	-	-	2	3	3
CO6	3	3	3	2	3	2	-	-	1	-	-	2	3	3

SEMESTER - I

20ESPL109 SDG NO. 4	FUNDAMENTALS OF COMPUTER SCIENCE LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop programs in C using basic constructs
- To impart writing skills of C programming and solving problems
- To learn to think logically and draw flow charts for problems
- To develop applications in C using arrays and functions
- To develop applications in C using Strings and Structures

LIST OF EXPERIMENTS

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
   - i. Small but tricky codes
   - ii. Proper parameter passing
   - iii. Command line Arguments
   - iv. Variable parameter
   - v. Pointer to functions
   - vi. User defined header
   - vii. Make file utility
   - viii. Multi file program and user defined libraries
   - ix. Interesting substring matching / searching programs
   - x. Parsing related assignments

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 60 STUDENTS

PC with C editor.

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Create flow chart for the problem and describe the C language syntax(K6)
2. Apply and practice logical formulations to solve some simple problems leading to specific applications(K3)
3. Develop C programs for simple applications making use of basic constructs, arrays and strings(K3)

4. Demonstrate C programming development environment, compiling, debugging, linking and executing a program using the development environment(K2)
5. Develop C programs involving functions, recursion, pointers, and structures &design applications using sequential and random access file processing(K3)
6. Design effectively the required programming components that efficiently solve computing problems in real world(K6)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO2	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO3	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO4	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO5	3	3	1	1	1	1	1	1	1	1	2	2	2	2
CO6	3	3	1	1	1	1	1	1	1	1	2	2	2	2

SEMESTER - I

20TPHS101 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES **6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp , Telegram, Youtube, Evolution of Android and IOS, Introduction to Linkedin & Benefits. (Practicals – Official Mail id- Linkedin Id Creation, Linkedin Profile Bulilding , Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE **6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN –DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode- VPN – Pros and Cons – Book mark.

UNIT III NETWORKING **6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online complier and editor (Practicals – Find Your System IP,Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM **6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION **6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking , Register for payment gateway).

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Social Network Etiquettes:

1. https://sproutsocial.com/glossary/social-media-etiquette/
2. https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx
3. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full
4. https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79
5. https://buffer.com/library/how-to-use-instagram/
6. https://www.webwise.ie/parents/what-is-youtube/
7. https://www.androidauthority.com/history-android-os-name-789433/
8. https://www.mindtools.com/pages/article/linkedin.htm

Unit II: Browsing Culture:

1. https://sites.google.com/site/bethanycollegeofteacheredn/unit--ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web

2. https://www.wordstream.com/articles/internet-search-engines-history
3. https://www.malwarebytes.com/phishing/
4. https://www.adpushup.com/blog/types-of-cookies/
5. https://www.eff.org/https-everywhere
6. https://www.sciencedirect.com/topics/computer-science/browsing-history\
7. https://www.vpnmentor.com/blog/pros-cons-vpn/
8. https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html

Unit III:Networking

1. https://www.guru99.com/types-of-computer-network.html
2. https://www.studytonight.com/computer-networks/network-topology-types
3. https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/
4. https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/
5. https://paiza.io/en

Unit IV : Professionalism

1. https://career.vt.edu/develop/professionalism.html
2. https://englishlabs.in/importance-dress-code/
3. https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life
4. https://www.thespruce.com/etiquette-of-proper-attire-1216800
5. https://shirleytaylor.com/why-are-communication-skills-important/
6. https://www.triad-eng.com/interview-tips-for-engineers/
7. https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself
8. https://toggl.com/track/business-etiquette-rules/

Unit V: Digital Identification

1. https://nad.ndml.in/nad-presentation.html
2. https://www.turtlemint.com/aadhaar-card-benefits/
3. https://www.bankbazaar.com/pan-card/uses-of-pan-card.html
4. https://www.passportindex.org/passport.php
5. https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account

6. https://en.wikipedia.org/wiki/QR_code
7. https://www.investopedia.com/terms/p/payment-gateway.asp
8. https://www.paisabazaar.com/banking/mobile-banking/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Learn and apply social network ethics. (K3)
2. Understand the browsing culture. (K2)
3. Analyze the networking concepts . (K4)
4. Develop self professionalism. (K3)
5. Gain hands-on experience in various digital identification procedures. (K2)
6. Analyse and apply the different digital payment gateway methods. (K4)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - I

20HSMG101 SDG NO. 4&5	PERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT **6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES **6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES **6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING **6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING **6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS

Note:

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Become an individual in knowing the self. (K4)
2. Acquire and express Personal Values, Spiritual values and fitness. (K4)
3. Practice simple physical exercise and breathing techniques. (K2)
4. Practice Yoga asana which will enhance the quality of life. (K1)
5. Practice Meditation and get benefitted. (K1)
6. Understanding moral values and need of physical fitness. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

20HSEN202 SDG NO. 4	BUSINESS COMMUNICATION AND VALUE SCIENCE - II	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To develop effective reading, presentation and group discussion skills
- To help students to identify personality traits and evolve as a better team player
- To understand what life skills are and their importance in leading a happy and well-adjusted life
- To motivate students to look within and create a morality, behavior & beliefs and to introduce the key concepts of values, diversity and inclusion
- To encourage the students to widen the writing skills in business communication

UNIT I LANGUAGE DEVELOPMENT 9

Listening: Social Issues - Class Discussion: Good And Bad Writing - Common Errors, Punctuation Rules - Use of Words – Definition – Compound Words – Jumbled Sentences - Speaking – Group Discussion on Social Cause – Writing Techniques - Creating an E Magazine : To Share Concepts and Ideas - Activity: Choose a Social Issue and Capture the Ideas in a Slam Book.

UNIT II READING TECHNIQUES 9

Create - Vision - Mission - Value Statement - Tagline and Design a Logo for an NGO – Speaking: Introduction to Basic Presentation Skills & Orai App – Reading - Introduction to Skimming and Scanning – Reading Passages and Short Stories – Writing: One Word Substitution – Sentences Expressing Purpose.

UNIT III PERSONALITY TRAITS AND TEAM PLAYER 9

Brain Storming - Class Discussion on Social Issue – Activity: Create – Design a Skit on Social Issue/NGO – Readout The Skit – Role Play – Individual Feedback - Team Work: Intro to Dr. Meredith Belbin and his Research on Team Work – Belbin's Personality Traits – Writing: Framing Questions – Report Writing.

UNIT IV CREATION OF COMMUNICATION 9

Listening: Short Film on Diversity – Discussion on The Concept Empathy – Group Activity: Create a Story of a Person's Life Affected by Social Issues -

Narrate The Story in First Person – Group Feedback – Write a Review in a Blog – Covering the Topics Discussed in Class – Verbal Analogies – Cause & Effect Expressions.

UNIT V MORALITY, DIVERSITY AND INCLUSION 9

Listening: "The Fish and I" by Babak Habibifar - Intro on Diversity & Inclusion - Different forms of Diversity in our society – Debate on the topic: diversity, morality and respect for individual – Group discussion: TCS Values – respect for individual and integrity – Writing: Job Application – resume preparation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2. Richards, C. Jack. Interchange Students' Book – 2 New Delhi: CUP, 2015.

REFERENCE BOOKS

1. Dr. A.P.J Abdul Kalam, "Guiding Souls : Dialogues on the purpose of life"; Publishing Year 2005; Co-author--Arun Tiwari .
2. Dr. A.P.J Abdul Kalam, "The Family and the Nation", Publishing year: 2015; Coauthor: Acharya Mahapragya.
3. Dr. A.P.J Abdul Kalam, "The Scientific India: A twenty First Century Guide to the World around us", Publishing year: 2011; Co-author- Y.S.Rajan.
4. Dr. A.P.J Abdul Kalam, "Forge Your Future: Candid, Forthright, Inspiring", Publishing year: 2014.
5. Peter H. Diamandis and Steven Kotler, "Abundance: The Future is Better Than You Think", Published: 21 Feb, 2012; Publisher: Free Press.
6. Simon Sinek, "Start With Why: How Great Leaders Inspire Everyone to Take Action", Published: 6 October 2011; Publisher: Penguin.
7. Sandra Moriarty, Nancy D. Mitchell, William D. Wells, "Advertising & IMC: Principles and Practice", Published: 15 June 2016; Publisher: Pearson Education India.

WEB REFERENCES:

1. ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS
   https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
2. A Framework for Making Ethical Decisions
   https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions

3. Five Basic Approaches to Ethical Decision- http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

ONLINE RESOURCES

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4. https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Understand and use the syntax appropriately in written communication (K2)
2. Develop materials to create vision, mission and tagline for a social cause (K2)
3. Apply the basic concept of speed reading, skimming and scanning in stories and passages (K3)
4. Write reports and reviews effectively using appropriate vocabulary, spelling and grammar. Also draft job application letters with Resume in a persuasive manner (K3)
5. Recognize the concepts of behavior and identify individual role in a team (K1)
6. Understand the basic concepts of Morality and Diversity and give respect for individual and integrity (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	1
CO2	-	-	2	-	-	-	-	-	2	2	-	2
CO3	-	-	-	-	-	1	1	2	3	3	-	3
CO4	-	-	-	-	-	-	-	2	2	3	1	3
CO5	-	-	-	-	-	-	-	2	3	3	1	1
CO6	-	-	-	-	-	-	1	2	2	2	1	1

SEMESTER - II

20BSPH205 SDG NO. 4	PRINCIPLES OF ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of semiconductors.
- To understand the principles of diodes and diode circuits.
- To learn the principles of bipolar junction transistors and field effect transistors.
- To understand the working of feedback amplifiers and oscillators.
- To learn the working of operational amplifiers and digital electronic fundamentals.

UNIT I SEMICONDUCTORS 9

Crystalline Material: Mechanical Properties - Energy Band Theory - Fermi Levels; Conductors - Semiconductors & Insulators - Electrical Properties - Band Diagrams - Semiconductors - Intrinsic & Extrinsic - Energy Band Diagram, P&N - Type Semiconductors - Drift & Diffusion Carriers.

UNIT II DIODES AND DIODE CIRCUITS 9

Formation of P-N Junction - Energy Band Diagram - Built-in-Potential - Forward and Reverse Biased P-N Junction - Formation of Depletion Zone, V-I Characteristics - Zener Breakdown - Avalanche Breakdown and its Reverse Characteristics - Junction Capacitance and Varactor Diode - Simple Diode Circuits - Load Line - Linear Piecewise Model - Rectifier Circuits - Half Wave - Full Wave - PIV, DC Voltage and Current - Ripple Factor - Efficiency - Idea of Regulation.

UNIT III BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS 9

Formation of PNP / NPN Junctions, Energy Band Diagram - Transistor Mechanism and Principle of Transistors - CE, CB, CC configuration - Transistor Characteristics - Cut-off Active and Saturation Mode - Transistor Action, Injection Efficiency - Base Transport Factor and Current Amplification Factors for CB and CE modes - Biasing and Bias stability - Calculation of Stability Factor Concept of Field Effect Transistors (Channel Width Modulation) - Gate Isolation Types - JFET Structure and Characteristics - MOSFET Structure and Characteristics - Depletion and Enhancement Type - CS, CG, CD Configurations - CMOS: Basic Principles.

UNIT IV FEEDBACK AMPLIFIER, OSCILLATORS 9

Concept (Block Diagram) - Properties - Positive and Negative Feedback - Loop Gain - Open Loop Gain - Feedback Factors - Topologies of Feedback Amplifier- Effect of Feedback on Gain - Output Impedance - Input Impedance - Sensitivities (qualitative) - Bandwidth Stability - Effect of Positive Feedback - Instability and Oscillation - Condition of Oscillation - Barkhausen Criteria.

UNIT V OPERATIONAL AMPLIFIERS AND DIGITAL ELECTRONICS FUNDAMENTALS 9

Introduction to Integrated Circuits - Operational Amplifier and its Terminal Properties - Application of Operational Amplifier - Inverting and Non-Inverting Mode of Operation - Adders - Subtractors - Constant-gain Multiplier - Voltage Follower - Comparator - Integrator - Differentiator - Difference Between Analog and Digital Signals - Logic ICS, Half and Full Adder/Subtractor - Multiplexers - Demultiplexers - Flip-flops - Shift Registers - Counters.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press.
2. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGrawHill Education.
3. Digital Logic & Computer Design, M. Morris Mano, Pearson

REFERENCES:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky.
2. Solid State Electronic Devices, 6 th Edition, Ben Streetman, Sanjay Banerjee
3. Electronic Principle, Albert Paul Malvino.
4. Electronics Circuits:Discrete & Integrated, D Schilling C Belove T Apelewicz R Saccardi.
5. Microelectronics, Jacob Millman, Arvin Grabel.
6. Electronics Devices & Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the basic principle of electronic circuits (K2)
2. Design electronic circuit with high efficiency (K3).
3. Building different application of diode, transistors, operational amplifier and logic circuit (K3)

4. Apply the working principle in various circuit such as feedback amplifier, operational amplifier and oscillator circuits(K3)
5. Identify and distinguish between active components and passive components (K4)
6. Gain extensive knowledge about Analog and digital electronics (K2)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	1	2	2	1	3	2
CO2	3	2	3	2	3	2	1	2	2	1	3	2
CO3	3	3	2	2	2	2	1	2	2	1	3	2
CO4	3	2	2	2	2	2	1	2	2	1	3	2
CO5	3	3	3	2	2	2	1	2	2	1	3	2
CO6	3	3	3	2	2	2	1	2	2	1	3	2

SEMESTER - II

20BSMA202 SDG NO. 4	LINEAR ALGEBRA	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement

UNIT I MATRICES AND DETERMINANTS 12

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

UNIT II SOLUTION OF SYSTEM OF LINEAR EQUATIONS 12

Vectors and Linear Combinations - Rank of a Matrix - Gaussian Elimination - LU Decomposition - Solving Systems of Linear Equations using the Tools of Matrices.

UNIT III VECTOR AND INNER PRODUCT SPACES 12

Vector Space - Dimension - Basis - Orthogonality - Projections - Gram-Schmidt Orthogonalization and QR Decomposition.

UNIT IV LINEAR TRANSFORMATIONS 12

Eigenvalues and Eigenvectors - Positive Definite Matrices - Linear Transformations - Hermitian and Unitary Matrices.

UNIT V APPLICATIONS OF LINEAR ALGEBRA 12

Singular Value Decomposition and Principal Component Analysis - Introduction to their Applications in Image Processing and Machine Learning.

TOTAL: 60 PERIODS

Note: Assignments & tutorials to cover the following topics: Vectors and linear combinations, Matrices, Linear Transformations, Complete solution to AX = b, Determinants, Eigenvalues and Eigenvectors.

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. Gilbert Strang, "Introduction to Linear Algebra", Wellesley-Cambridge Press, Fifth Edition, 2016.

REFERENCES:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, Seventh Edition, 2012.
2. Michael Greenberg, "Advanced Engineering Mathematics", Pearson, Second Edition, 1998.
3. P. N. Wartikar& J. N. Wartikar, "Applied Mathematics" Vol. I & II, Pune Vidyarthi Griha Prakashan, 1986.
4. R C Gonzalez and R E Woods, "Digital Image Processing", Pearson, Fourth Edition, 2018.

WEB RESOURCES:

1. https://machinelearningmastery.com/introduction-matrices-machine-learning/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
3. https://nptel.ac.in/courses/111/106/111106135/

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/
2. https://www.khanacademy.org/math/linear-algebra

OUTCOMES:

Upon completion of the course, the student should be able to

1. Solve the system of linear equations using Cramer's rule and matrix inversion methods .(K3)
2. Apply LU decomposition and Gauss elimination methods to solve system of linear equations.(K3)
3. Construct orthonormal basis using Gram Schmidt orthogonalisation process and use it for QR decomposition of a matrix. (K3)
4. Compute the eigen values and eigen vectors of positive definite, Hermitian and unitary matrices corresponding to the linear transformation of vector spaces.
5. Apply Singular Value Decomposition and Principal Component Analysis in analyzing data.(K3)

CO- PO,PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	2	1	-	-	-	1	1	-	1

SEMESTER - II

20BSMA203 SDG NO. 4	STATISTICAL METHODS WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- The objective of the course is to introduce the necessary statistical background for analyzing engineering problems
- To introduce R programming language

UNIT I LINEAR STATISTICAL MODELS AND TESTING OF HYPOTHESIS **14**

Simple Linear Regression and Correlation - Multiple Regression and Multiple Correlation. Test of Hypothesis – Concept and Formulation - Type I and Type II Errors - Neyman Pearson Lemma - Procedures of Testing - Analysis of Variance (one-way - Two-way with as Well as Without Interaction).

UNIT II ESTIMATION AND SUFFICIENT STATISTIC 10

Point Estimation, Criteria for Good Estimates (Un-biasedness - Consistency) - Methods of Estimation Including Maximum Likelihood Estimation - Sufficient Statistic – Concept and Examples - Complete Sufficiency - their Application in Estimation.

UNIT III NON-PARAMETRIC INFERENCE 12

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 IV BASICS OF TIME SERIES AND FORECASTING 10

Stationary - ARIMA Models: Identification -Estimation and Forecasting.

UNIT V R STATISTICAL PROGRAMMING LANGUAGE 14

Introduction to R - Functions, Control flow and Loops - Working with Vectors and Matrices - Reading in Data - Writing Data - Working with Data - Manipulating Data - Simulation - Linear model - Data Frame - Graphics in R.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. I. R. Miller, J. E. Freund and R. Johnson, "Probability and Statistics for Engineers" , 8th Edition, Pearson, 2015.
2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics" Vol. I and Vol. II., World Press, 1968.
3. Chris Chatfield, "The Analysis of Time Series: An Introduction", Chapman & Hall, 6th Edition, 2003.

REFERENCES:

1. D. C. Montgomery and E. Peck, "Introduction to Linear Regression Analysis", Wiley, Fifth Edition, 2012.
2. A. M. Mood, F. A. Graybill and D.C. Boes, "Introduction to the Theory of Statistics", Mc Graw Hill, Third Edition, 2001.
3. N. Draper and H. Smith, "Applied Regression Analysis", Wiley, Third Edition, 1998.
4. Garrett Grolemund, "Hands-on Programming with R", O'Reilly, 2014.
5. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison - Wesley, Second Edition, 2017.

WEB REFERENCES:

1. https://nptel.ac.in/content/syllabus.pdf/110105060.pdf

2. https://nptel.ac.in/content/syllabus.pdf/111105041.pdf
3. https://nptel.ac.in/content/syllabus.pdf/111104100.pdf

ONLINE RESOURCES

1. https://www.youtube.com/watch?v=VPZD aij8H0
2. https://www.youtube.com/watch?v=yZ0g-DIfVpc

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply the methods of Simple, Multiple - Correlation, Regression, Design of experiments to infer the relation among the given. (K3)
2. Analyse the properties of good estimators and methods of estimation in Statistical analysis. (K3)
3. Use testing of hypothesis to infer the given data. (K3)
4. Apply the appropriate non parametric hypothesis testing procedures based on inferences. (K3)
5. Analyse the various models of time series analysis for forecasting. (K3)
6. Apply the features of R language to implement statistical tests for the given data. (K3)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	1
CO2	3	3	3	2	-	-	-	-	-	-	-	1
CO3	3	3	3	2	-	-	-	-	-	-	-	1
CO4	3	3	3	2	-	-	-	-	-	-	-	1
CO5	3	3	3	2	-	-	-	-	-	-	-	1
CO6	-	-	3	2	3	-	-	-	-	-	-	1

SEMESTER - II

20CBPC201 SDG NO. 4 & 9	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basic terminologies of algorithm and data organization
- Understand the concepts of ADTs
- Learn linear data structures – lists, stacks, and queues
- Understand sorting, searching and hashing algorithms
- Learn dynamic data structures - Tree and Graph

UNIT I BASIC TERMINOLOGIES AND INTRODUCTION TO ALGORITHM 7

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 11

Array - Stack – Operations - Evaluating Arithmetic Expressions - Conversion of Infix to Postfix Expression - Queue – Circular Queue – DeQueue - Operations - Linked_List and its Types - Various Representations - Applications of Linear Data Structures.

UNIT III NON-LINEAR DATA STRUCTURE – TREES & GRAPHS 11

Trees – Tree Traversals - Binary Tree - Threaded Binary Tree - Binary Search Tree - B & B+ Tree - AVL Tree - Splay Tree - Graph - Directed - Undirected - Basic Terminologies and Representations - Graph Search and Traversal Algorithms - Operations & Applications of Non-Linear Data Structures.

UNIT IV SEARCHING AND SORTING ON VARIOUS DATA STRUCTURES 11

Sequential Search - Binary Search - Breadth First Search - Depth First Search Insertion Sort - Selection Sort - Shell Sort - Divide and Conquer Sort - Merge Sort - Quick Sort - Heapsort - Introduction to Hashing.

UNIT V FILES 5

File Organisation - Sequential - Direct - Indexed Sequential - Hashed and Various Types of Accessing Schemes.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. E. Horowitz, S. Sahni,S. A-Freed, "Fundamentals of Data Structures", Universities Press, Second Edition, 2008.
2. A.V.Aho, J. E.Hopperoft, J. D.UIlman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCES:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st Edition, Pat Morin, UBC Press.

WEB REFERENCES:

1. https://swayam.gov.in/nd2_cec19_cs04/preview
2. https://nptel.ac.in/courses/106102064/

ONLINE RESOURCES:

1. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
2. https://www.coursera.org/specializations/data-structures-algorithms

OUTCOMES:

Upon completion of the course, the student should be able to

1. Implement abstract data types for linear data structures.(K3)
2. Implement abstract data types for non-linear data structure(K3)
3. Apply the different linear and non-linear data structures to problem solutions(K3)
4. Implement the various sorting algorithms(K3)
5. Implement the various searching algorithms(K3)
6. Implement files and graph data structures for various applications(K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO2	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO3	3	3	2	3	3	1	1	1	2	2	3	3	3	2
CO4	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO5	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO6	2	2	1	2	1	1	1	0	2	2	3	3	3	2

SEMESTER - II

20HSMG206 SDG NO. 4 & 8	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge, with respect to concepts, principles of Economics, which govern the functioning of a firm / organization.
- To explain the students about concept of production, cost, national income, an aggregate supply and aggregate demand consumption
- To gain insights one economic concepts and its implications
- To obtain knowledge on market structures and its significance
- To understand the Macroeconomic variables and its real time impact on economy

UNIT I INTRODUCTION TO ECONOMICS 9

Economics – Definition - Types of Economic Analysis – Micro and Macro Economics, Demand - Types, Determinants; Supply - Determinants - Demand Curve - Supply Curve - Market Equilibrium -Elasticity of Demand and Supply.

UNIT II WELFARE ANALYSIS 9

Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice – Law of diminishing Marginal Utility - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve; Applications – Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect

UNIT III THEORY OF PRODUCTION **9**

Production Function – Types, Return to scale and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT IV INTRODUCTION – MACROECONOMICS BASIC **9**

National Income and its Components - GNP, NNP, GDP, NDP – Methods of measuring National Income; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports, Circular Flow of Money Income.

UNIT V MONEY - DEFINITIONS **9**

Demand for Money -Transactionary and Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model; Business Cycles and Stabilization – Monetary Policy – Objectives, Techniques, Fiscal Policy – Objectives, Types, Instruments, Economic Growth - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert S.Pindyck, and Daniel L. Rubinfeld, "Microeconomics", Pearson Publishing House 9th Edition.
2. Dornbusch, Fischer and Startz, "Macroeconomics", McGraw-Hill, 12th Edition, 2018.
3. D N Dwivedi, "Macroeconomics: Theory and Policy", McGraw-Hill, 5th Edition.

REFERENCE BOOKS:

1. Hal R, Varian, "Intermediate Microeconomics: A Modern Approach", W W Norton & Co Inc; Eigth edition.
2. N. Gregory Mankiw, "Principles of Macroeconomics", Cengage Learning, Eighth Edition, 2017.
3. Paul Anthony Samuelson, William D. Nordhaus, "Economics", McGraw-Hill, 19th Edition, 2011.

WEB REFERENCES:

1 https://www.rbi.org.in
2 https://data.oecd.org/economy.htm
3 https://www.focus-economics.com

4 www.mospi.gov.in
5 https://www.ibef.org

ONLINE REFERENCES:

1. https://www.udemy.com/course/principles-of-microeconomics-complete-course/
2. https://www.udemy.com/course/mastering-foundations-in-microeconomics/
3. https://swayam.gov.in/nd2_imb20_mg38/preview
4. https://swayam.gov.in/nd1_noc20_mg67/preview
5. https://www.coursera.org/learn/principles-of-macroeconomics/

OUTCOMES

Upon completion of the course, the student should be able to

1. To Understand basic principles and concepts of Microeconomics and use them to solve real world business problems (K2)
2. To Develop an understanding of the basic macroeconomic principles; and appreciate the relationship between key macroeconomic variables such as the investment, savings, inflation, employment, money supply, trade and forex, etc.(K4)
3. Applying the functioning principles of product and factor markets.(K3)
4. Able to Explain the fundamentals of national income and Aggregate supply and aggregate demand consumption.(K1)
5. To Comprehend the concepts of money and banking (K2)
6. Empathizing the implications of economic policy to society as a whole (K6)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	-	1	1	-	-	-	1	2	2
CO2	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO3	3	3	2	2	2	-	1	1	-	-	-	1	2	2
CO4	2	2	3	2	2	-	1	1	-	-	-	1	2	2
CO5	2	2	1	1	2	-	1	1	-	-	-	1	2	2
CO6	3	2	3	2	1	-	1	1	-	-	-	1	2	2

SEMESTER - II

20CYMC201 SDG NO. 4 & 8	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		2	0	0	0

OBJECTIVES:

- To study nature and facts about the environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organisms and the environment.
- To appreciate the importance of the environment by assessing its impact on the human world, the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – Biotic and abiotic components – Biogeochemical cycle (C, N & P) – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession - keystone species. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity – IUCN Red list species classification - endemic, endangered, rare, vulnerable, extinct and exotic species – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of Terrestrial (Forest, Grassland, Desert) and Aquatic ecosystem (Pond, Lake, River, Estuary and Marine)

UNIT II ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: Air pollution, Water pollution, Soil pollution Marine pollution, Noise pollution, Thermal pollution and Nuclear pollution – solid waste management: causes, effects and control measures of municipal solid wastes (MSW) – role of an individual in prevention of pollution – Case studies related to environmental pollution.

Disaster management: floods, earthquake, cyclone and landslides – nuclear holocaust – Case studies.

UNIT III NATURAL RESOURCES **6**

Forest resources: Use and over – exploitation, deforestation – Land resources: land degradation, man induced landslides, soil erosion and desertification – Water resources: Use and over- utilization of surface and groundwater – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – fertilizer – pesticide problems, water logging and salinity. Energy resources: Renewable energy (Solar energy, Wind energy, Tidal energy, Geothermal energy, OTE, Biomass energy) and non-renewable energy (Coal, Petroleum, Nuclear energy) sources. – role of an individual in conservation of natural resources. Case studies – timber extraction, mining, dams and their effects on forests and tribal people.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect- role of greenhouse gases on global warming. Chemical and photochemical reactions in the atmosphere - Formation of smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures). environmental ethics: Issues and possible solutions – Green chemistry - 12 principles of green chemistry.

Urbanisation - Urban problems related to energy - Water conservation: rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns - case studies. Environment Legislations and Laws : Environment (protection) act – 1986. Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act. Biomedical Waste(Management and Handling rules):1998 and amendments- scheme of labelling of environmentally friendly products (Ecomark) - Issues involved in enforcement of environmental legislation - central and state pollution control boards, role of non-governmental organization – Public awareness - Environmental Impact Assessment (EIA).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **5**

Population growth, variation among nations – population explosion – family welfare programme – women and child welfare environment and human health – HIV / AIDS – Role of Information Technology in environment and Human health – Case studies – human rights – value education – Sustainable Development – Need for sustainable development – concept – 17 SDG goals – 8 Millennium Development Goals(MDG).

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
1. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies'', Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

OUTCOMES

Upon successful completion of this course, student will be able to

1. Explain the different components of environment, structure and function of an ecosystem, importance of biodiversity and its conservation. (K1)
2 Aware about problems of environmental pollution, its impact on human and ecosystem, control measures and basic concepts in Disaster Management. (K2)
3. Disseminate the need for the natural resources and its application to meet the modern requirements and the necessity of its conservation. (K2)
4. Illustrate the various aspects of atmospheric chemistry with a focus on climate change and recognize the principles of green chemistry. Describe suitable scientific, technological solutions and Protection Acts to eradicate social and environmental issues. (K2)
5. Recognize the need for population control measures and the environmental based value education concepts to achieve the Sustainable Development Goals. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	1	2	-	1	1	-	2
CO2	2	2	2	-	2	2	3	1	2	2	-	2
CO3	1	1	1	1	-	1	1	-	1	2	-	1
CO4	2	2	2	2	1	1	1	-	1	1	1	1
CO5	2	2	1	-	-	1	1	-	-	-	1	-
CO6	1	1	1	1	1	1	1	1	1	1	1	1

SEMESTER - II

20CBPL202 SDG NO. 4	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Design and implement linear and non-linear data structures
- Develop & implement binary search trees with all operations
- Write functions to implement graph traversal algorithms
- Familiarize in sorting and searching algorithm
- Appropriately use the linear / non-linear data structure operations for a given problem

LIST OF EXPERIMENTS

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT

Equipments:

Standalone desktops with C compiler 30 Nos OR Server with C compiler supporting 30 terminals or more.

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Write functions to implement linear and non-linear data structure operations(K4)
2. Write programs to implement binary search trees with all operations(K4)
3. Write functions to implement graph traversal algorithms(K4)
4. Familiarize in sorting algorithm(K1)
5. Familiarize in searching algorithm(K1)
6. Appropriately use the linear / non-linear data structure operations for a given problem(K1)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	1	2	-	1	1	-	2
CO2	2	2	2	-	2	2	3	1	2	2	-	2
CO3	1	1	1	1	-	1	1	-	1	2	-	1
CO4	2	2	2	2	1	1	1	-	1	1	1	1
CO5	2	2	1	-	-	1	1	-	-	-	1	-
CO6	1	1	1	1	1	1	1	1	1	1	1	1

SEMESTER - II

20BSPL201 SDG NO. 4	PRINCIPLES OF ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To learn about the working of semiconductor diodes and its applications
- To learn about the working of transistor circuits
- To learn about the working of JFET, Oscillators and Amplifiers

LIST OF EXPERIMENTS

1. Semiconductor Diodes and application
2. Transisitor circuits
3. JFET, Oscillators and Amplifiers

TOTAL: 30 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No.	EQUIPMENTS
1.	SEMICONDUCTOR DIODES
2.	SEMICONDUCTOR DIODE CIRCUIT SET
3.	TRANSISTOR CIRCUIT SET
4.	TRANSISTORS (NPN,PNP)
5.	JFET CIRCUIT SET
6.	OSCILLATOR CIRCUIT SET
7.	AMPLIFIER CIRCUIT SET
8.	ELECTRONIC WIRES, ACCESSORIES, ETC

OUTCOMES

On completion of this laboratory course, the student should be able to:

1 Understand the diode circuits and its application. (K2)

2 Apply how to construct the transistor circuit and its working and its applications. (K3)

3 Design the Junction field Effect transistors and its working. (K6)

4 Design the oscillators circuit and its output waveform and their application. (K6)

5 Gain knowledge of amplifier circuit. (K1)

6 Gain knowledge of basic logic gate and universal logic gates and its application. (K1)

CO- PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	2	2	1	1	2	2
CO2	3	2	3	2	3	1	2	2	1	1	2	2
CO3	3	3	2	2	2	1	2	2	1	1	2	1
CO4	3	2	2	2	2	1	2	2	1	1	2	2
CO5	3	3	3	2	2	1	2	2	1	1	2	1
CO6	3	3	3	2	2	1	2	2	1	1	2	1

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING **6**

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS **6**

Basic Etiquette of virtual meeting – Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet – Screen Share - Jamboard - Feedback polling - Chatbox

(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING **6**

Online Certification - Coursera – Udemy – Edx – Cisco – Online Practice Platforms - SkillRack – Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

(Practicals - Campus Commune Registration , Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLE SUITE **8**

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts- Sites - Books - Blogger

(Practicals – Create google sheets and share - Create google Forms and share, Create Google Slide and share , Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS **4**

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

1. https://zety.com/blog/resume-tips
2. https://resumegenius.com/blog/resume-help/how-to-write-a-resume
3. https://www.hackerearth.com/recruit/
4. https://www.hackerrank.com/about-us

Unit – II:Virtual Meetings

1. https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general& cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB
3. https://hygger.io/blog/top-10-best-group-meeting-apps-business/
4. https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/

Unit – III:Online Learning

1. https://www.coursera.org/browse
2. https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion
3. https://www.edx.org/course/how-to-learn-online
4. https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html
5. https://campuscommune.tcs.com/en-in/intro
6. https://www.freshersnow.com/tcs-campus-commune-registration/
7. https://www.infosys.com/careers/hackwithinfy.html
8. https://www.mindtree.com/blog/osmosis-2013-my-experiences
9. https://www.myamcat.com/knowing-amcat
10. https://www.admitkard.com/blog/2020/02/06/amcat/

Unit IV: Google Suite

1. https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/
2. https://en.wikipedia.org/wiki/G_Suite
3. https://blog.hubspot.com/marketing/google-suite
4. https://kinsta.com/blog/g-suite/

Unit V: Presentation Skills

1. https://www.mindtools.com/CommSkll/EmailCommunication.htm
2. https://www.grammarly.com/blog/email-writing-tips/
3. https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://www.mbauniverse.com/group-discussion/tips
6. https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/
7. https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421
8 https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/
9. http://www.garrreynolds.com/preso-tips/design/

OUTCOMES:

On completion of this course, the student should be able to

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)
5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - II

20HSMG201 SDG NO. 4 & 5	INTERPERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES **6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION **6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS **6**

Group formation –Teamwork – Identify others attitude and behaviour – Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP **6**

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE **6**

Fostering trust and cooperation – Developing and maintain positive attitude – Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill India, 2012.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Develop a healthy relationship & harmony with others. (K1)
2. Practice respecting every human being. (K3)
3. Practice to eradicate negative temperaments. (K3)
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality. (K4)
5. Manage the cognitive abilities of an Individual. (K5)
6. Understanding the importance of public speaking and teamwork. (K2)

CO – PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - III

20BSMA305 SDG NO. 4	COMPUTATIONAL STATISTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the main features of multivariate data.
- To be able to use exploratory and confirmatory multivariate statistical methods effectively.
- To have insights in to various cluster analysis methods
- To use Factor analysis and Principal component analysis to identify patterns in the correlations between variables.
- To apply multivariate statistical techniques efficiently using statistical software such as python.

UNIT I MULTIVARIATE NORMAL DISTRIBUTION 9

Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

UNIT II MULTIPLE LINEAR REGRESSION MODEL 9

Standard multiple regression models with emphasis on detection of collinearity, outliers, non- normality and autocorrelation, Validation of model assumption. Assumptions of multivariate regression models, Parameter estimation.

UNIT III DISCRIMINANT ANALYSIS 9

Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. Multivariate Analysis of variance and covariance.

UNIT IV PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS 9

Principal components, algorithms for conducting principal component analysis, deciding on how many principal components to retain, H- plot. Factor analysis model, extracting common factors, determining number of factors, Transformation of factors analysis solutions, Factor scores.

UNIT V CLUSTER ANALYSIS 9

Introduction, types of clustering, correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-means Clustering- Profiling and Interpreting Clusters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Richard A. Johnson and Dean W. Wichem, "Applied Multivariate Statistical Analysis", 6th Edition, Pearson, 2013.
2. T.W. Anderson, "An Introduction to Multivariate Statistical Analysis", 3rd Edition, Wiley, 2003.
3. Mark Lutz, "Learning Python", 5th Edition, O'Reilly, 2013.

REFERENCE BOOKS:

1. J.D. Jobson, "Applied Multivariate Data Analysis", Volume I: Regression and Experimental Design, Springer, 1991.
2. J.D. Jobson, "Applied Multivariate Data Analysis", Volume II: Categorical and Multivariate Methods, 1st edition Springer, 1992.
3. H. Kris, "Statistical Tests for Multivariate Analysis", Springer – Verlag, Heidelberg.
4. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 2009.
5. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", 2nd edition, 2008.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=YgExEVji7xs
2. https://onlinecourses.swayam2.ac.in/ugc19_ma05
3. https://freevideolectures.com/course/3089/applied-multivariate-analysis

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105060/
2. https://www.digimat.in/nptel/courses/video/111104024/L02.html
3. http://nptel.ac.in/courses/111104024/

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Interpret the usage of multivariate Normal distribution. (K3)
2. Compute and interpret the results of multivariate regression. (K3)
3. Discriminate between groups and classify new observations. (K3)
4. Use principal component and factor analysis for multivariate data sets. (K3)
5. Apply cluster analysis to find groupings and associations. (K3)

CO-PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	1	1
CO2	3	3	2	1	1	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	1	1
CO4	3	3	2	1	1	-	-	-	-	-	1	1
CO5	3	3	2	1	1	-	-	-	-	-	1	1

SEMESTER - III

20CBPC301 SDG NO. 4	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To know about Turing machines and their capability
- To be familiar with undecidable problems and NP class problems

UNIT I INTRODUCTION 7

Alphabet - Languages and grammars- productions and derivation- Chomsky hierarchy of languages.

UNIT II REGULAR LANGUAGES AND FINITE AUTOMATA 10

Regular Expressions and languages- Deterministic Finite Automata (DFA) and equivalence with regular expressions- Non-deterministic Finite Automata (NFA) and equivalence with DFA- Regular grammars and equivalence with Finite Automata- Properties of regular languages- Kleene's theorem- pumping lemma for Regular languages- Myhill-Nerode theorem and its uses- Minimization of finite automata.

UNIT III CONTEXT-FREE LANGUAGES AND PUSHDOWN AUTOMATA 12

Context-Free Grammars (CFG) and Languages (CFL)- Chomsky and Greibach normal forms - nondeterministic pushdown automata (NPDA) and

equivalence with CFG - parse trees - ambiguity in CFG - pumping lemma for context-free languages - Deterministic Pushdown Automata (DPDA) - closure properties of CFLs. Context-sensitive languages- Context-sensitive grammars (CSG) and languages - linear bounded automata and equivalence with CSG.

UNIT IV TURING MACHINES **8**

The basic model for Turing machines (TM) - Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties - variants of Turing machines - Nondeterministic TMs and equivalence with Deterministic TMs - unrestricted grammars and equivalence with Turing machines - TMs as enumerators.

UNIT V UNDECIDABILITY **8**

Church-Turing thesis - Universal Turing machine - the Universal and Diagonalization languages - reduction between languages and Rice's theorem - undecidable problems about languages. Basic Introduction to Complexity-Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP classes - NP- completeness - Cook's Theorem - other NP -Complete problems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 3rd Edition, Pearson, 2008.
2. T.W. Anderson, "An Introduction to Multivariate Statistical Analysis", 3rd edition, Wiley, 2003
3. Mark Lutz, "Learning Python", 5th edition, O' Reilly, 2013

REFERENCE BOOKS:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice-Hall, 2nd Edition, 1981.
2. John Martin, "Introduction to Languages and the Theory of Computation". 2010.
3. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP Completeness", W.H. Freeman & co 1990.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/104/106104148
2. https:// automation simulator.com/
3. https://www.courseera.org/courses/
4. https://swayam.gov.in/nd1_noc19_cs79/

ONLINE RESOURCES:

1. https:// ocw.mit.edu/
2. online.standford.edu/courses/
3. http://www.youtube.com/watch?v=eqCkkC9A0Q4

OUTCOMES:

Upon completion of the course, the student should be able to

1 Understand the basic concepts of Automata theory (K2)
2 Illustrate FAs, NFAs, DFAs, Grammars, Languages modeling, small compiler basics (K3)
3 Describe the context free grammars and push down automata (K2)
4 Develop a computational model using Turing Machine (K3)
5 Explain the Decidability or Undecidability of various problems (K3)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	2	1	-	-	-	-	-	-	1	2	1
CO2	1	3	3	2	1	-	-	-	-	-	-	1	2	1
CO3	1	3	3	2	2	-	-	-	-	-	-	1	2	1
CO4	1	3	3	3	3	-	-	-	-	-	-	1	2	2
CO5	1	3	3	3	3	-	-	-	-	-	-	1	2	2

SEMESTER - III

20CBPC302 SDG NO. 4	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To recognize the basic structure of a digital computer and representation of nonnumeric data.
- To learn different arithmetic operations and organization of control unit.
- To study memory organization, different ways of communication with I/O devices and parallel processors.

- To understand the concept of pipelining and its impact in processor design.
- To learn memory organization techniques.

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Revision of Basics in Boolean Logic and Combinational/Sequential Circuits - 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 ARITHMETIC FOR COMPUTERS 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. Multiplication – Shift-and-Add - Booth Multiplier - Carry Save Multiplier. Division Restoring and Non-Restoring Techniques - Floating Point Arithmetic - IEEE 754 Format.

UNIT III PROCESSOR, CONTROL UNIT AND PARALLELISM 9

Introduction to X86 Architecture - 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. Parallel Processors: Introduction to Parallel Processors - Concurrent Access to Memory and Cache Coherency.

UNIT IV 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 – SCII - USB.

UNIT V MEMORY 9

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.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. M. Mano, “Computer System Architecture”, 3rd ed., Prentice Hall of India, New Delhi, 2009.

2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", The Morgan Kaufmann series, 5th Edition, 2014.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Mc Graw Hill, sixth edition, 2012.

REFERENCE BOOKS:

1. John P. Hayes, "Computer Architecture and Organization", 3rd edition, The McGraw Hill, 1998
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", 10th edition, Pearson, 2016.
3. Vincent P. Heuring and Harry F. Jordan Pearson, "Computer System Design and Architecture", 1996.

WEB REFERENCE:

1. https://www.sciencedirect.com/science/article/pii/B0122274105001319
2. https://cse.iitkgp.ac.in/~ksrao/caos2018.html
3. https://nptel.ac.in/courses/106/105/106105163/
4. https://www.cse.iitm.ac.in/course_details.php?arg=NjM

OUTCOMES:

Upon completion of the course, students should be ability to

1 Understand the physical and logical features of digital computers and express the data representation (K2)
2 Describe system architecture and identify instruction sets. (K2)
3 Illustrate the logic design of Arithmetic and control units. (K3)
4 Identify the mechanism of control units and distinguish hazards in pipelining to enhance system performance. (K1)
5 Describe and identify the standard I/O interface and peripheral devices. (K2)
6 Choose the appropriate memory mapping procedure and design. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	-	-	-	-	-	1	1	-
CO2	3	3	3	-	--	-	-	-	-	-	-	2	1	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO5	2	2	2	-	-	--	-	-	-	-	-	2	2	-
CO6	3	3	3	-	-	-	-	-	-	-	-	2	2	-

SEMESTER - III

20CSPC301 SDG NO. 4	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Object Oriented Programming concepts and principles of Packages, Inheritance and Interfaces
- To define Exceptions and use I/O streams
- To develop a Java application with threads and generic classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming – Abstraction – Objects and Classes – Encapsulation– Inheritance – Polymorphism– OOP in Java – Characteristics of Java – The Java Environment – Java Source File – Compilation - Fundamental Programming Structures in Java – Defining Classes in Java – Constructors - Methods - Access Specifiers – Static Members - Comments - Data Types- Variables - Operators- Control Flow- Arrays- Packages – Javadoc Comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super Classes– Sub Classes –Protected Members – Constructors in Sub Classes– The Object Class – Abstract Classes and Methods – Final Methods and Classes – Interfaces – Defining an Interface - Implementing Interface - Differences between Classes and Interfaces and Extending Interfaces – Object Cloning -Inner Classes -Array Lists -Strings.

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions-Creating own Exceptions - Stack Trace Elements - Input / Output Basics – Streams – Byte Streams and Character Streams – Reading and Writing Console – Reading and Writing Files.

UNIT IV MULTI-THREADING AND GENERIC PROGRAMMING 8

Differences between Multi-Threading and Multitasking - Thread Life Cycle - Creating Threads - Synchronizing Threads - Inter-Thread Communication - Daemon Threads - Thread Groups - Java Concurrency Packages - Generic Programming – Generic Classes – Generic Methods – Bounded Types – Restrictions and Limitations.

UNIT V LAMBDAS STREAMS AND REACTIVE PROGRAMMING 9

Lambda Expressions – Library Enhancements to Support Lambdas – No Parameter-Single Parameter - Multiple Parameters – With or Without Return Keyword-Comparator– Filter Collection Data-Streams-Generating Streams-Java Stream Interface Methods – For each-Map-Filter-Limit-Sorted - Parallel Processing - Reactive Programming– ReactiveX– ReactiveX Classes– Creating Operator– Reactive Subjects.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java - The Complete Reference", 8th Edition, McGrawHill Education, 2011.
2. E.Balagursamy- "Programming with Java", 6th Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, Harvey Deitel, "Java SE 8 for Programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Blackbook", Dream Tech Press, 2011.
3. Timothy Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000.

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. https://www.edureka.co/blog/object-oriented-programming/
3. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html

ONLINE RESOURCES :

1. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html
2. https://introcs.cs.princeton.edu/java/lectures/

OUTCOMES:

Upon completion of the course, students should be able to

1. Comprehend Object Oriented Programming Concepts in Java. (K2)
2. Illustrate the purpose of packages, Java documents and Analyze the various types of Inheritance. (K4)
3. Apply the Object Oriented Programming Concepts to develop the reusable Applications. (K3)
4. Illustrate the java applications using Java Exceptions and I/O Streams.(K4)
5. Understand the concept of Multithreading and Generic Classes in Java. (K2)
6. Design and implement Lambda expressions, streams and reactive programming. (K6)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	-	2	-	-	-	-	-	2	3	2
CO2	3	1	3	2	-	2	-	-	2	-	-	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	-	2	3	3
CO4	3	1	3	2	-	2	-	-	-	-	-	2	3	2
CO5	3	1	3	2	3	2	-	-	-	-	-	2	3	2
CO6	3	1	3	2	3	2	-	-	1	-	-	2	3	2

SEMESTER - III

20CBPC303 SDG NO. 4	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the phases in software project.
- To recognize the Cost estimation, risk and mitigation of Software project
- To understand fundamental concepts of requirements engineering and Analysis Modelling.

- To analyze the various software design methodologies, testing and maintenance measures.
- To Study the quality and Reliability of software products.

UNIT I INTRODUCTION **6**

Programming in the small vs. programming in the large, software project failures and importance of software quality and timely availability, engineering approach to software development, role of software engineering towards successful execution of large software projects, emergence of software engineering as a discipline; Basic concepts of life cycle models – different models and milestones;

UNIT II SOFTWARE PROJECT MANAGEMENTAND ESTIMATION TECHNIQUES **11**

Software Project Management:Software project planning –identification of activities and resources, concepts of feasibility study, techniques for estimation of schedule and effort,introduction to the concepts of risk and its mitigation, configuration management.

Estimation Techniques:Software cost estimation models and concepts of software engineering economics, techniques of software project control and reporting,Introduction to measurement of software size, software metrics and metrics-based control methods, measures of code and design quality.

UNIT III SOFTWARE REQUIREMENTS & Object Oriented ANALYSIS,DESIGN AND CONSTRUCTION **10**

Software Requirements Analysis, Design and Construction: Introduction to SRS and requirement elicitation techniques, requirement modeling techniques – decision tables, event tables, state transition tables, Petri nets

OOAD and Construction:Introduction to UML,Use cases, -Concepts - the principles of abstraction, modularity, specification, encapsulation and information hiding, concepts of abstract data type, Class Responsibility Collaborator (CRC) model, quality of design, design measurements, design patterns, Refactoring, object-oriented construction principles, object-oriented metrics.

UNIT IV SOFTWARE TESTING **9**

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables, testing use cases, transaction-based testing, testing for non-

functional requirements – volume, performance and efficiency, concepts of inspection.

UNIT V SOFTWARE QUALITY AND RELIABILITY 9

Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI), introduction to software reliability, reliability models and estimation.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning PrivateLimited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

ONLINE RESOURCES:

1. http://nptel.ac.in/.
2. http://infolab.stanford.edu/~burback/watersluice/watersluice.html.

WEB RESOURCES:

1. https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf.
2. http://www.darshan.ac.in/Upload/DIET/Documents/CE/2160701_Software%20Engineering%20Study%20Material%20GTU_23042016_032444AM.pdf.
3. https://jnec.org/lab-manuals/cse/te/se.pdf.

OUTCOMES :

Upon completion of the course, students should be ability to

1. Define the key approaches of engineering that yield the importance of software project quality.(K1)

2. Understand the different activities in software project plan , activities , management and cost estimation techniques.(K2)
3. Understand the software requirement specifications and the principles of unified modelling language to model the business requirements.(K2)
4. Select and apply the various testing concepts in software projects to maintain stable software products.(K3)
5. Compare and contrast the reliability and quality metrics of a software product.(K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	1	-	3	2	1	2
CO2	-	3	2	1	2	-	-	-	2	1	-	1	1	2
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	-
CO4	-	3	3	-	-	-	-	-	-	1	-	-	3	2
CO5	2	2	2	1	2	-	-	-	-	-	-	-	2	2

SEMESTER - III

20CBMG301 SDG NO. 4	FINANCIAL MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- Understand the fundamental concepts of financial management
- Appreciate basic concepts such as time value of money, cost of capital, risk and return, working capital management, capital budgeting etc.
- Leverage the concept for deciding financial angle of IT projects
- Understand the Importance of Financial Management to make good business decisions
- Implicate the Cost of Capital and Capital Structure for financing decisions

UNIT I FOUNDATIONS OF FINANCE 6

Financial Management- An Overview – Time Value of money – Introduction to the Concept of risk and return – Valuation of bonds and shares – Capital Assets Pricing model (CAPM).

UNIT II INVESTMENT DECISIONS 6

Capital Budgeting: Principles and techniques – nature of capital budgeting – Evaluation techniques: Payback, Accounting rate of return, Profitability Index – Project selection under capital rationing – Inflation and capital budgeting – concepts and measurement of cost of capital – Specific cost and overall cost of capital.

UNIT III FINANCING AND DIVIDEND DECISION 6

Financial and operating leverage – capital structure – cost of capital and valuation – designing capital structure – Dividend policy – aspects of dividend policy – practical consideration – forms of dividend policy – forms of dividends – share splits.

UNIT IV WORKING CAPITAL MANAGEMENT 6

Principles of working capital: concepts, needs, determinants, issues and estimation of working capital – Accounts receivables management and factoring – Inventory management – Cash management- Working capital finance: Trade credit, Bank finance and commercial paper.

UNIT V LONG TERM SOURCES OF FINANCE 6

Indian capital and stock market, new issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, private equity.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 12th edition, Dec, 2019
2 M.Y. Khan and P.K.Jain, "Financial management", Text, Problems and cases Tata McGraw Hill, 8th edition, 2018.
3. Aswat Damodaran, "Corporate Finance Theory and practice", John Wiley & Sons, 2019.
4. James C. Vanhorne, "Fundamentals of Financial Management", PHI Learning, 12th Edition, 2019.

REFERENCES:

1. Brigham, Ehrhardt, "Financial Management Theory and Practice", 13th edition, Cengage Learning 2015.
2. Srivatsava, Mishra, "Financial Management", Oxford University Press, 2018
3. K.Maran, "Financial Management", Sahara Publications, 2015.

ONLINE & WEB RESOURCES:

1. https://www.udemy.com/course/financial-management-a-complete-study/
2. https://www.udemy.com/course/business-finance-terms-for-everyone/
3. https://www.edx.org/course/financial-information-and-its-analysis?index=product&queryID=b8ab51bb31c1724f 7b93f7a7b124ad6e&position=11
4. https://www.edx.org/course/public-financial-management?index=product&queryID=c1302dcb629e3ad46265746fbeb06ca4&position=1

OUTCOMES:

Upon completion of the course, the student should be able to

1. Enable to learn and gain basic concepts of financial management. (K2)
2. Understand the role of financial management for performing business. (K2)
3. Gain knowledge for financial oriented problem solving in an organization. (K1)
4. Enable to identify causes and make inferences for financial feasibility. (K1)
5. Enhancing, evaluating and making judgment skills based on financial information. (K5)
6. Students to gain comparative analysis skills and able to predict the future financial results of the organization. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	-	2	3	3	2	-	3	-	2
CO2	2	-	1	3	-	-	2	-	3	-	-	3	-	1
CO3	2	2	1	3	1	-	2	-	3	2	-	3	-	2
CO4	2	2	-	3	1	-	2	-	1	3	-	3	-	2
CO5	1	2	-	-	1	-	2	-	2	-	-	3	-	2
CO6	2	-	-	2	3	-	2	-	2	3	-	3	-	3

SEMESTER - III

20HSEN301 SDG NO. 4	BUSINESS COMMUNICATION AND VALUE SCIENCE – III	L	T	P	C
		2	0	0	2

OBJECTIVES:

- Summarize the basic principles of SWOT and apply in real life situations.
- Recognize how motivation helps in real life and leverage in real life scenarios.
- Differentiate diversified culture of India. Identify the common errors acquire in cross – cultural communication and the implications of cross cultural communications.
- Define and differentiate global, glocal and translocational culture.
- Summarize the role of science in national building and define Artificial Intelligence and its impact.

UNIT I INTRODUCTION 5

SWOT and life positions – SWOT Vs. TOWS – activity create your SWOT – motivational stories on Maslow's Theory - Scenario based activity on identifying and leveraging motivation.

UNIT II PLURALISM IN CULTURAL SPACES 6

Identify pluralism in cultural spaces – activity: learn and exchange greetings - Awareness and respect for pluralism in cultural spaces - Differentiate between the different cultures of India - Group activity: Each group to perform a short dance piece from any of the Indian states - Define and differentiate the terms global, glocal and translocational culture – activity: Debate on Global, glocal, translocational impacts.

UNIT III CROSS-CULTURAL COMMUNICATION & GENDER AWARENESS 6

Cross-cultural communication: its implications and mistakes - Group activity to perform skits based on situations - Gender awareness: the roles and relations of different genders – activity: Gender awareness campaign - Groups to present the detailed plan of Gender awareness campaigns with four different themes: College, Workplace, Family and Friends.

UNIT IV SCIENCE IN NATION BUILDING& TECHNICAL WRITING 6

Role of Science in nation building - the role of scientists and mathematicians from ancient India - activity: Groups will be given five minutes to present on theinformation about ten eminent scientists and mathematicians of ancient India - Role of science post- independence - Introduction to technical writing -

Practice activity on technical writing.

UNIT V ARTIFICIAL INTELLIGENCE 7

Artificial Intelligence (AI) importance - AI in Everyday Life–activity:Design your college in the year 2090 - Groups need to create the college of future with the future teachers, teaching methods, types of students, etc - Communicating with machines – activity: Debate - Will machines control us in future? - Applying technical writing in profession: Theory with YouTube and DrBimal Ray's videos - Scenario-based Assessment on technical writing activity.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Lawrence G. Fine, The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats, 2010.
2. B. Hurn& B. Tomalin ,Cross-Cultural Communication Theory and Practice, Palgrave Macmillian, 2013.

REFERENCE BOOKS:

1. "The Handbook of Communication in Cross-cultural Perspective", Ed. DonalCarbaugh, Routledge, September 5, 2016
2. "Urban Diversity: Space, Culture, and Inclusive Pluralism in Cities Worldwide," Eds. Caroline Wanjiku, Blar A. Rubieet. al , John Hopkins University Press, 2010.
3. S.T. Raymond, "Artificial Intelligence in Daily Life", 2020.
4. "Morgan Kieran, Technical Writing Process: The simple, five-step guide that anyone can use to create technical documents such as user guides, manuals and procedures", Ed. SanjaSpajic, Better on paper publication, 2015.

WEB REFRENCES:

1. Examples of Technical Writing for Students
   https://freelance-writing.lovetoknow.com/kinds-technical-writing
2. 11 Skills of a Good Technical Writer
   https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/
3. 13 benefits and challenges of cultural diversity in the workplace
   https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/

ONLINE RESOURCES:

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M

3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4. https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

OUTCOMES

Upon completion of the course, the learners should be able to

1. Apply and analyse the basic principles of SWOT & life positions.(K3)
2. Understand the power of motivation and recognize the roles & relations of different genders.(K2)
3. Analyze cross cultural communication deeply and apply the concepts of global and glocal and translocational.(K3)
4. Apply the tools of technical writing and identify the best practices to produce technical writing.(K3)
5. Differentiate between the diverse cultures in India and apply the science of nation building.(K1)
6. Understand AI and recognize its impacts in daily life.(K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	-	3	3	3	3	2	2	3
CO2	-	-	1	-	-	2	2	2	2	2	-	-
CO3	-	-	2	-	-	2	2	2	2	2	-	-
CO4	-	-	-	-	-	-	1	2	2	3	2	3
CO5	-	-	-	-	-	1	1	2	2	2	-	-
CO6	-	-	1	-	2	1	1	2	1	1	1	2

SEMESTER - III

20CSPL301 SDG NO. 4	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of Packages, Inheritance and Interfaces
- To develop a Java application with Threads and Generic classes
- To make the students understand life cycle of the Applets and its functionality

LIST OF EXPERIMENTS :

1. Basic JAVA Programs
   a. Write a program to find the sum of individual digits of a positive integer.
   b. Write a program to generate the first n terms of the sequence.
   c. Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
   d. Write a program to find both the largest and smallest number in a list of integers.
   e. Write a program to find factorial of list of number reading input as command.
2. Write a program to calculate bonus for different departments using method overriding.
3. Write a program to sort list of elements in ascending and descending order and show the exception handling.
4. Write a program to implement the concept of importing classes from user defined package and creating packages.
5. Write programs that illustrate how the following forms of inheritance are supported:
   a) Single inheritance
   b) Multiple inheritance
   c) Multi level inheritance
   d) Hierarchical inheritance
6. Write a program to demonstrate use of implementing interfaces.
7. Write a program to implement interfaces all string operations.
8. Write a program to create student report using applet, read the input using text boxes and display the output using buttons.
9. Write a program to implement thread priorities.
10. Write a program to implement thread, applets and graphics to animate ball movement.
11. JAVA Applet program
    a) Write a Applet program using paint brush
    b) Write a program to display analog clock using Applet
    c) Write a program to create different shapes and fill colors using Applet
12. JAVA Event Handling program
    a) Write a program that display the x and y position of the cursor movement using Mouse
    b) Write a program that identifies key-up key-down event user entering text in a Applet

13. JAVA programs on Swings
    a) Write a program to build a Calculator in Swings
    b) Write a program to display the digital watch in swing
    c) Write a program that to create a single ball bouncing inside a Jpanel.
    d) Write a program JTree as displaying a real tree upside down

TOTAL : 45 PERIODS

LAB REQUIREMENTS :

Hardware :

Desktop Systems - Pentium IV with 2 GB RAM
160 GB HARD Disk
Monitor 1024 x 768 colour

Software :

Windows operating system
JDK 1.8

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Write Java programs in accordance with the object oriented programming concepts. (K6)
2. Design user defined java packages. (K6)
3. Create Java programs using Inheritance and Polymorphism. (K6)
4. Implement Error-handling techniques using Exception handling and Multithreading. (K6)
5. Develop Applet program and GUI using Swing components. (K6)
6. Enumerate the event handling techniques in Java Programming. (K5)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	-	-	-	-	2	2	3	2
CO2	2	2	3	2	-	2	-	-	-	-	2	2	3	2
CO3	2	2	3	2	-	2	-	-	2	2	2	2	3	2
CO4	3	3	2	2	-	2	-	-	-	-	2	2	3	2
CO5	3	3	3	2	-	2	-	-	-	-	2	2	3	2
CO6	2	3	3	2	-	2	-	-	2	2	2	2	3	2

SEMESTER - III

20CBPL301 SDG NO. 4	SOFTWARE ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the concepts of software engineering
- To understand the effectiveness of software project management
- To understand the metrics and models of software quality and reliability
- To implement software requirement analysis, design and construction
- To know the various software testing methods

LIST OF EXPERIMENTS

1. Preparation of required document for standard Application program in standard format(SRS).
2. DFD of standard application problem.
3. To prepare time line chart/Gantt Chart for selected software project.
4. Implement requirements modeling techniques and methods.
5. To perform the user's view analysis, Structural, behavioral diagram for the suggested system: Use case diagrams.
6. Implement of CRC model
7. Implement metrics of code and design quality
8. Implement verification and validation procedure
9. Implement Test plan /Test script
10. Implement Software Testing - Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT

EQUIPMENTS:

Argo UML/Star UML/UML Graph/Selenium or Equivalent

OUTCOMES:

On completion of this laboratory course, the student should be able to:

1. To utilize engineering approach to software development. (K3)
2. To practice various software life cycle models. (K3)
3. To implement software quality models. (K6)

4. To analyze the techniques of requirements gathering and modeling. (K4)
5. To implement class responsibility collaborator model. (K6)
6. To execute both white box and black box testing. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	1	-	3	2	1	-
CO2	2	3	1	1	-	1	-	-	-	-	-	-	-	-
CO3	2	2	2	1	2	-	-	-	-	-	-	-	1	1
CO4	-	3	2	1	2	-	-	-	2	1	-	1	2	1
CO5	2	3	-	1	-	1	-	-	-	-	-	-	2	-
CO6	-	3	3	-	-	-	-	-	-	1	-	-	2	-

SEMESTER - III

20CBPL302 SDG NO. 4	COMPUTATIONAL STATISTICS LABORATORY USING PYTHON	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To utilize the different data handling techniques
- To learn about Regression methods
- To understand clustering techniques for real-time applications
- To develop algorithms to find optimal solutions to prediction problems
- To learn the Python libraries to implement the techniques learnt in the course

LIST OF EXPERIMENTS

1. Write simple programs using Python statements, expressions and flow controls
2. Write programs using functions and numeric types
3. Write program using sequences, class definition and constructors
4. Implement file handling operations
5. Practice prediction concept
6. Test the performance analysis of regression analysis
7. Implementation of Principal Component Analysis for finding Important texts in a Corpus

8. Practice factor analysis
9. Clustering of images and text documents
10. Plot a graph using matplotlib package
11. Visualize various graph types

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT

EQUIPMENTS:

PYTHON 3 INTERPRETER FOR WINDOWS/LINUX

OUTCOMES :

On completion of this laboratory course, the student should be able to

1. Understand the basic concepts of python programming. (K2)
2. Practice prediction problems.(K3)
3. Implement regression methods. (K6)
4. Apply clustering techniques of images and text documents. (K3)
5. Develop principal component analysis for finding important texts in a corpus. (K6)
6. Plot a graph using matplotlib package. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	--	-	-	1	1	-
CO2	2	1	-	2	2	-	-	-	-	-	-	1	1	-
CO3	1	1	1	-	1	-	-	-	-	-	-	-	1	-
CO4	2	1	2	2	2	-	-	-	-	-	-	-	2	-
CO5	2	1	2	-	-	-	-	-	-	-	-	-	1	-
CO6	2	1	2	2	3	-	-	-	-	-	-	2	2	-

SEMESTER - III

20CBTE301 SDG NO. 4,11,15	LIVE-IN-LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems.
- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used

COURSE PLAN :

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: *The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.*

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 20 marks
3. Final evaluation (Last week of the semester) : 60 marks

Note: *All the three evaluations are mandatory for course completion and for awarding the final grade.*

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to

1. List the problems and conduct literature survey to identify the gap and come up with an application oriented research problem in the specific domain.(K1)
2. Understand the project characteristics and explore necessary tools and components needed at various stages of the project(K2)
3. Design and validate the proposed system using simulation.(K3)
4. Develop the Prototype of the proposed system by adapting Industrial safety standards and best financial management practices(K5)
5. Analyze the obtained results and prepare a technical report.(K4)
6. Evaluate the project and go for journals and patents publication.(K5)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20CBTP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVE:

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.

UNIT I QUANTITATIVE ABILITY – I **6**

Problems on Trains - Time and Distance - Height and Distance - Time and Work

UNIT II QUANTITATIVE ABILITY – II **6**

Problems on Ages - Alligation or Mixture - Chain Rule - Simple Interest - Simple Equation - Theory Of Equation.

UNIT III REASONING ABILITY – I **6**

Analytical Reasoning - Pipes and Cistern - Logical Problems - Logical Games - Logical Deduction - Data Sufficiency - Arithmetic Reasoning

UNIT IV VERBAL ABILITY – I **6**

Idioms & Phrases - Synonyms - Antonyms - Classification

UNIT V CREATIVITY ABILITY – I **6**

Venn Diagrams -Cube and Cuboids - Dice - Cubes and Dice - Figure Matrix.

TOTAL : 30 PERIODS

REFERENCES:

1. R. S. Agarwal ,"Quantitative Aptitude for Competitive Exams" .
2. Sarvesh Verma, Quantum CAT.
3. R. S. Agarwal , "A Modern Approach to Logical Reasoning".
4. Arun sharma , "Verbal Ability and Reading Comprehension".

PROBLEM SOLVING USING C PROGRAMMING AND WEB DEVELOPMENT, JAVA - PHASE 2

OBJECTIVES:

- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming language.
- To provide exposure to problem-solving through Java and Web Development.
- To give the student hands-on experience with the concepts

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING **6**

Introduction to Programming - Programing Domain : Artificial Intelligence - Systems Programming - Assembly Level Languages - Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING **6**

Features of C and its Basic Structure - Simple C programs - Constants - Integer Constants - Real Constants - Character Constants - String Constants Floating -

point Numbers - The type cast Operator - Interactive Programming.

Operators Expressions and Control statement - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The break statement and continue statement.

UNIT III OPERATORS, EXPRESSIONS AND CONTROL STATEMENTS 6

Arithmetic Operators - Unary Operators - Relational and Logical Operators - The Conditional Operator - Library Functions - Bitwise Operators - The Increment and Decrement Operators - The Size of Operator - Precedence of operators - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The switch statement - The while loop - The do…while loop - The for loop - The nesting of for loops - The break statement and continue statement.

UNIT IV WEB ESSENTIALS 6

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols the World Wide Web-HTTP request message-response message-Web Clients Web Servers-Case Study.

HTML5-Evolution of HTML-Request/Response Cycle-Uniform Resource Locator-Protocol-Document Object Model-HTML5 Tags and Syntax- Building Your First Web Page-Getting to Know HTML-Getting to Know CSS-Opening the Box Model-Positioning Content-Working with Typography-Setting Backgrounds & Gradients-Creating Lists-Adding Media-Building Forms-Organizing Data with Tables-Writing Your Best Code.

UNIT V : JAVA 6

Java Web Application Technologies -Servlet API and Overview Servlet- Java Server Pages : Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, JSP CRUD Application.

TOTAL : 30 PERIODS

REFERENCES:

1. Programming in ANSI C - Balagurusamy - Tata McGraw-Hill Education, 2008
2. Programming in C (3rd Edition), by Stephen G. Kochan, Sams, 2004
3. Programming in C - Stephen G. Kochan, III Edition, Pearson Education.
4. Web Technologies— HTML,JavaScript,PHP,java,JSP,ASP.Net,XML & Ajax – Black Book, Wiley, ISBN : 978-81-7722-997-4

ONLINE RESOURCES

1. Programming world wide web-Sebesta, Pearson Education ,2007.
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson
3. https://www.cs.uct.ac.za/mit_notes/web_programming.html
4. https://www.multitech.ac.ug/uploads/Introduction%20to%20Web%20Programming.pdf
5. https://www.youtube.com/watch?v=N6zCbPCBQ7A
6. https://www.youtube.com/watch?v=ewiOaDitBBw
7. https://www.youtube.com/watch?v=DzYyzmP4m5c

COURSE OUTCOMES :

Upon completion of this course, the students should be able to:

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Apply the concept of web publishing. (K3)
6. Analyze and Design applications using JAVA for Web Publishing. (K4)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - III

20MGMC301 SDG NO. 4	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

At the end of the course, the student is expected to

- To know about Indian constitution
- To know about central government functionalities in India
- To know about state government functionalities in India
- To know about Constitution function
- To Know about Constitutional remedies

UNIT I INTRODUCTION **6**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6**

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

UNIT V CONSTITUTIONAL REMEDIES **6**

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.

3. M.V. Pyle (2019) , "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
4 P.M. Bakshi, (2018) , "Constitution of India", Universal Law Publishing, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalandhar.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Explain the Constitution and Fundamental rights of citizens (K2)
2. Discuss the structure, hierarchy and functions of Central Government (K2)
3. Explain the functions of Supreme Court and Judiciary Systems in the state (K2)
4. Discuss the structure, hierarchy and functions of State Government (K2)
5. Recall the Centre-State relationship, constitutional amendments and functionaries (K1)
6. Discuss the remedies and rights available to India Citizens (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	-	-	-	-	-
CO2	-	-	-	-	-	1	1	-	-	-	-	-
CO3	-	-	-	-	-	1	1	-	-	-	-	-
CO4	-	-	-	-	-	1	1	-	-	-	-	-
CO5	-	-	-	-	-	2	1	3	-	-	-	-
CO6	-	-	-	-	-	2	1	2	3	-	-	-

SEMESTER - IV

20CBPC401 SDG NO. 4	DATATBASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of design of various data models and to study the database architecture
- To study the SQL and relational database design
- To understand the Query processing Techniques and internal storage structures using different file and indexing techniques
- To understand the fundamental concepts of transaction processing-concurrency control techniques and database security concepts
- To know the advanced database systems

UNIT I DATABASE DESIGN **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 DATABASES **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, Dependency preservation, Lossless design.

UNIT III QUERY PROCESSING AND STORAGE TECHNIQUES **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 AND DATABASE SECURITY **9**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic. Concurrency Control schemes, Database recovery. Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection

UNIT V ADVANCED TOPICS **9**

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. R. Elmasri S. B. Navathe, "Fundamentals of Database Systems", Addison Wesley, 2015
2. Raghu Ramakrishnan, "Database Management Systems", Mcgraw-Hill, 4th edition,2015.

REFERENCE BOOKS:

1. A. Silberschatz, H. F. Korth S. Sudershan, "Database System Concepts", McGraw Hill, 6th Edition 2010.
2. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", 6th Edition, 2012.
3. Pramod J. Sadalage and Marin Fowler, "NoSQL Distilled: A brief guide to merging world of Polyglot persistence", Addison Wesley, 2012.
4. Shashank Tiwari , "Professional No Sql", Wiley ,2011

ONLINE RESOURCES:

1. https://inst.eecs.berkeley.edu/~cs186/sp08/notes.html
2. https://www2.seas.gwu.edu/~bhagiweb/cs2541/lectures/lectures.html

WEB REFERENCES

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/

OUTCOMES:

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

1 Explain the fundamental concepts of database design using different models and relational query languages (K2)

2 Apply SQL Queries using open source and commercial database and relational database design (K3)

3 Apply the query processing techniques for the optimization of SQL queries (K3)

4 Utilize various indexing and hashing techniques of database and security mechanisms for authentication and recovery. (K3)

5 Apply various SQL queries for the Transaction processing & Locking using the concept of Concurrency control. (K3)

6 Interpret various advanced database to compare with traditional databases. (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	3	-	-	--	-	-	-	-	1	-
CO2	3	2	1	1	3	-	-	-	-	-	-	-	1	-
CO3	3	1	1	1	3	-	-	-	-	-	-	-	2	-
CO4	3	2	0	2	0	0	0	0	0	0	0	0	3	2
CO5	3	3	0	2	0	0	0	0	0	0	0	1	3	1
CO6	1	2	0	2	0	0	0	0	0	0	0	3	2	0

SEMESTER - IV

20CBPC402 SDG NO. 4	SOFTWARE DESIGN WITH UML	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Object Modeling and UML Language
- To discover requirements analysis using Case Modeling
- To implement the design using interaction diagrams
- To create the logical view of design stage using static UML diagrams
- To design the system using dynamic models

UNIT I INTRODUCTION TO OBJECT ORIENTED TECHNOLOGIES 9

Software development process: The Waterfall Model vs. The Spiral Model - The Software Crisis, description of the real world using the Objects Model. - Classes, inheritance and multiple configurations. - Quality software characteristics - Description of the Object-Oriented Analysis process vs. the Structure Analysis Model

UNIT II INTRODUCTION TO THE UML LANGUAGE AND DESIGN PATTERNS 9

Standards - Elements of the language. - General description of various models -

The process of Object-Oriented software development. - Description of Design Patterns - Technological Description of Distributed Systems

UNIT-III BUSINESS MODEL DIAGRAMS **9**

Requirements Analysis Using Case Modeling - Analysis of system requirements - Actor definitions. - Writing a case goal - Use Case Diagrams. - Use Case Relationships. Dynamic Model: State Diagram / Activity Diagram- Description of the State Diagram - Events Handling - Description of the Activity Diagram - Exercise in State Machine - Case studies to implement in design lab

UNIT IV THE LOGICAL VIEW DESIGN DIAGRAMS **9**

Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams - Description of goal - Defining UML Method, Operation, Object Interface, Class - Sequence Diagram - Finding objects from Flow of Events - Describing the process of finding objects using a Sequence Diagram - Describing the process of finding objects using a Collaboration Diagram –Mapping use case to sequence diagram - The Static Structure Diagrams. - The Class Diagram Model - Attributes descriptions - Operations descriptions - Connections descriptions in the Static Model - Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity- Case studies to implement in design lab.

UNIT-V TECHNICAL STACK DIAGRAMS **9**

Package Diagram Model - Description of the model. - White box, black box - connections between packagers - Interfaces - Create Package Diagram - Drill Down - Component Diagram Model - Physical Aspect - Logical Aspect - Connections and Dependencies - User face - Initial DB design in a UML environment. - Deployment Model - Processors - Connections - Components - Tasks - Threads - Signals and Events. – Mapping class diagram to create skeleton code to implement - Case studies to implement in design lab.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering: using UML, Patterns, and Java”, Third Edition, Prentice Hall, 2010.

REFERENCES

1. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, “Design Patterns: Elements of Reusable Object-Oriented Software” Addison-Wesley Professional, 1994.
2. Ali Bahrami, “Object Oriented Systems Development”, McGraw Hill Edition, 2017.

ONLINE RESOURCES

1. https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm
2. https://medium.com/omarelgabrys-blog/object-oriented-analysis-and-design-introduction-part-1-a93b0ca69d36

OUTCOMES :

At the end of the course, the students should be able to

1. Describe the fundamentals of software development process and object oriented technologies.(K2)
2. Identify an appropriate design pattern.(K2)
3. Explain OOAD systematic concepts and sketch the various UML diagrams.(K3)
4. Illustrate the logical view design diagrams.(K3)
5. Apply the knowledge of Technical stack diagrams to generate skeleton code to implement.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	-	-	-	-	-	-	-	1	1	-
CO2	1	1	3	2	-	-	-	-	-	-	2	2	2	1
CO3	2	2	3	-	2	-	-	-	-	-	-	2	2	-
CO4	1	1	2	-	-	-	-		-	-	-	-	1	-
CO5	1	1	3	-	2	-	-	-	-	-	-	1	2	-
CO6	2	2	3	3	2	-	-	-	-	-	-	-	2	-

SEMESTER - IV

20CBPC403 SDG NO. 4	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes, Threads and Scheduling algorithms.
- To understand the concept of Deadlocks and various memory management schemes.
- To understand I/O Management and File systems.

- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT I OPERATING SYSTEM OVERVIEW 7

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.

UNIT II PROCESS SCHEDULING 9

Processes – Definition - Process Relationship - Different states of a Process - Process State – transitions - Process Control Block (PCB) - Context switching - Thread: Definition - Various states - Benefits of threads - Types of threads - Concept of multithreads - 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.

UNIT III PROCESS MANAGEMENT 10

Inter-process Communication: Concurrent processes - precedence graphs - Critical Section - Race Conditions - Mutual Exclusion - Hardware Solution – Semaphores - Strict Alternation - Peterson's Solution - The Producer/Consumer Problem - Event Counters – Monitors - Message Passing - Classical IPC Problems: Reader's & Writer Problem - Dining Philosopher Problem - Barber's shop problem - Deadlocks: Definition - Necessary and sufficient conditions for Deadlock – Deadlock Prevention - Deadlock Avoidance: Banker's algorithm - Deadlock detection and Recovery - Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP).

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 SYSTEMS AND I/O SYSTEMS 10

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 – LOOK - Disk reliability - Disk formatting - Boot-block - Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls, Linux.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts Essentials", 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCE BOOKS:

1. William Stallings, "Operating Systems: Internals and Design Principles", Eighth edition, Pearson,2014.
2. Charles Patrick Crowley, "Operating System: A Design-oriented Approach", Mc Graw Hill, 2017
3. Gary J. Nutt, "Operating Systems: A Modern Perspective", Pearson, 1997
4. Maurice J. Bach, "Design of the Unix Operating Systems", Prentice/Hall International, Inc, 1986
5. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.

WEB RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106144/
2. https://www.coursera.org/courses?query=operating%20system
3. https://www.computerhope.com/jargon/o/os.html
4. https://www.os-book.com/OS9/slide-dir/
5. http://web.iitd.ac.in/~minati/MTL458.html

ONLINE RESOURCES:

1. https://www.udacity.com/course/introduction-to-operating-systems--ud923
2. https://freevideolectures.com/course/3670/introduction-to-operating-systems

OUTCOMES:

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

1 Describe the basic concepts and functionality of the operating system. (K2)
2 Illustrate various resource scheduling algorithms. (K3)
3 Understand process concepts, thread and deadlock management. (K2)
4 Discuss various memory management schemes. (K2)
5 Explain File & I/O management techniques.(K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-		-		-	-	1	-
CO2	2	3	-	2	-	-	-	-	-	-	-	2	2	-
CO3	3	2	-	1	-	-	-	-	-	-	-	1	1	-
CO4	2	3	-	2	-	-	-	-	-	-	-	1	1	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	1	-

SEMESTER - IV

20CBMG401 SDG NO. 4	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To Understand the Innovation – What it is and why it matter
- Learn to be familiar with creative and innovative thinking styles
- Learn to investigate, understand and internalize the process of founding a startup
- Learn to manage various types of IPR to protect competitive advantage
- To Understand the trends in entrepreneurship

UNIT I INNOVATION **6**

Innovation, invention and creativity, Types of innovation, Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations, Innovation is economy- entrepreneur and employment.

UNIT II BUILDING AN INNOVATIVE ORGANIZATION 6

Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture. Explore and manage the effects of new technology on people and work systems. An effective management for technological innovation- need for the integration of people, processes and technology.

UNIT III ENTREPRENEURSHIP 6

Entrepreneurship – character, quality of entrepreneur, Opportunity – risk – establishment strategies – Entrepreneurship is born or made – Techno entrepreneur – registration process and prosperous in global economy - Competitive Advantage.

UNIT IV PROJECT AND FINANCIAL PLANNING 6

Project feasibility – Types of feasibility study – sources of finance – Venture capital- Angel investors, Incubators – crowd funding – Grants and subsidies, Debts and term loans.

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) 6

Meaning, significance – IPR in India – Genesis and development- Innovation and IPR- Global Context. Types of IPR – Patent – Trademark – Copyrights – Geographical Indications- Industrial Designs – Application and registration Process. Uses for inventors, Industries and protect the intellectuals.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Joe Tidd, John Bessant. "Managing Innovation: Integrating Technological, Market and Organizational Change", Wiley India edition, 2020
2. Narayanan, V. K., "Managing Technology and Innovation for Competitive Advantage", first edition, Pearson education, New Delhi, (2006)
3. Raj Shankar, "Entrepreneurship – Theory and Practice" Vijay Nicole Publications, 2014.

REFERENCE BOOKS:

1. Bosworth D. & Webster E, "The Management of Intellectual Property (New Horizons in Intellectual property)", Edward Elgar Publications, 2006.
2. Richard Dorf & Thomas Byers, "Technology ventures from idea to enterprise", 2 nd edition, Mc Graw Hill publication, 2008.

3. Rajeev Roy, "Entrepreneurship" Second Edition, Oxford University Press, 2008.
4. K.Aswathappa, "Human Resource Management", 8th Edition, The Mcgraw-Hill Companies, 2018.

ONLINE & WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_hs102/preview
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc21_mg63/preview
4. https://onlinecourses.swayam2.ac.in/ntr21_ed41/preview
5. https://www.udemy.com/course/the21principles/

OUTCOMES :

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

1 Identify the basic concept of I innovation, creation invention and to develop economy through innovative K2
2 Explain new technologies style, role of entrepreneur in the new enterprise creation process (K2)
3 Demonstrate entrepreneurial style, role of entrepreneur in the new enterprise creation process (K2)
4 Explain the feasibility study and identify the source of fund for financial planning (K3)
5 Explain the fundamentals of intellectual property right, patent, trademark, copyright in industry sector and illustrate the registration process to protect intellectuals (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	-	-	1	3	1	1	3	3	1	1
CO2	1	2	3	-	2	-	3	2	-	3	2	-	1	1
CO3	1	1	3	-	1	-	1	2	-	3	2	-	1	1
CO4	2	-	2	-	1	-	1	2	-	2	2	-	1	1
CO5	1	-	3	3	3	-	1	2	-	2	-	-	1	1

SEMESTER - IV

20BSMA405 SDG NO. 4	OPERATIONS RESEARCH WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To provide students with knowledge and skills needed to apply various operations research tools and techniques for decision making in organizations.

UNIT I INTRODUCTION TO OR & LINEAR PROGRAMMING 12

Origin of OR and its definition – Types of OR problems – Deterministic vs stochastic optimization, Phases of OR – Problem formulation – Building mathematical model – Deriving solutions, Validating model, Controlling and implementing solution.

Linear programming – Example from industrial cases, Formulation of LPP – Implicit assumptions of LPP. Solution of LPP – Graphical method, Simplex method – Artificial variables – Big M method –Identification & resolution of special cases – Infeasibility, Unboundedness, Redundancy & Degeneracy – Sensitivity analysis.

UNIT II DUALITY OF LPP, TRANSPORTATION & ASSIGNMENT PROBLEMS 12

Duality of LPP – Formulation – Fundamental Theorem of duality, Dual – Simplex method and primal-dual algorithms.

Transportation problem – Introduction – Mathematical formulation – Balanced & Unbalanced Transportation Problems – Initial basic feasible solution – North-west corner rule – Lest cost method – Vogel's approximation method – Test for optimality – MODI method – Degeneracy & its solution.

Assignment problem – Introduction – Mathematical formulation – Balanced & Unbalanced Assignment Problem. Solution method – Hungarian algorithm.

UNIT III INVENTORY CONTROL 12

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy – Order, lead time. Fixed Order Quantity, Economic Order Quantity (EOQ), Production Order Quantity (POQ) and Quantity Discount models.

EOQ models for discrete units, sensitivity analysis and robustness, Special cases of EOQ models for safety stock with known / unknown stock out situation, models under prescribed policy – Probability situations.

UNIT IV QUEUING THEORY **12**

Definitions – Queue (waiting line), waiting time costs, characteristics of queuing system (arrival, service & queue discipline), queue types (channel vs phase).

Kendall's notation, Little formula, steady state behavior, Poisson's process & queue, Queuing models M|M|1, M|M|k – and its performance measures with examples – Brief description about some special models.

UNIT V PERT – CPM **12**

Project definition, project scheduling techniques – PERT & CPM, Grant chart – Determination of critical paths, Estimation of project time and its variance in PERT. Concept of project crashing / time – Cost trade off.

Simulation methodology:

Definition and steps of simulation, random number, random number generator, discrete event system simulation – Clock, event list. Application in scheduling, Queuing systems and inventory systems.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Hamdy A. Taha, "Operation Research: An introduction", 10th Edition, Pearson, 2017.

REFERENCE BOOKS:

1. Linear Programming, Katta G. Murty, Wiley, 1983.
2. Linear programming, G. Hadley, Addison-Wesley publishing company, 1978.
3. Principles of Operation Research with Applications to Managerial Decisions, H.M Wagnes, Englewood Cliffs: Prentice Hall, 1975.
4. Introduction to Operation Research, F.S. Hillier and G. J. Lieberman, 11th Edition, McGraw Hill, 2021.
5. Elements of Queuing Theory, with Applications, Thomas L. Saaty, New York, McGraw – Hill, 1961.
6. Operations Research and Management Science, Hand Book: Edited by A. Ravi Ravindran, 1st edition, CRC press, 2007.
7. Management Guide to PERT / CPM, J.D. Wiest and F.K. Levy, NJ: Prentice –Hall, 1969.
8. Modern Inventory Management, J.W. Prichard, R.H. Eagle, Wiley, 1965.

WEB REFERENCES:

1. https://freevideolectures.com/course/2678/advanced-operations-research
2. https://onlinecourses.swayam2.ac.in/cec21_ma09

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111/105/111105039/
2. https://nptel.ac.in/courses/110/106/110106059/
3. https://nptel.ac.in/courses/110/106/110106062/
4. https://nptel.ac.in/courses/110/105/110105095/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Construct LP models for various type of problems and solve them using graphical method and simplex algorithm and analyze the sensitivity of the optimal solution based on the changes in the model parameters. (K3)
2. Formulate the dual problem from primal and solve it to find the solution of the primal using duality principles.Model and solve transportation and assignment problems. (K3)
3. Develop a sound understanding about the various aspects of inventory management and will be able to calculate optimum inventory order quantities and compute safety levels. (K3)
4. Derive the mathematical models of Markovian queues and compute various measures of performance through these models. (K3)
5. Construct networks and find optimal scheduling using CPM and PERT. (K3)
6. Apply simulation techniques in Project scheduling, Queueing and Inventory systems. (K3)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	1	1
CO2	3	3	2	1	1	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	1	1
CO4	3	3	2	1	1	-	-	-	-	-	1	1
CO5	3	3	2	1	1	-	-	-	-	-	1	1
CO6	3	3	2	1	1	-	-	-	-	-	1	1

SEMESTER - IV

20CBMG402 SDG NO. 4	MARKETING MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- Understand basic marketing concepts
- Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world
- Leverage marketing concepts for effective decision making
- Understand basic concepts and application of statistical tools in Marketing research
- To Practice research report writing and presentation

UNIT I MARKETING - CONCEPTUAL FRAMEWORK **6**

Market Environment – Internal and External - Marketing relationship with other functional areas – Consumer Marketing – Service Marketing – Market Segmentation.

UNIT II MARKETING MIX **6**

Product Planning and Development – PLC – New Product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and Sales Promotion – Pricing Objectives – Factors and Methods.

UNIT III BUYER BEHAVIOUR **6**

Consumer Behaviour – Understanding Industry and Individual Buyer Behaviour – Influencing Factor – Buyer Behaviour Models; Buyer Behaviour – Methods and Measuring Customer Satisfaction – CRR - Customer Acquisition – Retaining - Defection.

UNIT – IV MARKETING RESEARCH **6**

Introduction - Scope and Importance - Types of Market Research – Techniques – Sources of Data Collection – Hypothesis - Sampling – Different Techniques of Sampling – Data Analysis – Importance of Statistical Tools for Analysis – Quality of Good Research Report and Process.

UNIT – V NETWORK MARKETING **6**

Internet Marketing – Scope - Objectives – Social Media Marketing - Types of Social Media and its Role for New - Age Business Development; Uses of Online

Business - E-Commerce – Scope – Strategy - Importance for Business Development – Economic Development.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Philip Kotler and Kevin Keller, "Marketing Management",15th edition, PHI, 2017.
2. Ramaswamy and Namakumari, "Marketing Management", 6e edition, AGE Publications India Pvt Ltd, 2018.
3. Paul Baines, Chriss Fill Kelly Pagb, "Marketing Management", II Edition, Asian Edition, 2018.

REFERENCE BOOKS:

1. S. A. Sherlekar and R.Krishnamoorthy, "Marketing Management", Himalaya Publishing House, 2015
2. Micheal R. Czinkota & Masaaki Kotabe, "Marketing Management", Vikas Thomson Learning, 2016
3. KS Chandrasekar, "Marketing Management Text and Cases", McGrawHill Publications, 2015.
4. Philip Kotler, Abraham Koshy, Mithileswar Jha, Kevin Lane Keller, "Marketing Management: A South Asian Perspective", 14th edition Pearson 2016.
5. NAG, "Marketing successfully - A Professional Perspective", Macmillan 2012.

ONLINE & WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg51/preview
2. https://www.edx.org/course/marketing management?index=product&queryID=d757b8fcf377fb56ab5f232913737553&position=1
3. https://www.edx.org/course/marketing-management 2?index=product&queryID=3f97462d431d5de04821d99a5a8ce238&position=2
4. https://www.udemy.com/course/event-marketing-how-to-create-a-successful-event-series/

COURSE OUTCOMES:

1 Explain the marketing environment components and different fields in marketing (K2)

2 Demonstrate the method of market segmentation, targeting and positioning and the management of marketing mix factors and methods (K2)

3 Build the consumer buying behaviour models and methods (K3)

4 Demonstrate the steps involved in marketing research and the statistical tools for market research (K2)

5 Illustrate the importance of business as well as economic development incorporating ideas of social media marketing and e-commerce (K2)

CO-PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	-	-	1	3	1	1	3	3	1	1
CO2	1	2	3	-	2	-	3	2	-	3	2	-	1	1
CO3	1	1	3	-	1	-	1	2	-	3	2	-	1	1
CO4	2	-	2	-	1	-	1	2	-	2	2	-	1	1
CO5	1	-	3	3	3	-	1	2	-	2	-	-	1	1

SEMESTER - IV

20CBPL401 SDG NO. 4	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand and learn the data definitions and data manipulation commands
- To use of nested and join queries
- To learn functions, procedures and procedural extensions of databases
- To be familiarize with the use of front end tool
- To expose the DBMS concepts on different applications

LIST OF EXPERIMENTS:

1. Database Design using ER modeling, normalization and Implementation for any application.
2. Data definition commands, Data manipulation commands performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Database querying – Simple queries, Nested queries, sub queries and join queries to retrieve information from the database.
4. Creation of Views, Synonyms, Sequence, Indexes, Save point.
5. Creation of Cursors, Procedures and Functions
6. Creation of Triggers
7. Write a PL/SQL block that handles all types of exceptions.

   Mini project (Application Development using Oracle/ Mysql)

   a) Inventory Control System.
   b) Material Requirement Processing.
   c) Hospital Management System.
   d) Railway Reservation System.
   e) Personal Information System.
   f) Web Based User Identification System.
   g) Timetable Management System.
   h) Hotel Management System

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE:

Standalone desktops 30 Nos.

(or)

Server supporting 30 terminals or more.

SOFTWARE:

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent

OUTCOMES:

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

1. Understand the concepts of databases and SQL queries. (K2)
2. Design and implement a database schema for a given problem-domain by using typical data definitions and manipulation commands. (K6)
3. Analyse the database and normalise it. (K4)
4. Populate and query a database for implementing in real world applications. (K3)
5. Demonstrate PL/SQL programming using stored procedures, functions and packages. (K6)
6. Design front end and back end for enterprise applications . (K6)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	1	-	-	-	-	-	-	1	1	-
CO2	1	1	2	-	-	-	-	-	-	-	-	1	2	-
CO3	-	2	-	2	-	-	-	-	-	-	-	0	2	-
CO4	-	1	2	-	-	-	-	-	-	-	-	1	2	-
CO5	-	-	1	2	2	-	-	-	-	-	-	1	2	-
CO6	-	-	3	-	2	-	-	-	-	-	-	2	2	-

SEMESTER - IV

20CBPL402 SDG NO. 4	SOFTWARE DESIGN WITH UML LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Understand the object-oriented software development process
- Design suitable pattern to develop software models
- Analyze requirements to create requirements design model
- Apply business modeling and modeling languages to design software
- Develop correct and robust software deployment models

LIST OF EXPERIMENTS:

1. Requirements Engineering
2. Writing Problem Statement
3. Writing Requirement Specification
   a. SRS
   b. Use Case
4. Planning Project with PERT Diagram
5. Designing Project
   - Use Case Diagrams
   - Interaction Diagrams
   - State chart Diagrams and Activity Diagrams
   - Class Diagrams
   - Package Diagrams
   - Component Diagrams and Deployment Diagrams
6. Mapping Design to code

Suggested Domains for Mini-Project:

1. Passport automation Systems
2. Stock Management Systems
3. Online Reservation Systems
4. Student Information Systems
5. Software Personnel Management Systems
6. Credit Card Management Systems
7. Recruitment Systems
8. Library Management Systems

Total : 45 PERIODS

WEB REFERENCES

1. https://www.ibm.com/support/pages/ibm-rational-rose-enterprise-7004-ifix001

OUTCOMES :

After completion of the course, the students should be able to

1. Decide a suitable software model for a project. (K5)
2. Describe how to model object-oriented languages . (K2)
3. Design a project business model. (K6)
4. Elicit requirements and design a user interface model. (K6)
5. Create a deployment model. (K6)
6. Apply object-oriented design to develop a software. (K3)

CO-PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	-	-	-	-	-	-	-	1	-
CO2	3	2	1	1	3	-	-	-	-	-	-	-	1	-
CO3	3	2	1	1	3	-	-	-	-	-	-	-	2	2
CO4	3	2	1	1	3	-	-	-	-	-	-	-	1	-
CO5	3	2	1	1	3	-	-	-	-	-	-	-	2	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-	2	-

SEMESTER - IV

20CBPL403 SDG NO. 4	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms,Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement File Organization and File Allocation Strategies
- To implement Page Replacement Algorithms

LIST OF EXPERIMENTS:

1. Basics of UNIX commands
2. Write shell programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Implementation of Semaphores
6. Implementation of Shared memory and IPC
7. Banker's Algorithm for deadlock avoidance.
8. Implementation of Deadlock Detection Algorithm
9. Write C program to implement Threading & Synchronization Applications
10. Implementation of the following Memory Allocation Methods for
    a) First Fit b) Worst Fit c) Best Fit

11. Implementation of Paging Technique of Memory Management
12. Implementation of Page Replacement Algorithms
    a) FIFO b) LRU c) LFU
13. Implementation of various File Organization Techniques.
14. Implementation of the following File allocation techniques.
    a) Sequential b) Indexed c) Linked
15. Case Study on XV6 OS

TOTAL : 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos. with Linux OS (or)

Server with C / C++ / Java / Equivalent compiler 30 terminals or more with Linux OS.

Open source : Case study: XV6

OUTCOMES:

After completion of the course, the students should be able to

1. Learn the basic Unix commands and shell programming. (K2)
2. Evaluate the performance of System call and different types of CPU Scheduling algorithms. (K5)
3. Examine Process creation and Inter Process communication. (K1)
4. Implement Deadlock avoidance and Deadlock Detection algorithms.(K6)
5. Demonstrate page replacement algorithms and memory management techniques. (K6)
6. Implementation of file organization and file allocation strategies. (K6)

CO-PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	0	0	0	0	0	0	0	0	0	1	-
CO2	3	2	0	1	0	0	0	0	0	0	0	1	2	-
CO3	2	3	0	2	0	0	0	0	0	0	0	2	2	-
CO4	2	3	0	2	0	0	0	0	0	0	0	1	1	-
CO5	3	2	0	0	0	0	0	0	0	0	0	1	1	-
CO6	1	0	3	0	2	0	0	0	0	0	0	1	2	-

SEMESTER - IV

20CBTE401 SDG NO. 4,11,15	LIVE-IN-LAB - II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To offer students a glimpse into real world problems and challenges that need IT based solutions
- To improve the team building, communication and management skills of the students
- To introduce students to the vast array of literature available of the various research challenges in the field of CSE

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
2. The course must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
3. Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
4. On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 30marks
3. Final evaluation (Last week of the semester) : 50marks

Note: *All the three evaluations are mandatory for course completion and for awarding the final grade*

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
2. Design and validate the proposed system using simulation(K6)
3. Prototype the proposed system(K5)
4. Analyze the obtained results and prepare a technical report(K4)
5. Publish the work in journals and apply for the patents.(K3)
6. Prepare for industrial environment and real time work(K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20CBTP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS – PHASE 1

OBJECTIVES:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III **6**

Compound Interest - Profit and Loss- Partnership - Percentage- Set Theory

UNIT II QUANTITATIVE ABILITY – IV **6**

True Discount-Ratio and Proportion - Simplification - Problems On H.C.F and L.C.M

UNIT III REASONING ABILITY – II **6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY – II **6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part-Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY – II **6**

Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror &Water Images.

TOTAL : 30 PERIODS

REFERENCES:

1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams".
2) Sarvesh Verma, "Quantum CAT".
3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
4) Arun sharma, "Verbal Ability and Reading Comprehension".

ADVANCED C PROGRAMMING AND DATA PROCESSING AND VISUALIZATION WITH PYTHON - PHASE 2

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To understand procedural programming methods using Dynamic memory Allocation.
- To use python and open source tools.
- To understand the general concepts of data analysis using python

UNIT I INTRODUCTION TO RECURSION **6**

Introduction to Recursion, Types of Recursion - Head Recursion , Tail Recursion, Tree Recursion, Indirect Recursion and Nested Recursion . Recursion vs Looping - Analysis on efficiency of looping and recursion,

Working of recursive code in main memory. Recurrence Relation , Different types of recurrence relation. Deriving time complexity and space complexity using recurrence relation.

UNIT II GROWTH FUNCTIONS AND RECURSION 6

Polynomial Equations, Compare growth functions - order growth functions, omega growth functions, theta growth functions - Constant time, Linear time, Logarithmic time, Quadratic time and exponential time. Problems on Recursions - Factorial Number, Sum of first N Natural Numbers, Nth Fibonacci Number, Exponent Function, Taylor Series, Tower of Hanoi.

UNIT III STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION 6

Storage Classes and Visibility, Automatic or local variables, Global variables, Static variables, External variables, File Inclusion, Macro Definition and Substitution, Macros with Arguments, Nesting of Macros, Conditional Compilation, Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with calloc, Freeing Memory, Reallocating Memory Blocks, Pointer Safety, The Concept of linked list, Inserting a node by using Recursive Programs, Sorting and Reversing a Linked List, Deleting the Specified Node in a Singly Linked List.

UNIT IV DATA ANALYSIS 6

Introduction to data science-open source tools- exploratory data analysis-Descriptive statistics, Frequency Tables and summarization.

UNIT V VISUALIZATION WITH PYTHON 6

Univariate Analysis (Distribution of data & Graphical Analysis) -Bivariate Analysis (Cross Tabs, Distributions & Relationships, Graphical Analysis) - Creating Graphs- Bar/pie/line chart/histogram/ boxplot/ scatter/ density etc)

TOTAL : 30 PERIODS

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988.
4. Frank Pane, “Hands On Data Science and Python Machine Learning”, Packt Publishers, 2017.

5. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials", Packt Publications, 2nd Edition, 2016
6. https://www.coursera.org/learn/datavisualization

COURSE OUTCOMES :

Upon completion of this course, the students should be able to:

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
5. Apply predictions and data analysis using Open Source Tools. (K3)
6. Analyze data visualisation using Python. (K4)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - IV

20CBMC401 SDG NO. 4	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		1	0	0	0

OBJECTIVES:

- To get a knowledge about Indian Culture
- To Know Indian Languages and Literature religion and philosophy and the fine arts in India
- To Explore the Science and Scientists of Ancient, Medieval and Modern India
- To Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 6

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 6

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature.

UNIT III RELIGION AND PHILOSOPHY 6

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only).

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 6

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT V EDUCATION SYSTEM IN INDIA 6

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 30 PERIODS

REFERENCES:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition",ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200
4. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

OUTCOMES:

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

1. Understand philosophy of Indian culture. (K2)
2. Distinguish the Indian languages and literature. (K4)
3. Explain the philosophy of ancient, medieval and modern India. (K2)
4. Outline the information about the fine arts in India. (K2)
5. Analyze the contribution of scientists of different eras. (K4)
6. Understand education systems in India (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	1	-	-	-	3	-	-	-	-	-	-
CO2	-	2	-	1	-	-	-	3	-	-	-	-	-	-
CO3	-	2	-	1	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	2	1	3	-	-	-	-	-	-	-
CO5	-	2	-	1	-	-	-	3	-	-	-	-	-	-
CO6	-	2	-	1	-	-	-	3	-	-	-	-	-	-

SEMESTER - V

20CBPC501 SDG NO. 4,9	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the various phases of a Compiler.
- Analyze the various parsing techniques and different levels of translation.
- Understand Semantic analysis and run-time environment.
- Understand intermediate code generation and optimization.
- Learn about code improvement and type systems.

UNIT I INTRODUCTION TO COMPILERS 6

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

UNIT II SYNTAX ANALYSIS 12

Context-free languages and grammars, push-down automata, LL(1) gram mars 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 9

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 location, scope.

UNIT IV INTERMEDIATE CODE GENERATION AND CODE IMPROVEMENT 9

Translation of different language features, different types of intermediate forms. Code Improvement: Control-flow, data-flow dependence, local optimization, global optimization, loop optimization, peep-hole optimization

UNIT V ARCHITECTURE DEPENDENT CODE IMPROVEMENT & ADVANCED TOPICS 9

Instruction scheduling (for pipeline), loop optimization (for cache memory). Register allocation and target code generation. Type systems, data

abstraction, compilation of object oriented features and non-imperative programming languages.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", Second Edition, Pearson Education, 2007.

REFERENCE BOOKS:

1. Doug Brown, John Levine, and Tony Mason, "Lex & Yacc Second Edition, O'Reilly & Associates, 1995.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
3. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

WEB REFERENCES:

1. http://www.holub.com/software/compiler.design.in.c.docs.pdf
2. http://www.cs.usfca.edu/~galles/compilerdesign/x86.pdf

ONLINE RESOURCES:

1. https://www.javatpoint.com/compiler-tutorial

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Demonstrate the functioning of a Compiler. (K2)
2. Develop language specifications using context free grammars (CFG). (K3)
3. Illustrate the syntax tree and the memory management process. (K3)
4. Apply the concepts of intermediate code generation and various optimization techniques. (K3)
5. Implement architecture dependent code generation. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	1	1	-	-	-	-	-	-	1	2	1
CO3	2	3	1	2	-	-	-	-	-	-	-	1	2	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1	2	1
CO5	3	2	-	-	-	-	-	-	-	-	-	1	2	1

SEMESTER - V

20CBPC502 SDG NO. 4	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Familiarize the student with asymptotic analysis, performance of algorithm
- Enable the student to analyze various techniques of designing an algorithm
- Familiarize the student with the concepts, graph and tree traversals
- Introduce the computability of algorithms
- Introduce the concepts of beyond NP

UNIT I INTRODUCTION **9**

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 master's Theorem.

UNIT II FUNDAMENTAL ALGORITHMIC STRATEGIES **9**

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

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 8

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 10

Approximation algorithms, Randomized algorithms, Class of problems beyond NP-PSPACE, Introduction to Quantum Algorithms.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. E. Horowitz and S. Sahni, Fundamental of Computer Algorithms,2nd Edition, Universities Press,2007.
2. A. Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms, Addison-Westey Publishing Company,1974.

REFERENCE BOOKS:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012
2. S. Baase, D. E. Knuth, The Art of Computer Programming, 3rd Edition, Addision-Wesley, 1998.
3. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information,10th edition, Cambridge University Press, 2010.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106101060
2. https://www.cse.iitm.ac.in/course_details.php?arg=OTI
3. https://swayam.gov.in/nd1_noc19_cs47/previ

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/
2. http://www.learnalgorithms.in/
3. https://courses.cs.vt.edu/ csonline/Algorithms/Lessons/

4. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms.

OUTCOMES:

Upon completion of the course, the student should be able to

1 Review the fundamentals of algorithmic problem solving and analyzing efficiency of algorithms (K2)
2 Apply mathematical formulation, complexity analysis and methodologies to solve recurrence relations for algorithms (K3)
3 Critically analyze the different algorithm design techniques for a given problem (K3)
4 Synthesize graph and tree traversal algorithms and algorithms that employ computations as key components and analyze them (K3)
5 Illustrate NP class problems and formulate solutions using standard approach (K2)
6 Articulate solutions for real life problems using approximation algorithm and quantum principles (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	1
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	1
CO3	2	3	-	1	-	-	-	-	-	-	-	-	-	1
CO4	2	3	-	2	-	-	-	-	-	-	-	-	-	1
CO5	1	2	-	1	-	-	-	-	-	-	-	-	-	1
CO6	1	2	1	2	-	-	-	-	-	-	-	-	-	1

SEMESTER - V

20CBMG501 SDG NO. 4	FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To help students gain an understanding of the functions and responsibilities of managers
- To provide them with techniques and be used in the performance of managerial jobs
- To help students to develop cognizance of the importance of human behavior in organizations
- To enable the students to learn principles of organizational design, culture and
- To help students recognize the organizational challenges to ethical behavior.

UNIT I MANAGEMENT THEORIES **6**

Concept and Foundations of Management, Evolution of Management Thoughts. Organisational Environment, Types of Business Organization.

UNIT II FUNCTIONS OF MANAGEMENT **6**

Planning - Process, Types, MBO, Planning Premises, Decision Making, Problems in Decision Making - Organising-Formal vs. Informal Organisation, Departmentation, Delegation – Staffing - Recruitment, Selection, Training, Performance Appraisal- Directing- Motivation and Communication - Controlling- Process, Types, Budgetary and Non budgetary Control Techniques.

UNIT III ORGANIZATION BEHAVIOUR **6**

Introduction, Personality, Perception, Learning and Reinforcement, Group Dynamics, Power & Influence, Work Stress and Stress Management, Leadership - Concept, Nature, Importance, Attributes of a leader, Leadership Grid.

UNIT IV ORGANIZATIONAL DESIGN **6**

Determinants, Traditional and Modern Organizational types, Organizational Culture, Change Process and Types, Organizational Innovation Process

UNIT V MANAGERIAL ETHICS **6**

Ethics and Business, Ethics of Marketing & Advertising, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility, Current Trends & Issues in organisation types.

TOTAL:30 PERIODS

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, David De Cenzo (2016) " Fundamentals of Management", Pearson publication, 9th edition.
2. Dr. Mishra and Dr. O.P. Gupta(2022), Fundamentals of management, SBPD Publishing house, 1st edition
3. L. M. Prasad (2021), Principles and practice of management, Sultand Chand and sons.
4. Ranjeet Verma(2016) , Fundamentals of management, Vayu education of India, Latest edition.

REFERENCE BOOKS:

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Prasad L M, "Principels and Practices of Management", Sultan Chand & Sons, 2019.
3. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

WEB REFERENCES:

1. https://theintactone.com/2019/09/18/fom-u1-topic-1-fundamentals-of-management-introduction-and-concepts/
2. https://www.smu.edu/cox/Executive-Education/Fundamentals-of-Management
3. https://www.slideshare.net/Knight1040/fundamentals-of-management-lesson-1

REFERENCES:

1. https://gateknowledge.in/fundamentals-of-management/
2. https://nios.ac.in/media/documents/srsec319new/319EL10.pdf
3. https://www.coursera.org/learn/fundamentals-of-management

OUTCOMES:

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

1. Understand the concepts related to business and the evolution of management thoughts (K2)

2. Describe the roles skills processes of functions of management(K2)
3. To analyze challenges and opportunities of organizational behavior, perception, learning of group dynamics, stress management, motivation & leadership management(K4)
4. To apply various organizational structures, and cultures and analyze how an effective organizational design, and suitable innovation process coordinate to achieve the organizational purpose(K3)
5. Demonstrate an understanding of common ethical problems in business and improve the ability of the students towards a resolution of an ethical dilemma.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	2	-	2	-	2
CO2	-	-	-	-	-	-	-	-	2	1	-	1	-	3
CO3	-	1	-	-	-	-	-	-	-	1	-	2	-	3
CO4	-	2	2	2	2	1	1	1	1	1	-	2	-	3
CO5	-	2	2	2	2	-	-	2	2	2	-	3	-	3

SEMESTER - V

20CBMG502 SDG NO. 4	BUSINESS STRATEGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of strategic management and understand its nature in the competitive landscape
- To enable the students to understand the firm's resources and capabilities to determine the best path forward for the firm
- To identify the threats and opportunities that exist in an external business environment
- Prepare organizational strategies that will be effective for the current business environment
- To guide the students in strategy implement

UNIT I INTRODUCTION TO STRATEGIC MANAGEMENT 9

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

UNIT II INTERNAL ENVIRONMENT OF FIRM 9

Recognizing a Firm's Intellectual Assets - 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 9

Competitive Strategy - 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 Portfolio Analysis - Expansion,Integration and Diversification - Strategic Alliances, Joint Ventures and Mergers & Acquisitions – case studies.

UNIT V STRATEGY IMPLEMENTATION 9

Structure and Systems - The 7S Framework - Strategic Control and Corporate Governance

TOTAL :45 PERIODS

TEXT BOOKS :

1. AzharKazmi, Adela Kazmi,(2020) Strategic Management, Mc Graw Hill, Fifth Edition
2. Callie Daum(2020), , Business Strategy Essentials You Always Wanted To Know , Vibrant Publishers , Second Edition
3. Suman Chopra , 2017 ,Strategic Management And Business Policy ,Sarup Book Publishers ,
4. Thomas L. Wheelen , J. David Hunger, Alan N. Hoffman , Strategic Management and Business Policy: Globalization, Innovation and Sustainability ,Fifteenth Edition , Pearson

REFERENCE BOOKS:

1. M.E. Porter, Competitive Strategy, The Free Press, New York, 1980.https://doi.org/10.1002/smj.4250020110
2. Michael E.Porter, Competitive Advantage, The Free Press, New York, 1985.

3. Richard Rumelt , Good Strategy Bad Strategy: The Difference and Why It Matters. Profile Books, Fourth edition,2011

ONLINE RESOURCES:

1. https://www.feedough.com/business-strategy-definition-levels-examples/
2. https://www.imd.org/imd-reflections/reflection-page/business-strategy/
3. https://www.vistage.com/research-center/business-leadership/strategic-planning/20181105-10-steps-building-best-business-strategies/

OUTCOMES:

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

1. Memorise the major theories, background work, and concepts in the field of strategic management.(K2)
2. To understand the firm's internal resources and capabilities and determine strategies for competitive advantage.(K2)
3. Analyze the different strategies that the firm must be aware of in the external environment.(K3)
4. Devise corporate and growth strategies in managing a business successfully in a global context.(K3)
5. To apply how to leverage organizational structure and systems and strategies in the implementation.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	1	1	-	1	2	-	1	-	1	-	2
CO2	-	2	2	2	-	1	-	2	2	2	-	2	-	2
CO3	-	2	2	2	-	2	2	2	3	3	2	3	-	2
CO4	-	2	2	2	3	-	-	2	2	2	3	2	-	3
CO5	-	-	1	2	-	-	-	2	3	2	2	2	-	3

SEMESTER - V

20CBPC503 SDG NO. 4,9	DESIGN THINKING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To learn design thinking concepts and principles.
- To familiarize the different phases of design thinking.
- To recognize the importance of design thinking.
- To ideate and find solutions by applying various methods to different problems.
- To develop a prototype and perform testing.

UNIT I INTRODUCTION **6**

Introduction to design thinking - Importance of design thinking for business – Principles of Design Thinking - Phases of design thinking – How to plan a Design Thinking project - Experiential activity – Case study.

UNIT II EMPATHIZE PHASE **6**

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

UNIT III DEFINE PHASE **6**

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

UNIT IV IDEATION PHASE **6**

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

UNIT V PROTOTYPE AND TESTING **6**

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 : 30 PERIODS

TEXT BOOKS:

1. Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing, November 2018.

REFERENCE BOOKS:

1. Nir Eyal and Ryan Hoover, "Hooked: How to Build Habit-Forming Products", Library of Congress, 2014.
2. Dan Senor and Saul Singer, "Start-Up Nation", Grand Central Publishing, Twelfth Edition, 2009.
3. Rod Juokins, "The Art of Creative Thinking Hardcover, Hodder & Stoughton, 2016.
4. Simon Sinek, "Start With Why How Great Leaders Inspire Everyone To Take Action Simon Sinek", PENGUIN PUBLISHING INDIA, First Edition, 2011.

WEB REFERENCES:

1. "What is Design Thinking? Interaction Design Foundation", https://www.interaction-design.org/literature/topics/design-thinking
3. "Design thinking 101: Principles, Tools & Examples to transform your creative process", https://justcreative.com/design-thinking-101/

ONLINE RESOURCES:

1. https://in.pinterest.com/pin/design-thinking-process-introduction-national-entrepreneurship-network--792633603136916519/
2. https://www.slideshare.net/liwei1025/design-thinking-and-innovation-at-apple-63380402
3. https://www.pinterest.com/pin/177681147777359702/
4. https://www.innovationtraining.org/virtual-design-thinking-workshop-from-stanford-d-school/
5. https://edcaptain.com/so-many-uses-an-activity-designed-to-spark-creativity-and-design-thinking/

Outcomes:

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

1. Familiarize the key concepts of design thinking and its principles. (K2)
2. Recognize the steps to empathize phases of Design Thinking.(K2)
3. Illustrate the steps in the define phase of Design Thinking. (K3)
4. Apply the ideation phase of Design Thinking.(K3)
5. Develop and test a prototype created through a Design Thinking process (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	1	2	1	2
CO2	2	2	2	2	-	-	-	-	-	-	1	2	1	2
CO3	2	2	2	2	-	-	-	-	-	-	1	2	1	2
CO4	2	2	2	2	-	-	-	-	-	-	1	2	1	2
CO5	2	2	2	2	-	-	-	-	-	-	1	2	1	2

SEMESTER - V

20CBPL501 SDG NO. 4	COMPILER DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the various phases in the design of a compiler.
- To understand the design of top-down and bottom-up parsers.
- To understand syntax directed translation schemes.
- To understand code optimization techniques
- To introduce LEX and YACC tools.

LIST OF EXPERIMENTS

1. Implement a lexical analyzer to recognize tokens in C. (Ex. identifiers, constants, operators, keywords etc.).
2. Design a Calculator using LEX.
3. Identify an arithmetic expression using LEX and YACC.
4. Evaluate expression that takes digits, *, + using YACC.
5. Generate Three address codes for a given expression (arithmetic expression, flow of control).
6. Implement Code Optimization Techniques like copy propagation, dead code elimination, common subexpression elimination.
7. Generate Target Code (Assembly language) for the given set of Three Address Code.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos.
with Linux OS (or)

Server with C / C++ / Java / Equivalent compiler 30 terminals or more with Linux OS.Open source: C, LEX, YACC, BISON

OUTCOMES:

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

1. Understand the basics of compiler (K2)
2. Analyze the role of syntax and semantic of programming language in compiler construction(K4)
3. Apply the techniques and algorithms used in compiler constructions in compiler component design(K3)
4. Implement different tools in construction of different phases of compiler(K6)
5. Understand the applications of compiler design language (K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	-	-	-	-	-	-	2	2	2	2
CO2	1	2	2	1	-	-	-	-	-	-	2	2	2	2
CO3	1	2	2	1	-	-	-	-	-	-	2	2	2	2
CO4	1	2	2	1	-	-	-	-	-	-	2	2	2	2
CO5	1	2	2	1	-	-	-	-	-	-	2	2	2	2

SEMESTER - V

20CBPL502 SDG NO. 4	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Analyze the asymptotic performance of algorithms
- Demonstrate the familiarities the major algorithms and data structures
- Apply important algorithm design paradigms and methods of analysis
- Synthesize efficient algorithms in common engineering design situations
- Construct correctness proof of algorithms

LIST OF EXPERIMENTS:

- Bin packing algorithm

- Knapsack problem using greedy method
- Travelling salesman problem using dynamic programming
- Binary Tree traversals
- Graph traversals
- Dijkstras shortest path algorithm
- Prims and kruskals minimum spanning tree algorithms
- Topological sorting
- Network flow algorithm

TOTAL : 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos. with Linux OS (or)

Server with C / C++ / Java / Equivalent compiler 30 terminals or more with Linux OS.

Open source: Case study: Xv63

OUTCOMES:

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

1. Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)(K6)
2. Develop variety of algorithms for traversals such as graph and tree etc.,(K6)
3. Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language. (K6)
4. Analyze and compare the performance of algorithms using language features. (K4)
5. Apply and implement learned algorithm design techniques and data structures to solve real-world problems. (K3)

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO3	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO4	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO5	2	2	2	2	-	-	-	-	-	-	-	1	2	1

SEMESTER - V

20CBTE501 SDG NO. 4,11,15	LIVE-IN-LAB - III	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY:

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

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

1 Perform literature survey to identify the gap and an application oriented research problem in the specific domain (K2)
2 Design and validate the proposed system using simulation (K3)
3 Implement the proposed system (K3)
4 Examine the obtained results and prepare a technical report (K4)
5 Publish the work in journals and apply for the patents.(K3)
6 Prepare for industrial environment and real time work (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - V

20CBTP501 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS - PHASE I

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.
- Equip with creative thinking and problem solving skills

Unit I Quantitative Ability – V **10**

Square Root And Cube Root, Logarithm, Volume and Surface Area, Permutation and Combination

Unit II Quantitative Ability – VI **10**

Probability, Averages, Area, Odd Man Out, Crypt Arithmetic, Flowcharts

Unit III Reasoning Ability – III **8**

Data Interpretation Table Charts, Data Interpretation Bar Charts, Blood Relationship, Puzzles

Unit IV Verbal Ability – III **10**

Spellings, Selecting Words, Spotting Errors, Ordering of Words, Logical Sequence of Words

Unit V Creativity Ability – III **7**

Logical Puzzles, Playing Cards Puzzles, Clock Puzzles, Number Puzzles, Sudoku

TOTAL : 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun Sharma

PYTHON PROGRAMMING & FULL STACK DEVELOPMENT – PHASE II

OBJECTIVES

- The course is designed to provide Strong knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

UNIT I INTRODUCTION, DATATYPES AND STRINGS, LIST & TUPLES 10

DataTypes - Integer , Float , Boolean , String , List , Tuple , Dictionary and Sets. String - Concatenation and Replication, isalnum functions, Slicing Operation sorted() , reversed() , min() , max() , index() and count() function, packing and unpacking of data in a tuple

UNIT II DICTIONARY AND SETS and HANDLING **10**

Dictionary - del Keyword,. Sets - Frozen sets, Internal working of sets, add() , union() , intersection() and difference() method, symmetric_difference, clear() method, Operators in sets, Higher Order Functions - map , filter , reduce

and lambda function, Random Library

UNIT III EXCEPTIONAL HANDLING, REGULAR EXPRESSIONS AND OBJECT ORIENTED PROGRAMMING 10

Exception Handling - All Error Categories, try , except , finally blocks, Raising an exception, Regular Expression, Object Oriented Programming - Types of Inheritence, Data encapsulation and Abstraction, Polymorphism, Method OverRiding, Operator overloading, operator overRiding,

UNIT IV JAVA SCRIPT AND REACTJS 8

JavaScript-Introduction to JavaScript-Applying JavaScript (internal and external)-Understanding JS Syntax-Introduction to Document and Window Object-Variables and Operators-Data Types and Num Type Conversion-Math and String Manipulation-Objects and Arrays-Date and Time-Conditional Statements-Switch Case -Looping in JS-Functions ReactJS-Introduction-Templating using JSX-Components, State and Props-Lifecycle of Components-Rendering List and Portals-Error Handling-Routers-Redux and Redux Saga-Immutable.js-Service Side Rendering-Unit Testing-Webpack

UNIT 5 NODEJS AND MONGODB 7

NodeJS-Overview- Basics and Setup-Console-Command Utilities-Modules-Concepts-Events-Node js with Express js-Database Access MongoDB- SQL and NoSql Concepts-Create and Manage MongoDB- Migration of Data into MongoDB-MongoDB with PHP-MongoDB with NodeJS-Services Offered by MongoDB

TOTAL:45 PERIODS

REFERENCES:

1. Python-(Mark Lutz)
2. Python Training guide (BPB Publications)

OUTCOMES

Upon completion of this course, the students should be able to:

1. Explain basic principles of Python programming language (K2)
2 Implement object oriented concepts (K2)
3 Implement database and GUI applications.(K2)
4 Design a user interface specifically for single page applications. (K2)
5 Demonstrate how to Handle a view layer for web and mobile apps. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VI

20HSEN601 SDG NO. 4	BUSINESS COMMUNICATION AND VALUE SCIENCE – IV	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To identify the significance of diversity in workplace and the uses of communicative writing
- To understand the value of emotional intelligence in personal and professional lives
- To realize the importance of corporate social responsibility and corporate etiquettes
- To recognize the best practices to share and receive feedback
- To understand how stress impacts life and work and to manage stress
- To encourage the students to practice the best time management practices

UNIT I IMPORTANCE OF DIVERSITY **9**

Introduce the concept of Diversity in corporate environments through an activity – Discussion, role plays and sharing reference materials

UNIT II COMMUNICATIVE WRITING **9**

Identifying the principles of communicative writing – formal and business letters – group activity: writing in real life scenarios; creating business proposal to get funding to begin a start-up of their choice – Activity: to tell a story with graphs and charts.

UNIT III EMOTIONAL INTELLIGENCE **9**

Introduction to EI – Activity; Applying Emotional Intelligence using scenarios within each start-up group – Awareness of multiple intelligence and learning styles in communication – Activity; scenario based quiz – Impact of conflicts – Guideline to manage conflicts - Activity; Each group will draw up a list of tips to manage conflicts at work – Need of public speaking – Activity; Each group should present the list of best practices in public speaking.

UNIT IV CORPORATE SOCIAL RESPONSIBILITY **9**

Introduction to Corporate Social Responsibility – Activity; Groups will research and present CSR activity of Tata Steel, Microsoft, Google, TCS, Starbucks, Titan, Tata Chemicals and TOMS Shoes – Attributes required for work and life – Qualities of a good team member – Activity; Who am I? – Features of corporate etiquette – Activity; Mock interview – Business Idioms

and Corporate terms – Activity; Quiz to identify the business idioms and business terms – Share and receive feedback.

UNIT V CONFLICTS AND MANAGING STRESS 9

Impact of Conflicts – Activity; Each group will be given a scenario of typical conflicts that occurs in a corporate office - Tips to manage conflicts – Best practices to manage Stress – Time Management – Activity; Time Squared – Project Each group to create a POC (Proof of Concept) for their start-up applying their learnings from the CSBS course (core subjects + BCVS).

TOTAL: 45 Periods

TEXT BOOKS:

There are no prescribed texts– there will be handouts and reference links shared.

REFERENCE BOOKS:

1. Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman
2. Putting Emotional Intelligence To Work by Ryback David
3. How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie -author- Y.S.Rajan
4. TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations

WEB REFERENCES:

1. https://www.tata.com/about-us/tata-group-our-heritage
2. https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms

ONLINE RESOURCES:

1. https://youtu.be/reu8rzD6ZAE
2. https://youtu.be/Wx9v_J34Fyo
3. https://youtu.be/F2hc2FLOdhI
4. https://youtu.be/wHGqp8lz36c
5. https://youtu.be/hxS5He3KVEM
6. https://youtu.be/nMPqsjuXDmE

OUTCOMES

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

1. Understand the importance of diversity in workplace.(K2)
2. Apply emotional intelligence in real life scenarios. (K3)

3. Recognize the best practices of communicative writing. (K1)
4. Understand the importance of corporate social responsibility (CSR).(K2)
5. Identify the best practices to manage stress and time management.(K1)
6. Recognize the best practices to share and receive feedback.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	1	3	2	-	-	1
CO2	-	-	-	-	-	2	1	3	3	2	2	1
CO3	-	-	-	-	-	2	-	2	2	3	2	1
CO4	-	-	-	-	-	2	2	3	3	2	2	2
CO5	-	-	-	-	-	1	1	3	2	2	2	2
CO6	-	-	-	-	-	1	-	3	3	2	2	1

SEMESTER - VI

20CBPC601 SDG NO. 4	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the concepts of computer networks and learn techniques for bandwidth utilization.
- To be exposed to various addressing schemes and error detection-correction of data
- To Learn the routing protocols, transport layer, flow control and congestion control algorithms.
- To be familiar with real time applications of networking devices and tool
- To write different applications using different types of sockets.

UNIT I FUNDAMENTALS AND PHYSICAL LAYER 9

Introduction: Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. Data communication components: Representation of data and its flow, Various connection topology, Protocols and standards, OSI model, Transmission Media. LAN: Wired LAN, Wireless LAN, Virtual LAN. Techniques for Bandwidth

utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

UNIT II DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER 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, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT III NETWORK LAYER 9

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

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

UNIT V APPLICATION LAYER AND SECURITY 9

Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls. Network Security: Electronic mail, directory services and network management, Basic concepts of Cryptography.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th edition, Pearson education, 2016.
2. William Stallings, “Data and Computer Communication”, 10th edition, Pearson education, 2017.

REFERENCE BOOKS:

1. Kaufman, R. Perlman and M. Speciner, “Network Security”, Pearson education, 2017.
2. W. Richard Stevens, “UNIX Network Programming, Vol. 1,2 & 3”, Prentice-Hall of India, 2004.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the required functionality at each layer for a given application. (K2)
2. Understand the flow of information from one node to another node in the network. (K2)
3. Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.(K3)
4. Monitor the traffic within the network and analyse the transfer of packets.(K2)
5. Apply real time applications of networks using socket programming.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	2	2	2	1
CO2	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO3	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO4	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO5	2	2	2	2	2	-	-	-	-	-	2	2	2	1

SEMESTER - VI

20CBPC602 SDG NO. 4	INFORMATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the overview of computer security.
- To understand the information security policy and system design.
- To understand techniques of system security.
- To learn about various applications of system security.
- To learn about operating systems and database security.

UNIT I OVERVIEW OF COMPUTER SECURITY **9**

The Basic Components- Confidentiality, integrity and availability; Security policy and procedure; Assumptions and Trust; Security Assurance,

Implementation and operational issues; Security Life Cycle -Access Control Models: Role based Model.

UNIT II SECURITY POLICIES AND SYSTEM DESIGN 10

Types of Security Policies-Confidentiality policies: Goals of Confidentiality Policies, The Bell-LaPadula Model- Integrity policies: Biba Integrity Model, Clark-Wilson Integrity Model -Hybrid policies: Chinese Wall Model, Clinical Information Systems Security Policy. Access Control Mechanisms: Access Control Lists- Information Flow: Compiler-Based Mechanisms, Execution-Based Mechanisms- Confinement Problem: Isolation, Covert Channels-Assurance: Building Secure and Trusted Systems- Evaluating Systems: Goals of Formal Evaluation.

UNIT III SYSTEM SECURITY 10

Malicious Logic: Trojan Horses, Computer Viruses, Computer Worms-Vulnerability Analysis: Penetration Studies, Vulnerability Classification-Auditing: Anatomy of an Auditing System, Auditing Mechanisms, Audit Browsing- Intrusion Detection: Architecture, Organization of Intrusion Detection Systems- Design Principles- Representing Identity: Files and Objects, Users, Groups and Roles, Naming and Certificates.

UNIT IV APPLICATIONS 10

Network Security: Policy Development, Network Organization- System Security: Policy- User Security: Policy, Access, Files and Devices- Program Security: Requirements and Policy, Design, Case Study: Common Security-Related Programming Problems.

UNIT V OPERATING SYSTEM AND DATABASE SECURITY 6

Operating System Security: Security Architecture, Analysis of Security in Linux/Windows-Database Security: Security Architecture, Database Auditing-Case Study: Discretionary Access Control.

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Third Edition,Wiley, 2021.

2 M. Bishop, "Computer Security: Art and Science", 2nd Edition, Pearson Education, 2019.

3 M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, 2011.

REFERENCE BOOKS:

1 C.P. Pfleeger, S.L. Pfleeger, J. Margulies, "Security in Computing", 5th Edition, Prentice Hall, 2015.
2 David Wheeler, "Secure Programming HOW TO", v3.010 Edition, 2003.
3 Michael Zalewski, "Browser Security Handbook", Google Inc., 2009.
4 M. Gertz, S. Jajodia, "Handbook of Database Security", Springer, 2008.

OUTCOMES:

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

1. Understand the basics of information security and international standards. (K2)
2. Express information security policy and system design.(K2)
3. Describe various system level security methods.(K2)
4. Apply system level security in various environments.(K3)
5. Illustrate the operating system and database security methods.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO2	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO3	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO4	2	2	2	2	1	-	-	-	-	-	2	2	2	1
CO5	3	3	3	3	1	-	-	-	-	-	2	2	2	1

SEMESTER - VI

20CBPC603 SDG NO. 4	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the intelligent agents and formulate a problem in search space.
- To analyze the problem and learn the different search techniques.
- To learn the constraint satisfaction problem and game theory.
- To study the system of knowledge representation using rules and reasoning.
- To gain knowledge on probabilistic reasoning and expert systems.

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM-SOLVING AGENT 9

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

UNIT II SEARCH TECHNIQUES 9

Problem solving agents, searching for solutions; uninform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uninform 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 AND GAME THEORY 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 AND EXPERT SYSTEMS 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

TEXT BOOK:

1 Stuart J. Russell, Peter Norwig , "Artificial Intelligence –A Modern approach", 3rd Pearson Education, 2016.

REFERENCE BOOKS:

1 Ritch & Knight, "Artificial Intelligence", Third Edition, Tata McGraw Hill, 2009.

2 Patterson, "Introduction to Artificial Intelligence & Expert Systems", First Edition, Pearson, 2015.

3 Saroj Kaushik, "Logic & Prolog Programming", First Edition, New Age International, 2008.

4 Joseph C. Giarratano, Gary D. Riley,"Expert Systems: Principles and Programming", Fourth Edition, Cengage, 2007.

WEB REFERENCES:

1. https://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&dq=Supervised+Learning&hl=en&sa=X&ved=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand a problem and build intelligent agents.(K2)
2. Build systems to analyze a problem and make decisions using suitable search techniques.(K3)
3. Infer the constraint satisfaction problem and game theory.(K2)
4. Apply reasoning and rules on knowledge representation.(K3)
5. Identify the methods on probabilistic reasoning and expert systems.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	2	2	2	1
CO2	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO3	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO4	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO5	2	3	3	2	2	-	-	-	-	-	2	2	2	1

SEMESTER - VI

20CBPL601 SDG NO. 4	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the protocol layering and physical level communication
- To analyze the performance of a network
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

LIST OF EXPERIMENTS (Communication and Career Labs)

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
   a)Echo client and echo server
   b)Chat
   c)File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.

7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of an error correction code (like CRC).

TOTAL: 45 PERIODS

HARDWARE AND SOFTWARE REQUIREMENTS:

System with:

1. C/C++/JAVA/Equivalent compiler
2. Network Simulator like NS2/OPNET/Wireshark

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the basic layers and its functions in computer networks.(K2)
2. Evaluate the performance of a network.(K6)
3. Understand the basics of how data flows from one node to another.(K2)
4. Analyse and design routing algorithms.(K4)
5. Design protocols for various functions in the network.(K6)
6. Understand the working of various application layer protocols.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	2	2	-	2	1	-	1	3	2
CO2	3	3	2	2	-	-	1	-	-	-	-	-	2	1
CO3	3	3	3	2	1	-	1	-	-	1	-	1	3	1
CO4	3	3	3	2	-	-	1	-	-	1	-	-	2	2
CO5	3	3	3	2	1	-	1	-	-	2	-	-	3	2

SEMESTER - VI

20CBPL602 SDG NO. 4	INFORMATION SECURITY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand the application number theory in security.
- To study the symmetric key and public key algorithms.
- To understand the compression techniques for security.
- To learn the auditing techniques of mobile applications
- To learn the intrusion detection system

LIST OF EXPERIMENTS

1. Analysis of security in Unix/Linux.
2. Administration of users, password policies, privileges and roles.
3. Implementation of discretionary access control and mandatory access control.
4. Demonstrate intrusion detection system (ids) using any tool Eg. Snort or any other software.
5. Implementation of IT audit, malware analysis and vulnerability assessment and generate the report.
6. Implementation of mobile audit and generate the report of the existing artifacts.
7. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other information.
8. Implementation of digital forensics tools for disk imaging, data acquisition, data extraction and data analysis and recovery.
9. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT.
10. Implementation to identify web vulnerabilities, using OWASP project.

TOTAL: 45 PERIODS

SOFTWARE AND HARDWARE REQUIREMENTS:

System with :

1. C/C++/JAVA/Equivalent compiler

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Analyze the basics of information security and Administration of Users in UNIX/LINUX. (K3)

2. Implement the access control and Demonstrate Intrusion Detection System. (K3)
3. Implement the Vulnerability Assessment and Mobile Audit. (K3)
4. Implement disk imaging, data acquisition, data extraction using digital forensics tools. (K3)
5. Apply vulnerability assessment and malware analysis techniques. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	1	1	1	-	-	-	1	2	1	2
CO2	2	3	3	2	1	1	1	-	-	-	1	2	1	2
CO3	2	3	3	2	1	1	1	-	-	-	1	2	1	2
CO4	2	3	3	2	1	1	1	-	-	-	1	2	1	2
CO5	2	3	3	2	1	1	1	-	-	-	1	2	1	2

SEMESTER - VI

20CBPL603 SDG NO. 4	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed, and partially observable, settings.
- To apply appropriate algorithms for solving given AI problems.
- To Design and implement logical reasoning agents.
- To Design and implement agents that can reason under uncertainty.
- To understand the Implementation of these reasoning systems using either backward or forward inference mechanisms

List of Experiments

1. Programs on Problem Solving
   a. Write a program to solve 8 Queens problem.
   b. Solve any problem using depth first search.
   c. Implement MINIMAX algorithm.

d. Implement A* algorithm

2. Programs on Decision Making and Knowledge Representation
   a. Introduction to PROLOG
   b. Implementation of Unification and Resolution Algorithm.
   c. Implementation of Backward Chaining
3. Programs on Planning and Learning
   a. Implementation of Blocks World program.
   b. Implementation of SVM for an application using python.
   c. Implementing Artificial Neural Networks for an application using python.
   d. Implementation of Decision Tree
   e. Implementation of K-mean algorithm

TOTAL: 45 PERIODS

SOFTWARE AND HARDWARE REQUIREMENTS:

System with :

1. C/C++/JAVA/Equivalent compiler

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Implement simple PEAS descriptions for given AI tasks.(K3)
2. Develop programs to implement simulated annealing and genetic algorithms.(K4)
3. Demonstrate the ability to solve problems using searching and backtracking.(K3)
4. Implement simple reasoning systems using either backward or forward inference mechanisms .(K3)
5. Choose and implement a suitable technics for a given AI task.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	1	1	1	-	-	-	1	3	1	2
CO2	2	3	3	2	1	1	1	-	-	-	1	3	1	2
CO3	2	3	3	2	1	1	1	-	-	-	1	3	1	2
CO4	2	3	3	2	1	1	1	-	-	-	1	3	1	2
CO5	2	3	3	2	1	1	1	-	-	-	1	3	1	2

SEMESTER - VI

20CBPJ601 SDG NO. 4,11&15	INNOVATIVE DESIGN PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems.
- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used

COURSE PLAN :

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: *The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.*

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 20 marks
3. Final evaluation (Last week of the semester) : 60 marks

Note: *All the three evaluations are mandatory for course completion and for awarding the final grade.*

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand how to approach innovation challenges from a human-centred perspective [K2]
2. develop many creative ideas through structured brainstorming sessions [K3]
3. Apply the perspectives of different people that lead to best innovations [K3]
4. Comprehend the importance of incorporating multidisciplinary approach that address human needs and sustainable development [K3]
5. The significance of developing innovation projects with a prototyping mind set, where iterations, trial and error, and even failure are all part of a valuable, creative learning process [K4]

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	2	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VI

20CBTP601 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS - PHASE I

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

Unit I Quantitative Ability – VII **10**

Races And Games, Boats and Streams, Surds and Indices, Pipes and Cistern, Alligations And Mixtures

Unit II Quantitative Ability – VIII **10**

Numbers, Problems on Numbers, Pick Wrong Number, Missing Number, Areas, Shapes, Perimeter

Unit III Reasoning Ability – IV **8**

Data Interpretation Pie Charts, Data Interpretation Line Charts, Data Sufficiency (DS), Data Arrangements, LR – Arrangements, LR – Ranking

Unit IV Verbal Ability – IV **10**

Sentence Correction, Sentence Improvement, Completing Statements, Sentence Formation, Paragraph Formation

Unit V Creativity Ability – IV **7**

Dot Situation, Rule Detection, Embedded Images, Grouping Of Images, Image Analysis

TOTAL : 45 PERIODS

REFERENCES

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun Sharma

PROBLEM SOLVING USING BASIC DATA STRUCTURES & CLOUD INSIGHTS– PHASE II

OBJECTIVES

- The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.

UNIT I LINKED LIST & STACK, QUEUE & HEAP **10**

Linked List - Doubly Linked List Traversal, Circular Linked List, Structure, Node creation, Traversal Stack, Stack –Time Complexities of the Operations, Infix to Postfix/Prefix Conversation, Histogram Problem, Implementation - Using Array, Using Linked List, Queue Implementation - Queue using Stack

UNIT II BINARY TREE AND HASHING **10**

Binary Tree - Types of Binary Tree,Balanced Tree, Degenerate or pathological Tree, Binary Search Tree, Inorder , Preorder , PostOrder and LevelOrder Traversal, Hashing, Linear Probing for Collision Handling, Union and Intersection of two Linked Lists

UNIT III TREES AND GRAPH 10

AVL Tree -Right-Left Imbalance, Left and Right Rotation, - Red Black Tree, Rules of coloring Left and Right Rotation,Graph terminology –Representation of graphs –Path matrix –Graph Traversal –BFS (breadth first search) –DFS (depth first search) –Minimum spanning Tree –Kruskal's Algorithm & Prim's Algorithm –Warshall's algorithm (shortest path algorithm).

UNIT IV CLOUD COMPUTING FUNDAMENTALS 8

Cloud Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability , simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies. Introduction to VMWare Simulator Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

UNIT V WEB DEVELOPMENT TECHNIQUES 7

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.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, " Developing and Hosting Applications on the Cloud", IBM Press, 2012.
2. 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.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing:Principles and Paradigms”, Wiley,2011.
4. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
5. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008

REFERENCES:

1. Weiss, Mark. A. (2012), Data structures and algorithm analysis in Java. 3 edition. Harlow, Essex : Pearson (632 p).
2. Zobel, Justin (2014), Writing for Computer Science. 3 edition. Springer Verlag London Ltd (270 p).

OUTCOMES:

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

1. Implement linear data structures and their applications in problem solving and programming.(K2)
2. Implement Nonlinear data structures and their applications in problem solving and programming.(K2)
3. Implement Internal and external sort and search techniques.(K2)
4. Demonstrate the core concepts of cloud, its characteristics, advantages, key technologies and its various delivery and deployment models.(K3)
5. Acquire the basic and important design concepts and issues of web application development techniques in cloud.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VII

20CBPW701 SDG NO. 4	USABILITY DESIGN OF SOFTWARE APPLICATIONS WITH LABORATORY	L	T	P	C
		2	0	2	3

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 artifacts.
- 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 – Case study: A Heuristic Evaluation of Iraq E-Portal.

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, and 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

List of Experiments

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 Product Demo(Mobile or Web Application)

TEXT BOOKS:

1. Jenny Preece, Helen Sharp and Yvonne Rogers, "Interaction Design: Beyond Human-Computer Interaction", 3 rd Edition, 2004.
2. Jonny Schneider , "Understanding Design Thinking, Lean, and Agile", 1 st Edition, 2020.

REFERENCE BOOKS:

1. Alan Cooper and Robert Reimann, "About Face", John Wiley, 4th Edition.
2. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, "Observing the User Experience: A Practitioner's Guide to User Research", 2nd Edition, 2012.
3. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2 nd Edition, 2010.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the fundamentals and importance of User-Centred design.(K2)
2. Describe the design evaluation by applying the heuristic principles.(K2)
3. Develop an application focusing on the design aspects.(K3)
4. Demonstrate research on understanding user requirement. (K3)
5. express iterative product development using prototyping technique.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	2	2	2	1
CO2	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO3	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO4	2	3	3	2	2	-	-	-	-	-	2	2	2	1
CO5	2	3	3	2	2	-	-	-	-	-	2	2	2	1

SEMESTER - VII

20CBPW702 SDG NO. 4	IT WORKSHOP SKY LAB/MAT LAB	L	T	P	C
		2	0	2	3

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 and 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 if-end structures and loops.

UNIT I INTRODUCTION TO MATLAB 9

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.

UNIT II MATRIX, ARRAY AND BASIC MATHEMATICAL FUNCTIONS 9

Matrix generation, entering a vector, entering a matrix, matrix indexing, colon operator, linear spacing, creating a submatrix, dimension, matrix operations and functions matrix generators, special matrices, array and array operations, solving linear equations, other mathematical functions.

UNIT III BASIC PLOTTING 9

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

UNIT IV INTRODUCTION TO PROGRAMMING 9

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.

UNIT V DEBUGGING M-FILES 9

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

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS:

1. Programs using mathematical, relational expressions and the operators.
2. Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
3. Programs on input and output of values.
4. Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
5. Loop Statements and Vectorizing Code: Programs based on the concepts of counted (for) and conditional (while) loops.
6. Programs based on scripts and user-defined functions.
7. Programs on Built-in text manipulation functions and conversion between string and number types.

8. Programs based on two main data structures: cell arrays and structures.
9. Programs based on Data Transfer
10. Programs based on Advanced Functions.
11. Introduction to Object-Oriented Programming and Graphics.
12. Programs based on Advanced Plotting Techniques.
13. Programs based on sound files and image processing.
14. Programs based on Advanced Mathematics.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
2. Stormy Attaway, Butterworth-Heinemann, "MATLAB: A Practical Introduction to Programming and Problem Solving", 5th Edition, 2018.

REFERENCE BOOKS:

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

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Implement simple PEAS descriptions for given AI tasks.(K3)
2. Develop programs to implement simulated annealing and genetic algorithms.(K4)
3. Demonstrate the ability to solve problems using searching and backtracking.(K3)
4. Implement simple reasoning systems using either backward or forward inference mechanisms .(K3)
5. Choose and implement a suitable technics for a given AI task.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3	-	-	-	-	-	1	2	2	1
CO2	2	3	3	2	3	-	-	-	-	-	1	2	2	1
CO3	2	3	3	2	3	-	-	-	-	-	1	2	2	1
CO4	2	3	3	2	2	-	-	-	-	-	1	2	2	1
CO5	2	3	3	2	2	-	-	-	-	-	1	2	2	1

SEMESTER - VII

20CBPW703 SDG NO. 4	IT PROJECT MANAGEMENT WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Gain knowledge on fundamental concepts of project and project scheduling.
- Understand Project Cost Control, Scheduling and Management Features.
- Obtain knowledge on Agile Project Management.
- Know about the Scrum framework in detail
- 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 FEATURES9

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

LIST OF EXPERIMENTS

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.

TEXT BOOKS:

1. Mike Cohn, "Succeeding with Agile: Software Development Using Scrum", Addison-Wesley Professional Publisher, 1st Edition, 2009.

REFERENCE BOOKS:

1. Roman Pichler, "Agile Product Management with Scrum", Addison-Wesley publisher, 1st Edition, 2010.
2. Ken Schwaber, "Agile Project Management with Scrum (Microsoft Professional)", Microsoft Press US publisher, 1st Edition, 2004.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand how effectively plan, and schedule projects within time and cost targets.(K2)
2. Describe Cost Control, Scheduling and Management Features.(K2)
3. Discuss different Agile Project Methodologies.(K2)
4. Apply various scrum practices.(K3)
5. Demonstrate the techniques used in DevOps. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	2	2	2	2
CO2	2	2	2	2	2	-	-	-	-	-	2	2	2	2
CO3	2	2	2	2	2	-	-	-	-	-	2	2	2	2
CO4	2	2	3	3	3	-	-	-	-	-	2	2	2	2
CO5	2	2	3	3	3	-	-	-	-	-	2	2	2	2

SEMESTER - VII

20CBMG701 SDG NO. 4	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- Facilitate student to imbibe knowledge about understanding the basic concepts and importance of Human Resources Management, Recruitment, Training, Communications, Employee Empowerment, Employee Interaction, Various Human Resources Applications and Practices, Managerial functions etc.

UNIT I HUMAN RESOURCES MANAGEMENT 9

Human Resource Management – Importance and Challenges – Human Resource Policy, Procedures and Practices.

UNIT II HUMAN RESOURCE PLANNING 9

Human Resource Planning – Human Resource Demand, Forecasting and Supply – Human Resource Retention and Strategy – Performance Appraisal – Benefits, Methods.

UNIT III HUMAN RESOURCE FUNCTIONS 9

Human Resource Functions – Recruitment and Staffing, Training – Types Of Training, Compensation, Promotion – Types Of Promotion – Job Security in Software Division – Employees Relations – Human Resource Information Systems and Payroll.

UNIT IV QUALITY OF WORK LIFE 9

Quality of Work Life – Need and Importance Workplace Environment – Stress Management, IQ vs EQ, Cross Culture and Adoptability in MNC's Environment

UNIT V STRATEGIC HUMAN RESOURCE MANAGEMENT 9

Strategic Management of Human Resources – SHRM , Relationship Between HR and Corporate Strategy, Strategies for Managing Careers – Competency Mapping – Need – Classification – Competency Need For Recruitments and retention of Talent Acquisitions.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Prof. Gary Dessler , Human Resources Management, Pearson, 16th Edition, 2020.
2. Prof.John M.Ivancevich, "Human Resource Management", Tata McGraw Hill Publication, 12th Edition, 2003.
3. Prof.Aswathappa, "Human Resource Management and Personnel Management", 3 rd Edition, Tata McGraw Hill, 2002.

REFERENCE BOOKS:

1. Dr.C.B.Gupta, "Human Resource Management ", Sultan Chand & Sons, New Delhi, 1st Edition, 2018.
2. Prof.S.S.Khanka, "Human Resource Management", Chand & Company, New Delhi, 2019.
3. Dr.S.Seetharaman et al., "Human Resource Management", SciTech Publications Pvt Ltd. Chennai,2012

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the basic principles of Human Resource Management.(K2)
2. Be familiarize with the system design of Human Resource Management. (K2)
3. Describe the concepts, roles, functional areas and activities of HR.(K2)
4. Express the organization's employee, their interest, motivation, satisfaction belief of fair treatment.(K2)

5. Apply the actual impact on the firm's current performance and sustaina bility in the long run.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	1	1	2	1
CO2	2	3	3	2	2	-	-	-	-	-	1	1	2	1
CO3	2	2	2	2	2	-	-	-	-	-	1	1	2	1
CO4	2	2	2	2	1	-	-	-	-	-	1	1	2	1
CO5	2	2	2	2	1	-	-	-	-	-	1	1	2	1

SEMESTER - VII

20CBMG702 SDG NO. 4	FINANCIAL AND COST ACCOUNTING	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications.
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements.
- To create awareness about cost accounting, different types of costing and cost management.
- Understand how financial statement information can help solve business problems and increase the ability to read and understand financial statements and related information

UNIT I ACCOUNTING CONCEPT **9**

Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls.

UNIT II ACCOUNTING PROCESS **9**

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.

UNIT III FINANCIAL STATEMENTS **9**

Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam.

UNIT IV CASH FLOW AND FUND FLOW TECHNIQUES **9**

Introduction, How to prepare – Cash flow and Fund flow, Difference between them.

UNIT V COSTING SYSTEMS **9**

Elements of Cost, Cost Behaviour, Cost Allocation, Overhead Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis. Class Discussion: Application of costing concepts in the Service Sector

TOTAL: 45 PERIODS

TEXT BOOK(S):

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.
3. R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi,2011.

REFERENCE BOOKS(S):

1. Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", Fifteenth Edition, Tata McGraw Hill Publishers, 2010.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting", Sixteenth Edition, PHI Learning, 2014.
3. Stice&Stice," Financial Accounting Reporting and Analysis", Eight Edition, Cengage Learning, 2010.
4. Singhvi Bodhanwala, "Management Accounting -Text and cases", Third Edition, PHI Learning, 2018.
5. Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2009

ONLINE RESOURCES:

1. https://www.coursera.org/specializations/costaccounting
2. https://www.udemy.com/course/managementaccounting/
3. https://onlinecourses.nptel.ac.in/noc19_mg38/preview
4. https://alison.com/course/diploma-in-cost-accounting
5. http://ecoursesonline.iasri.res.in/course/view.php?id=485

OUTCOMES:

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

1. Enable to learn and recall the basic concepts of financial management and cost accounting. (K1)
2. Understand the interpretation of various financial, cost and management accounting results. (K2)
3. Ability to compare the basic concepts of financial, cost and management accounting for in-depth understanding. (K2)
4. Posses the knowledge of applying the financial and cost oriented problem solving in an organization. (K3)
5. Posses the acquired knowledge towards applying for the new problems that arise in the financial and cost oriented. (K3)
6. Able to analyze and making judgments based on provided financial and cost information. (K4)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	2	-	-	-	1	3	1	1	3	3
CO2	2	1	2	3	2	1	1	-	-	2	1	-	3	2
CO3	2	1	2	2	2	2	-	-	-	2	1	1	3	2
CO4	2	1	2	3	2	2	-	-	1	1	2	1	3	3
CO5	2	1	2	3	2	1	--	-	1	2	1	1	2	2
CO6	2	1	2	2	3	3	-	-	1	1	1	1	3	2

SEMESTER - VII

20CBPJ701 SDG NO. 4, 6,7,8, 9,11,12,13, 17	PROJECT PHASE - I	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by External and Internal examiners constituted by the Head of the Department. The Project Work Phase-I will have the following sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / System Architecture / Process Flow)
2. Feasibility Study
3. List of possible solutions including alternatives and constraints
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following:

1. Literature survey on existing system
2. Implementation Phase (Hardware &Software)
3. Testing and Validation of the developed system

IV. Consolidated report preparation

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K3)
3. Compose a project report based on the findings. (K6)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	2	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VII

20CBTP701 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & TECHNICAL REFRESHER & COMPANY SPECIFIC TRAINING & KOTLIN

OBJECTIVES:

- Enhance Their Quantitative Ability.
- Enhance Their Reasoning Ability
- Enhance Their Verbal Ability.

UNIT I PRODUCT COMPANY SPECIFIC TRAINING – I **10**

Product Specific Training For Amazon, Microsoft, Ibm, Thoughtworks, Juspay, Paypal, Mu Sigma, Zoho Corporation, Vm Ware, Directi, Oracle, Wells Fargo, Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe Systems., Ernst And Young, Ba Continuum, Standard Chartered, Aon Hewitt, Soliton Technologies, Payoda Technologies, Infoviewtechnologies,athena Health Technology.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II **10**

Product Specific Training for TCS,Wipro,TechMahindra, InfoView, RobertBosch, , NTT Data, Verizon, Payoda Technologies. CTS, Accenture, MindTree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I **10**

Capgemini, Infosys, IBM, UGAM Solutions, Skava Systems, L&T Infotech, BahwanCybertech, Dhyan Infotech.

UNIT IV ANDROID DEVELOPMENT WITH KOTLIN **8**

Kotlin: - Introduction, Advantages & Disadvantages, Kotlin for Android, Kotlin for Server Side Development. Setting up Kotlin Environment (Android). Environment Familiarization: - User Interfaces, AVD, Emulator, Testing, Android Studio Code Editor. Android Architecture: Stack, Kernel, Runtime, Libraries.

UNIT V PROGRAMMING KOTLIN **7**

Activities, Intents, Broadcast (Intents & Receivers), Service, Content Providers, Manifest, Resource, Gradle, Resource & Context. Kotlin: - Kotlin & Java, Java to Kotlin, Kotlin & Android Studio

TOTAL : 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun Sharma
5. Antonio Leiva , Kotlin for Android Developers: Learn Kotlin while developing an Android App, CreateSpace Independent Publishing, 2016, ISBN-13: 978-1530075614
6. Marcin Moskala, Igor Wojda , Android Development with Kotlin, Packt Publishing, 2017, ISBN-13: 978-1787123687
7. Dmitry Jemerov, Svetlana Isakova, Kotlin in Action, Manning Publications, 2017, ISBN13: 978-1617293290
8. Stephen Samuel, Stefan Bocutiu , Programming Kotlin, Packt Publishing Limited, 2017, ISBN-13: 978-1787126367 5. Milos Vasic, Mastering Android Development with Kotlin, Packt Publishing Limited, 2017, ISBN-13: 978-1788473699

OUTCOMES:

Upon Completion Of The Course, The Students Should Be Able To

1. Identify their quantitative ability.(K2)
2. Describe the ability of arithmetic reasoning along with creative thinking and problem solving skills.(K2)
3. Illustrate their verbal ability through vocabulary building and grammar.(K2)
4. Discuss Android development with Kotlin.(K2)
5. Explain programming concepts with Kotlin.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VIII

20CBPJ801 SDG NO. 4,6,7, 8, 9,11,12,13,17	PROJECT PHASE-II	L	T	P	C
		0	0	8	4

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The Project Work Phase-II will have the following Sequence:

I. Problem Identification

1. List of possible solutions including alternatives and constraints
2. Cost benefit analysis
3. Time Line of activities

II. A report highlighting the design finalization [based on functional, non-functional requirements and standards (if any)]

III. A presentation including the following:

1. Implementation Phase (Hardware & Software)
2. Testing and Validation of the developed system
3. Learning in the Project and Future Enhancement

IV. Consolidated report preparation **TOTAL: 60 PERIODS**

OUTCOMES :

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

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K3)
3. Compose a project report based on the findings. (K6)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2

PROFESSIONAL ELECTIVE I

20CBEL501 SDG NO. 4	CONVERSATIONAL SYSTEMS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To be familiar with the basic knowledge about conversational systems.
- To understand the different techniques of natural language processing
- To learn the working knowledge of a chatbot and the prerequisite knowledge.
- Study the fundamental role of machine learning in building conversational systems.
- To know the various applications of conversational systems and its future developments.

UNIT I FUNDAMENTALS OF CONVERSATIONAL SYSTEMS 9

Overview, 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. Introduction to Top players in Current Market –Messaging Platforms. Ethical and Legal Considerations in AI Overview.

UNIT II NATURAL LANGUAGE PROCESSING 9

Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chatbots. General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfilment. 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.

UNIT III BUILDING A CHATBOT/CONVERSATIONAL AI SYSTEMS 9

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 - Overview of CE Testing techniques, A/B Testing, Introduction to Testing

Frameworks - Botium /Mocha ,Chai Security & Compliance – Data Manag ement, Storage,GDPR, PCI.

UNIT IV ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES 9

Understanding on how conversational systems uses ML technologies in ASR, NLP - Advanced Dialog management - Language Translation - Emotion/Sentiment Analysis - Information extraction to effectively converse.

UNIT V CONVERSATIONAL ANALYTICS AND THE FUTURE OF COVERSATIONAL SYSTEMS 9

Introduction to contact centers – Impact & Terminologies - Case studies & Trends, How does a Virtual Agent/Assistant fit in here? - 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 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.
3. A python program to perform morphological analysis of a word by the use of Add-Delete table.
4. A python program to calculate the bigrams from a given corpus and calculate probability of a sentence.
5. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.
6. A python program to find Parts – Of - Speech tags of words in a sentence.
7. 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.
8. A python program to detect the entities from the dataset and tag them based on their categories.
9. A python program to build a Neural Network to recognize handwritten digits using MNIST dataset.
10. A python program to build a Recurrent Neural Model with Keras.
11. Formulate a problem statement for mini-project to build a chatbot for an application that proves its importance from a social perspective.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Micheal McTear, Conversational AI: Dialogue Systems, Conversational Agents and chatbots, 2020, 1st Edition, Morgan and Claypool.

REFERENCE BOOKS:

1. Luis Fernando D Haro, Zoraida Callejas, Satosh Nakamura, Conversational Dialogue Systems for the Next Decade, 2021,1st Edition, Springer
2. Srini Janarthanam, Chatbots and Conversational UI Development, 2017, 1 stEdition, Packt Publishers.
3. Diana Perez-marin and Ismael Pascual-Nieto, Conversational Agents And Natural Language Interaction, 2011, 1stEdition, IGI Global publishers.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Understand the fundamentals of a conversational system.(K2)
2. Grasp the concept and the pre-processing techniques of natural language processing.(K2)
3. Build a chatbot for any applications and deploy it.(K3)
4. Use AI in building conversational system and build advanced systems that can be cognitively inclined towards human behavior.(K3)
5. Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	1	-	-	-	-	-	-	-	2	2
CO2	2	1	2	1	1	-	-	-	-	-	-	-	2	2
CO3	2	1	2	2	2	-	-	-	-	-	-	-	2	2
CO4	2	1	2	2	2	-	-	-	-	-	-	-	2	2
CO5	2	1	2	2	2	-	-	-	-	-	-	-	2	2

PROFESSIONAL ELECTIVE I

20CBEL502 SDG NO. 4	CLOUD, MICRO SERVICES AND APPLICATION WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To know basic components and fundamentals of cloud computing.
- To develop an application using various services in the cloud.
- Understand how to desigN web application development in the cloud.
- To learn the basic and important concepts of python to implement in an application.
- Understand the issues and solutions for cloud security and cloud monitoring.

UNIT I INTRODUCTION 9

Cloud Fundamentals-Cloud Service Components-Cloud Service, Deployment Models-Cloud components-Guiding principle with respect to utilization, Security, Pricing- Application of Cloud Computing. Case Study: Design and Implementation of Public and Private Cloud Environments – OpenStack and AWS.

UNIT II CLOUD BASED APPLICATIONS DEVELOPMENT 9

Application Architectures-Monolithic & Distributed, Microservice Fundamental and Design Approach-Cloud Native Applications-12 Factors App-Application Integration Process and APIfication Process- API Fundamental-Microservice and API Management- Spring Boot Fundamental and Design of Microservice - API Tools - Developer Portal- Applications of Microservice and APIfication.

UNIT III WEB DEVELOPMENT TECHNIQUES 9

Devops fundamentals - Devops Role and Responsibility-Tools and Applications- Containerization Process and Application-Evolution of APP Deployment- Docker Fundamentals - Docker Architecture- Docker Commands. Case study Orchestration, Kubernetes, Docker Container.

UNIT IV CLOUD SECURITY AND MONITORING TOOL 9

Cloud Security-Cloud Security Shared Responsibility Architecture-Security By Design Principles-Identity And Access Management-Cloud Security Layers Illustration-Cloud Network, Host And Data Security Concepts-Security Operations and Major Cloud Service Provider Tools-Security Compliance and

Regulations-Cloud Monitoring-Benefits of Cloud Monitoring-Overview of Cloud Monitoring Tools.

UNIT V BUILDING AN APPLICATION USING PYTHON 9

Developing and Deploying an Application in the Cloud- Building a python project based on Design-Development- Testing-Deployment of an application in the cloud using a development framework and deployment platform. Case Study: Python Use case and Python Framework.

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 a 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 restoring 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 application 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.
9. Find the procedure to develop a DevSecOps – Cloud (AWS, GCP, Azure).
10. Find the procedure to develop a DevSecOps – Cluster (Kubernetes).
11. Find the procedure to develop a Container (Docker).
12. To Build and Test Your Docker Images in the Cloud with Docker commands.
13. Perform the installation steps and configure Google App Engine.
14. Find the Procedure to develop a SalesForce application in the cloud.
15. Create an Application in SalesForce.com using Apex programming Language.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.

2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press, 2012.

REFERENCE BOOKS

1. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", 1st Edition, Wiley, 2014.
2. 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.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley,2011.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Demonstrate the main concepts of cloud, its characteristics, advantages, key technologies and its various delivery and deployment models.(K3)
2. Illustrate an application using various tools in cloud environment.((K3)
3. Describe the basic and important design concepts and issues of web application development techniques in cloud.(K2)
4. Understand the cloud security and monitoring tools.(K2)
5. Build an application in the cloud using python.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	1
CO3	2	3	1	1	2	-	-	-	-	-	-	1	2	1
CO4	2	3	1	2	2	-	-	-	-	-	-	1	2	1
CO5	3	3	3	3	2	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVE I

20CBEL503 SDG NO. 4	MACHINE LEARNING WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Provide introduction to basic concepts of machine learning and classification techniques.
- Introduce the concepts of statistical decision techniques
- Explore the regression techniques and association mining rules
- Understand the different clustering algorithms
- Exposure mathematical models or techniques

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Introduction to Machine Learning (ML), Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML, Classification: Supervised Learning; The problem of classification; Feature engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-mesure, accuracy, area under curve), Expectation-Maximization (EM) algorithm for unsupervised learning.

UNIT II STATISTICAL DECISION THEORY and CLASSIFICATION 10

Statistical decision theory including discriminant functions and decision surfaces; Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbour classification; Support Vector Machines, Artificial neural networks including backpropagation; Applications of classifications; Ensembles of classifiers including bagging and boosting.

UNIT III REGRESSION 8

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO;Applications of regression.

UNIT IV CLUSTERING 9

Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN Anomaly and outlier detection methods.

UNIT V HIDDEN MARKOV MODELS **9**

Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

LIST OF EXPERIMENTS:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. A python program to implement decision tree
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML libraries
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the support vector Classifier model to perform this task. Python can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML libraries can be used for this problem.
8. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML API in the program.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

REFERENCE BOOKS:

1. E. Alpaydin, Introduction to Machine Learning, 3/e, Prentice-Hall, 2014.
2. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
3. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.

OUTCOMES:

Upon Completion of the course, the Students will be able to

1. Describe different machine learning categories (K2)
2. Understand statistical decision theory for various machine learning techniques.(K2)
3. Understand and use classification algorithms for various applications.(K3)
4. Use regression techniques for various applications (K3)
5. Understand and Use various algorithms for clustering (K3)
6. Apply Hidden Markov Model for specific application (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	-	-	-	-	2	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	2	2	1
CO3	3	3	1	2	2	-	-	-	-	-	-	2	2	1
CO4	2	3	1	1	2	-	-	-	-	-	-	2	2	1
CO5	2	3	1	1	2	-	-	-	-	-	-	2	2	1
CO6	2	3	1	2	2	-	-	-	-	-	-	2	2	1

PROFESSIONAL ELECTIVE I

20CBEL504 SDG NO. 4	WEB TECHNOLOGY WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand different Internet Technologies.
- To learn java-specific web services architecture
- To understand dynamic web pages using server side scripting
- To get an introduction about various Scripting Languages.
- To know techniques involved to support real-time Software development.

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT SIDE PROGRAMMING 9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III SERVER SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP and XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Callback Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

List Of Experiments:

1. Create a web page with the following using HTML.
   - To embed an image map in a web page.
   - To fix the hot spots.
   - Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
   - To invoke servlets from HTML forms.
   - Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
   - For conducting on-line examinations.
   - For displaying student mark lists. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Database.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program",Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, WileyPublications, 2009.

3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective",Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

OUTCOMES:

Upon Completion of the course, the Students will be able to

1. Construct a basic website using HTML and Cascading Style Sheets.(K3)
2. Build dynamic web pages with validation using Javascript objects and by applying different event handling mechanisms.(K3)
3. Develop server side programs using Servlets and JSP.(K3)
4. Use PHP for designing simple web pages and to represent data in XML format.(K3)
5. Understand AJAX and web services to develop interactive web applications.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	2	2	2
CO2	3	2	2	1	1	-	-	-	-	-	-	2	2	2
CO3	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO4	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO5	2	1	2	1	1	-	-	-	-	-	-	2	2	2

PROFESSIONAL ELECTIVE I

20CBEL505 SDG NO. 4	MOBILE APPLICATION DEVELOPMENT WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in marketplace for distribution

UNIT I INTRODUCTION TO MOBILE APPLICATIONS 9

Web Vs mobile App – Cost of Development – Myths - Mobile Applications – Marketing – Mobile User Interface Design - Effective Use of Screen – Mobile Users - Mobile Information Design - Mobile Platforms - Tools of Mobile Interface Design

UNIT II ANDROID USER INTERFACE DESIGN 9

Android Architecture – Android SDK Tools - Application Components - Intents – Content providers - Broadcast receivers – Services - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications – Android Localization

UNIT III ANDROID DATA STORAGE 9

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases

UNIT IV ANDROID NATIVE CAPABILITIES 9

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services - Location Updates - Location Providers - Selecting a Location Provider- Finding Location

UNIT V IOS DESIGN 9

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective C Basics – Building iOS App– Actions and Outlets – Delegates - User Interface Elements – Accelerometer – Location Handling - SQLite Database

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message

10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.

REFERENCES:

1. Reto Meier, "Professional Android 4 Development", John Wiley and Sons, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

OUTCOMES:

Upon Completion of the course, the Students will be able to

1. Understand the requirements for mobile applications.(K2)
2. Articulate user interface for mobile applications.(K3)
3. Apply mobile data of android applications.(K3)
4. Develop android applications using native capabilities .(K3)
5. Construct iOS applications with tools.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	-	-	-	-	-	-	1	2	1
CO2	3	3	2	1	1	-	-	-	-	-	-	1	2	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1	2	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	2	1
CO5	2	2	2	2	1	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVE I

20CBEL506 SDG NO. 4	SOFT COMPUTING WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks
- To understand the basics of genetic algorithms
- To analyze various techniques fuzzy systems.
- To apply soft computing techniques to solve problems.

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network-Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III FUZZY SYSTEMS 9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS 9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A

Brief Introduction – Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

LIST OF EXPERIMENTS:

1. Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights
2. Write a program to implement artificial neural network without back propagation.
3. Write a program to implement artificial neural network with back propagation.
4. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
5. Implement travelling sales person problem (tsp) using genetic algorithms.
6. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
7. Implement linear regression and multi-regression for a set of data points
8. Implement crisp partitions for real-life iris dataset
9. Write a program to implement Hebb's rule Write a program to implement Delta srule.
10. Write a program to implement logic gates.
11. Implement svm classification by fuzzy concepts.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.

4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

OUTCOMES:

Upon Completion of the course, the Students will be able to

1. Describe the suitable soft computing techniques for various applica tions.(K2)
2. Apply various techniques of neural networks.(K3)
3. Describe the basic principles of fuzzy systems.(K2)
4. Understand the basics of genetic algorithms.(K2)
5. Understand Hybrid Systems and apply soft computing tools with real time applications.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	-	-	-	-	1	1	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	1	1
CO3	2	3	1	1	2	-	-	-	-	-	-	1	1	1
CO4	2	3	1	2	2	-	-	-	-	-	-	1	1	1
CO5	2	2	1	1	2	-	-	-	-	-	-	1	1	1

PROFESSIONAL ELECTIVE II

20CBEL507 SDG NO. 4	BEHAVIORAL ECONOMICS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To impart knowledge on current ideas and concepts regarding decision making in Economics, Particularly from a behavioral science perspective.
- The course will explore key departures and the consequences of behavior of firms, households and other economic entities.
- To provide an overview of how behavioral principles have been applied to economic problems.

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 self-projection; inconsistent and biased beliefs; probability estimation; trading applications – trade in counterfeit goods, financial trading behavior, trade-in memorabilia

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.

UNIT V INTERTEMPORAL CHOICE & GAME AND STRATEGIC 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. Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry

TOTAL: 45 PERIODS

TEXT BOOK:

1. N. Wilkinson and M. Klaes, "An Introduction to Behavioral Economics", 2017, 3rd Edition, Red Globe Press.

REFERENCE BOOKS:

1. Bazerman, Max and Don Moore. Judgment in Managerial Decision Making, 2012. 8th Edition, John Wiley & Sons.
2. Kahneman, Daniel.Thinking, Fast and Slow, 2011, New York: Farrar, Straus and Giroux
3. Orrell David, Behavioural Economics, 2018, Icon Books Ltd
4. Behavioral Economics 3Rd Edition 2018 by Edward Cartwright, Taylor and Francis
5. Philip Corr, Anke Plagnol, Behavioral Economics the Basics, 2019, 1st Edition Routledge.
6. Partha Dasgupta, Economics: A Very Short Introduction, Oxford University Press, 2017

WEB REFERENCES:

1. https://www.coursera.org/learn/intro-economic-theories
2. https://www.coursera.org/learn/microeconomics-part1
3. https://www.edx.org/course/behavioural-economics-in-action?index=product&queryID=5905e698f8f037ce8c61144a14236bfe&position=1
4. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-mg77/
5. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-hs67/

OUTCOMES:

Upon Completion of the course, the Students will be able to

1. Identify and evaluate evidence for systematic departures of economic behavior from the Predictions of the neoclassical model, and psychological explanations for these anomalies.(K5)
2. Incorporate psychologically motivated assumptions into economic models, and interpret the implications of these assumptions.(K4)

3. Exhibit how these models change the predictions for equilibrium behavior and welfare analysis, and assess the implications for optimal policy.(K2)
4. Compare the predictions of neoclassical and behavioral models, and evaluate the best method for approaching a given topic.(K5)
5. Apply Behavioral principles in economic problems.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	1	1	-	-	-	1	3	3
CO2	3	3	2	2	2	-	1	1	-	-	-	1	3	3
CO3	3	3	2	2	2	-	1	1	-	-	-	1	3	3
CO4	3	3	2	2	2	-	1	1	-	-	-	1	3	3
CO5	3	3	2	2	2	-	1	1	-	-	-	1	3	3

PROFESSIONAL ELECTIVE II

20CBEL508 SDG NO. 4	COMPUTATIONAL FINANCE AND MODELING	L	T	P	C
		2	1	0	3

OBJECTIVES:

- 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 NUMERICAL METHODS AND MODELS 9

Regression models – Time series Data - Numerical methods relevant to integration, differentiation and solving the partial differential equations of mathematical finance-finite difference methods -algorithms and question of stability and convergence, treatment of near and far boundary conditions, the connection with binomial models, interest rate models, Multifactor models

UNIT II BLACK-SCHOLES FRAMEWORK 12

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; the pricing of American options, pricing interest rate dependent claims, and credit risk. Optimal exercise strategy and the smooth pasting condition. Volatility considerations - actual, historical, and implied volatility; local vol and volatility surfaces.

UNIT III APPLICATION AREAS 12

Simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. Pseudo random numbers, Linearcongruential generator, Mersenne twister RNG. Monte Carlo integration, Simulation of Random walk and approximations to diffusion processes, martingale control variables, stratification, and the estimation of the "Greeks". Application areas include The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options.

UNIT IV FINANCIAL PRODUCTS AND MARKETS 6

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 V STATISTICAL ANALYSIS OF FINANCIAL RETURNS 6

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

REFERENCES:

1. R. Seydel: Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2004.
2. P. Glasserman: Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York,2004.
3. 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/.
4. D. Ruppert, Statistics and Data Analysis for Financial Engineering
5. R. Carmona: Statistical Analysis of Financial Data in S-Plus

6. N. H. Chan, Time Series: Applications to Finance
7. R. S. Tsay, Analysis of Financial Time Series
8. J. Franke, W. K. Härdle and C. M. Hafner, Statistics of Financial Markets: An Introduction

ONLINE REFERENCES

1. https://www.coursera.org/learn/financial-engineering-computational methods
2. https://www.udemy.com/course/quantitative-finance-algorithmic-trading-in-python/
3. https://www.edx.org/course/mathematical-methods-for-quantitative-finance
4. https://www.iiqf.org/courses/certificate-program-applied-mathematical-finance-engineers.html

OUTCOMES:

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

1. Recall the existing financial models in a quantitative and mathematical way. (K1)
2. Understand these quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering. (K2)
3. Understand the approaches required to calculate the price of options. (K2)
4. Apply the various statistical methods to analyse the financial data (K3)
5. Apply acquired knowledge to new problems in a quantitative way (K3)
6. Analyse information from financial data and trading systems (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	2	-	-	-	1	2	1	1	3	3
CO2	2	1	1	3	2	1	1	-	-	2	2	-	3	2
CO3	2	1	2	2	2	2	-	-	-	2	1	1	3	2
CO4	2	1	2	3	2	2	-	-	1	1	2	2	3	3
CO5	2	1	1	2	2	1	--	-	1	2	1	1	2	2
CO6	2	1	2	2	3	3	-	-	1	1	1	1	3	2

PROFESSIONAL ELECTIVE II

20CBEL509 SDG NO. 4	PSYCHOLOGY	L	T	P	C
		2	1	0	3

OBJECTIVES:

- Review critically contemporary organizational psychology topics
- To imbibe the competency to recruit, select and appraise the performance of employees
- Describe their motivational theories to improve productivity
- Achieving the Organizational goals through team building and leadership styles
- Equip with the stress coping strategies and effective work-life balance

UNIT I INDUSTRIAL AND ORGANISATIONAL PSYCHOLOGY 9

Introduction to Industrial and Organisational Psychology, Research Methods, Evidence-based Practice. Overview of Legal Context of Industrial Psychology, Job Analysis & Competency Modelling, Job Evaluation, Compensation and Benefits, Job Design & Employee Well-Being.

UNIT II RECRUITMENT, SELECTION AND PERFORMANCE EVALUATION9

Human Resource Planning process, Recruitment – Internal and External sources of Recruitment, Recruitment process. Selection – Process of Selection, Identifying talent & Validating Tests, Screening Methods. Performance Evaluation – Process of appraisal, Traditional and Modern methods. Feedback mechanism, Performance management.

UNIT III MOTIVATION AND JOB SATISFACTION 9

Concept of Motivation – Type s of Motivation, Process of motivation, Motivation theories and work behaviour (Maslows theory, Theory X and Y, McClelland's, Need Theory, Herzberg's Two Factor Theory), cultural differences in motivation. Job Satisfaction and factors that influence job satisfaction.

UNIT IV LEADERSHIP AND TEAM BEHAVIOUR 9

Leader and Leadership, Qualities of Effective Leaders, leadership style, types of leaders. Organizational Climate, Culture, and Development. Significance of psychology in Team building, channelizing teams towards goal attainment

UNIT V STRESS MANAGEMENT AND WORK-LIFE BALANCE 9

Stress Management – Types of stress, Identifying stressors, analysing the current stress management practices in organisations, stress coping strategies. Facing the demands of Life and Work through effective Work-life balance.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Thomas M. Heffernan,(2015),The Student's Guide to Studying Psychology ,Psychology press
2. Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford: Blackwell Publishing
3. Muchinsky, P. M. and Culbertson, S. S. (2015). Psychology applied to work (11th Edition). Hypergraphic Press.
4. Robert Baron and Misra(2000)Psychology , Pearson Publications, Fith edition.
5. Clifford T. Morgan, Richard King, John R. Weinz, John Schoplar(1986), " Introduction to Psychology" Mc Graw Hill Education, 7 th edition.

REFERENCE BOOKS:

1. Luthans, Fred, Organizational Behavior, McGraw Hill 2008.
2. Udai Pareek, Understanding Organizational Behavior, Oxford University Press.
3. Robbins, Stephen, Organizational Behavior, Prentice Hall, India

WEB REFERENCES:

1. https://www.apa.org/ed/graduate/specialize/industrial
2. https://www.alliant.edu/blog/what-organizational-psychology-and-why-it-growing-so-rapidly-united-states
3. https://www.verywellmind.com/what-is-industrial-organizational-psychology-2795302

REFERENCES:

1. https://en.wikipedia.org/wiki/Industrial_and_organizational_psychology
2. https://www.manchester.ac.uk/study/masters/courses/list/02302/msc-organisational-psychology/course-details/
3. https://london.ac.uk/courses/organizational-psychology

OUTCOMES:

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

1. To understand the contemporary conceptual framework relating to industry and organizational psychology (K1)
2. To analyze the strategies required for recruitment and selection processes and methods of performance management (K4)
3. To describe the theories of motivation and the importance of job sacrifice (K1)
4. Construct the ability to build teams through leadership styles towards goal attainment (K3)
5. Identify and analyse for current stress management practices to face their work-life balance(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	-	-	2	-	-	2	2
CO2	-	1	1	2	2	1	1	-	1	-	-	2	1	3
CO3	1	-	-	-	-	-	-	-	2	1	-	2	-	-
CO4	-	2	2	2	1	-	-	-	-	3	1	2	1	3
CO5	-	2	2	2	-	-	-	-	1	-	-	-	-	2

PROFESSIONAL ELECTIVE II

20CBEL510 SDG NO. 4	INFORMATION SYSTEMS AND BUSINESS ANALYTICS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To understand the concepts and applications of Information system in business world
- To Study basic techniques on data retrieval, analysis and mining
- To understand the purpose of using business analysis tools within an organization

UNIT I INFORMATION SYSTEMS: AN OVERVIEW 9

Data, Information, Intelligence, Knowledge - Systems: Meaning, Elements, Types - System Stakeholders - System Development Methodologies - IS: Nature and Characteristics, Framework, ISPyramidand Types.

UNIT II DATABASE MANAGEMENT, DATA SECURITY AND CONTROL 9

Database Management - Challenges, Data Independence - Data Redundancy-Data Consistency- Data Access - Data Administration - Managing Concurrency-Managing Security. Database - Principles and Types, Data Models - Types,DBMS and Types - Data Warehouses and Data Mart. Data Security – Firewalls,Network Security.Cloud computing - Case study

UNIT III INTRODUCTION TO BUSINESS ANALYTICS AND BIG DATA 9

Business Analytics – Definition - Need – Scope - Analytics in action – Big data –Business analytics in practice – Types of data – Data mining – market basket –Creating Distributions from data–measures of location- case study.

UNIT IV APPLICATION OF BUSINESS ANALYTICS 9

Machine Learning - Introduction and Concepts - Differentiating algorithmic and model based frameworks, Decision analytics. Descriptive analytics - Predictive analytics - Prescriptive analytics. Optimization – methods, Web analytics -Casestudy.

UNIT V DATA VISUALIZATION 9

Visual analysis: Data concepts – Data Dashboards - Data exploration & visualization – Scorecard. Role of business analytics in decision making and business development. Case studies in Insurance, health care, operations and banking.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ramesh Behl, James A. O'Brien, George Marakas, Management InformationSystems,11thedition,TataMcGrawHill,January10,2019
2. MajidNabavi, David L.Olson, Introduction to Business Analytics, Business ExpertPress,2018.

REFERENCE BOOKS:

1. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Managing the digital firm, PHI Learning / Pearson Education,PHI, ,Asia,2014.
2. Rahul de, MIS in Business, Government and Society, Wiley India Pvt Ltd,2ed,2018
3. Jeffery D.Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann,David R. Anderson, Essentials of Business Analytics, Cengage Learning,2015
4. Sandhya Kuruganti, Business Analytics: Applications To Consumer Marketing, McGraw Hill,2015

WEB REFERENCES:

1. https://study.com/academy/lesson/what-are-information-systems-definition-types-quiz.html
2. https://www.sciencedirect.com/topics/economics-econometrics-and-finance/information-system
3. https://www.xplenty.com/blog/data-warehouse-vs-database
4. https://futureoflife.org/background/benefits -risks-of-artificial-intelligence/?cn-reloaded=1
5. https://emerj.com/ai-sector-overviews/artificial-intelligence-the-internet-of-things-iot-3-examples-worth-learning-from/
6. https://data-flair.training/blogs/data-analytics-tutorial/

REFERENCES:

1. https://www.coursera.org/courses?query=information%20systems
2. https://www.edx.org/course/introduction-to-management-information-systems-mis
3. https://www.classcentral.com/course/independent-information-systems-11923
4. https://www.coursera.org/learn/business-analytics-r
5. https://www.udemy.com/course/business-analytics/
6. https://swayam.gov.in/nd1_noc20_mg66/preview

OUTCOMES:

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

1. Recognize the role and importance of information in business (K1)
2. Understand the significance of database management system (K2)
3. Recognize and understand the theory and models in the field of business analytics (K2)
4. Ability to explore and demonstrate data for meaningful insights (K3)
5. Critically analyze the business problems and apply basic analytical knowledge in big data (K4)
6. Able to comprehend the applications of business analytics Social and Digital Marketing (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	-	-	-	1	3	1	1	3	3
CO2	3	3	3	3	2	1	1	-	-	2	1		3	2
CO3	3	2	2	2	2	2	-	-	-	2	1	1	3	2
CO4	2	3	3	3	2	2	-	-	1	1	3	1	3	3
CO5	2	3	3	3	2	1	-	-	1	2	1	1	2	2

PROFESSIONAL ELECTIVE II

20CBEL511 SDG NO. 4	SOFTWARE TESTING	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To learn the criteria for test cases.
- To learn the design of test cases.
- To learn levels of testing
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

UNIT I INTRODUCTION **9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

UNIT II TEST CASE DESIGN STRATEGIES **9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

UNIT III LEVELS OF TESTING **9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

UNIT IV TEST MANAGEMENT **9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test Specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- The Technical Training Program.

UNIT V TEST AUTOMATION **9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com

REFERENCES:

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
3. Boris Beizer," Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, New York, 1990.

4. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

OUTCOMES:

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

1. Understand test cases suitable for different domains.(K2)
2. Illustrate a range of different software testing techniques and statergies.(K2)
3. Describe various levels of testing for software development.(K2)
4. Apply test management process to design test cases.(K3)
5. Use automatic testing tools to develop and validate a test plan.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	-	-	-	-	-	-	1	2	1
CO2	3	3	1	1	1	-	-	-	-	-	-	1	2	1
CO3	3	3	1	1	1	-	-	-	-	-	-	1	2	1
CO4	3	3	1	1	1	-	-	-	-	-	-	1	2	1
CO5	2	2	1	1	1	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVE II

20CBEL512 SDG NO. 4	GRAPH THEORY AND APPLICATIONS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To understand the fundamentals of graph theory.
- To study proof techniques related to various concepts in graphs.
- To understand trees and graphs concepts of graph theory
- To learn the circuits to apply in various applications
- To explore modern applications of graph theory.

UNIT I INTRODUCTION **9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph – Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

UNIT II TREES **9**

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets -Properties - Fundamental Circuit and Cut-set- Connectivity- Separability –Related Theorems.

UNIT III NETWORK FLOWS AND PLANARITY **9**

Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

UNIT IV MATRICES AND COLORING **9**

Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix -Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring – Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

UNIT V CONNECTIVITY **9**

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.

REFERENCES:

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., “Introduction to Graph Theory”, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, “A First Look at Graph Theory”, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill ,2007.

OUTCOMES:

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

1. Understand the basic concepts of graphs, and different types of graphs(K2)
2. Use the tree algorithms for the different applications .(K3)
3. Illustrate graph algorithms for real time applications.(K2)
4. Describe various types of matrices and coloring concepts.(K2)
5. Apply suitable graph model and algorithm for solving applications.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	1	2	1
CO2	3	3	1	1	-	-	-	-	-	-	-	1	2	1
CO3	2	3	1	1	-	-	-	-	-	-	-	1	2	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1	2	1
CO5	1	2	1	1	-	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVE II

20HSMC501 SDG NO. 4,9	UNIVERSAL HUMAN VALUES-II : UNDERSTANDING HARMONY	L	T	P	C
		2	1	0	3

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.

UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self exploration

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulof aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulthe 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!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. 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 program for ensuring health vs dealing with disease

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

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulto ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reon relationships in family, hostel and institute as 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

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulamong the four orders of nature-recyclability and self- regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature ("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

22. Natural acceptance of human values
23. Deveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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 ecofriendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. 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.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCES:

1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOMES:

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

1 Express the harmony of relationship among human being,family, society, nature and existence with right understanding and right feeling. (K2)

2 Develop the responsibility of handling problems by finding holistic and sustainable solutions based on the natural acceptance for maintaining mutual human relationships. (K2)

3 Develop a holistic perspective of life based on self-exploration about self, family, society and nature/existence. (K2)

4 Eluditate a critical ability for dedicative commitment towards human values, relationships and society. (K2)

5 Implement the process of verification and validation of learning in daily life.

6 Develop self reflection, commitment and courage to act in life challenging situations. (K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	1	1	2	0	3	2	3	2	1	0	1	0	2
CO2	0	1	1	2	0	3	2	3	2	1	2	2	0	2
CO3	0	1	1	2	0	3	2	3	2	1	2	2	0	2
CO4	0	1	1	2	0	3	2	3	2	1	2	2	0	2
CO5	0	1	1	2	0	3	2	3	2	1	2	2	0	2
CO6	0	1	1	2	0	3	2	3	2	1	2	2	0	2

PROFESSIONAL ELECTIVE III

20CBEL601 SDG NO. 4,9	DATA MINING AND ANALYTICS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the fundamental concepts of data mining and data representation.
- To learn the data preprocessing task and attribute oriented analysis
- To understand the association rules, classification and prediction algorithms
- To learn and apply the linear and non-linear models of data analysis
- To understand the time series analysis and aspects of prescriptive analysis

UNIT I INTRODUCTION AND KNOWLEDGE REPRESENTATION 9

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

UNIT II DATA PREPROCESSING 9

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies. Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical Measures

UNIT III ASSOCIATION AND MINING METHODS 9

Association rules: Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis. Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules. Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance- based methods (nearest neighbor), linear models.

UNIT IV LINEAR AND NON-LINEAR MODELS 9

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, interpr etation 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 9

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 ARIMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARIMA Processes, Forecasting using ARIMA models. Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

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
7. validation and interpretation of results.
8. Implementation of linear regression technique for statistical model building.
9. Implementation of Non-linear regression technique for statistical model building.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
2. Lior Rokach and OdedMaimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010.
3. Ian H. Witten, Eibe Frank and Mark A. Hall "Data Mining: Practical Machine Learning Tools and Techniques", Fourth Edition, Elsevier, 2017.

REFERENCE BOOKS:

1. Draper, N. R. and Smith, H., "Applied Regression Analysis", Third Edition, John Wiley, 1998.
2. Hosmer, D. W. and Lemeshow, S., "Applied Logistic Regression", Third Edition, Wiley, 2003.
3. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.
4. Jason Brownlee "Machine Learning Mastery with Weka" ,2020.
5. http://garfield.library.upenn.edu/classics1989/A1989AV485000 01.pdf

OUTCOMES:

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

1. Understand the fundamentals of data mining and data representation.(K2)
2. Describe preprocessing tasks for the data set.(K2)
3. Apply association rules and predictive methods for data mining.(K3)
4. Build data models using linear and non-linear regression techniques.(K3)
5. Gain knowledge on time series analysis and prescriptive analysis.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	-	-	-	-	-	-	1	2	1
CO2	2	2	1	1	1	-	-	-	-	-	-	1	2	1
CO3	2	2	2	2	1	-	-	-	-	-	-	1	2	1
CO4	2	2	2	2	1	-	-	-	-	-	-	1	2	1
CO5	2	2	1	1	1	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVE III

20CBEL602 SDG NO. 4	ROBOTICS AND EMBEDDED SYSTEMS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the concept of Industry 4.0 and technologies for cognitive robotics
- To understand the fundamentals of robotics operating systems
- To understand the role of AI in cognitive robotics
- To understand and demonstrate the role of Data Science and their working principles in robotics
- To demonstrate the concepts of cloud computing with robot on various real time applications

UNIT I INTRODUCTION TO MODERN DAY ROBOTICS AND THEIR INDUSTRIAL APPLICATIONS 9

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 BASICS OF ROBOTIC OPERATING SYSTEM 9

Basics of Robotic operating System: 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 Towards cloud robotic system: A case study of online co-localization for fair resource competence-A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata

UNIT III AI IN THE CONTEXT OF COGNITIVE ROBOTICS AND ROLE OF AI IN ROBOTICS 9

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 Introduction to computer vision and application of Vision Systems in Robotics: Concepts of computer vision and the how vision systems are becoming essential part of obotics-Computer Vision: Models, Learning, and Inference - Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques- Machine Vision Applications- Application areas for vision systems-Robot inspection case study-Autonomous driving using 3D imaging case study.

UNIT IV DATA SCIENCE AND BIG DATA IN THE CONTEXT OF COGNITIVE ROBOTICS 9

Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities Introduction to Python and R Programming in the context of Robotics: Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics-An introduction to R -The R in Robotics rosR: A New Language Extension for the Robot Operating System Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots -Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction

UNIT V CONCEPTS OF CLOUD COMPUTING, CLOUD PLATFORMS AND IT APPLICATIONS IN ROBOTICS 9

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

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 : 45 PERIODS

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

REFERENCE BOOKS:

1. Krishnendu Kar, "Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques", Packt publishing, 2020.
2. Armando Vieira, Bernardete Ribeiro," Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing",Apress, 2018.
3. Steve Heath, "Embedded System Design 2nd Edition", EDN Series for Design Engineers, 2003

OUTCOMES:

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

1. Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries.(K3)
2. Understand the basics of Robotic operating systems and communication system.(K2)
3. Describe basic concepts and technological advancements in AI and robotics.(K3)

4. Apply several statistical analysis techniques, business analytics for cognitive robotics and programming of robots using python and R languages.(K3)
5. Build the cloud computing concepts in robotics.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	2	1	2	2
CO2	2	2	2	2	2	-	-	-	-	-	2	1	2	2
CO3	2	2	2	2	2	-	-	-	-	-	2	1	2	2
CO4	2	2	2	2	2	-	-	-	-	-	2	1	2	2
CO5	2	2	2	2	2	-	-	-	-	-	2	1	2	2

PROFESSIONAL ELECTIVE III

20CBEL603 SDG NO. 4	MODERN WEB APPLICATIONS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To enable students to develop modern web application by leveraging latest technologies
- To build strong foundation in students making them job ready as per industry requirements
- To enable them to learn new technologies by applying foundation paradigms
- To building strong expertise to develop end to end application - web frontend and backend development
- To understand the modern applications development

UNIT I INTRODUCTION TO INTERNET & WORLD WIDE WEB 9

History of the Internet & World- Wide Web, Web Browsers, Web Servers, Uniform Resource Locator, Tools and Web Programming Languages. Web Standards, Categories of Web Applications, Characteristics of Web Applications, Tiered Architecture.

UNIT II HYPERTEXT MARKUP LANGUAGE (HTML) AND CASCADING STYLE SHEETS (CSS) 9

HTML: Basic HTML page, Text Formatting, Table, Headers, Linking, Images, List, Meta Elements. CSS: Inline, Internal and External Style Sheet, Bootstrap-CSS Text, CSS forms, CSS components drop down

UNIT III JAVASCRIPT AND EXTENSIBLE MARKUP LANGUAGE(XML) 9

JavaScript: Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, Bootstrap- JS Alert, JS Button, JS popover. XML: Introduction, Structuring Data, Document Type Definition, XML Vocabularies, Document Object Model (DOM) with JavaScript, Extensible Stylesheet Language Transforms (XSL).

UNIT IV PHP BASICS 9

Writing Basic PHP Programs: Creating PHP Programs, Numbers and Strings, Literals and Variables, Operators and Functions. Form & PHP: Creating Form Controls, Using Values Returned From, Forms Using PHP

UNIT V PHP DATABASE CONNECTIVITY 9

PHP Database Connectivity: Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server Connection. Manipulating Data in MySQL Using PHP: Inserting, Viewing, Updating and Deleting Records, Manipulating joined tables. User Authentication: Creating Session, Authorization Level

LIST OF EXPERIMENTS:

1. Create a HTML page with frames, links, tables and other tags for highlighting the facilities in the Department in your College. State the assumptions you make (business logic you are taking into consideration).
2. Create a web page with the following using HTML: a. To embed a map in a web page. b. To fix the hot spots in that map. c. Show all the related information when the hot spots are clicked. Embed an image map picture (India map) on a Web page that provides different links to other Web pages (different states) and show the all the related information depending on where a user clicks on the image. Create a webpage to embed a human body image, identify and display all the related information about the human body parts (head, eye, nose, finger etc.) based on the user clicks on the human body image map.
3. Create a web page with the following: a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. d. Use your college information for the web pages

4. Create a User Registration form with First Name, Last name, Address, City, State, Country, Pincode, Username and Password fields for a General login webpage and satisfy the following criteria: a. Create a validate() function that does the following: b. Checks that the First Name, Last Name, City, Country, Username, and Password fields are filled out. c. Checks that the Pincode is exactly 6 numeric. d. Checks that the state is exactly two characters. e. Checks that the email is a valid email address. false if email has fewer than 6 characters false if email does not contain an @ symbol false if email does not contain a period (.) true otherwise
5. Write a DTD for a XML document that declares an address book containing contacts. Each contact has a name and address. An address should contain attributes for street name, state and phone number. Write a XML document and validate it against this DTD.
6. Create and save a XML document at the server, which contains 10 users information. Write a Program, which takes user Id as an input and returns the user details by taking the user information from the XML document
7. Create a XML to represent the BOOKS catalog that has the following elements (TITLE, ISBN NO, AUTHOR, PUBLISHER, and PRICE). Display the book details styled with XSLT
8. Create an Extensible markup language to represent the students mark information of a class. Create a webpage to display all the students consolidated mark statement with pass (green color) or fail (red color) using XSLT.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Internet and World Wide Web: How to Program, Deitel P. J., Deitel H. M. and Deitel A. 5th Edition, Pearson Prentice Hall, 2012
2. HTML & CSS: Design and Build Websites, Jon Duckett, John Wiley & Sons https://wtf.tw/ref/duckett.pdf

REFERENCES:

1. Programming the World Wide Web, Sebesta R. W, 8th edition, Pearson, 2014
2. Web Engineering: a practitioner's approach, Pressman R. and Lowe D,1st Edition, Mc GrawHill, 2008
3. Web Engineering: The Discipline of systematic Development of Web Applications, Kappel G., et al, 1st Edition, John Wiley & Sons, 2006
4. Web Engineering: Principles and Techniques, Suh W,Idea Group Inc, 2005
5. PHP for the Web: Visual Quick Start Guide, Ullman L, 5th Edition, Peachpit Press, 2016

OUTCOMES:

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

1. Implement modern web application by leveraging latest technologies.(K3)
2 Understand scripting languages and apply it with latest technologies.(K2)
3 Understand new technologies by applying foundation paradigms.(K2)
4 Develop end to end application web frontend and backend development. (K3)
5 Develop the modern applications with latest technologies.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO2	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO3	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO4	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO5	2	2	2	2	1	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE III

20CBEL604 SDG NO. 4	COMPUTER GRAPHICS AND MULTIMEDIA WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Develop an understanding and awareness of how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- Be familiar with various software programs used in the creation and implementation of multimedia (interactive, motion/animation, presentation, etc.).
- Be aware of current issues relative between new emerging electronic technologies and graphic design (i.e. social, cultural, cognitive, etc). understand the relationship between critical analysis and the practical application of design.
- Appreciate the importance of technical ability and creativity within design practice

UNIT I OUTPUT PRIMITIVES 9

Basic – Line – Curve and ellipse drawing algorithms – Examples – Applications - Attributes – Two- Dimensional geometric transformations – Two-Dimensional clipping and viewing – Input techniques.

UNIT II THREE-DIMENSIONAL CONCEPTS 9

Three-Dimensional object representations – Three-Dimensional geometric and modeling transformations – Three-Dimensional viewing – Hidden surface elimination – Color models – Virtual reality - Animation.

UNIT III MULTIMEDIA SYSTEMS DESIGN 9

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases.

UNIT IV MULTIMEDIA FILE HANDLING 9

Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies

UNIT V HYPERMEDIA 9

Multimedia authoring and user interface – Hypermedia messaging – Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems.

LIST OF EXPERIMENTS:

1. Implement Brenham's line drawing algorithm for all types of slope
2. Create and rotate a triangle about the origin and a fixed point.
3. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing.
4. Clip a lines using Cohen-Sutherland algorithm
5. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
6. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
7. Develop a menu driven program to animate a flag using Bezier Curve algorithm

8. Develop a menu driven program to fill the polygon using scan line algorithm

TOTAL:45 PERIODS

TEXT BOOKS:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003.
2. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003.

REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Huges, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2003.

OUTCOMES:

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

1. Understand the basic concepts in output primitives.(K2)
2. Understand and apply three dimensional concepts in animation.(K3)
3. Describe how multimedia systems are designed.(K3)
4. Manipulate multimedia file handling with various storage and retrieval techniques.(K3)
5. Discuss issues related to emerging electronic technologies and graphic design.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	-	-	-	-	-	-	1	1	2	2
CO2	2	2	2	1	-	-	-	-	-	-	1	1	2	2
CO3	2	1	1	1	-	-	-	-	-	-	1	1	2	2
CO4	2	2	2	1	-	-	-	-	-	-	1	1	2	2
CO5	2	1	1	1	-	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE III

20CBEL605 SDG NO. 4	COGNITIVE SCIENCE AND ANALYTICS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Introduction to cognitive science, psychology, nervous system and brain.
- Understand brain and sensory motor information, representation of sensory information.
- Analyze from sensation to cognition; Roots of cognitive science.
- Develop language and embodiment.
- Implement affordances in biological and artificial systems, cognitive development

UNIT I INTRODUCTION TO THE STUDY OF COGNITIVE SCIENCES 9

Introduction to the study of cognitive sciences - A brief history of cognitive science - Methodological concerns in philosophy - Artificial intelligence and psychology - Structure and constituents of the brain - Brief history of neuroscience - Mathematical models - Looking at brain signals - Processing of sensory information in the brain.

UNIT II COGNITIVE MODELS 9

Brain Imaging - FMRI, MEG - PET, EEG - Multisensory integration in cortex - Information fusion - From sensation to cognition – Cybernetics - From physics to meaning, Analog vs. Digital: Code duality.

UNIT III LINGUISTIC KNOWLEDGE 9

Linguistic knowledge: Syntax, semantics, (and pragmatics) - Generative linguistic - Brain and language - Language disorders – Lateralization - The great past tense debate - Cognitivist and emergent stand points - A robotic perspective

UNIT IV AFFORDANCES 9

Direct perception - Ecological Psychology - Affordance learning in robotics - Child and robotic development - Attention and related concepts - Human visual attention - Computational models of attention - Applications of computational models of attention.

UNIT V CATEGORIES AND CONCEPTS **9**

Logic; Machine learning - Constructing memories - Explicit vs. implicit memory - Information processing (three-boxes) model of memory - Sensory memory; Short term memory – Long term memory; Rationality - Bounded rationality; Prospect theory; Heuristics and biases - Reasoning in computers - Key points in social cognition - Context and social judgment; Schemas; Social signals

LIST OF EXPERIMENTS:

1. Overview and practice: Cognitive Science and its methodology concerns in philosophy.
2. Experimental approach to processing sensory information in the brain using python.
3. Perform stemming operation in python using NLTK
4. Perform lemmatization in python using NLTK
5. Perform parts of speech tagging in python using NLTK
6. Writing and running Robot programs – Activity of PICK and Place of an object.
7. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
8. RNN NLU: Build a Recurrent Neural Network model using Microsoft Cognitive Tool Kit for spoken language understanding, mainly for intent detection and slot filling.
9. LSTM Human Activity Recognition: Build a Recurrent Neural Network model using Python for Human Activity Recognition (HAR) using TensorFlow on smartphone sensors dataset and a LSTM RNN.
10. NER-LSTM Build a Recurrent Neural Network model using Python for Named Entity Recognition.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pradeep Kumar Mallick, Samarjeet Borah," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

REFERENCE BOOKS:

1. Jose Luis Bermudez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2020.

OUTCOMES:

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

1. Understand the cognitive science, psychology, nervous system and brain.(K2)
2. express brain and sensory motor information through the representation of sensory information.(k2)
3. describe the linguistic knowledge on cognitive sciences.(k2)
4. Implement affordances in biological and artificial systems, cognitive development.(K3)
5. Illustrate the categories and concepts of attention, learning, memory, reasoning, social cognition.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO2	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO3	2	2	1	1	1	-	-	-	-	-	1	2	2	2
CO4	2	2	2	2	1	-	-	-	-	-	1	2	2	2
CO5	2	2	2	2	1	-	-	-	-	-	1	2	2	2

PROFESSIONAL ELECTIVE III

20CBEL606 SDG NO. 4	CRYPTOLOGY WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Basics of Number Theory.
- To be able to secure a message over an insecure channel by various means.
- To use a variety of public key cryptosystems and authentication methods.
- To gain a better understanding of the different security applications.
- To acquire a deeper insight of quantum computing on cryptography and security.

UNIT I INTRODUCTION **9**

Introduction to Cryptography: Elementary number theory, Pseudo-random bit generation, Elementary cryptosystems. Basic security services: confidentiality, integrity, availability, non-repudiation, privacy.

UNIT II SYMMETRIC KEY CRYPTOSYSTEMS **10**

Stream Cipher: Basic Ideas, Hardware and Software Implementations, Examples with some prominent ciphers: A5/1,Grain family, RC4, Salsa and ChaCha, HC128, SNOW family, ZUC; Block Ciphers: DES, AES and Modes ofOperation.

UNIT III PUBLIC KEY CRYPTOSYSTEM & AUTHENTICATION **8**

Public Key Cryptosystems: RSA, ECC; Digital signatures; Hash Functions; Authentication.

UNIT IV SECURITY APPLICATIONS **9**

Electronic commerce (anonymous cash, micro-payments), Key management, Zero-knowledge protocols, Cryptology inContact Tracing Applications.

UNIT V QUANTUM CRYPTANALYSIS & POST-QUANTUM CRYPTOGRAPHY **9**

Quantum cryptography, quantum encryption, Issues related to Quantum Cryptanalysis. Post-Quantum Cryptography: Lattice-based cryptography : NTRU, Hash-based cryptography : SPHINCS, Multivariate cryptography: Rainbow.

LIST OF EXPERIMENTS

1. Implement the following Substitution and Transposition Techniques:
   a) Caesar Cipher
   b) Playfair Cipher
   c) Hill Cipher
   d) Vigenere Cipher
   e) Rail fence – row & Column Transformation
   f) Affine Cipher
2. Implement the following algorithms
   a) DES
   b) RSA Algorithm
   c) Md5
   d) SHA-1

3. Implement the Digital Signature Algorithm (DSA).
4. Implement Linux Privilege Escalation Checker.
5. Implement a Keylogger to record the keystrokes.
6. Set Up a honey pot and monitor the honeypot on network (Pentbox or Honeyd or any other equivalent s/w).
7. Demonstrate Intrusion Detection System using any tool (snort or any other equivalent s/w).
8. Demonstrate various exploits of Windows OS using Metasploit framework.
9. Install and Configure Firewalls for a variety of options (iptables or pfsense).
10. Demonstrate simple MITM attack (ettercap).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Douglas R. Stinson, "Cryptography, Theory and Practice", CRC Press, 3rd Edition, 2018.
2. A. Menezes, P. Van Oorschot and S. Vanstone, "Handbook of Applied Cryptography", CRC Press, 5th printing,2001.
3. Stallings William, "Cryptography and Network Security - Principles and Practice", Pearson, Seventh Edition,2017.

REFERENCE BOOKS:

1. Neal Koblitz, "A course in number theory and cryptography", GTM, Springer.
2. Ross Anderson, "Security Engineering", Wiley, 3rd Edition, 2020.
3. http://theory.caltech.edu/~preskill/ph229/

OUTCOMES:

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

1. Understand and apply the various concepts of basics of Number Theory.(K3)
2. Manipulation of Secure a message over an insecure channel by numerous symmetric key cryptosystem.(K3)
3. Apply diverse Public Key Cryptosystem &Authentication.(K3)
4. Implement varied security applications.(K3)
5. Describe the implications of quantum computing on cryptography and security.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	1	1	2	2
CO2	2	2	2	2	-	-	-	-	-	-	1	1	2	2
CO3	2	3	1	2	-	-	-	-	-	-	1	1	2	2
CO4	2	2	2	2	-	-	-	-	-	-	1	1	2	2
CO5	2	2	1	2	-	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE III

20CBEL607 SDG NO. 4	INTERNET OF THINGS WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
- To gain knowledge about IoT Architecture.
- To understand and learn about Sensors and industrial systems.
- To understand the other associated technologies like networking and communication in the domain of IoT.
- To understand the data processing and standards designed for IoT and the current research on it.

UNIT I INTRODUCTION TO IOT AND USE CASES 9

Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains.

UNIT II ARCHITECTURE 9

IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion and Data Processing Pipelines, Data Stream Processing.

UNIT III SENSORS AND INDUSTRIAL SYSTEMS 9

Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems and their functions.

UNIT IV NETWORKING AND COMMUNICATION FOR IOT 9

Recap of OSI 7 layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CANbus), Communicating with cloud applications - web services, REST, TCP/IP and UDP/IP sockets, MQTT, WebSockets, protocols. Message encoding (JSON, Protocol Buffers)

UNIT V IOT DATA PROCESSING AND STORAGE 9

Time series data and their characteristics, time series databases, basic time series analytics, data summarization and sketching, dealing with noisy and missing data, anomaly and outlier detection

LIST OF EXPERIMENTS:

1. Setting up the Arduino development environment, connecting analog sensors to an Arduino board and reading analog sensor data.
2. Digital input and output reading using an Arduino board and Arduino development environment.
3. Integrate an Arduino board to a Raspberry Pi computer and send sensor data from Arduino to the R Pi. 4 Setup Python on the R Pi and run sample R Pi programs on the R Pi. Read the data from Arduino using Python language.
5. Connect a R Pi Camera module to the Raspberry Pi and using Python programming capture still images and video.
6. Set up TCP/IP socket server on a PC. Send a message from the R Pi to the PC using socket communication.
7. Set up a MQTT broker on the PC. Send data from R Pi to PC using MQTT protocol. Receive data from PC to R Pi using MQTT protocol.
8. Connect LED lights to an Arduino. Connect the Arduino to the R Pi. Send Message from PC to R Pi via MQTT protocol. On receipt of the message, toggle the LED lights on the Arduino.
9. Set up an account in a cloud service (such as Google / AWS or Azure). Set up a simple Http server using a language of your choice. Push the image captured from the R Pi camera to this web service. On receiving the image, store the image in a database or file.
10. Develop a mobile application to view the images captured by the R Pi camera.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Samuel Greengard, "The Internet of Things-Essential Knowledge Series", MIT Press, 1 st Edition, 2015.

REFERENCE BOOKS(S) :

1. Industrial Internet Reference Architecture - http://www.iiconsortium.org/IIRA.htm
2. World Economic Forum Report on Industrial Internet of Things - https://www.weforum.org/reports/industrialinternet-things
3. 50 Sensor Applications for a Smarter World - http://www.libelium.com/resources/top_50_iot_sensor_applications_ranking/
4. Ben Fry, "Visualizing Data-Exploring and Explaining Data with the Processing Environment", O'Reilly Media, 2007.
5. Andrew K Dennis, "Raspberry Pi Computer Architecture Essentials", 2016.
6. M. Banzi, "Getting Started with Arduino", O Reilly Media.
7. GSMA IoT Security Guidelines & Assessment - https://www.gsma.com/iot/future-iot-networks/iot-securityguidelines/

OUTCOMES:

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

1. Understand basic principles and concepts of Internet-of-Things use cases, applications, architecture and technologies. (K2)
2. Understand an overview of an end to end IoT system encompassing the edge, cloud and application tiers. (K2)
3. Apply different sensors and transducers in Industrial Systems. (K3)
4. Describe the networking and communication for IOT. (K2)
5. Implement IOT data processing and storage. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	2	-	-	-	-	1	1	2	2	1
CO2	2	1	2	2	2	-	1	-	-	2	1	2	2	1
CO3	2	1	3	2	2	1	1	-	1	2	2	2	2	1
CO4	2	1	3	2	2	-	-	-	-	2	1	2	2	1
CO5	2	1	2	3	2	-	1	-	1	2	2	2	3	1

PROFESSIONAL ELECTIVE IV

20CBEL608 SDG NO. 4	ENTERPRISE SYSTEMS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To impart knowledge, with respect to concepts, Enterprise Systems, Architecture and Cloud Computing.
- To explain the students about the characteristics and applications of Enterprise Systems,Architecture and Cloud Computing
- To gain insights on deployment of various Enterprise System Models and Architecture

UNIT I INTRODUCTION TO MODERN ENTERPRISE SYSTEMS 9

Introduction to enterprise systems. – BIS, DSS, KMS - Kinds of Enterprise systems- B2C and B2B models Components of Enterprise systems: Channels - Data management, workflow, Controlling and Auditing, Accounting - Enterprise systems: ERP, SCM, CRM, Product Life cycle management (PLM), HR Systems (HRM), GL systems.

UNIT II ENTERPRISE SYSTEMS CHARACTERISTICS AND ARCHITECTURES 9

Distributivity, Managed redundancy, Exception processing, Collaboration, Data transformation - Enterprise System architectures: Batch processing, Monolithic, client server, ecommerce, service oriented, microservice, and cloud architectures - Enterprise Application architectures: Layer Architecture, Event driven Architecture, Service oriented Architecture, Microservice architecture, Plug-in architecture

UNIT III ENTERPRISE APPLICATION INTEGRATION AND DEPLOYMENT9

Introduction to Enterprise Integration, different integration styles. Elements of messaging-based Integration - Integration patterns: Modern service integration techniques. Introduction to WSDL, SOAP. Introduction RESTFul web services integration. Differences between SOAP and REST - Deployment of Enterprise applications: Key requirements in deployment - Stability, capacity, Security, availability, Network, Availability, and Transparency

UNIT IV ROLE OF CLOUD COMPUTING, CLOUD PLATFORMS 9

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 - Cloud service models: - Infrastructure, platform, Software as a Service in Cloud Computing. Major public clouds: Google cloud, AWS, Azure.

UNIT V APPLICATION DEPLOYMENT IN CLOUD AND ENTERPRISE ARCHITECTURE MODELS 9

Application development and deployment in cloud – Dockers, micro services, Kubernetes,Serverless. Continuous Integration/Continuous Delivery Importance of Enterprise Architecture - Enterprise architecture models: Zachman Framework, TOGAF Framework - Enterprise Architecture Case study

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ralph Stair, George Reynold, & quot; Principle of Information Systems ", 10 ed.
2. Martin Fowler et al, "Pattern of Enterprise Application Architecture", Addison- Wesley, 2012
3. Gregor Hohpe, Bobby Woolf, Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions,
4. Mark Richards, Software Architecture patterns, 2015, O'Reilly.
5. Sam Newman, "Building Microservices", 2015,O'Reilly.
6. David Farley, Jez Humble, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", Jan 2016

REFERENCE BOOKS:

1. Brendan Burns, Designing Distributed Systems, O'Reilly, 2016
2. Enterprise Integration Patterns - Messaging Patterns Overview
3. Software architecture in Practice 3rd Edition- 2014

WEB REFERENCES:

1. https://www.floridatechonline.com/blog/information-technology/types-of-enterprise-systems-and-their-applications/
2. https://standardbusiness.info/enterprise-system/
3. https://pimcore.com/en/how-to-build-modern-enterprise-data-architecture
4. https://www.ringcentral.com/us/en/blog/what-is-enterprise-architecture-ea/

MOOC REFERENCES:

1. https://www.coursera.org/learn/enterprise-systems
2. https://www.coursera.org/learn/application-modernization-for-enterprise-systems
3. https://www.udemy.com/course/enterprise-information-system/
4. https://www.udemy.com/course/software-architecture-design-of-modern-large-scale-systems/
5. https://alison.com/course/evolution-of-modern-architecture

OUTCOMES:

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

1. Getting familiar with the basic elements of Enterprise systems and Enterprise architectures (K1)
2. Develop skills in understanding architecture and non-functional requirements in developing Enterprise system development and their deployment (K2)
3. Applying the functioning principles of developing Enterprise Systems and Architecture.(K3)
4. Analysing the motives, purpose and causes in development and deployment of various Enterprise Systems and Architecture.(K4)
5. To Comprehend and defend the latest technology advancement in ES and Architecture based on functionality as a criteria (K5)
6. Compile skills in developing architecture and Enterprise system of a new pattern or proposing an alternative solutions.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	-	1	1	-	-	-	1	2	2
CO2	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO3	3	3	2	2	2	-	1	1	-	-	-	1	2	2
CO4	2	2	3	2	2	-	1	1	-	-	-	1	2	2
CO5	2	2	1	1	2	-	1	1	-	-	-	1	2	2

PROFESSIONAL ELECTIVE IV

20CBEL609 SDG NO. 4	ADVANCE FINANCE	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To develop critical thinking and problem solving competencies, at both the individual and group levels, of financial statement analysis, financial planning, principles of valuation, capital structure, and issues in financial policy, and to apply financial theory to analyze real life situations in an uncertain environment with an incomplete data set.

UNIT I SOURCES OF FUNDS **9**

Types of securities, issuing the capital in market, Pricing of issue, valuation of stocks and bonds, Basics of Futures, Forwards, Options, Swaps.

UNIT II DIVIDEND DECISIONS **9**

Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split.

UNIT III EVALUATION OF LEASE CONTRACTS **9**

Concept of Leasing, types of leasing, advantages and Disadvantages, Leasing Vs Buying Decision, Differentiate between hire purchase and leasing.

UNIT IV CORPORATE RESTRUCTURING **9**

Mergers and Acquisitions- Types of Mergers, Evaluation of merger Proposal, Take-over, Amalgamation, Leverage buy-out, management buy-out, Corporate Failure and Liquidation. Financial Restructuring Share Split, Consolidation, Cancellation of Paid-up Capital, Other Mechanisms.

UNIT V 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, and Inventory Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 12th edition, Dec, 2019

2. M.Y. Khan and P.K.Jain, "Financial management", Text, Problems and cases Tata McGraw Hill, 8th edition, 2018.
3. Aswat Damodaran, "Corporate Finance Theory and practice", John Wiley & Sons, 2019.
4. James C. Vanhorne, "Fundamentals of Financial Management", PHI Learning, 12th Edition, 2019.
5. Bhattacharya Hrishikes, "Working Capital Management: Strategies and Techniques", PHI Learning PVT Ltd, 4th Edition, June 2021, New Delhi.
6. Patrick A. Gaughan, "Mergers, Acquitions and Corporate Restructuring", Wiley Publications, 5th Edition, January 2011.
7. John. C.Hull, Sankarshan Basu, "Options, Futures and Other Derivatives", Pearson Publications, 9th Edition, New Delhi.
8. Prasanna Chandra, "Financial Management Theory and Practice", McGraw Hill Education India, 10th Edition, New Delhi.

REFERENCES:

1. Brigham, Ehrhardt, "Financial Management Theory and Practice", 13th edition, Cengage Learning 2015.
2. Srivatsava, Mishra, "Financial Management", Oxford University Press, 2018
3. K.Maran, "Financial Management", Sahara Publications, 2015.

WEB RESOURCES:

1. https://www.udemy.com/course/financial-management-a-complete-study/
2. https://www.udemy.com/course/business-finance-terms-for-everyone/
3. https:// www. edx. org/ course/ financial- information- and- its-analysis?index=product&queryID=b8ab51bb31c1724f 7b93f7a7b124ad6e&position=11
4. https://www.edx.org/course/public-financial-management?index=product&queryID=c1302dcb629e3ad46265746fbeb06ca4&position=1

OUTCOMES

Upon completion of the course, the student should be able to

1. Enable to learn and gain basic concepts of sources of funds. (K1)
2. Understand the concepts of dividend distribution and various theories involved it. (K2)
3. Gain the knowledge about leasing and HP Financing towards effective business performance. (K3)
4. Able to understand the corporate financial mechanism relating merger and acquisition. (K4)

5. Posses the acquired knowledge towards fund requirement decision for day-to-day business. (K4)
6. Able to make effective financial decision towards Corporate world. (K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	2	2	-	-	1	2	2	1	3	3
CO2	2	2	2	3	2	1	1	-	1	2	1	1	2	3
CO3	2	3	2	2	2	2	1	-	1	2	1	1	3	2
CO4	2	3	2	3	2	2	2	-	2	1	2	1	3	3
CO5	3	3	2	3	2	1	1	-	1	2	1	2	2	3

PROFESSIONAL ELECTIVE IV

20CBEL610 SDG NO. 4	IMAGE PROCESSING AND PATTERN RECOGNITION	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To learn the fundamentals of image formation and formats.
- To understand the intensity transformations and filtering techniques.
- To acquire knowledge on image segmentation operations.
- To learn the feature extraction and image registration process.
- To 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 itsrepresentation, neighborhood metrics.

UNIT II INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING 9

Enhancement, contrast stretching, histogram specification, local contrast enhancement; Smoothing, linear and orderstatistic 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; Optimumthresholding - Bayes analysis, Otsumethod; 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; Distancetransform, 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

TEXT BOOKS

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson, 4th Edition, 2018.
2. Maria Petrou and PanagiotaBosdogianni, "Image Processing: The Fundamentals", John Wiley & Sons, Ltd, 2ndEdition , 2010.
3. K. R. Castleman, "Digital Image Processing", Prentice Hall, Englewood Cliffs, 1st Edition, 1995.

REFERENCE BOOKS

1. A. Blake and A. Zisserman, "Visual Reconstruction", MIT Press, Cambridge. https://doi.org/10.7551/mitpress/7132.001.0001
2. A. N. Netravali and B. G. Haskell, "Digital Pictures", Plenum Press, 2nd Edition, 1995
3. A. B. Watson, "Digital Images and Human Vision", MIT Press, Cambridge, 1993.

OUTCOMES:

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

1. Be familiar with the fundamentals of image formation and formats.(K2)
2. Understand image transformation functions and filtering operations.(K2)
3. Apply the segmentation techniques on the images.(K3)

4. Describe the features of an image and perform image registration.(K2)
5. Manipulate Colour image processing and conversion operations.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO2	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO3	2	3	1	2	1	-	-	-	-	-	1	1	2	2
CO4	2	2	2	2	1	-	-	-	-	-	1	1	2	2
CO5	2	2	1	2	1	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE IV

20CBEL611 SDG NO. 4	SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT	L	T	P	C
		2	1	0	3

OBJECTIVES:

- Understand the services and service operations management concepts.
- Comprehend the techniques of service operations.
- Understand the service quality and service design aspects.
- Understand the service innovation aspects.
- To analyse how services are different from products by its characteristics.

UNIT I INTRODUCTION **9**

Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector. Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters. Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value co-creation.

UNIT II SERVICE STRATEGY AND COMPETITIVENESS 10

Development of Strategic Service Vision (SSV), Data Envelopment Analysis-New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system - Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design - Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools.

UNIT III SERVICE GUARANTEE & SERVICE RECOVERY 8

Service quality GAP analysis, Service guarantee-Service encounter-service profit chain.

UNIT IV FORECASTING DEMAND FOR SERVICES 9

Types of demand forecasting methods for Managing Capacity and Demand: Strategies for matching capacity and demand, managing waiting line in services. Managing Facilitating Goods: inventory models, Role of inventory in services - Managing service supply relationship: Understanding the supply chain, Strategies for managing suppliers of service - Vehicle Routing Problem: understanding services that involve transportation of people and vehicle.

UNIT V SERVICE INNOVATION 9

Services Productivity, Need for Services Innovation, service innovation in different service sector – educational, health and hospitality sectors.

TOTAL: 45 Periods

TEXT BOOKS:

1. Fitzsimmons & Fitzsimmons, "Service Management: Operations, Strategy, Information Technology", McGraw Hill publications, 7th Edition, 2017.
2. Christopher H.Lovelock and JochenWirtz, "Services Marketing", Pearson Education, New Delhi, 7th Edition, 2011.
3. Richard Metters, Karthryn King-Metters, Madeleine pullman, Steve Walton, "Successful Service Operations Management", South-Western, Cengage Learning, 2nd Edition, 2008.
4. Cengiz Haksever, Barry Render, Roberta S Russell, Pobert G Mirdick, "Service Management and Operations", Pearson Education, 2nd Edition, 2000.

REFERENCE BOOKS:

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D., " Services marketing: Integrating customer focus across the firm", McGraw Hill, 2012

2. Lovelock, C,Services, " Marketing", Pearson Education India, 7 th Edition ,2011.
3. Robert Johnson, Graham clark, "Service Operations Management", Pearson Education, 2nd Edition, 2005.
4. Reason, Ben, and Lovlie, Lavrans, "Service Design for Business: A Practical Guide to Optimizing the Customer Experience", Pan Macmillan India, 2016.
5. Chesbrough, H, "Open Services Innovation: Rethinking Your Business To Grow and Compete in a New Era". John Wiley & Sons, 2010.

OUTCOMES:

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

1. Understand concepts about services and distinguish it from goods.(K2)
2. Express the characteristics and nature of services.(K2)
3. Demonstratethe ways to design services and evaluate them using service qualities.(K2)
4. Illustrate how various methods can be used to operate and manage service businesses.(K3)
5. Discuss how innovation can be approached from services point of view.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	-	-	-	-	-	-	1	1	3	3
CO2	2	1	2	3	-	-	-	-	-	-	1	1	3	2
CO3	2	1	2	2	-	-	-	-	-	-	1	1	3	2
CO4	2	1	2	3	-	-	-	-	-	-	2	1	3	3
CO5	2	1	2	3	-	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE IV

20CBEL612 SDG NO. 4	ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To learn the fundamentals of text mining analysis.
- To be able to use various tools for text mining and carry out pattern discovery, predictive modeling.
- Explore the use of social network analysis to understand the growing connectivity and complexity.
- Perform social network analysis to identify important network properties in social media sites.
- Analysing interactions between people, and determine structural patterns in such interactions in real time application.

UNIT I INTRODUCTION TO TEXT MINING 9

Introduction- Defining text mining, general architecture of text mining systems. Core text mining operations- Using background knowledge for text mining, Text mining query languages. Pre-processing techniques-Task oriented approaches. Categorization-Applications of text categorizations, Definition of the problem, Document representations, Knowledge engineering approach to TC, Machine learning approach to TC, Using unlabeled evaluation of text classifiers.

UNIT II CLUSTERING AND INFORMATION EXTRACTION 9

Information extraction –Introduction, Historical evolution, Examples, Architecture of IE systems, Anaphora Resolution,Inductive algorithms, Structural IE. Probabilistic models for information extraction- Hidden Markov Models, Stochastic Context Free Grammars, Maximal entropy Markov Models, Conditional Random Fields. Text mining applications.

UNIT III TEXT MINING METHODS & APPROACHES 9

Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modelling; Sentiment Analysis; Sentiment Prediction.

UNIT IV WEB ANALYTICS 9

Web analytics tools, Clickstream analysis, A/B testing, online surveys; Web search and retrieval, Search engine optimization, Web crawling and Indexing, Ranking algorithms, Web traffic models

UNIT V SOCIAL MEDIA ANALYTICS **9**

Social network and web data and methods. Graphs and Matrices-Why Graphs? Graphs, Directed Graphs, Signed Graphs, Valued Graphs, Multigraphs, Hypergraphs, Relations, Matrices. Basic measures for individuals and networks. Information visualization: Architectural considerations, common visualization approaches for text mining, visualization technique in link analysis; Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity; Social network analysis

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press, 2006.

2 Hansen, Derek, Ben Sheiderman, Marc Smith, "Analyzing Social Media Networks with NodeXL: Insights from a Connected World", Morgan Kaufmann, 2011.

3 Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability", 2009.

4 Hanneman, Robert and Mark Riddle, "Introduction to Social Network Method", 2005.

5 Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press, 2006.

REFERENCE BOOKS:

1 Wasserman, S. & Faust, K.. "Social Network Analysis: Methods and Applications", New York: Cambridge University Press, 1994.

2 Monge, P. R. & Contractor, N. S., "Theories of Communication Networks", New York: Oxford University Press, 2003.
http://nosh.northwestern.edu/vita.html

WEB REFERENCES:

1. http://www.afaqs.com/
2. https://www.linkedin.com/learning/

COURSE OUTCOMES:

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

1. Understand the trends in recent years on online social networks.(K2)
2. Describe the graphical relation between the community.(K2)

3. Apply various social network algorithms related to predictive modelling and pattern discovery. (K3)
4. Express the relation between the participants of various social media.
5. Use the Social Network Mining Tools and apply in real time problems.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	1	-	-	2	2	3
CO2	1	2	2	2	3	-	-	-	-	2	-	2	2	3
CO3	-	2	2	2	3	-	-	-	-	3	-	2	2	3
CO4	2	2	2	2	3	-	-	-	-	2	-	3	2	3
CO5	-	2	2	2	2	-	-	-	3	3	-	2	2	3

PROFESSIONAL ELECTIVE IV

20CBEL613 SDG NO. 4	QUANTUM COMPUTATION AND QUANTUM INFORMATION	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To learn about Quantum information.
- To gain knowledge about Quantum algorithms.
- To understand and learn about Quantum random number generators.
- To study the basis of Post-Quantum cryptography.

UNIT I INTRODUCTION TO QUANTUM INFORMATION 9

States, Operators, Measurements, Quantum Entanglement: Quantum Teleportation, Super-dense coding, CHSH Game,Quantum gates and circuits.

UNIT II QUANTUM ALGORITHMS 9

Deutsch-Jozsa, Simon, Grover, Shor, Implication of Grover's and Simon's algorithms towards classical symmetric keycryptosystems, Implication of Shor's algorithm towards factorization and Discrete Logarithm based classical public keycryptosystems.

UNIT III QUANTUM TRUE RANDOM NUMBER GENERATORS 9

Detailed design and issues of quantumness, Commercial products and applications.

UNIT IV QUANTUM KEY DISTRIBUTION 9

BB84, Ekert, Semi-Quantum QKD protocols and their variations, Issues of Device Independence, Commercialproducts.

UNIT V INTRODUCTORY TOPICS IN POST-QUANTUM CRYPTOGRAPHY9

API-Public-key Signatures, Key Encapsulation Mechanism (KEM), Digital Signature standard, Pair-Wise KeyEstablishment-Discrete Logarithm Cryptography, Integer Factorization Cryptography.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information", Cambridge UniversityPress, 10th Edition, 2010.
2. Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

REFERENCE BOOKS:

1. P. Kaye, R. Laflamme, and M. Mosca, "An Introduction to Quantum Computing". Oxford University Press,New York.
2. N. David Mermin, "Quantum Computer Science", Cambridge University Press.
3. Quantum Cryptography. D. Unruh:, Available online: https://courses.cs.ut.ee/all/MTAT.07.024/2017_fall/uploads/
4. SAPV Tharrmashastha, D. Bera, A. Maitra and S. Maitra, "Quantum Algorithms for CryptographicallySignificant Boolean Functions - An IBMQ Experience", Springer, 2020.
5. Quantum Algorithm Zoo. https://quantumalgorithmzoo.org/
6. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, "Handbook of Applied Cryptography", CRC Press.

OUTCOMES:

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

1. Understand quantum gates and circuits using quantum information.(K2)
2. Apply quantum algorithms in cryptosystem.(K3)
3. Express the importance of Quantum random number generator.(K2)

4. Discuss the importance of Quantum key distribution.(K2)
5. Apply the concept of post-quantum cryptography.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	1	1	2	2
CO2	3	2	2	2	-	-	-	-	-	-	1	1	2	2
CO3	3	3	1	2	-	-	-	-	-	-	1	1	2	2
CO4	3	2	2	2	-	-	-	-	-	-	1	1	2	2
CO5	3	2	1	2	-	-	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVE IV

20CBEL614 SDG NO. 4	MOBILE COMPUTING	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To learn about the mobile infrastructure, radio resource management, overview of generation 1G to 5G.
- To illustrate the location management involved in GSM, Mobile IP.
- To illustrate the transmission, transaction technology involved in mobile.
- To explore the wireless network in mobile.
- To discover the cognitive radio networks in mobile.

UNIT I INTRODUCTION 9

Overview of wireless and mobile infrastructure, Preliminary concepts on cellular architecture, Design objectives andperformance issues, Radio resource management and interface, Propagation and path loss models, Channel interferenceand frequency reuse, Cell splitting, Channel assignment strategies, Overview of generations:- 1G to 5G.

UNIT II LOCATION AND HANDOFF MANAGEMENT 10

Introduction to location management (HLR and VLR), Mobility models characterizing individual node movement(Random walk, Fluid flow, Markovian, Activity based), Mobility models characterizing the movement of groups ofnodes (Reference point based group mobility model, Community

based group mobility model), Static (Always vs.Never update, Reporting Cells, Location Areas) and Dynamic location management schemes (Time, Movement,Distance, Profile Based), Terminal Paging (Simultaneous paging, Sequential paging), Location management andMobile IP, Overview of handoff process, Factors affecting handoffs and performance evaluation metrics, Handoffstrategies, Different types of handoffs (soft, hard, horizontal, vertical).

UNIT III WIRELESS TRANSMISSION FUNDAMENTALS 8

Introduction to narrow and wideband systems, Spread spectrum, Frequency hopping, Introduction to MIMO, MIMOChannel Capacity and diversity gain, Introduction to OFDM, MIMO-OFDM system, Multiple access control (FDMA,TDMA, CDMA, SDMA), Wireless local area network, Wireless personal area network (Bluetooth and zigbee).

UNIT IV WIRELESS NETWORK 9

Mobile Ad-hoc networks - Characteristics and applications; Coverage and connectivity problems, Routing in MANETs,Wireless sensor networks - Concepts, basic architecture, design objectives and applications; Sensing and communicationrange, Coverage and connectivity, Sensor placement, Data relaying and aggregation, Energy consumption, Clustering ofsensors, Energy efficient Routing (LEACH).

UNIT V COGNITIVE RADIO NETWORKS 9

Fixed and dynamic spectrum access, Direct and indirect spectrum sensing, Spectrum sharing, Interoperability and coexistence issues, Applications of cognitive radio networks, Introduction to D2D communications-High levelrequirements for 5G architecture, Introduction to the radio resource management, power control and mode selectionproblems, Millimeter wave communication in 5G.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson, 2004.
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.

REFERENCE BOOKS:

1. Theodore Rappaport, "Wireless Communications: Principles and Practice", Pearson Education, 2014.
2. Ezio Biglieri, MIMO, "Wireless Communications", Cambridge University Press, 2009.

3. Ivan Stojmenovic, "Handbook of Wireless Networking and Mobile Computin", Wiley, 2002.
4. James Cowling, "Dynamic Location Management in Heterogeneous Cellular Networks", 2004.

OUTCOMES:

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

1. Understand and apply the various concepts of basics of Number Theory.(K3)
2. Manipulation of Secure a message over an insecure channel by numerous symmetric key cryptosystem.(K3)
3. Apply diverse Public Key Cryptosystem & Authentication.(K3)
4. Implement varied security applications.(K3)
5. Describe the implications of quantum computing on cryptography and security.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	1	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	1	2	2	2
CO3	2	3	2	2	-	-	-	-	-	-	1	2	2	2
CO4	2	2	2	2	-	-	-	-	-	-	1	2	2	2
CO5	2	2	2	2	-	-	-	-	-	-	1	2	2	2

Imagine the Future and

Make it happen!

Together let's build a better world where there is NO POVERTY and ZERO HUNGER.

We have GOOD HEALTH AND WELL BEING QUALITY EDUCATION and full GENDER EQUALITY everywhere.

There is CLEAN WATER AND SANITATION for everyone. AFFORDABLE AND CLEAN ENERGY

which will help to create DECENT WORK AND ECONOMIC GROWTH. Our prosperity shall be fuelled

by investments in INDUSTRY, INNOVATION AND INFRASTRUCTURE that will help us to

REDUCE INEQUALITIES by all means. We will live in SUSTAINABLE CITIES AND COMMUNITIES.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing LIFE BELOW WATER, rich and diverse LIFE ON LAND.

We will enjoy PEACE AND JUSTICE through STRONG INSTITUTIONS

and will build long term PARTNERSHIPS FOR THE GOALS.

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Sai Prakash Leo Muthu

Chairman & CEO – Sairam Institutions

We build a Better nation through Quality education.

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Sri SAI RAM ENGINEERING COLLEGE

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