

**VELAMMAL COLLEGE OF
ENGINEERING AND TECHNOLOGY,
MADURAI-625009
(Autonomous)**



REGULATIONS-2021

**B.E. COMPUTER SCIENCE AND
ENGINEERING
(CYBER SECURITY)**

**CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABUS FOR
SEMESTERS I TO VIII**

GOLDEN GOALS OF VET:

1. Regularity & Punctuality.
2. Nil Failures, High Subject Average & More Centums.
3. Research & Development.
4. Focus in General Knowledge & Depth in the Subject.
5. Communication Skills (Spoken English & Learning more Languages).
6. Extracurricular Activities & Co-Curricular Activities (All-around Development).
7. Good Health and Food Habits.
8. Human Values.

VISION AND MISSION OF THE INSTITUTE

VISION OF VCET

To emerge and sustain as a center of excellence for technical and managerial education upholding social values.

MISSION OF VCET

Our aspirants are

- Imparted with comprehensive, innovative and value – based education.
- Exposed to technical, managerial and soft skill resources with emphasis on research and professionalism.
- Inculcated with the need for a disciplined, happy, married and peaceful life.

VISION AND MISSION OF CSE (Cyber Security) DEPARTMENT

VISION

To become a Centre of Excellence by providing quality technical education in the field of Cyber Security with professionalism and social responsibility.

MISSION

- Enriching the knowledge in recent trends of Cyber Security through continuous knowledge transfer programs.
- Transforming the students into competent Cyber Security professionals with the capability of providing solutions in various areas of cyber domain.
- Providing allied research and academic resources for the development of cyber security tools that support Social, National and International needs.



VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY,
VIRAGANOR, MADURAI-625009
(AUTONOMOUS)
B. E. COMPUTER SCIENCE AND ENGINEERING
(CYBER SECURITY)
[CHOICE BASED CREDIT SYSTEM]
REGULATIONS 2021
CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER I

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
1.	21IP101	Induction Programme (Common to all B.E./B.Tech. Programmes)	-	-	-	-	0
THEORY							
2.	21EN101	Professional English–I (Common to all B.E./B.Tech. Programmes)	HS	3	2	0	4
3.	21MA101	Matrices and Calculus (Common to all B.E./B.Tech. Programmes)	BS	3	2	0	4
4.	21PH101	Engineering Physics (Common to all B.E./B.Tech. Programmes)	BS	3	0	0	3
5.	21CH101	Engineering Chemistry (Common to all B.E./B.Tech. Programmes)	BS	3	0	0	3
6.	21CB101	Problem Solving and C Programming. (Common to all B.E. Cyber Security and BE. VLSI Design)	ES	3	0	0	3
7.	21ME101	Engineering Graphics (Common to all B.E./B.Tech. Programmes)	ES	2	0	2	3
8.	21TA101	தமிழ்மரபு/Heritage of Tamils	HS	1	0	0	1
PRACTICAL COURSES							
9.	21CS102	Problem Solving and C Programming Laboratory (Common to all B.E. Cyber Security and BE. VLSI Design)	ES	0	0	4	2
	21EM101	Engineering Practices Laboratory (Common to all B.E./B.Tech. Programmes)	ES	0	0	4	2
TOTAL CREDITS							25

SEMESTER II

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21EN102	English – II (Common to all B.E./B.Tech. Programmes)	HS	3	0	0	3
2.	21MA103	Sampling Techniques and Numerical Methods (Common to B.E CSE/B.TechProgrammes)	BS	3	2	0	4
3.	21PH103	Physics for Information Science (Common to B.E CSE/B.TechProgrammes)	BS	3	0	0	3
4.	21EE104	Basic Electrical and Electronics Engineering for Information Science (Common to B.E CSE/B.Tech Programmes)	ES	3	0	0	3
5.	21CB103	Python Programming	PC	3	0	0	3
6.	21CH103	Environmental Science (Common to all B.E./B.Tech. Programmes)	ES	2	0	0	2
7.	21TA102	தமிழரும் தொழில்நுட்பமும் /Tamil and Technology	HS	1	0	0	1
PRACTICAL COURSES							
8.	21PC101	Physics and ChemistryLaboratory (Common to all B.E./B.Tech. Programmes)	BS	0	0	4	2
9.	21CB104	Python Programming Laboratory	PC	0	0	4	2
TOTAL CREDITS							23

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21MA203	Discrete Mathematics (Common to B.E CSE/B.Tech Programmes)	BS	3	2	0	4
2.	21CB201	Data Structures and Algorithms	PC	3	0	0	3
3.	21CB202	Digital Principles and Computer Architecture	PC	3	0	0	3
4.	21CB203	Data Communication and Networks	PC	3	0	0	3
5.	21CB204	Introduction to Cyber Threats	PC	3	0	0	3
6.	21CB205	Object Oriented Programming Using C++ and Java	PC	3	0	0	3
PRACTICAL COURSES							
8.	21CB206	Data Structures and Algorithms Laboratory	PC	0	0	4	2
9.	21CB207	Object Oriented Programming Using C++ and Java Laboratory	PC	0	0	4	2
TOTAL CREDITS							23

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21MA209	Mathematical Foundation for Cyber security	BS	3	2	0	4
2.	21CB208	Formal Language and Automata Theory	PC	3	0	0	3
3.	21CB209	Database Management System and Security	PC	3	0	0	3
4.	21CB210	Network Security	PC	3	0	0	3
5.	21CB211	Cryptography and Cyber Security	PC	3	0	0	3
THEORY WITH PRACTICAL COURSE							
6.	21CB212	Operating Systems and Security	PC	3	0	2	4
PRACTICAL COURSES							
7.	21CB213	Database Management System and Security Laboratory	PC	0	0	4	2
8.	21CB214	Cryptography and Cyber Security Laboratory	PC	0	0	4	2
9	21CB215	Internship	EE	0	0	0	1
TOTAL CREDITS							25

SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21CB301	Cyber Forensics	PC	3	0	0	3
2.	21CB302	Web Programming	PC	3	0	0	3
3.	21CB303	Machine Learning and Security	PC	3	0	0	3
4.	21PCBXX	Professional Elective-I	PE	3	0	0	3
5.	21PCBXX	Professional Elective-II	PE	3	0	0	3
6.	21MCB01	Introduction to Women and Gender Studies	MC	2	0	0	0
THEORY WITH PRACTICAL COURSE							
7.	21CB304	Secure Software Systems	PC	2	0	2	3
PRACTICAL COURSES							
8.	21CB305	Web Programming Laboratory	PC	0	0	4	2
TOTAL CREDITS							20

SEMESTER VI

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21CB306	Cloud Security	PC	3	0	0	3
2.	21PCBXX	Professional Elective-III	PE	3	0	0	3
3.	21PCBXX	Professional Elective-IV	PE	3	0	0	3
4.	21OCBXX	Open Elective – I	OE	3	0	0	3
5.	21OCBXX	Open Elective-II	OE	3	0	0	3
6.	21MCB02	Industrial Safety	MC	2	0	0	0
THEORY WITH PRACTICAL COURSE							
7.	21CB307	Web Application Security	PC	3	0	2	4
PRACTICAL COURSE							
8.	21CB308	Cloud Security Laboratory	PC	0	0	4	2
TOTAL CREDITS							21

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21HS401	Human Values and Ethics	HS	2	0	0	2
2.	21CB402	Privacy and Security in Internet of Things	PC	3	0	0	3
3.	21OCBXX	Open Elective-III	OE	3	0	0	3
4.	21OCBXX	Open Elective –IV	OE	3	0	0	3
PRACTICAL COURSES							
6.	21CB403	Project Work-I	EE	0	0	4	2
TOTAL CREDITS							13

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCBXX	Professional Elective V	PE	3	0	0	3
2.	21PCBXX	Professional Elective VI	PE	3	0	0	3
PRACTICAL COURSE							
3.	21CB404	Project Work II	EE	0	0	20	10
TOTAL CREDITS							16

Total Credits: 166

SEMESTERWISE CREDIT DISTRIBUTION

Sem./Cat.	I	II	III	IV	V	VI	VII	VIII	Total Credits
HS	5	4	-	-	-	-	2	-	11
BS	10	9	4	4	-	-	-	-	27
ES	10	5	-	-	-	-	-	-	15
PC	-	5	19	20	14	8	5	-	70
PE	-	-	-	-	6	6	-	6	18
OE	-	-	-	-	-	6	6	-	12
EE	-	-	-	1	2*	2*	2*+2	10	13
MC					✓	✓			
Total	25	23	23	25	20	20	15	16	166

Sl. No.	Category	Type of Course
1.	HS	Humanities and Social Sciences including Management (HS)
2.	BS	Basic Sciences (BS)
3.	ES	Engineering Sciences including Workshop, Drawing, Basics of Civil / Electrical / Mechanical / Computer etc. (ES)
4.	PC	Professional Core Courses (PC)
5.	PE	Professional Electives : Courses relevant to chosen specialization / branch (PE)
6.	OE	Open Electives: Electives from other Technical and / or emerging Courses (OE)
7.	EE	Project Work, Seminar and Internship in Industry – Employability Enhancement Courses (EE)
8.	MC	Mandatory Courses(MC)
9.	OC	One Credit Courses(OC)

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL – I

CYBER SECURITY AND DATA PRIVACY

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCB01	Cyber Threat Intelligence	PE	3	0	0	3
2.	21PCB02	Malware Analysis	PE	3	0	0	3
3.	21PCB03	Social Networks and Security	PE	3	0	0	3
4.	21PCB04	Modern Cryptography	PE	3	0	0	3
5.	21PIT04	Digital and Mobile Forensics	PE	3	0	0	3
6.	21PCB05	Block chain Technologies	PE	3	0	0	3
7.	21PCB06	Steganography and Watermarking	PE	3	0	0	3

VERTICAL – II

SYSTEM SECURITY AND ASSESSMENT

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCB07	Biometrics and Security	PE	3	0	0	3
2.	21PCB08	Cybercrime investigations and Law Enforcement	PE	3	0	0	3
3.	21PCB09	Secure Coding	PE	3	0	0	3
4.	21PCB10	Security Assessment and Risk Analysis	PE	3	0	0	3
5.	21PCB11	Proactive Security Tools and Techniques	PE	3	0	0	3
6.	21PCB12	Intrusion Detection System	PE	3	0	0	3
7.	21PCB13	Cyber Physical Systems	PE	3	0	0	3

VERTICAL – III

FULL STACK DEVELOPMENT

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCB14	Software Testing	PE	3	0	0	3
2.	21PIT11	UI and UX Design	PE	3	0	0	3
3.	21PAD43	Digital marketing	PE	3	0	0	3
4.	21PIT17	Techniques of Robotic Process Automation	PE	3	0	0	3
5.	21PAD45	App Development	PE	3	0	0	3
6.	21PAD46	DevOps	PE	3	0	0	3
7.	21PAD47	Open-Source Technologies	PE	3	0	0	3

VERTICAL – IV

EMERGING INTELLIGENCE

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCB15	Artificial Intelligence	PE	3	0	0	3
2.	21PIT15	Concepts of Augmented Reality &Virtual Reality	PE	2	2	0	3
3.	21PCB16	Foundations of Data Science	PE	3	0	0	3
4.	21PCS03	Neural Networks and Deep Learning	PE	2	2	0	3
5.	21PAD08	Fog Computing	PE	2	2	0	3
6.	21PIT14	Game Design and Development	PE	3	0	0	3
7.	21PIT21	Quantum Computing	PE	3	0	0	3

VERTICAL – V

MANAGEMENT

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
THEORY							
1.	21PME34	Principles of Management	PE	3	0	0	3
2.	21PME35	Total Quality Management	PE	3	0	0	3
3.	21PCB17	Engineering Economics and Financial Accounting	PE	3	0	0	3
4.	21PCB18	Human Resource Management	PE	3	0	0	3
5.	21PCB19	Knowledge Management	PE	3	0	0	3
6.	21PCB20	Industrial Management	PE	3	0	0	3
7.	21PME38	Introduction to Industry 4.0	PE	3	0	0	3

VERTICAL – VI

COMPUTING SCIENCE

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			CREDITS
				L	T	P	
THEORY							
1.	21PCB26	Programming in C	PE	3	0	0	3
2.	21PCB27	Fundamentals of Data Structures and Algorithms	PE	3	0	0	3
3.	21PCB28	Object Oriented Programming using Java	PE	3	0	0	3
4.	21PCB29	Introduction to Database Management System	PE	3	0	0	3
5.	21PCB30	Fundamentals of Operating Systems	PE	3	0	0	3
6.	21PCB31	Data Communication and Computer Networks.	PE	3	0	0	3
7.	21PCB32	Internet and Web Technologies	PE	3	0	0	3
8.	21PCB33	Software Engineering	PE	3	0	0	3

LIST OF ONE CREDIT COURSES

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
1.	21OCCB01	Vulnerability and Penetration Testing	OC	0	0	2	1
2.	21OCCB02	Intrusion Detection and Prevention System	OC	0	0	2	1
3.	21OCCB03	Unified Endpoint Management	OC	0	0	2	1
4.	21OCCB04	Block Chain and Machine Learning Integration for Enhanced Cyber Security	OC	0	0	2	1
5.	21OCCB05	Endpoint Detection & Response	OC	0	0	2	1

SEMESTER – I

21IP101	INDUCTION PROGRAMME (Common to all B.E./ B.Tech. programmes)	L	T	P	C
		0	0	0	0
This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over. The induction programme has been introduced by AICTE with the following objective: “Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfil his/her responsibility as an engineer, as a citizen and as a human being. Besides the above, several meta-skills and underlying values are needed.” “One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “ The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program. (i) Physical Activity This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc. (ii) Creative Arts Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later. (iii) Universal Human Values This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme. (iv) Literary Activity Literary activity would encompass reading, writing and possibly, debating, enacting a play etc. (v) Proficiency Modules This would address some lacunas that students might have, for example, English, computer familiarity etc.					

(vi) Lectures by Eminent People
Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.
(vii) Visits to Local Area
A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.
(viii) Familiarization to Dept./Branch & Innovations
They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.
(ix) Department Specific Activities
About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.
Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.
REFERENCE: Guide to Induction program from AICTE

21EN101	PROFESSIONAL ENGLISH-1 (Common to all B.E./B.Tech. Programmes)	L	T	P	C
		3	2	0	4
COURSE OBJECTIVES:					
- To develop learner’s skills in listening and responding effectively. - To improve basic grammar for better communication. - To practice reading exercise for understanding vocabulary. - To initiate and participate in pair presentation, extempore. - To strengthen writing skills for various compositions.					
UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION				12
Listening – Listening for general information - Specific details - Conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form; Speaking- Self Introduction; Introducing a friend; Conversation - Politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form; Reading- Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails; Writing- Writing emails / letters introducing oneself; Grammar- Present Tense (simple, continuous); Question types: Wh/ Yes or No/ and Tags Vocabulary- Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).					
UNIT II	NARRATION AND SUMMATION				12

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities; Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews; Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs; Writing - Guided writing - Paragraph writing Short Report on an event (field trip etc.); Grammar - Past tense (Simple, continuous); Subject-Verb Agreement; and Prepositions; Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.		
UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	12
Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products; Speaking - Picture description; Giving instruction to use the product; Presenting a product; and Summarizing a lecture; Reading - Reading advertisements, gadget reviews; user manuals; Writing - Writing definitions; instructions; and Product /Process description; Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect, Present and past perfect continuous tenses; Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)		
UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	12
Listening - Listening to TED Talks; Scientific lectures; and educational videos; Speaking – Small Talk; Mini presentations and making recommendations; Reading - Newspaper articles; Journal reports - Non Verbal Communication (tables, pie charts etc.) Writing - Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode) Grammar - Articles; Pronouns - Possessive & Relative pronouns; Vocabulary - Collocation s; Fixed / Semi fixed expressions.		
UNIT V	EXPRESSIONS	12
Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions; Speaking - Group discussions, Debates, and Expressing opinions through Simulations & Role-play; Reading - Reading editorials; and Opinion Blogs; Writing - Essay Writing (Descriptive or narrative); Grammar - Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences; Vocabulary - Cause & Effect Expressions - Content vs. Function words.		
		TOTAL: 60 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Listen and comprehend complex academic texts CO2: Read and infer the denotative and connotative meanings of technical texts CO3: Write definitions, descriptions, narrations and essays on various topics CO4: Speak fluently and accurately in formal and informal communicative contexts CO5: Express their opinions effectively in both oral and written medium of communication		
TEXT BOOKS: 1. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University. English for Science & Technology. Cambridge University Press, 2021 2. Board of Editors, Department of English, Anna University. English for Engineers & Technologists. Orient Blackswan Private Ltd, 2020. 3. Board of Editors, Department of English, Anna University. Using English Orient Blackswan Private Ltd, 2017		

REFERENCES:

1. Meenakshi Raman & Sangeeta Sharma. Technical Communication – Principles And Practices Oxford University Press, New Delhi, 2016
2. Lakshminarayanan K.R. A Course Book On Technical English. SciTech Publications (India) Pvt. Ltd., 2012
4. Ayesha Viswamohan. English For Technical Communication (With CD). McGraw Hill Education, ISBN: 0070264244. 2008.
5. Kulbhusan Kumar, RS Salara, Effective Communication Skill. Khanna Publishing House. First Edition, 2018.
6. Dr. V. Chellammal. Learning to Communicate. Allied Publishing House, New Delhi, 2003.

21MA101	MATRICES AND CALCULUS (Common to all B.E. / B.Tech. Programmes)	L	T	P	C
		3	2	0	4
COURSE OBJECTIVES: - To develop the use of matrix algebra techniques that is needed by engineers for practical applications. - To explain the students about differential calculus. - To demonstrate the functions of several variables technique to solve problems in many engineering branches. - To demonstrate the various techniques of integration. - To prepare the student to use mathematical tools in evaluating multiple integrals and their applications.					
UNIT I	MATRICES	12			
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms– Applications: Stretching of an elastic membrane.					
UNIT II	DIFFERENTIAL CALCULUS	12			
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.					
UNIT III	FUNCTIONS OF SEVERAL VARIABLES	12			
Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange’s method of undetermined multipliers.					
UNIT IV	INTEGRAL CALCULUS	12			
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centre of mass.					
UNIT V	MULTIPLE INTEGRALS	12			

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centre of mass, moment of inertia.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Use the matrix algebra methods for solving engineering problems.

CO2: Apply differential calculus tools in solving various application problems.

CO3: Make use of differential calculus ideas on several variable functions.

CO4: Identify suitable methods of integration in solving practical problems.

CO5: Solve practical problems of areas, volumes using multiple integrals.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, New Delhi, 2016.
2. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
3. James Stewart, "Calculus: Early Transcendentals", 8th Edition, Cengage Learning, New Delhi, 2015.

REFERENCES:

1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", 7th Edition, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, New Delhi, 2016.
3. Ramana. B.V., "Higher Engineering Mathematics", 6th Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
4. Thomas. G. B., Hass. J and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

21PH101	ENGINEERING PHYSICS (Common to all B.E. / B.Tech. Programmes)	L	T	P	C
		3	0	0	3
OBJECTIVES: - To illustrate the students effectively to achieve an understanding of mechanics. - To infer the students to gain knowledge of electromagnetic waves and its applications. - To explain the basics of oscillations, optics and lasers. - To outline the importance of quantum physics. - To relate the students towards the applications of quantum mechanics.					
UNIT I	MECHANICS	9			
Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum– double pendulum – Introduction to nonlinear oscillations.					
UNIT II	ELECTROMAGNETIC WAVES	9			

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.		
UNIT III	OSCILLATIONS, OPTICS AND LASERS	9
Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave – sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference– Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.		
UNIT IV	BASIC QUANTUM MECHANICS	9
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.		
UNIT V	APPLIED QUANTUM MECHANICS	9
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Explain the importance of mechanics. CO2: Extend their knowledge in electromagnetic waves. CO3: Illustrate a strong foundational knowledge in oscillations, optics and lasers. CO4: Interpret the importance of quantum physics. CO5: Summarize quantum mechanical principles towards the formation of energy bands.		
TEXT BOOKS: 1. D.Kleppner and R.Kolenkow, "An Introduction to Mechanics", 1 st Edition, McGraw Hill Education, 2017. 2. E.M.Purcell and D.J.Morin, "Electricity and Magnetism", 3 rd Edition, Cambridge University Press, 2013. 3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", 7 th Edition, McGraw-Hill, 2017.		

REFERENCES:

1. R.Wolfson. "Essential University Physics", Volume 1 & 2. , 1st Edition (Indian Edition) Pearson Education, 2009.
2. Paul A. Tipler, "Physics"- Volume 1 & 2, 1st Edition (Indian Edition), CBS Publishers & Distributors, 2004.
3. K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", 2nd Edition, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R. Resnick and J. Walker, "Principles of Physics", 10th Edition (Indian Edition), Wiley, 2015.
5. N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students", 1st Edition, Springer Verlag, 2012.

21CH101	ENGINEERING CHEMISTRY (Common to all B.E / B.Tech. Programmes)	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To inculcate sound understanding of water quality parameters and water treatment techniques. • To impart knowledge on the basic principles and preparatory methods of nanomaterials. • To introduce the basic concepts and applications of phase rule and composites. • To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics. • To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.					
UNIT I	WATER AND ITS TREATMENT				9
Water: Sources and impurities, Water quality parameters: Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming & foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.					
UNIT II	NANOCHEMISTRY				9
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.					
UNIT III	PHASE RULE AND COMPOSITES				9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		
UNIT IV	FUELS AND COMBUSTION	9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.		
UNIT V	ENERGY SOURCES AND STORAGE DEVICES	9
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H ₂ -O ₂ fuel cell, microbial fuel cell; Super capacitors: Storage principle, types and examples.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water. CO2: Identify and apply basic concepts of nano science and nanotechnology in designing the synthesis of nano materials for engineering and technology applications. CO3: Apply the knowledge of phase rule and composites for material selection requirements. CO4: Recommend suitable fuels for engineering processes and applications. CO5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors.		
TEXT BOOKS: 1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17 th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018. 2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008. 3. S.S. Dara, "A text book of Engineering Chemistry", 12 th Edition, S. Chand Publishing, , 2018.		

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B.B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-II M Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", 2nd Edition, Cambridge University Press, Delhi, 2019
5. O.V. Roussak and H.D. Gesser, "Applied Chemistry-A Text Book for Engineers and Technologists", 2nd Edition, Springer Science Business Media, New York, 2013.

21CB101	PROBLEM SOLVING AND C PROGRAMMING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To describe the basics of algorithmic problem solving. • To demonstrate the fundamentals of C programming • To describe the reusable modules (collections of function). • To examine code, document, test, and implement a well-structured program using the C • To use the C programming concepts in trivial problem solving.					
UNIT-I	PROBLEM SOLVING AND C FUNDAMENTALS	9			
Introduction-Problem Solving Using Computer-Algorithms-Flowchart-Pseudo code- Programming Languages as tools-Converting pseudo code to program-Structure of C program - C programming: Data Types - Constants - Enumeration Constants - Keywords - Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements - Decision making statements - Switch statement - Looping statements - Pre-processor directives - Compilation process					
UNIT-II	ARRAYS AND STRINGS	9			
Introduction to Arrays: Declaration, Initialization - One dimensional array - Two dimensional arrays - String operations: length, compare, concatenate, copy - Selection sort, linear and binary search.					
UNIT-III	FUNCTIONS AND POINTERS				
Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) - Recursion, Binary Search using recursive functions - Pointers - Pointer operators - Pointer arithmetic - Arrays and pointers - Array of pointers - Parameter passing: Pass by value, Pass by reference					
UNIT-IV	STRUCTURES AND UNION	9			
Structure - Nested structures - Pointer and Structures - Array of structures - Self-referential structures - Dynamic memory allocation - Singly linked list - typedef - Union - Storage classes and Visibility					
UNIT-V	FILE PROCESSING	9			
Files -Defining and Opening a file, closing a file- input/output operations on files- error handling during I/O operations- random access to files-Command Line Arguments.					

TOTAL :45 PERIODS	
COURSE OUTCOMES At end of the course, learners will be able to: CO1: Impart adequate knowledge in programming languages and problem-solving techniques. CO2: Develop programs using the basic elements like arrays and Strings CO3: Implement modular applications in C using functions and pointers. CO4: Demonstrate Storage classes and pointers in C which is essential for utilizing memory. CO5: Design applications using sequential and random-access file processing.	
TEXT BOOKS: 1. ReemaThareja, “Programming in C”, Oxford University Press, 2 nd Edition, 2016. 2. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, 2 nd Edition, Pearson Education, 2015. 3. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1 st Edition, Pearson Education, 2013	
REFERENCES: 1. Yashwant Kanetkar, Let us C, 17 th Edition, BPB Publications, 2020. 2. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw Hill Education, 1996. 3. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, 2 nd Edition, Oxford University Press, 2013.	

21ME101	ENGINEERING GRAPHICS (Common to all B.E./B.Tech. Programmes)	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES: - To sketch the projection of points, lines and planes. - To sketch the projection of simple solids - To sketch the projection of sectioned solids and development of lateral surfaces - To sketch the isometric and perspective views of simple solids. - To sketch the orthographic projection of various objects freehand.					
UNIT I	PROJECTIONS OF POINTS, LINES AND PLANE SURFACE				12
Importance of graphics in engineering applications – Use of drafting instruments - Lettering and dimensioning. Introduction to Orthographic projections - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method. (Not for Examination)					
UNIT II	PROJECTION OF SOLIDS				12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.					
UNIT III	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES				12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		
UNIT IV	ISOMETRIC AND PERSPECTIVE PROJECTIONS	12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .		
UNIT V	FREEHAND SKETCHING	12
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects. Introduction to drafting packages and demonstration. (Not for examination).		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, learners will be able to CO1:Construct the orthographic projections of points, straight lines and plane surfaces. CO2:Sketch the orthographic projections of simple solids CO3:Sketch the orthographic projections of sectional solids and lateral surfaces of the solids. CO4:Construct the isometric projections and perspective projections of simple solids. CO5:Sketch the orthographic projection of objects using freehand.		
TEXT BOOKS:		
1. Natarajan K.V., “A text book of Engineering Graphics”, 31 st Edition, Dhanalakshmi Publishers, Chennai, 2018. 2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, 15 th Edition, New Age International (P) Limited, 2018. 3. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, 53 rd Edition, Charotar Publishing House, 2014.		
REFERENCES:		
1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, 2 nd Edition, Tata McGraw Hill Publishing Company Limited, 2013. 2. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, 2 nd Edition, Oxford University, Press, New Delhi, 2015. 3. Shah M.B., and Rana B.C., “Engineering Drawing”, 2 nd Edition, Pearson, 2009.		

21TA101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1
UNIT I	LANGUAGE AND LITERATURE				3
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.					

UNIT II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT III	FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT IV	THINAI CONCEPT OF TAMILS	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aham Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
TOTAL: 15 PERIODS		
TEXT-CUM-REFERENCE BOOKS		
1. தமிழகவரலாறு – மகக்ஞம்பண்பாடும் – க.க.க. பிள்ளை (வவளியீடு: தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்). 2. கணினிதமிழ் – முன்னவர்இல. சுந்தரம். (விகடன்பிரசுரம்). 3. கீழடி – எவளநதிகக்ளரயில்சங்ககாலநகரநாகரிகம் (வதால்லியல்துளறவவளியீடு) 4. வபாருளந – ஆற்றங்களநாகரிகம். (வதால்லியல்துளறவவளியீடு) 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.		

21TA101	தமிழர் மரபு	L	T	P	C
		1	0	0	1
அலகு 1	மொழி மற்றும் இலக்கியம்				3
இந்திய மொழிக் குடும்பங்கள், திராவிட மொழிகள், தமிழ் ஒரு செம்மொழி, தமிழ் செவ்விலக்கியங்கள், சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை, சங்க இலக்கியத்தில் பகிர்தல் அறம், திருக்குறளில் மேலாண்மைக் கருத்துக்கள், தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம், பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள், சிற்றிலக்கியங்கள், தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் பங்களிப்பு.					
அலகு 2	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை-சிற்பக்கலை				3
நடுகல் முதல் நவீன சிற்பங்கள் வரை, ஐம்பொன் சிலைகள், பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள், தேர் செய்யும் கலை, சுடுமண் சிற்பங்கள், நாட்டுப்புறத் தெய்வங்கள், குமரிமுனையில் திருவள்ளுவர் சிலை, இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு					
அலகு 3	நாட்டுப்புற கலைகள் மற்றும் வீர விளையாட்டுக்கள்				3
தெருக்கூத்து, கரகாட்டம், விலுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுக்கள்					
அலகு 4	தமிழர்களின் திணைக் கோட்பாடுகள்				3
தமிழகத்தின் தாவரங்களும், விலங்குகளும், தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள், தமிழர்கள் போற்றிய அறக்கோட்பாடு, சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் சங்ககால நகரங்களும் துறை முகங்களும், சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.					
அலகு 5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு				3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு, இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம், சுயமரியாதை இயக்கம், இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கைழுத்துப்படிகள், தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.					
TOTAL: 15 PERIODS					
TEXT-CUM-REFERENCE BOOKS					
1. தமிழக வரலாறு - மக்களும் பண்பாடும் -கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்) .					

2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்) .
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

21CB102	PROBLEM SOLVING AND C LABORATORY (Common to B.E. CSE(Cyber Security) and B.E. Electronics(VLSI))	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
• To demonstrate the fundamentals of C programming • To describe the reusable modules (collections of function) • To examine code, document, test, and implement a well-structured program using the C • To use the C programming concepts in trivial problem solving. • To develop logics which will help them to create programs, applications in C.					
LIST OF EXPERIMENTS					

1. I/O statements, operators, expressions 2. Decision-making constructs: if-else, goto, switch-case, break-continue 3. Loops: for, while, do-while 4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal 5. Strings: operations 6. Functions: call, return, passing parameters by (value, reference), passing arrays to function. 7. Recursion 8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions. 9. Files: reading and writing, File pointers, file operations, random access, processor directives. 10. Mini Project
TOTAL :60 PERIODS
COURSE OUTCOMES: At end of the course, learners will be able to CO1:Develop simple applications using basic C components. CO2:Solve applications adopting array and string concepts. CO3:Construct and implement applications in C using functions and pointers. CO4:Prepare applications in C by employing structure and union concepts. CO5:Build applications using sequential and random access file processing.

21EM101	ENGINEERING PRACTICES LABORATORY (Common to all B.E / B.Tech. Programmes)	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
• To draw pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work. • To demonstrate the basic switch board wiring, fluorescent lamp wiring and stair case wiring using various electrical components. • To choose various joints in steel plates using arc welding work and machining various simple processes like turning, drilling, tapping in parts • To build a tray out of metal sheet using sheet metal work. • To develop electronic circuit and testing for soldering and desoldering using PCB board.					
LIST OF EXPERIMENTS:					
GROUP – A (CIVIL & ELECTRICAL)					
PART – I					

CIVIL ENGINEERING PRACTICES PLUMBING**WORK:**

- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

- Sawing,
- Planning and Making joints like T-Joint, Cross lap and Dovetail joint.

PART – II**ELECTRICAL ENGINEERING PRACTICES**

- Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
 - Staircase wiring
 - Fluorescent Lamp wiring with introduction to CFL and LED types.
 - Energy meter wiring and related calculations/ calibration
 - Study of Iron Box wiring and assembly
 - Study of Fan Regulator (Resistor type and electronic type using Diac/Triac/quadrac)
- Measurement of resistance to earth of an electrical equipment.

GROUP – B (MECHANICAL & ELECTRONICS)**PART III****MECHANICAL ENGINEERING PRACTICES WELDING****WORK:**

- Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- Practicing gas welding.

BASIC MACHINING WORK:

- Usage of Spanners and screw drivers □ Facing and Turning.
- Taper Turning

ASSEMBLY WORK:

- Assembling a centrifugal pump.
- Assembling a household mixer.
- Assembling an air conditioner.

SHEET METAL WORK:

- Making of a square tray

FOUNDRY WORK:

- Demonstrating basic foundry operations.

PART IV**ELECTRONIC ENGINEERING PRACTICES SOLDERING****WORK:**

- Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:	
Assembling and testing electronic components on a small PCB.	
ELECTRONIC EQUIPMENT STUDY:	
- Study elements of smart phone. - Assembly and dismantle of computer / laptop	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, learners will be able to CO1: Build various plumbing joints CO2: Develop various carpentry joints. CO3: Construct various wiring electrical joints in common household electrical wire work. CO4: Construct various welded joints, sheet metal and basic machining operations CO5: Develop the electronic circuit for soldering and testing using PCB board.	

SEMESTER-II

21EN102	ENGLISH-II (Common to all B.E./B.Tech. Programmes)	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts. • Foster their ability to write convincing job applications and effective reports. • Develop their speaking skills to make technical presentations and participate in group discussions. • Strengthen their Listening skill which will help them comprehend lectures and talks in their areas of specialization. • Create awareness about the soft skills					
UNIT I	INTRODUCTION TO TECHNICAL ENGLISH				9
Listening - Factual and Academic speeches; Speaking - Asking for and giving directions - Reading - Technical texts from - Newspapers /websites; Writing - Statements - Definitions - issue based writing instructions-Checklists - Recommendations; Vocabulary Development - technical vocabulary; Grammar - Error spotting - Compound words; Soft skills - Leadership Skills					
UNIT II	READING AND STUDY SKILLS				9
Listening - Listening to longer technical talks and completing exercises based on them; Speaking - Describing a general process; Reading - Reading longer technical texts - Identifying the various transitions in a text - Paragraphing; Writing - Interpreting charts, graphs; Vocabulary Development - Vocabulary used in formal letters/emails and reports Grammar - Impersonal passive voice, numerical adjectives - Soft skills - Teamwork					
UNIT III	TECHNICAL WRITING AND GRAMMAR				9
Listening - Listening to classroom lectures, talks on engineering /technology; Speaking - introduction to technical presentations; Reading - longer texts both general and technical, practice in speed reading; Writing - Describing a technical process; Vocabulary Development - Sequence words - Misspelled words; Grammar - Embedded sentences ; Soft skills - Decision making					
UNIT IV	JOB APPLICATIONS				9

Listening - Listening to Documentaries and Making Notes; **Speaking** - Mechanics of Presentations; **Reading** - Reading for Detailed Comprehension; **Writing** - Email Etiquette, Job Application, Cover Letter, Resume Preparation(softcopy and hard copy), Analytical Essay Writing; **Vocabulary Development** Finding Suitable Synonyms, Paraphrasing; **Grammar** – Clauses, ‘If’ Conditionals; **Soft Skills** - Time Management.

UNIT V	GROUP DISCUSSION AND REPORT WRITING	9
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Listening - TED Talks; **Speaking** - Participating in a Group Discussion; **Reading** - Reading and Understanding Technical Articles; **Writing** - Writing Reports, Survey Report, Accident Report, Minutes of a Meeting; **Vocabulary Development** - Verbal Analogies; **Grammar** - Reported Speech; **Soft Skills** - Conflict Resolution.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

CO1: Critically read and interpret information in technical texts

CO2: Write convincing job applications, resume and effective reports

CO3: Present the technical ideas effectively in spoken and written forms

CO4: Understand spoken language in lectures and talks

CO5: Demonstrate basic soft skills in life

TEXT BOOKS:

1. Board of Editors, Fluency in English-A Course book for Undergraduate Engineers and Technologist. Orient Blackswan Pvt Ltd, Hyderabad: 2018
2. Jawahar, Jewelcy & Rathna.P. Communicative English Workbook. VRB Publishers Pvt Ltd. Chennai. 2018.
3. Board of Editors, Department of English, Anna University, Chennai. Mindscapes-English for Technologists and Engineers. Orient Black Swan Pvt Ltd, Chennai, 2012.

REFERENCES:

1. Verma, Shalini.” Technical Communication for Engineers. “Vikas Publishing House Pvt Ltd. New Delhi. 2015
2. Raman, Meenakshi & Sharma, Sangeeta,”Technical Communication English Skills for Engineers” Oxford University Press. 2008.
3. Rizvi, Ashraf.M. “Effective Technical Communication.”,MC Graw Hill Education Pvt Ltd. New Delhi. 2016.

21MA103	SAMPLING TECHNIQUES AND NUMERICAL METHODS (Common to B.E. CSE/ B.Tech. IT/B.E.ECE/B.E.CSE(CB))	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To describe the necessary basic concepts in probability
- To explain the concept of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the basic concepts of classification of design of experiments.
- To choose the method for solving algebraic and transcendental equations using numerical techniques.

To discuss the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.		
UNIT I	PROBABILITY	15
Introduction -Sample Spaces and Events-Axioms of Probability-Interpretations and Properties of Probabilities-Conditional Probabilities-Bayes's theorem- Independence.		
UNIT II	TESTING OF HYPOTHESIS	15
Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, χ^2 and F distributions for testing means and variances – Contingency table (Test for Independence) – Goodness of fit.		
UNIT III	DESIGN OF EXPERIMENTS	15
Introduction, aim, basic designs of experiments, one way and two way classifications - Completely randomized design – Randomized block design – Latin square design.		
UNIT IV	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	15
Newton Raphson method –Method of False position- pivoting – Gauss Jordan methods – Iterative method: Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.		
UNIT V	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	15
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rd rules, 3/8 th rule.		
TOTAL: 75 PERIODS		
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Apply the concepts of Probability in Engineering problems. CO2: Explain the test of hypothesis for small and large samples by using various test like t-test, F-test, Z-test and χ^2 test. CO3: Apply the basic concepts of classifications of design of experiments. CO4: Solve the system of equations and the eigen value problems using iterative procedure. CO5: Interpret the value of an unknown function at any interpolated point of the given tabulated values.		
TEXT BOOKS: 1. JAY.L. Devore, "Probability and Statistics for Engineering and the Science", 9 th Edition, Cengage Learning, 2021. 2. Johnson. R.A., and Irwin Miller, John Freund, "Miller and Freund's Probability and Statistics for Engineers", 12 th Edition, Pearson Education, Asia, 2011. 3. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis", 7 th Edition, Pearson Education, Asia, New Delhi, 2008.		

REFERENCES:

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", 3rd Edition, Tata McGraw Hill, 2012.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill, New Delhi, 2007.

21PH103	PHYSICS FOR INFORMATION SCIENCE (Common to B. E. CSE / B. Tech. IT)	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To infer the importance in studying electrical properties of materials. • To extend the students knowledge in semiconductor physics. • To illustrate knowledge on magnetic properties of materials. • To summarize different optical properties of materials, optical displays and applications. • To translate an idea of significance of nano structures, quantum confinement, ensuing nano device applications and quantum computing.					
UNIT I	ELECTRICAL PROPERTIES OF MATERIALS				9
Classical free electron theory - Expression for electrical conductivity - Thermal conductivity, expression - Wiedemann-Franz law - Success and failures -Electrons in metals - Particle in a three dimensional box Degenerate states - Fermi- Dirac statistics - Density of energy states - Electron effective mass -Concept of hole.					
UNIT II	SEMICONDUCTOR PHYSICS				9
Intrinsic Semiconductors - Energy band diagram -Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - extrinsic semiconductors - Carrier concentration in n-type &p-type semiconductors - Variation of carrier concentration with temperature -Variation of Fermi level with temperature and impurity concentration - Carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and devices - Ohmic contacts - Schottky diode.					
UNIT III	MAGNETIC PROPERTIES OF MATERIALS				9
Magnetic dip ole moment -Atomic magnetic moments- Magnetic permeability and susceptibility - Magnetic material cla ssification: diamagnetism -Paramagnetism - Ferromagnetism - Antiferromagnetism Ferrimagneti sm - Ferromagnetism: origin and exchange interactionsaturation magnetization and Curie temperature Domain Theory- M versus H behaviour - Hard and soft magnetic materials -Examples and uses- Magnet ic principle in computer data storage - Magnetic hard disc (GMR sensor).					
UNIT IV	OPTICAL PROPERTIES OF MATERIALS				9
Classification of optical materials - carrier generation and recombination processes - Absorption emission and scatterin g of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode - solar cell - LED - Organic LED - Laser diodes - Optical data storage techniques.					
UNIT V	NANODEVICES AND QUANTUM COMPUTING				9

Introduction - Quantum confinement -Quantum structures: quantum wells, wires and dots -Band gap of nanomaterials. Tunneling - Single electron phenomena: Coulomb blockade - Resonant- tunneling diode - single electron transistor - quantum cellular automata - Quantum system for information processing - quantum states - classical bits - quantum bits or qubits - CNOT gate - multiple qubits - quantum gates - advantage of quantum computing over classical computing (qualitative).	
	TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Demonstrate the classical and quantum electron theories, and energy band structures. CO2: Infer knowledge on basics of semiconductor physics and its applications in various devices. CO3: Summarize magnetic properties of materials and their applications in data storage. CO4: Extend the functioning of optical materials for optoelectronics CO5: Translate the basics of quantum structures towards quantum computing.	
TEXT BOOKS: 1. Jasprit Singh, “Semiconductor Devices Basic Principles”, First Edition (Indian Edition), Wiley, 2007. 2. S.O. Kasap, “Principles of Electronic Materials and Devices”, Fourth Edition (Indian Edition), McGraw-Hill Education, 2020. 3. Parag K. Lala, “Quantum Computing: A Beginner's Introduction”, First Edition (Indian Edition) McGraw-Hill Education, 2020.	
REFERENCES: 1. Charles Kittel, “Introduction to Solid State Physics”, Indian Edition Wiley, 2019. 2. Y.B.Band and Y.Avishai, “Quantum Mechanics with Applications to Nanotechnology and Information Science”, First Edition, Academic Press, 2013. 3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, “Introduction to Nanoelectronics”, First Edition, Cambridge University.Press, 2008. 4. G.W. Hanson, “Fundamentals of Nanoelectronics”, Indian Edition, Pearson Education 2009. 5. B.Rogers, J.Adams and S.Pennathur, “Nanotechnology: Understanding Small Systems”, CRC Press, 2014.	

21EE104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING FOR INFORMATION SCIENCE (Common to B.E. CSE / B.Tech.IT /B.E. CSE(CS))	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To explain the basics of electric circuits and analysis. • To summarize the basics of working principles and application of AC and DC machines. • To interpret the domestic and industrial wiring. • To demonstrate analog devices and their characteristics. • To illustrate the application of operational amplifier.					
UNIT I	ELECTRICAL CIRCUITS				9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws– Simple problems- Nodal Analysis, Mesh analysis. Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – (Simple problems only)		
UNIT II	ELECTRICAL MACHINES	9
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and. Construction and Working Principle of DC motors, Back EMF equation, Types, Speed and Torque Equation, Transformer-Construction, Working principle and Three phase Alternator, Synchronous motor and Three Phase Induction Motor-construction, working principle and Applications(Qualitative Analysis)		
UNIT III	DOMESTIC AND INDUSTRIAL WIRING	9
Lighting, provision of sockets-MCB- Selection of wires and cables-Protection-need for earthing, fuses, relay and circuit breakers. Load calculation, generation cost and Energy Tariff calculation for domestic and industrial loads- HT & LT wiring- Power factor correction.		
UNIT IV	ANALOG ELECTRONICS	9
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing – Types, I-V Characteristics and Applications, Rectifier. (Qualitative Analysis)		
UNIT V	OPERATIONAL AMPLIFIERS AND ITS APPLICATIONS	9
Operational amplifiers, Inverting and Non-Inverting Amplifier, Summer, Differentiators, Integrator, Voltage to Current (V/I) and Current to Voltage (I/V) Converter, Multivibrator using 555 timer IC.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Interpret the electric circuit parameters of simple DC Circuits. CO2: Explain the working principle and applications of DC machines. CO3: Demonstrate the working principle of AC machines. CO4: Describe the characteristics of analog electronic devices. CO5: Summarize the basic concepts of operational amplifiers.		
TEXT BOOKS 1. Bhattacharya.S.K “Basic Electrical and Electronics Engineering”, 2 nd Edition, Pearson Education, 2017. 2. Sedha R.S., “A textbook book of Applied Electronics”, 3 rd Edition, S. Chand & Co., 2008. 3. Salivahanan.S, Suresh Kumar.N, “Electronic Devices and Circuits”, 3 rd Edition, Tata McGraw Hill 2012. 4. Roy Choudhary.D, Sheil B. Jani, “Linear Integrated Circuits”, 5 th Edition, New Age international Pvt Ltd publishers, 2018.		
REFERENCES 1. Kothari DP and Nagrath. I.J, “Basic Electrical Engineering”, 4 th Edition, McGraw Hill Education, 2019. 2. Albert Malvino, David Bates, “Electronic Principles”, 7 th Edition, McGraw Hill Education; 2017. 3. Badrinar, B.H.Vishwakarma, “Power system protection and switchgear”, 2 nd Edition, New age international Pvt Ltd publishers, 2011.		

21CB103	PYTHON PROGRAMMING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: • To learn the syntax and semantics of Python Programming Language. • To write Python functions to facilitate code reuse and manipulate strings. • To illustrate the process of structuring the data using lists, tuples and dictionaries. • To demonstrate the use of built-in functions to navigate the file system. • To appraise the need for working on web scraping.								
UNIT-I	PYTHON BASICS							9
Introduction: Importance – limitations - Python impressions - Internal working – comments. Basics: Identifiers -reserved keywords – literals - fundamental data types - base conversion - type casting -escape characters - eval(),input(), and print() functions - command line arguments - delete statement. Operators - operator precedence – conditional, iterative and transfer statements - loops with else block. Strings: multiline string literal – accessing characters of string - operators for string - string operations – formatting.								
UNIT-II	DATA STRUCTURES, FUNCTIONS AND MODULES							9
Data structures: list, tuple, set, dictionary - Types of Functions - Return Statement - arguments in a function – scope of variables - global keyword - recursive, Lambda - filter(), map(), and reduce() function - function aliasing - nested, decorator, and generator functions. Modules: Module Aliasing - Member Aliasing - Reloading a Module - Dir() Function - Math Module - Random Module - Packages.								
UNIT-III	OBJECT ORIENTED PROGRAMMING AND EXCEPTION HANDLING							9
Class – object – self variable – constructor – types of variables and methods – setter and getter methods – passing members of one class to another class. Types of Error – Exception - Default Exception Handling – Customized. Exception Handling: Using Try- Except - Multiple Except Blocks – finally block - Nested Try- Except- Finally Block -Types of Exception - Raise User- Defined Exception – Assertion.								
UNIT-IV	ADVANCED OOPS CONCEPTS							9
Inner class - Garbage collection – destructor - Finding the number of references of an object – Encapsulation –Inheritance – Aggregation vs Composition – Inheritance types – method resolution order – super() method –polymorphism – abstract class and method – interface - __str__() method								
UNIT-V	FILE HANDLING AND PACKAGES							9
Introduction to file – With statement – seek() and tell() methods – Testing the existence of a file – Handling binary data and CSV files – Zipping and unzipping files – Directory – Get information about a file – Pickling and unpickling of objects, using Packages: Math – Numpy - Matplotlib								
TOTAL:45 PERIODS								

COURSE OUTCOMES:

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

CO1: Explore the basics of Python programming such as operators and control structures

CO2: Construct functions and modules with various data structures

CO3: Create Classes and Objects using Python and handle exceptions

CO4: Apply advanced OOP concepts in solving real-world problems

CO5: Work on files and packages.

TEXT BOOKS:

1. Vijay Kumar Sharma, Vimal Kumar, Swati Sharma, Shashwat Pathak, "Python Programming – A Practical Approach", 1st Edition CRC Press, 2022.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Shroff, O'Reilly Publishers, 2016.
3. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", 1st Edition Network Theory Ltd., 2011

REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press, 2013.
2. Charles Dierbach, "Introduction to Computer Science using Python", 1st Edition Wiley India Edition, 2016.
3. Timothy A. Budd, "Exploring Python", 1st Edition, Mc-Graw Hill Education (India) Private Ltd., 2011.
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 201

21CH103	ENVIRONMENTAL SCIENCE (Common to all B.E / B.Tech. Programmes)	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES:					
• To describe the structure and function of an ecosystem and biodiversity. • To interpret the environmental impacts of natural resources. • To demonstrate causes, effects and control measures of different types of pollution. • To manipulate the importance of disaster management, environmental ethics and values. • To dramatize the important social issues and sustainable practices.					
UNIT-I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY				6
Multidisciplinary nature of environmental studies - ecosystem- general structure and function of an ecosystem- ecological succession-biodiversity-types-values of biodiversity- endangered and endemic species-red data book- hot spots of biodiversity-criteria- hot spots in India-threats to biodiversity(man-animal conflict s, habitat loss, poaching)-case studies-conservation of biodiversity- in-situ and ex-situ conservation					
UNIT-II	NATURAL RESOURCES AND ITS ENVIRONMENTAL IMPACTS				6

Natural resources-forest resource-ecological functions – causes, effects and control measures of deforestation-water resource-sources-conflict over water-dams benefits and problems-food resource overgrazing- impacts of over grazing- impacts of modern agriculture-energy resource-environmental impacts of wind mills and solar panels- role of an individual in conservation of natural resources.		
UNIT III	ENVIRONMENTAL POLLUTION AND CONTROL	6
Air pollution-causes, effects and control methods - water pollution- causes, effects-waste water treatment soil pollution-causes, effects-solid waste management-e-waste- causes, effects and management Pollution control acts-air (prevention and control of pollution) act,1981-water(prevention and control of pollution) act,1974- wildlife (protection) act,1972 - e-waste management rules,2016-case studies - role of an individual in control of pollution.		
UNIT IV	DISASTER MANAGEMENT AND ENVIRONMENTAL ETHICS	6
Disaster management-causes, effects and management of- flood, landslide, earthquake and tsunami-case studies- environmental ethics- value education-traditional value systems in India-water conservation-rain water harvesting-watershed management.		
UNIT V	SOCIAL ISSUES AND SUSTAINABLE PRACTICES	6
Unsustainable development- social issues-climate change-causes, effects and control measures-global warming-causes, effects and control measures-Acid rain-causes, effects and control measures-ozone layer depletion-causes, effects and control measures-nuclear accident and holocausts-EIA-Sustainable development-goals-target- green buildings- ISO 14000 series.		
		30 PERIODS
COURSE OUTCOMES :		
At the end of the course, learners will be able to CO1: Explain the concept, structure and function of an ecosystem and biodiversity. CO2: Demonstrate the environmental impacts of natural resources. CO3: Illustrate the suitable management method for pollution control. CO4: Relate the proper way of managing disaster with environmental ethics. CO5: Apply social issues and adopt suitable sustainable practices.		
TEXT BOOKS:		
1. Kaushik, A &Kaushik. C.P, “Environmental Science and Engineering”, 6 th Edition, New Age International, 2018. 2. Garg S.K &Garg, Ecological and Environmental studies, Khanna Publishers, 2015. 3. Wright &Nebel, Environmental science towards a sustainable future, 12 th Edition, Prentice Hall of India Ltd, 2015.		
REFERENCE BOOKS:		
1. ErachBharucha,“Text book of Environmental studies for Undergraduate courses”, 3 rd Edition, UGC, 2021. 2. Ravi P. Agrahari, Environmental ecology, Biodiversity, climatic change & Disaster management, 1 st Edition, McGraw Hill, 2020 3. Benney Joseph, “Environmental Science and Engineering”, 1 st Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017		

21TA102	TAMIL AND TECHNOLOGY	L	T	P	C
		1	0	0	1
UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3			
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffition Potteries.					
UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3			
Designing and Structural construction House & Designs in household materials during Sangam AgeBuilding materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Peri od - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.					
UNIT III	MANUFACTURING TECHNOLOGY	3			
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.					
UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3			
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.					
UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3			
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.					
TOTAL : 15 PERIODS					
TEXT-CUM-REFERENCE BOOKS					
1. தமிழகவரலாறு – மகக்ஞம்பண்பாடும் –கக.கக. பிள்ளை (வவளியீடு: 2. தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்). 3. கணினிததமிழ் – முளனவர்தில. சுநத்தர்ம். (விகடன்பிரசுரம்). 4. கீழடி-ளவளகநதிகக்ளரயில்சங்ககாலநகரநாகரிகம்(வதால்லியல் துளறவவளியீடு) 5. வபாருளந – ஆற்றங்களரநாகரிகம். (வதால்லியல்துளறவவளியீடு) 6. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 7. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. 8. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 9. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 10. Keeladi - ‘Sangam City C ivilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 11. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby:					

The Author)

12. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

13. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

21TA102	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1
அலகு 1	நெசவு மற்றும் பாணைத் தொழில்நுட்பம்				3
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள் .					
அலகு 2	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்				3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும்- சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங் கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ -சாரோஸெனிக் கட்டிடக் கலை .					
அலகு 3	உற்பத்தித் தொழில்நுட்பம்				3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் -நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் -தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள் .					
அலகு 4	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்				3
அணை , ஏரி, குளங்கள், மதகு - சோழர் காலக் குழுமித் தூம்பின் முக்கியத்துவம் -கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார்ச்சமூகம் .					
அலகு 5	அறிவியல் தமிழ் மற்றும் கணிததமிழ்				3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய்தல்
 - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் -தமிழ் மின்நூலகம்
 - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம் .

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

21PC101	PHYSICS AND CHEMISTRY LABORATORY (Common to all B.E. / B.Tech., Programmes)	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
• To explain the proper use of various kinds of physics laboratory equipment. • To extend how data can be collected, presented and interpreted in a clear and concise manner. • To infer problem solving skills related to physics principles and interpretation of experimental data. • To summarize error in experimental measurements and techniques used to minimize such error. • To translate the student as an active participant in each part of all lab exercises.					
LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 7 Experiments)					
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.					

2. Simple harmonic oscillations of cantilever. 3. Non-uniform bending - Determination of Young's modulus 4. Uniform bending – Determination of Young's modulus 5. Laser- Determination of the wave length of the laser using grating 6. Air wedge - Determination of thickness of a thin sheet/wire 7. a)Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser. 8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids. 9. Ultrasonic interferometer – Determination of the velocity of sound and compressibility of liquids 10. Post office box - Determination of Band gap of a semiconductor. 11. Photoelectric effect 12. Michelson Interferometer. 13. Melde's string experiment 14. Experiment with lattice dynamics kit.		TOTAL: 30 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Explain the functioning of various physics laboratory equipment CO2: Relate the graphical models to analyze laboratory data CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality. CO4: Explain Access, process and analyze scientific information. CO5: Translate students to solve problems individually and collaboratively		
REFERENCES : 1. "Physics Laboratory Manual", Department of Physics, Velammal College of Engineering & Technology, Madurai (2021) 2. P. Mani, "Physics Laboratory", Dhanam Publications, 2021		
*Each class is divided in to two batches (30 students / batch) and each batch will perform their experiments alternatively per week in physics and chemistry laboratory		

21PC101	PHYSICS AND CHEMISTRY LABORATORY (Common to all B.E / B.Tech. Programmes)	L	T	P	C
		0	0	4	2
CHEMISTRY LABORATORY					
COURSE OBJECTIVES:					
• To identify the required glass wares and instruments for chemical analysis. • To estimate water quality parameters such as hardness, dissolved oxygen and chloride content. • To relate electrochemical techniques such as pH metry, conductometry and potentiometry. • To interpret the data collected from the analysis. • To express the skills to get accurate results					
List of Experiments (Any7 experiments)					
1. Preparation of Na2CO3 as a primary standard and estimation of acidity of a water sample using the primary standard.					

- Determination of types and amount of alkalinity in water sample.
- Determination of total, temporary & permanent hardness of water by EDTA method.
- Determination of DO content of water sample by Winkler's method.
- Determination of chloride content of water sample by Argentometric method.
- Estimation of copper content of the given solution by Iodometry.
- Estimation of TDS of a water sample by gravimetry.
- Determination of strength of given hydrochloric acid using pH meter.
- Determination of strength of acids in a mixture of acids using conductivity meter.
- Conductometric titration of barium chloride against sodium sulphate. (precipitation titration)
- Estimation of iron content of the given solution using potentiometer.
- Estimation of sodium /potassium present in water using flame photometer.
- Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
- Estimation of Nickel in steel.
- Proximate analysis of Coal.

COURSE OUTCOMES:

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

CO1: Extend the skills to choose and handle appropriate glass wares.

CO2: Interpret the water quality parameters using volumetric method.

CO3: Estimate the conductivity, pH & emf by electro chemical methods.

CO4: Infer the collected data for appropriate chemical analysis.

CO5: Demonstrate systematic approach to obtain accurate results

TEXT BOOK:

I.J.Mendham, R.C.Denney, J.D.Barnes, M.Thomas and B.Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis" 2009.

21CB104	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
• To describe the problem solving approaches. • To solve the basic programming constructs in Python. • To illustrate various computing strategies for Python-based solutions to real world problems. • To make use of Python data structures - lists, tuples, and dictionaries. • To explain input/output with files in Python.					
LIST OF EXPERIMENTS					
1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points). 2. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern) 3. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples) 4. Implementing real-time/technical applications using Sets, Dictionaries. (Language,					

components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries) - Implementing programs using Functions. (Factorial, largest number in a list, area of shape) - Implementing programs using Strings. (reverse, palindrome, character count, replacing characters) - Implementing programs using written modules and Python Standard Libraries (pandas,numpy. Matplotlib, scipy) - Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word) - Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation).
TOTAL:60 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Develop algorithmic solutions to simple computational Problems CO2: Illustrate and execute basic Python programs using simple statements. CO3: Build program for scientific problems using strings, functions and control statements. CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications. CO5: Experiment the python packages, files and exceptions for developing software applications

SEMESTER-III

21MA203	DISCRETE MATHEMATICS (Common to B.E. CSE/B.Tech IT/ B.E. CSE(CB))	L	T	P	C
		3	2	0	4
COURSE OBJECTIVES:					
- To extend student's logical and mathematical maturity and ability to deal with abstraction. - To discuss the basic concepts of Combinatory. - To explain the students about the properties and characteristics of different graphs. - To demonstrate the applications of algebraic structures. - To identify the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering					
UNIT I	LOGIC AND PROOFS				15
Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.					
UNIT II	COMBINATORICS				15
Mathematic al induction – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications					
UNIT III	GRAPHS				15
Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.					
UNIT IV	ALGEBRAIC STRUCTURES				15

Groups – Subgroups – Cyclic groups - Homomorphism – Normal subgroup and Cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V	LATTICES AND BOOLEAN ALGEBRA	15
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Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Some special lattices: Bounded, Modular, Distributive, complemented.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to
 CO1: Extend student's logical and mathematical maturity and ability to deal with abstraction.
 CO2: Explain the basic concepts of combinatorics.
 CO3: Make use of the concept of graph theory in computer science and engineering.
 CO4: Manipulate the applications of algebraic structures.
 CO5: Demonstrate the basic theorems and properties of Lattices and Boolean Algebra.

TEXT BOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2011.
2. Tremblay J.P. & Manohar.R, "Discrete Mathematics Structures with Application to Computer Science", 1st Edition, Tata McGraw Hill Publication Ltd., New Delhi, 30th reprint 2011.
3. Liu C.L, Mohapatra D.P, "Elements of Discrete Mathematics: A computer oriented approach", 4th Edition, Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Grimaldi R.P., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Koshy, "Discrete Mathematics with Applications", 1st Edition, Elsevier Publications, 2006.
3. Bernard Kolman, Robert C Busby, Sharon Cutler Ross, "Discrete Mathematical Structures", 3rd Edition, Prentice Hall, New Delhi, 2015.

21CB201	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Exploring basic data structures such as list, stacks and queues.
- Familiar with advanced data structures such as balanced search trees, priority queues
- Develop skills to apply graph data structures in problem solving
- Learn some basic algorithms with their rigorous proofs of correctness and efficiency analysis
- Describe different searching and sorting Algorithms.

UNIT-I	LINEAR STRUCTURES	9
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Abstract Data types-List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – Stack ADT – Queue ADT – double ended queues – applications.

UNIT-II	TREE STRUCTURES	9
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Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multiway search trees

UNIT-III	GRAPH STRUCTURES	9
Graph ADT – representations of graph – graph traversals – DAG – topological ordering – greedy algorithms – dynamic programming – shortest paths – minimum spanning trees – introduction to complexity classes and intractability		
UNIT-IV	INTRODUCTION TO ALGORITHMS	9
Introduction to Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and Basic efficiency classes – Mathematical analysis for Recursive and Non-Recursive algorithms		
UNIT-V	SORTING AND SEARCHING	9
Bubble sort – selection sort – merge sort – quick sort – analysis of sorting algorithms – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At the end of the course, the learners will be able to CO1: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists and be able to use these structures effectively in application programs. CO2: Familiarize with nonlinear data structures tree for solving real world problems. CO3: Design, implement, and analyze efficient graph structures for real world problems. CO4: Estimate the algorithmic complexity of simple, non-recursive program and recursive programs. CO5: Understanding of various sorting and searching algorithms, and to compare the efficiency of these algorithms in terms of both time and space.		
TEXT BOOKS: 1. Reema Thareja, “Data Structures Using C”, Oxford University Press, 2 nd Edition 2011 2. Jean-Paul Tremblay & Paul G. Sorenson, “An Introduction to Data Structures with Applications “Tata McGraw Hill 2 nd Edition 2017. 3. T.Cormen, C.Lieserson, R.Rivest, and C.Stein, “Introductions to Algorithms”, 3 rd edition, Prentice-Hall/India, 2009		
REFERENCES: 1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 4 th Edition, Pearson Education, 2014 2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, 1 st Edition Pearson Education, 2013. 3. Stephen G. Kochan, “Programming in C”, 3 rd Edition, Pearson Edition, 2004		

21CB202	DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To analyze and design combinational circuits. - To analyze and design sequential circuits - To understand the basic structure and operation of a digital computer. - To study the design of data path unit, control unit for processor and to familiarize with the hazards. - To understand the concept of various memories and I/O interfacing.					

UNIT-I	NUMBER SYSTEM AND BOOLEAN ALGEBRA	9
Review of number systems, binary codes, error detection and correction codes, Combinational logic – representation of logic functions-SOP and POS forms, K-map representations – minimization using K maps-Tabulation Method-NAND-NOR Implementation.		
UNIT-II	COMBINATIONAL LOGIC	9
Combinational Circuits – Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder – Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers		
UNIT-III	SYNCHRONOUS SEQUENTIAL LOGIC	9
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.		
UNIT-IV	COMPUTER FUNDAMENTALS	9
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High-Level Language.		
UNIT-V	MEMORY AND I/O	9
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At the end of the course, the learners will be able to CO1: Make use of the basic concepts of numbers systems, gates to design digital combinational circuits including arithmetic circuits CO2: Analyze and design sequential digital circuits like counters, registers. CO3: State the fundamentals of computer systems and analyze the execution of an instruction CO4: Design a pipeline for consistent execution of instructions with minimum hazards. CO5: Exemplify in a better way the memory organization is communicating with processing unit.		
TEXT BOOKS: 1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, 6 th Edition, Pearson Education, 2018. 2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, 6 th Edition, Morgan Kaufmann/Elsevier, 2020. 3. Thomas L. Floyd” Digital Fundamentals” 11 th Edition Preason Prentice Hall, 2000		
REFERENCES: 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, 6 th Edition, Tata McGraw-Hill, 2012. 2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 10 th Edition, Pearson Education, 2016.		

3. M. Morris Mano, “Digital Logic and Computer Design”, 1st Edition Pearson Education, 2016 .

21CB203	DATA COMMUNICATION AND NETWORKS			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES: - To describe the Network Architecture and the performance metrics of switched networks. - To demonstrate the various Link layer services. - To explain the concepts of subnetting and routing mechanisms. - To illustrate the process-to-process delivery models and congestion control principles. - To summarize the services of various protocols in Application layer.							
UNIT-I	INTRODUCTION TO DATA COMMUNICATION AND NETWORKS						9
Data communication -data representation, data flow, components. Definition of node, link, branch, network, network criteria. Physical structures -types of connection, working of different network topologies, network configuration and their advantages, concepts and comparison of LAN, MAN, WAN. Switching concepts of circuit switching, packet switching & message switching and their applications.							
UNIT-II	NETWORKING PROTOCOLS AND OSI MODEL						9
Protocol layering -Scenarios, principles. Logical connection-connection oriented and connection less. Protocols in computer communications, OSI reference model - functions of all layers. Data link control -concept of framing, flow control and error control.MAC protocol- addressing mechanism.							
UNIT-III	NETWORK LAYER						9
NetworkLayerServices–IPV4Addresses–ClassfulAddressing–ClasslessAddressing–DynamicHost Configuration Protocol (DHCP)–Network Layer Protocols:IP,ICMPv4–Unicast Routing Algorithms and Protocols- IPV6 Addressing.							
UNIT-IV	TRANSPORT LAYER						9
Introduction–TransportLayerProtocols–Services–PortNumbers–UserDatagramProtocol– Transmission Control Protocol – SCTP.							
UNIT-V	APPLICATION LAYER						9
World Wide Web and Hyper Text Transfer Protocol – File Transfer Protocol – Electronic Mail –Telnet – Secure Shell – Domain Name System – Simple Network Management Protocol.							
TOTAL:45 PERIODS							
COURSE OUTCOMES: At end of the course, learners will be able to: CO1: Make use of evaluation metrics to measure the performance of packet switched network. CO2: Utilize the Link layer services for various IEEE standards. CO3: Experiment with sub netting to optimize network configuration and various routing algorithms for unicast routing. CO4: Choose protocols for Process-to-Process communication in various application. CO5: Utilize application layer protocols for real time Scenario.							

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, Tata McGraw Hill, 2017.
2. William Stallings, "Data and Computer Communication", 10th Edition, Pearson Education, 2022.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann Publishers Inc., 2017.

REFERENCES:

- 1.P.C .Gupta , "Data communications and Computer Networks", 2nd Edition, PHI. 2014.
- 2.S. Keshav , "An Engineering Approach to Computer Networks", 2nd Edition, Pearson Education, 2008.
- 3.James F.Kurose & Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet" 3rd Edition, Pearson Education, 2017

21CB204	INTRODUCTION TO CYBER THREATS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES:								
- To infer the basics of cyber security. - To outline the security aspects of operating systems and networks. - To make use of cryptographic techniques in network security. - To explain the privacy principles and policies. - To illustrate the security management and incidents.								
UNIT-I		INTRODUCTION TO CYBER SECURITY					9	
Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls – Authentication Access Control and Cryptography - Web-User Side - Browser Attacks - Web Attacks- Targeting Users - Obtaining User or Website Data - Email Attacks.								
UNIT-II		SECURITY IN OPERATING SYSTEM & NETWORKS					9	
Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service								
UNIT-III		DEFENCES: SECURITY COUNTER MEASURES					9	
Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure- Data Mining and Big Data.								
UNIT-IV		PRIVACY IN CYBERSPACE					9	
Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.								
UNIT-V		MANAGEMENT AND INCIDENTS					9	
Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster- Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law – Information and Laws - Cyber-crime - Cyber Warfare and Home Land Security.								
					TOTAL : 45 PERIODS			

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of computer security.

CO2: Illustrate methods for Security in operating system and networks.

CO3: Identify the various security counter measures.

CO4: Summarize the privacy principles and policies.

CO5: Interpret the management strategies of cyber space.

TEXT BOOKS:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, "Security in Computing", 5th Edition, Pearson Education, 2015.
2. Martti Lehto and Pekka Neittaanmäki, "Cyber Security: Analytics, Technology and Automation edited", Springer International Publishing Switzerland, 2015.
3. George K. Kostopoulos, "Cyber Space and Cyber Security", 2nd Edition, CRC Press, 2017.

REFERENCES :

1. Jan L. Harrington, "Network Security A Practical Approach", 1st Edition, Morgan Kaufmann Publishers, 2005.
2. Edward Amoroso, "Cyber Security", 1st Edition, Silicon Press, 2006.
3. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", 1st Edition, CBS publishers, New Delhi, 2004.

21CB205	OBJECT ORIENTED PROGRAMMING USING C++ AND JAVA	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To understand the basic concepts of Java • To know the concepts of inheritance, polymorphism and exceptions • To practice event-driven programming using AWT and swings • To work with generics, collection classes and native methods • To learn the basics of concurrent programming in Java					
UNIT-I	INTRODUCTION				9
Object Oriented Programming Concepts – Procedure vs. Object-oriented programming –Tokens - User-defined types – ADT- Static, Inline and Friend Functions-Function Overloading – Pointers - Reference variables-Classes and Objects – Constructors and Destructors.					
UNIT-II	OBJECT ORIENTED PROGRAMMING CONCEPTS				9
Operator Overloading and Type Conversions -Function object– Dynamic Memory Management - Inheritance – Constructors and Destructors in Derived Classes – Polymorphism and Virtual Functions.					
UNIT-III	TEMPLATES, EXCEPTION HANDLING and FILES				9
Function Template and Class Template – Name spaces- Casting- Exception Handling- C++ Stream classes – Formatted IO – File classes and File operations - Standard Template Library					
UNIT-IV	INTRODUCTION TO JAVA				9

Java features - Objects and classes in Java - Defining classes and methods - Access specifiers - Static Fields –Methods Parameters - Object Constructors – Overloading - Arrays - Strings - StringBuffer – String Tokenizer - String Object in Switch Statement – I/O stream classes - Packages – JAR File Creation -Java Doc comments - Class Design Hints - Exceptions - Dealing with errors – Catching exceptions		
UNIT-V	INHERITANCE AND POLYMORPHISM	9
Inheritance – Super classes method/Constructor calling - Polymorphism - Dynamic binding - final Keyword - Object Cosmic Super Class Methods- Object Wrappers and Autoboxing - Abstract classes - Reflection - Interfaces - Lambda expressions- Inner classes – Object Serialization - Saving and loading Serializable Objects.		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At the end of the course, the learners will be able to CO1: Under the basic concepts of object-oriented programming. CO2: write program using inheritance and polymorphism. CO3: Infer knowledge of templates, exception handling and files. CO4: Write object-oriented programs using Java CO5: Derive and invoke methods in classes with inheritance and polymorphism		
TEXT BOOKS: 1. Cay S. Horstmann, “Core Java: Volume I – Fundamentals”, 12 th Edition, Pearson Education Inc, 2021. 2. HM Deitel and PJ Deitel “C++ How to Program”, 7 th Edition, Prentice Hall. 2014 3. Herbert Schildt, “The Complete Reference in C++”, 4 th Edition, Tata McGraw Hill.,2017		
REFERENCES: 1. E Balagurusamy, “Object oriented Programming with C++”, 8 th edition,Tata McGraw Hill,2020. 2. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, 4 th Edition, Tata McGraw-Hill Publishing company Ltd.,2006. 3. Cay S. Horstmann, “Core Java: Volume II – Advanced Features”, 12 th Edition, Pearson Education Inc, 2022		

21CB206	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
- Understand the concept of Abstract data types to develop stack, queue and List Data Structures. - Infer the knowledge in sorting and searching algorithms. - Develop a hash table to handle the collision during data storage. - Design and implement advanced data structures like graphs, balanced search trees, hash tables, priority queues etc. - Apply graph algorithms to solve real world problems like finding shortest paths on huge maps.					

LIST OF EXPERIMENTS:	
1. Linked list implementations of List 2. Implementation of Stack and Queue ADTs 3. Applications of List, Stack and Queue ADTs 4. Implementation of sorting and searching algorithms 5. Implementation of Hash tables 6. Tree representation and traversal algorithms 7. Implementation of Binary Search Trees 8. Implementation of Heaps 9. Graph representation and Traversal algorithms 10. Implementation of single source shortest path algorithm 11. Implementation of minimum spanning tree algorithms	
TOTAL:60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the learners should be able to:	
CO1: Design, implement and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications	
CO2: Design, implement, and analyse efficient tree structures.	
CO3: Model problems as graph problems and implement efficient graph algorithms to solve them	
CO4: Implement sorting and searching algorithms using relevant data structures.	
CO5: Implement tree traversal and graph traversal for real world problems.	

21CB207	OBJECT ORIENTED PROGRAMMING USING C++ AND JAVA LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
- To understand object-oriented programming concepts using the C++ language. - To enhance programming skills in the principles of data abstraction, inheritance and polymorphism; - To construct C++ Program for handling I/Exception Handling and STL. - To understand object-oriented programming concepts using Java language. - To develop code using the principles of OOPS.					
LIST OF EXPERIMENTS:					
C++ Programs:					
- Programs using Data types, Operators and Control Structures - Programs using Arrays and Strings. - Programs using Functions and Pointers. - Programs using User-defined types. - Programs using Classes and Objects. - Programs using Constructors and Destructors - Programs using Operator Overloading. - Programs using Inheritance, Polymorphism and its types.					

- Programs using Dynamic memory allocation.
- Programs using Templates and Exceptions.
- Programs using Sequential and Random-access files.
- Programs using STL

Java Programs:

- Classes and objects
- Inheritance and Polymorphism.
- Abstract classes and Object Class

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners should be able to:

CO1: Develop simple C++ programs using object-oriented features

CO2: Write C++ programs to evaluate object-oriented programming concepts.

CO3: Develop C++ program that incorporated templates, exception handling and files.

CO4: Write simple Java program include basic programming features.

CO5: Implement java program for OOPS concepts.

SEMESTER IV

21MA209	MATHEMATICAL FOUNDATION FOR CYBER SECURITY	L	T	P	C
		3	2	0	4
COURSE OBJECTIVES: • To introduce the basic notions of rings, fields which will then be used to solve related problems. • To introduce and apply the concepts of rings, finite fields and polynomials. • To understand the basic concepts in Number Theory • To examine the key questions in the Theory of Numbers. • To give an integrated approach to number theory and abstract algebra, and provide a firm Basis for further reading and study in the subject.					
UNIT-I	RINGS AND INTEGRAL DOMAIN				12
Algebra: Rings, fields, finite fields and their applications to cryptography					
UNIT-II	FINITE FIELDS AND POLYNOMIALS				12
Rings–Polynomial rings–Irreducible polynomials over finite fields Factorization of polynomial s over finite fields.					
UNIT-III	DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS				12
Division algorithm–Base–b representations–Number patterns–Prime and composite numbers–GCD–Euclidean algorithm–Fundamental theorem of arithmetic–LCM.					
UNIT-IV	DIOPHANTINE EQUATIONS AND CONGRUENCES				12
Linear Diophantine equations–Congruence’s–Linear Congruence’s Applications: Divisibility tests–Modular exponentiation–Chinese remainder theorem –2x2 linear systems.					

UNIT-V	MULTIPLICATIVE FUNCTIONS	12
Wilson's theorem–Fermat's little theorem–Euler's theorem–Euler's Phi functions–Tau and Sigma functions.		
TOTAL:60 PERIODS		
COURSE OUTCOMES: At the end of the course, the learners will be able to CO1: Apply the basic notions of rings, fields which will be used to solve related problems. CO2: Explain the fundamental concepts of advanced algebra and their role in modern Mathematics and applied contexts. CO3: Demonstrate accurate and efficient use of Number Theory techniques. CO4: Demonstrate their mastery by solving non-trivial problems related to the concepts, and by proving simple theorems about the statements proven by the text. CO5: Apply integrated approach to number theory and abstract algebra		
TEXT BOOKS: 1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", 5 th Edition, Pearson Education, 5th Edition, New Delhi, 2007. 2. Koshy, T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002. 3. David M. Burton "Elementary number theory", 7 th Edition, TATA McGraw Hill Education, 2011		
REFERENCES: 1. Lidl, R. and Pitz, G., "Applied Abstract Algebra", 2 nd Edition, Springer Verlag, New Delhi, 2006. 2. Niven, I., Zuckerman, H.S., and Montgomery, H.L., "An Introduction to Theory of Numbers", 1 st Edition John Wiley and Sons, Singapore, 2004. 3. San Ling and Chaoping Xing, "Coding Theory – A first Course", 1 st Edition, Cambridge Publications, Cambridge, 2004.		

21CB208	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • Introduce the fundamental concepts of formal languages, grammars and automata theory. • Classify machines by their power to recognize languages. • Employ finite state machines to solve problems in computing. • Understand deterministic and non-deterministic machines. • Infer the knowledge in decidability and undecidability problems.					
UNIT-I	AUTOMATA FUNDAMENTALS				9
Chomskian Hierarchy-Introduction to Automata Theory-Alphabets, Strings and Languages, Finite Automata- Deterministic finite Automata (DFA)-Nondeterministic finite Automata (NFA)-Finite Automata with epsilon transition.					
UNIT-II	REGULAR EXPRESSIONS AND LANGUAGES				9
Operation of regular expression and their precedence-Finite Automata and Regular expression-DFA to Regular Expression-Regular expression to Finite Automata-Algebraic laws of Regular Expression-Pumping Lemma for regular Languages-Equivalence and Minimization of Finite Automata.					

UNIT-III	CONTEXT FREE GRAMMAR AND LANGUAGES	9
Context Free Grammar- Parse tree- Ambiguity in Grammar and Language- Simplification of CFGs- Normal forms for CFGs – Chomsky Normal Form, Greibach Normal Form- Pumping lemma for CFLs.		
UNIT-IV	PUSHDOWN AUTOMATA AND LINEAR BOUNDED AUTOMATA	9
PUSH DOWN AUTOMATA (PDA): Definition of PDA- Language of PDA- Equivalence of PDA and CFG- Deterministic PDA. LINEAR BOUNDED AUTOMATA (LBA): Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.		
UNIT-V	TURING MACHINES AND UNDECIDABILITY	9
Turing Machine- Programming Techniques for TM, Variations of TM. Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem.		
TOTAL :45 PERIODS		
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Construct finite automata to recognize the patterns for the real-world problems. CO2: Make use of algebraic laws and properties to write a regular language CO3: Simplify the context free grammar by applying normal forms CO4: Construct Pushdown automata and linear bound automata for the given Language. CO5: Examine the suitable programming techniques for the construction of Turing Machine.		
TEXT BOOKS: 1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", 3 rd Edition, Pearson Education, 2008. 2. John C Martin, "Introduction to Languages and the Theory of Computation", 4 th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010. 3. Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", 3 rd Edition, Prentice Hall of India, 2007.		
REFERENCES: 1. Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", 2 nd Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015. 2. Peter Linz, "An Introduction to Formal Language and Automata", 3 rd Edition, Narosa Publishers, New Delhi, 2016. 3. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", 1 st Edition, Pearson Education 2009		

21CB209	DATABASE MANAGEMENT SYSTEM AND SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:		
- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram. - To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems. - To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure. - To understand the need of security in Database Management systems - To learn how to secure Database Management systems		
UNIT-I	RELATIONAL DATABASES	9
Data Models – Relational Data Models – Relational Algebra – Structured Query Language –Entity Relationship Model – Mapping ER Models to Relations – Distributed Databases – Data Fragmentation – Replication		
UNIT-II	DATABASE DESIGN	9
ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation –Boyce/C odd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form		
UNIT-III	TRANSACTION MANAGEMENT	9
Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels –Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling –Recovery System – Failure Classification – Recovery Algorithm		
UNIT-IV	DATABASE SECURITY	9
Need for database security – SQL Injection Attacks – The Injection Technique – SQLi Attack Avenues and Types		
UNIT-V	ACCESS CONTROL AND ENCRYPTION	9
Database Access Control – SQL based access definition – Cascading Authorizations – Rolebasedaccess control – Inference – Database encryption		
TOTAL:45 PERIODS		
COURSE OUTCOMES:		
At the end of this course, the students will be able to:		
CO1: Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model.		
CO2: Formulate solutions to a broad range of query problems using relational algebra/SQL.		
CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.		
CO4: Run transactions and estimate the procedures for controlling the consequences of concurrent data access.		
CO5: Understand and handle security issues in database management systems		

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 7th Edition, Tata McGraw Hill, 2021.
2. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson Education, 2016.
3. William Stallings, Lawrie Brown, “Computer Security: Principles and Practice”, 4th Edition, Pearson, 2019.

REFERENCES:

1. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3rd Edition, McGraw Hill, 2014.
3. NarainGehani and MelliyaAnnamalai, “The Database Book: Principles and Practice Using the Oracle Database System”, Universities Press, 2012.

21CB210	NETWORK SECURITY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To Introduce the basic concepts of security • To understand the concept of authentication protocols and digital signatures. • To learn various methods and protocols to understand the cryptography. • To learn various network security attacks. • To infer the IP and Web security.					
UNIT-I	FUNDAMENDALS OF NETWORKING SECURITY				
Overview of networking security- Security Services -Confidentiality, Authentication, Integrity, Nonrepudiation, access Control - Availability and Mechanisms- Security Attacks -Interruption, Interception, Modification and Fabrication.					
UNIT-II	AUTHENTICATION AND SECURITY				
Authentication overview - Authentication protocols - Authentication and key establishment – key exchange mediated key exchange - User Authentication –password-based authentication -password security - Certificate Authority and key management - digital signatures – digital Certificates.					
UNIT-III	PUBLIC-KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION				
Basics of cryptography -cryptographic hash functions - symmetric and public-key encryption -public key cryptography principles & algorithms - cipher block modes of operation - Secure Hash Functions – HMAC					
UNIT-IV	SECURITY ATTACKS				
Buffer overflow attacks & format string vulnerabilities - Denial-of-Service Attacks -Hijacking attacks: exploits and defenses - Internet worms – viruses – spyware –phishing – botnets - TCP session hijacking - ARP attack s - route table modification - UDP hijacking - man-in-the-middle attacks.					
UNIT-V	IP SECURITY AND WEB SECURITY				

Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters - Email privacy: Pretty Good Privacy (PGP) and S/MIME - Network security protocols in practice- Introduction to Wire shark – SSL - IPsec, and IKE -DNS security- Secure Socket Layer (SSL) and Transport Layer Security (TLS) - Secure Electronic Transaction (SET)
TOTAL:45 PERIODS
COURSE OUTCOMES: At the end of this course, the learners will be able to: CO1: Describe computer and network security fundamental concepts and principles. CO2: Acquire the knowledge of various authentication protocols, key exchange mechanism, and digital certificates. CO3: Understand the fundamental concepts of cryptography, encryption and hashing techniques. CO4: Identify the different types of threats and attacks such as social engineering, rootkit, and botnets CO5: Acquire the knowledge in different IP and Web Security Privacy
TEXT BOOKS: 1. William Stallings, "Network Security Essentials (Applications and Standards)" 4 th Edition, Pearson Education, 2017. 2. C. Kaufman, R. Perlman and M. Speciner, Network Security: Private Communications in a public world" 2 nd Edition Prentice Hall, 2010 3. Jie Wang "Computer Network Security Theory and Practice, Springer Berlin, Heidelberg, 1 st Edition, 2009
REFERENCES: 1. Atul Khahate, "Cryptography and network security", 3rd Edition, TMH Publishing, 2013. 2. William Stallings, "Cryptography and network Security", 3 rd edition, Stallings, PHI/Pearson 2002 3. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Perme, "Hack Proofing your network" 1 st Edition, Wiley Dreamtech, 2002.

21CB211	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES: • To learn to analyze the security of in-built cryptosystems. • To know the fundamental mathematical concepts related to security. • To develop cryptographic algorithms for information security. • To comprehend the various types of data integrity and authentication schemes • To understand cybercrimes and cyber security.						
UNIT-I	INTRODUCTION TO SECURITY					9
Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.						

UNIT-II	SYMMETRIC CIPHERS	9
SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.		
UNIT-III	ASYMMETRIC CRYPTOGRAPHY	9
RSA crypt osystem – ElGammal Cryptosystem - Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.		
UNIT-IV	INTEGRITY AND AUTHENTICATION ALGORITHMS	9
Authentica tion requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, C MAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Response protocols – Authentica tion applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Cert ificates.		
UNIT-V	CYBER CRIMES AND CYBER SECURITY	9
Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods –Password Cracking, Key loggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At the end of this course, the students will be able to: CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms CO3: Apply the different cryptographic operations of public key cryptography CO4: Apply the various Authentication schemes to simulate different applications. CO5: Understand various cyber crimes and cyber security.		
TEXT BOOKS: 1. William Stallings, "Cryptography and Network Security - Principles and Practice", 7 th Edition, Pearson Education, 2017. 2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", 1 st Edition, Wiley India, 2011. 3. Bernard Menezes , "Cryptography, Network Security and Cyber Laws", 1 st Edition, Cengage Learning, 2018.		
REFERENCES: 1. Behrouz A. Ferouzan, DebdeepMukhopadhyay, "Cryptography and Network Security", 3 rd Edition, Tata McGraw Hill, 2015. 2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", 5 th Edition, Prentice Hall, New Delhi, 2015. 3. Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, "Cyber security and Cyber Laws", 1 st Edition ,Cengage learning,2017		

21CB212	OPERATING SYSTEMS AND SECURITY				L	T	P	C
					3	0	2	4
COURSE OBJECTIVES:								
- To understand the basic concepts of Operating Systems. - To explore the process management concepts including scheduling, synchronization, threads and deadlock. - To describe the memory, file and I/O management activities of OS. - To gather the knowledge in trust model, secure operating systems. - To learn how security is implemented in various operating systems.								
UNIT-I	OPERATING SYSTEM OVERVIEW							9
Computer System Organization – Architecture – Operating-System Operations – Resource Management – Security and Protection – Distributed Systems – Kernel Data Structures –Operating-System Services – System Calls – System Services – Why Applications Are Operating-System Specific – Operating-System Design and Implementation - Operating-System Structure –Building and Booting an Operating System								
UNIT-II	PROCESS MANAGEMENT							9
Process Concept – Process Scheduling – Operation on Processes, Inter-process Communication–Threads – Overview – Multithreading models – Threading issues; CPU Scheduling – Scheduling criteria,Scheduling algorithms; Process Synchronization – critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Critical regions, Monitors; Deadlock –System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Detection, Recovery.								
UNIT-III	MEMORY MANAGEMENT AND FILE SYSTEMS							9
Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation – Virtual Memory – Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory. Mass Storage system - HDD Scheduling - File concept, Access methods, Directory Structure, Sharing and Protection; File System Structure, Directory implementation, Allocation Methods, Free Space Management								
UNIT-IV	SECURE SYSTEMS AND VERIFIABLE SECURITY GOALS							9
Security Goals – Trust and Threat Model – Access Control Fundamentals – Protection System –Reference Monitor – Secure Operating System Definition – Assessment Criteria – Information Flow – Information Flow Security Models – Denning’s Lattice Model – Bell LaPadula Model –Information Flow Integrity Models – Biba Integrity Model – Low-Water Mark Integrity – Clark-Wilson Integrity								
UNIT-V	SECURITY IN OPERATING SYSTEMS							9
UNIX Security – UNIX Protection System – UNIX Authorization – UNIX Security Analysis – UNIX Vulnerabilities – Windows Security – Windows Protection System – Windows Authorization – Windows Security Analysis – Windows Vulnerabilities – Address Space Layout Randomizations – Retrofitting Security into a Commercial Operating System – Introduction to Security Kernels								
LIST OF EXPERIMENTS								

1.	Basics of UNIX commands, Understand and practice Linux permissions, special permissions and authentication (various options of chmod, setuid, setgid)
2.	Write programs using the following system calls of UNIX operating system a. fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3.	Write C programs to implement the various CPU Scheduling Algorithms
4.	Implementation of Semaphores
5.	Implementation of Shared memory
6.	Bankers Algorithm for Deadlock Detection & Avoidance
7.	Implementation of the following Memory Allocation Methods for fixed partition a) First Fit b) Worst Fit c) Best Fit
8.	Implementation of the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
9.	Program to demonstrate the working of Bell LaPadula Model and Biba Integrity Model
10.	Setting up access control lists of files and directories and testing the lists in Linux
11.	Learn to enable and disable address space layout randomization
TOTAL:75 PERIODS	
COURSE OUTCOMES: At the end of this course, the learners will be able to: CO1: Understand the basic concepts of Operating Systems. CO2: Acquire knowledge on process management concepts including scheduling, Synchronization, threads and deadlock. CO3: Infer the knowledge on memory, file and I/O management activities of OS. CO4: Explain the security issues in operating systems and appreciate the need for security models CO5: To Understand the operating systems security models of WINDOWS and UNIX OS.	
TEXT BOOKS: 1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10 th Edition, John Wiley & Sons, Inc., 2021. 2. Trent Jaeger, “Operating System Security”, 2 nd Edition Morgan & Claypool Publishers series, 2008. 3. Gary McGraw, Software Security: Building Security In, 1 st Edition, Addison Wesley software security series, 2006.	
REFERENCES: 1. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", 5 th Edition, Prentice Hall, New Delhi, 2015. 2. William Stallings, “Operating Systems – Internals and Design Principles”, 9 th Edition, Pearson, 2017. 3. Michael Palmer, “Guide to Operating Systems Security”, Course Technology – Cengage Learning, New Delhi, 2008.	

21CB213	DATABASE MANAGEMENT SYSTEM AND SECURITY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand attacks on databases and to learn to defend against the attacks on databases.
- To learn to store and retrieve encrypted data in databases

LIST OF EXPERIMENTS:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in database table.
9. Use SQLi to authenticate as administrator, to get unauthorized access over sensitive data, to inject malicious statements into form field.
10. Write programs that will defend against the SQLi attacks given in the previous exercise.
11. Write queries to insert encrypted data into the database and to retrieve the data using decryption.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Create databases with different types of key constraints.

CO2: Write simple and complex SQL queries using DML and DCL commands.

CO3: Realize database design using 3NF and BCNF.

CO4: Use advanced features such as stored procedures and triggers.

CO5: understand Secure databases and mitigate attacks on databases.

21CB214	CRYPTOGRAPHY AND CYBER SECURITY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Learn different transposition cipher techniques. .
- Understand different substitution cipher techniques
- Implement the algorithms DES, AES, RSA and Diffie-Hellman.
- Implement hashing techniques such as SHA-1, MD-5.
- Develop a digital signature scheme

LIST OF EXPERIMENTS:

1. Write a program to implement the following cipher techniques to perform encryption and decryption
 - a Caesar Cipher
 - b Playfair Cipher
 - c Hill Cipher
2. Write a program to implement the following transposition techniques
 - a. Rail fence technique –Row major transformation
 - b. Rail fence technique - Column major transformation
3. Write a program to implement DES algorithm
4. Write a program to implement AES algorithm
5. Write a program to implement RSA Encryption algorithm
6. Write a program to implement the Diffie-Hellman Key Exchange mechanism. Consider one of the parties as Alice and the other party as bob.
7. Write a program to calculate the message digest of a text using the SHA-1 algorithm.
8. Write a program to calculate the message digest of a text using the MD-5 algorithm.
9. Write a program to implement digital signature standard.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop a code for classical encryption techniques.

CO2: Build symmetric cryptographic algorithms.

CO3: Build asymmetric cryptographic algorithms.

CO4: Construct a code for various Authentication schemes.

CO5: Apply the principles of digital signature

SEMESTER V

21CB301	CYBER FORENSICS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES:								
- To discuss cybercrime and forensics. - To operate with forensics tools. - To demonstrate and validate forensics data. - To examine cyber laws and the admissibility of evidence with case studies. - To illustrate the vulnerabilities in network infrastructure with ethical hacking.								
UNIT-I	INTRODUCTION TO CYBER CRIME AND FORENSICS							9
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition								
UNIT-II	EVIDENCE COLLECTION AND FORENSICS TOOLS							9
Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody- Forensic Tools								
UNIT-III	ANALYSIS AND VALIDATION							9
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India - Case Studies								
UNIT-IV	ETHICAL HACKING							9
Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking								
UNIT-V	ETHICAL HACKING IN WEB							9
Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.								
TOTAL:45 PERIODS								
COURSE OUTCOMES								
At end of the course, learners will be able to:								
CO1: Infer the basics of cybercrime and computer forensics								
CO2: Operate different computer forensic tools to a given scenario								
CO3: Demonstrate and validate forensics data								
CO4: Illustrate the vulnerabilities in a given network infrastructure								
CO5: Develop real-world hacking techniques to test system security								

TEXT BOOKS:			
1. Bill Nelson, Amelia Phillips, Christopher Steuart, — Guide to Computer Forensics and Investigations”, 6 th Edition, Cengage Learning, India, 2019.			
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.			
3. Dejeay, S. Murugan - Cyber Forensics, 1 st Edition, Oxford University Press, India, 2018			
REFERENCES:			
1. John R.Vacca, “Computer Forensics “, 3 rd Edition, Cengage Learning, 2008			
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2013.			
3. Kenneth C.Brancik “Insider Computer Fraud” 1 st Edition Auerbach Publications Taylor & Francis Group– 2019.			

21CB302	WEB PROGRAMMING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To express the different internet technologies. • To discover Java specific web services architecture. • Compare and contrast features of C++ and Java. • To understand Object Oriented Programming concepts and basic characteristics of Java. • To know the principles of packages, inheritance and interfaces.					
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-Call Back 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
TOTAL:45 PERIODS
COURSE OUTCOMES: At the end of the course, the learners will be able to CO1: Distinguish the different web technologies. CO2: Sketch a dynamic web page with validation using Java Script objects and different event handling mechanisms. CO3: Model server-side programs using Servlets and JSP. CO4: Analyze and implement PHP - based web applications. CO5: Infer the Ajax architecture and Java web services.
TEXT BOOKS: 1. Deitel and Deitel and Nieto, “Internet and World Wide Web - How to Program”, 5 th Edition, Prentice Hall, 2011. 2. Robert W. Sebesta, “Programming the World Wide Web”, 6 th Edition, Addison-Wesley, 2018. 3. Matt Frisbie, "Professional JavaScript for Web Developers", 4 th Edition, Wiley Publishing, Inc,2019
REFERENCES: 1. Stephen Wynkoop and John Burke, “Running a Perfect Website”, 2 nd Edition ,QUE, 2010. 2. Chris Bates, “Web Programming – Building Intranet Applications”, 3rd Edition, Wiley Publications, 2009. 3. Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”,3 rd Edition Pearson Education, 2011.

21CB303	MACHINE LEARNING AND SECURITY				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: ● To recognize basic concepts and techniques in Machine Learning. ● To interpret probabilistic model-based learning ● To analyze the concepts of Supervised learning techniques ● To examine the concepts of Unsupervised learning techniques ● To illustrate the concepts of Machine learning in cyber security								
UNIT I		INTRODUCTION TO MACHINE LEARNING						9
Introduction to Machine learning-Types of machine learning-Applications of ML-Languages /Tools in ML-Preparing Model-ML activities-Basic types of data in ML-Exploring structure of data-Data quality and remediation-Data pre-processing-Modelling and Evaluation-Selecting a model-Training a model- Model representation and interpretability-Evaluating performance of a model-Basics of Feature Engineering-Feature Transformation-Feature subset selection.								
UNIT II		PROBABILISTIC MODELS						9
Brief review of probability-Basic concept of probability, random variables- Discrete distributions- Binomial, Poisson, Bernoulli, etc. Continuous Distributions -Uniform, Normal, Laplace- Central theorem-Central theorem, Monte Carlo approximation. Bayesian concept learning- Bayes theorem- Prior and Posterior probability, Likelihood, Bayes’ theorem and Concept learning- Bayesian Belief network..								
UNIT III		SUPERVISED LEARNING						9

Supervised Learning-Classification-Basics of supervised learning-Classification model -K-nearest neighbor- Decision tree-Random Forest-Support Vector Machine. Supervised Learning- Regression-Linear regression-other regression techniques		
UNIT IV	UNSUPERVISED LEARNING	9
Unsupervised learning- Basics of unsupervised learning-Clustering Techniques-Association rules-Instance Based Learning-Ensemble Learning.		
UNIT V	MACHINE LEARNING FOR SECURITY	9
Machine learning for security – anomaly detection, fraud detection, malware detection, spam detection, phishing detection, IDS, and NIDS. Security of machine learning: adversarial attacks on machine learning. Data poisoning, model stealing, evasion attacks at inference time. Adversarial hardening.		
		TOTAL:45 PERIODS
COURSE OUTCOMES		
At end of the course, learners will be able to:		
CO1: Review the concepts for Machine learning model.		
CO2: Demonstrate the probabilistic models in solving problems.		
CO3: Solve the prediction problems using Classification and Regression techniques.		
CO4: Employ suitable unsupervised learning algorithms to solve descriptive problems.		
CO5: Apply anomaly detection, spam classification, automated malware classification.		
TEXT BOOKS:		
1. Tom M Mitchell, "Machine Learning", 1 st Edition, McGraw Hill Education, 2013.		
2. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", 1 st Edition, Pearson, 2019.		
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2 nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.		
REFERENCES:		
1. Hastie, Trevor, Tibshirani, Robert, Friedman, Jerome, "The Elements of Statistical Learning. Data Mining, Inference, and Prediction", 2 nd Edition, February 2009, Springer.		
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", 1 st Edition, Springer, 2006.		
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1 st Edition, Cambridge University Press, 2012.		

21MC301	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
		3	0	0	0
UNIT-I	CONCEPTS				9
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, inaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.					
UNIT-II	FEMINIST THEORY				9
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist					
UNIT-III	WOMEN’S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL				9
Rise of Feminism in Europe and America. Women’s Movement in India.					
UNIT-IV	GENDER AND LANGUAGE				9
Linguistic Forms and Gender. Gender and narratives					
UNIT-V	GENDER AND REPRESENTATION				9

Advertising and popular visual media. -Gender and Representation in Alternative Media. -Gender and social media.
TOTAL:45 PERIODS

21CB304	SECURE SOFTWARE SYSTEMS				L	T	P	C
					2	0	2	3
COURSE OBJECTIVES:								
- Recognize the importance and need for software security. - Infer about secure software design. - Compute risk management in secure software development. - Analyze the working of tools related to software security. - Examine the security and project management techniques.								
UNIT-I	NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS							9
Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks								
UNIT-II	SECURE SOFTWARE DESIGN							9
Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles								
UNIT-III	SECURITY RISK MANAGEMENT							9
Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management								
UNIT-IV	SECURITY TESTING							9
Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing								
UNIT-V	SECURE PROJECT MANAGEMENT							9
Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice								
LIST OF EXPERIMENTS								
- Implement the SQL injection attack. - Implement the Buffer Overflow attack. - Implement Cross Site Scripting and Prevent XSS. - Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux. - Develop and test the secure test cases - Penetration test using kali Linux								
COURSE OUTCOMES								
At end of the course, learners will be able to:								

CO1: Identify various vulnerabilities related to memory attacks.
CO2: Classify the security principles in software development.
CO3: Discover the extent of risks.
CO4: Identify the selection of testing techniques related to software security in the testing phase of software development.
CO5: Point out the security and project management principles.
TEXT BOOKS:
1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, 1 st edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006
REFERENCES:
1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2 nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, 1 st Edition, Syngress Publishing, 2012

21CB305	WEB PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
- To develop a java application with I/O Streams and generics classes - To create a web page using HTML/XML and style sheets - To design user interfaces using Java frames and applets. - To generate dynamic web pages using server-side scripting. - To set up Client Server applications.					
LIST OF EXPERIMENTS:					
- 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. - Create a web page with all types of Cascading style sheets. - Client Side Scripts for Validating Web Form Controls using DHTML. - Installation of Apache Tomcat web server. - Write programs in Java using Servlets: - To invoke servlets from HTML forms. - Session Tracking. - Write programs in Java to create three-tier applications using JSP and Databases - For conducting on-line examination. - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server. - Programs using XML – Schema – XSLT/XSL.					
					TOTAL:60 PERIODS
COURSE OUTCOMES:					

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

CO1: Construct Web pages using HTML/XML and style sheets.

CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Develop dynamic web pages using server-side scripting and JSP

CO4: Construct simple web pages in PHP and to represent data in XML format.

CO5: Develop interactive web applications.

SEMESTER VI

21CB306	CLOUD SECURITY			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
- To discuss the Cloud Computing terminology, definition & concepts - To discover the security design and architectural considerations for Cloud - To use the Identity, Access control in Cloud - To examine the best practices for Cloud security using various design patterns - To select the monitoring and auditing methods in cloud applications for security							
UNIT-I	FUNDAMENTALS OF CLOUD SECURITY CONCEPTS						9
Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.							
UNIT-II	SECURITY DESIGN AND ARCHITECTURE FOR CLOUD						9
Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key							
UNIT-III	ACCESS CONTROL AND IDENTITY MANAGEMENT						9
Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention							
UNIT-IV	CLOUD SECURITY DESIGN PATTERNS						9
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud							
UNIT-V	MONITORING, AUDITING AND MANAGEMENT						9
Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management							
TOTAL:45 PERIODS							
COURSE OUTCOMES							
At end of the course, learners will be able to:							
CO1: Review the cloud concepts and fundamentals.							

CO2: Show the security challenges in the cloud.
CO3: Employ cloud policy and Identity and Access Management.
CO4: Identify the various architectural and design considerations for security in the cloud.
CO5: Categorise various risks and audit and monitoring mechanisms in the cloud.
TEXT BOOKS:
1. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing:" 1 st Edition, Wiley 2013
2. Dave Shackleford, "Virtualization Security", SYBEX a Wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY 2011
REFERENCES:
1. Mark C. Chu-Carroll —Code in the Cloud, CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi

21MC302	INDUSTRIAL SAFETY				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: ● To Understand the Introduction and basic Terminologies safety. ● To enable the students to learn about the Important Statutory Regulations and standards. ● To enable students to Conduct and participate the various Safety activities in the Industry. ● To have knowledge about Workplace Exposures and Hazards. ● To assess the various Hazards and consequences through various Risk Assessment ● Techniques.								
UNIT-I	SAFETY TERMINOLOGIES							9
Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators- Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) -Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS								
UNIT-II	STANDARDS AND REGULATIONS							9
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998-Hazard Identification and Risk Analysis- code of practice IS 15656:200								
UNIT-III	SAFETY ACTIVITIES							9
Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment								
UNIT-IV	WORKPLACE HEALTH AND SAFETY							9
Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety-Toxic gas Release								
UNIT-V	HAZARD IDENTIFICATION TECHNIQUES							9
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment								

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Understand the basic concept of safety.

CO2: Obtain knowledge of Statutory Regulations and standards.

CO3: Know about the safety Activities of the Working Place.

CO4: Analyze on the impact of Occupational Exposures and their Remedies

CO5: Obtain knowledge of Risk Assessment Techniques

TEXT BOOKS:

- 1.R.K. Jain and Prof. Sunil S. Rao Industrial Safety, "Health and Environment Management Systems", khanna publisher
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education
- 3.Alan Waring.(1996).Safety management system: Chapman &Hall,England Society of Safety Engineers, USA

REFERENCES:

1. Frank Lees "Loss Prevention in Process Industries", 4th Edition,,Butterworth-Heinemann publications, UK,2012
2. John Ridley & John Channing Safety at Work: Routledge, 7th Edition,2008
3. Dan Petersen Techniques of Safety Management: A System Approach,2003

21CB307	WEB APPLICATION SECURITY				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES:									
● To understand the fundamentals of web application security ● To focus on wide aspects of secure development and deployment of web applications ● To learn how to build secure APIs ● To learn the basics of vulnerability assessment and penetration testing ● To get an insight about Hacking techniques and Tools									
UNIT-I	FUNDAMENTALS OF WEB APPLICATION SECURITY								9
The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation									
UNIT-II	SECURE DEVELOPMENT AND DEPLOYMENT								9
Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)									
UNIT-III	SECURE API DEVELOPMENT								9
API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.									
UNIT-IV	VULNERABILITY ASSESSMENT AND PENETRATION TESTING								9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.		
UNIT-V	HACKING TECHNIQUES AND TOOLS	9
Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.		
PRACTICAL EXERCISES: 1. Install wireshark and explore the various protocols 2. Analyze the difference between HTTP vs HTTPS 3. Analyze the various security mechanisms embedded with different protocols. 4. Identify the vulnerabilities using OWASP ZAP tool 5. Create simple REST API using python for following operation • GET • PUSH • POST • DELETE 6. Install Burp Suite to do following vulnerabilities: • SQL injection • Cross-site scripting (XSS) • Attack the website using Social Engineering method		
TOTAL:75 PERIODS		
COURSE OUTCOMES At end of the course, learners will be able to: CO1: Understanding the basic concepts of web application security and the need for it CO2: Be acquainted with the process for secure development and deployment of web applications CO3: Acquire the skill to design and develop Secure Web Applications that use Secure APIs CO4: Be able to get the importance of carrying out vulnerability assessment and penetration testing CO5: Acquire the skill to think like a hacker and to use hackers tool sets		
TEXT BOOKS: 1. Andrew Hoffman, “Web Application Security: Exploitation and Countermeasures for Modern Web Applications”, 1st Edition, O’Reilly Media, Inc.,2020. 2. Bryan Sullivan, “Vincent Liu, Web Application Security: A Beginners Guide”, The McGraw-Hill Companies,2012 3. Neil Madden, API Security in Action, Manning Publications Co., NY, USA,2020		
REFERENCES: 1. Michael Cross, Developer’s Guide to Web Application Security, Syngress Publishing, Inc, 2007. 2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, Taylor & Francis Group, LLC., 2021 3. Prabath Siriwardena, Advanced API Security, Apress Media LLC, USA,2020. 4. Malcom McDonald,” Web Security for Developers”, No Starch Press, Inc,2020.		

21CB308	CLOUD SECURITY LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
- To Introduce Cloud Computing terminology, definition & concepts - To understand the security design and architectural considerations for Cloud - To understand the Identity, Access control in Cloud - To follow best practices for Cloud security using various design patterns - To be able to monitor and audit cloud applications for security					
UNIT-I	LIST OF EXPERIMENTS				9
- Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim - simulate resource management using cloud sim - simulate log forensics using cloud sim - simulate a secure file sharing using a cloud sim - Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc) - Implement any encryption algorithm to protect the images - Implement any image obfuscation mechanism - Implement a role-based access control mechanism in a specific scenario - Implement an attribute-based access control mechanism based on a particular scenario - Develop a log monitoring system with incident management in the cloud					
TOTAL:60 PERIODS					
COURSE OUTCOMES					
At end of the course, learners will be able to:					
CO1: Understand the cloud concepts and fundamentals.					
CO2: Explain the security challenges in the cloud.					
CO3: Define cloud policy and Identity and Access Management.					
CO4: Understand various risks and audit and monitoring mechanisms in the cloud.					
CO5: Define the various architectural and design considerations for security in the cloud.					

SEMESTER VII

21HS401	HUMAN VALUES AND ETHICS	L	T	P	C
		2	0	0	2
COURSE OBJECTIVES:					
● To create awareness about values and ethics enshrined in the Constitution of India ● To sensitize students about the democratic values to be upheld in the modern society. ● To inculcate respect for all people irrespective of their religion or other affiliations. ● To instill the scientific temper in the students' minds and develop their critical thinking. ● To promote sense of responsibility and understanding of the duties of citizen.					
UNIT-I	DEMOCRATIC VALUES				6
Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement. Reading Text: Excerpts from John Stuart Mills' On Liberty					

UNIT-II	SECULAR VALUES	6
Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani		
UNIT-III	SCIENTIFIC VALUES	6
Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.		
UNIT-IV	SOCIAL ETHICS	6
Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.		
UNIT-V	SCIENTIFIC ETHICS	6
Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.		
TOTAL:30 PERIODS		
COURSE OUTCOMES		
At end of the course, learners will be able to:		
CO1 : Identify the importance of democratic, secular and scientific values in harmonious functioning of social life		
CO2 : Practice democratic and scientific values in both their personal and professional life.		
CO3 : Find rational solutions to social problems.		
CO4 : Behave in an ethical manner in society		
CO5 : Practice critical thinking and the pursuit of truth.		
TEXT BOOKS:		
1. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.		
REFERENCES:		
1. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.		
2. The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.		
3. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,		

21CB402	PRIVACY AND SECURITY IN INTERNET OF THINGS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
● To understand Cyber Security versus IoT security ● To understand Wireless reconnaissance and mapping ● To Understand Security Requirements in IoT. ● To understand the various Cryptographic primitives. ● To learn various Cloud services and IoT					
UNIT-I	INTRODUCTION	9			
Cyber Security versus IoT security – IoT attacks and Countermeasures – Common IoT attack types, Attack trees, Fault trees and CPS–Attacks.					
UNIT-II	INTERNET OF THINGS	9			

Wireless reconnaissance and mapping, Security Protocol attacks, Physical security attacks, Application security attacks – Security Engineering for IoT Development		
UNIT-III	SECURING THE INTERNET OF THINGS	9
Security Architecture in Internet of Things, Security Requirements in IoT – Vulnerabilities – Secrecy and Secret–Key Capacity – Authentication/Authorization for Smart Devices – Transport Encryption – Attack & Fault trees – Identity lifecycle – Authentication credentials		
UNIT-IV	CRYPTOGRAPHIC FUNDAMENTALS FOR IOT	9
IoT IAM infrastructure – Authorization with Publish / Subscribe schemes, access control – Cryptographic primitives and its role in securing IoT –key management fundamentals – cryptographic controls for IoT protocols.		
UNIT-V	CLOUD SECURITY & PRIVACY FOR IOT	9
Cloud services and IoT –IoT offerings from cloud service providers– Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing – Privacy challenges introduced by the IoT.		
TOTAL:45 PERIODS		
COURSE OUTCOMES		
At end of the course, learners will be able to:		
CO1: Understand Cyber Security versus IoT security		
CO2: Know Wireless reconnaissance and mapping		
CO3: Understand Security Requirements in IoT.		
CO4: Know the various Cryptographic primitives.		
CO5: Learn various Cloud services and IoT		
TEXT BOOKS:		
1. Shancang Li, Li Da Xu, “Securing the Internet of Things”, Elsevier, USA, 2017		
2. Brian Russell, Drew Van Duren, “Practical Internet of Things Security”, Packt Publishing, USA,2016.		
REFERENCES:		
1. FeiHu,” Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations”, CRC Press, USA,2016.		
2.Himanshu Dwivedi, Chris Clark and David Thiel, “Mobile Application Security”, Tata McGraw Hill, New Delhi, 2010.		
3. Johnny Cache, Joshua Wright and Vincent Liu, “Hacking Exposed Wireless: Wireless Security Secrets and Solutions”, Tata McGraw Hill, New Delhi, 2010.		

VERTICAL I

21PCB01	CYBER THREAT INTELLIGENCE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To guide organizations in accurately accessing threats, - To analysis Risks, and vulnerabilities - To minimize the potential for incidents and, - To provide more thoughtful responses when necessary - To provide threat indicators					
UNIT I	DEFINING CYBER THREAT INTELLIGENCE				9
The Need for Cyber Threat Intelligence: The menace of targeted attacks, The monitor– and–respond strategy, Why the strategy is failing, Cyber Threat Intelligence Defined, Key Characteristics: Adversary based, Risk focused, Process oriented, Tailored for diverse consumers, The Benefits of Cyber Threat Intelligence					
UNIT II	DEVELOPING CYBER THREAT INTELLIGENCE REQUIREMENTS				9
Assets That Must Be Prioritized: Personal information, Intellectual property, Confidential business information, Credentials and IT systems information, Operational systems. Adversaries: Cybercriminals, Competitors and cyber espionage agents, Hack activists. Intelligence Consumers: Tactical users, Operational users, Strategic users					
UNIT III	COLLECTING CYBER THREAT INFORMATION				9
Threat Indicators, File hashes and reputation data, Technical sources: honey pots and scanners, Industry sources: malware and reputation feeds. Level 2: Threat Data Feeds, Cyber threat statistics, reports, and surveys, Malware analysis. Level 3: Strategic Cyber Threat Intelligence, Monitoring the underground, Motivation and intentions, Tactics, techniques, and procedures					
UNIT IV	ANALYZING AND DISSEMINATING CYBER THREAT INTELLIGENCE				9
Information versus Intelligence, Validation and Prioritization: Risk scores, Tags for context, Human assessment. Interpretation and Analysis: Reports, Analyst skills, Intelligence platform, Customization. Dissemination: Automated feeds and APIs, Searchable knowledge base, Tailored reports.					
UNIT V	OPEN-SOURCE SOFTWARE DEVELOPMENT				9
Types of Partners: Providers of threat indicators, Providers of threat data feeds, Providers of comprehensive cyber threat intelligence. Important Selection Criteria: Global and cultural reach, Historical data and knowledge, Range of intelligence deliverables, APIs and integrations, Intelligence platform, knowledge base, and portal, Client services, Access to experts. Intelligence–driven Security.					
TOTAL : 45 PERIODS					
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Study of different Cyber Threat. CO2: Study the technique to Develop Cyber Threat Intelligence Requirements. CO3: Collect Cyber Threat Information. CO4: Help in Analyzing and Disseminating Cyber Threat Intelligence. CO5: Study of Open-Source Software Development.					
TEXT BOOKS: - Jon Friedman. Mark Bouchard, CISSP. Foreword by John P. Watters, “Cyber Threat Intelligence- Definitive Guide TM”, 3rd Edition, Cyber Edge Press, 2015. - Scott J. Roberts, Rebekah Brown, “Intelligence– Driven Incident Response: Outwitting the Adversary”, 3rd Edition, O’Reilly Media, 2017.					

3. John Robertson, Ahmad Diab, Ericsson Marin, Eric Nunes, Vivin Paliath, Jana Shakarian, Paulo Shakarian, DarkWeb, "Cyber Threat Intelligence Mining", 4 th Edition, Cambridge University Press, 2017.
REFERENCES:
1. Martin Lee, "Cyber Threat Intelligence" 1 st Edition, Wiley Publications, 2023
2. Bob Gourley, "The Cyber Threat", 2 nd Edition, Createspace Independent Pub, 2014.
3. Henry Dalziel, "How to Define and Build an Effective Cyber Threat Intelligence Capability", 3 rd Edition, Elsevier Science & Technology, 2014

21PCB02	MALWARE ANALYSIS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: - To introduce the fundamentals of malware, types and its effects. - To enable to identify and analyze various malware types by static analysis. - To enable to identify and analyze various malware types by dynamic analysis. - To deal with detection, analysis, understanding, controlling, and eradication of malware. - To provide the static and dynamic analysis Android Malware Analysis								
UNIT I	INTRODUCTION AND BASIC ANALYSIS							9
Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots								
UNIT II	ADVANCED STATIC ANALYSIS							9
The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism								
UNIT III	ADVANCED DYNAMIC ANALYSIS							9
Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching								
UNIT IV	MALWARE FUNCTIONALITY							9
Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection								
UNIT V	ANDROID MALWARE ANALYSIS							9
Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies								
							TOTAL : 45 PERIODS	
COURSE OUTCOMES: At the end of the course, learners will be able to								

CO1: Understand the various concepts of malware analysis and their technologies used.
 CO2: Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques
 CO3: Understand the methods and techniques used by professional malware analysts
 CO4: Safely analyze, debug, and disassemble any malicious software by malware analysis
 CO5: Understand the concept of Android malware analysis their architecture, and App development

TEXT BOOKS:

1. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, 2nd Edition, O'Reilly, 2015.
2. Michael Sikorski and Andrew Honig, "Practical Malware Analysis", 3rd Edition, No Starch Press, 2012.
3. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis", 3rd Edition, CRC Press, Taylor & Francis Group, 2015.

REFERENCES:

1. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel", 2nd Edition, AddisonWesley Professional, 2005.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2nd Edition, willey, 2014.
3. Victor Marak, "Windows Malware Analysis Essentials", 3rd Edition, Packt Publishing, 2015

21PCB03	SOCIAL NETWORKS AND SECURITY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To develop semantic web related simple applications. - To explain Privacy and Security issues in Social Networking. - To explain the data extraction and mining of social networks. - To discuss the prediction of human behaviour in social communities. - To describe the Access Control, Privacy and Security management of social networks.					
UNIT I	FUNDAMENTALS OF SOCIAL NETWORKING				9
Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security					
UNIT II	SECURITY ISSUES IN SOCIAL NETWORKS				9
The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world					
UNIT III	EXTRACTION AND MINING IN SOCIAL NETWORKING DATA				9
Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy					
UNIT IV	PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES				9
Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties					

UNIT V	ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT	9
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning		
		TOTAL : 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Develop semantic web related simple applications CO2: Address Privacy and Security issues in Social Networking CO3: Explain the data extraction and mining of social networks CO4: Discuss the prediction of human behavior in social communities CO5: Describe the applications of social networks		
TEXT BOOKS: - GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, 1st Edition, Springer, 2011 - BorkoFurht, “Handbook of Social Network Technologies and Application, 1st Edition, Springer, 2010 - Peter Mika, “Social Networks and the Semantic Web, 1st Edition, Springer, 2007.		
REFERENCES: - Easley D. Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly Connected World”, 2nd Edition, Cambridge University Press, 2010. - Jackson, Matthew O., “Social and Economic Networks”, 2nd Edition, Princeton University Press, 2008. - Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, 3rd Edition, IGI Global Snippet, 2008.		

21PCB04	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To learn about Modern Cryptography. - To focus on how cryptographic algorithms and protocols work and how to use them. - To build a Pseudorandom permutation. - To construct Basic cryptanalytic techniques. - To provide instruction on how to use the concepts of block ciphers and message authentication codes.					
UNIT I	INTRODUCTION				9
Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.					
UNIT II	FORMAL NOTIONS OF ATTACKS				9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model		
UNIT III	RANDOM ORACLES	9
Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong oneway functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)		
UNIT IV	BUILDING A PSEUDORANDOM PERMUTATION	9
Definition, Application of the Luby Rack off Construction to the construction of Block Ciphers, The DES in the light of Luby Rack off Construction.		
UNIT V	MESSAGE AUTHENTICATION CODES	9
Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: Oneway functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.		
		TOTAL : 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, learners will be able to		
CO1: Interpret the basic principles of cryptography and general cryptanalysis.		
CO2: Determine the concepts of symmetric encryption and authentication.		
CO3 Identify the use of public key encryption, digital signatures, and key establishment.		
CO4: Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.		
CO5: Express the use of Message Authentication Codes		
TEXT BOOKS:		
1. Hans Delfs and Helmut Knebl, "Introduction to Cryptography: Principles and Applications", 2nd Edition, Springer Verlag, 2005. 2. Wenbo Mao, "Modern Cryptography, Theory and Practice", Low Priced Edition, 1st Edition Pearson Education, 2014. 3. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, PHI 2014.		
REFERENCES:		
1. Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, 2008 2. Oded Goldreich, Foundations of Cryptography, Low Priced Edition, CRC Press, 2005 3. Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone, "Handbook of Applied Cryptography", 1st Edition, CRC Press, 1996.		

21PIT04	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3
COURSEOBJECTIVES: • To explain the basic digital forensics techniques. • To infer pre-well-trained computer crime investigators. • To apply the knowledge for processing evidence using forensic tools. • To identify the various tools involved in forensic investigation. • To outline the various phases of mobile forensics extraction.					
UNIT-I	FUNDAMENTALS OF DIGITAL FORENSICS	9			
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidenceand courts, legalconcernsandprivateissues-Introduction to computer crime Investigations & its types-Assess the situation-Acquire the data-Analyze the data-Report the investigation.					
UNIT-II	DATA ACQUISITION AND TOOLS	9			
Digital evidence, First responder tool kit, techniques of digital forensics, recovery of deleted files, stochastic forensics, steganography, Acquisition methods, The Booting Process, web attack forensics, Web application forensic tool.					
UNIT-III	PROCESSINGEVIDENCE	9			
Types of digital evidence, Evidence gathering consideration, data security requirement, Preservation strategies, seizure, acquisition and examination analysis, Rules of evidence, Good forensic practices.					
UNIT-IV	FORENSICSINVESTIGATIONTOOLS	9			
Current computer forensics tools-software, hardware tools, validating and testing forensic software E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, Specialized E-Mail forensics tool.					
UNIT-V	MOBILEFORENSICS	9			
Mobile forensics- Mobile forensic & its challenges- Mobile phone evidence extraction process: The evidence intake phase- The identification phase, The preparation phase, The isolation phase, The processing phase, The verification phase, The document and reporting phase, The presentation phase-Mobile forensic tool leveling system.					
					TOTAL:45PERIODS
COURSEOUTCOMES: At the end of the course, learners will be able to: CO1: Summarize forensic analysis tools to recover important evidence for identifying Computer crime. CO2: Demonstrate as well-trained computer crime investigators. CO3: Apply the knowledge for processing evidence using forensic tools. CO4: Make use of the various tools involved in forensic investigation. CO5: Explain the various phases of mobile forensics extraction.					

TEXTBOOKS:

1. Dr. Jeetendra Pande and Dr. Ajay Prasad, "Digital Forensics", 1st edition, Uttarakhand Open University, 2016.
2. Jason Sachouski, "Computer Forensics and Investigations", 2nd edition, CRC Press, 2018.
3. Satish Bommisetty, Rohit Tamma and Heather Mahalik, "Practical Mobile Forensics", 2nd edition, Packt Publishing Ltd., 2014.

REFERENCES:

1. Vacca, J., "Computer Forensics, Computer Crime Scene Investigation", 2nd edition, Charles River Media, 2005.
2. Iosif I. Androulidakis, "Mobile phone security and forensics: A practical approach", 1st edition, Springer publications, 2012.
3. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", 1st edition, Addison Wesley, 2002.

21PCB05	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To understand the basics of Block chain. - To learn Different protocols and consensus algorithms in Block chain. - To learn the Block chain implementation frameworks. - To understand the Block chain Applications. - To experiment the Hyperledger Fabric, Ethereum networks					
UNIT I	INTRODUCTION TO BLOCKCHAIN				9
Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree					
UNIT II	BITCOIN AND CRYPTOCURRENCY				9
A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay					
UNIT III	BITCOIN CONSENSUS				9
Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.					
UNIT IV	HYPERLEDGER FABRIC & ETHEREUM				9
Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity					
UNIT V	BLOCKCHAIN APPLICATIONS				9
Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.					
					TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

CO3: Provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply Hyperledger Fabric and Ethereum platform to implement the Block chain Application

CO5: Understand the different applications of Blockchain Technology

TEXT BOOKS:

1. Bashir and Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography", 1st Edition, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 2nd Edition, O'Reilly, 2014.
3. Daniel Drescher, "Blockchain Basics", 1st Edition, Apress, 2017.

REFERENCES:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", 1st Edition, Princeton University Press, 2016.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", 2nd Edition, O'Reilly, 2015
3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", 1st Edition, Create Space Independent Publishing Platform, 2017

21PCB06	STEGANOGRAPHY AND WATERMARKING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To understand basics of steganography techniques. - To understand necessary cryptographic techniques to build protection mechanisms in order to secure data. - To understand the watermarking techniques. - To understand the attacks on data hiding techniques. - To understand the design of integrity of data					
UNIT I	INTRODUCTION OF STEGANOGRAPHY				9
Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Exploring steganography: Digital Image Hiding, information in Images, Issues in Information Hiding.					
UNIT II	CRYPTOGRAPHY TECHNIQUES				9
Framing Information–Encryption: pure white–encryption and white noise–DES and modern cipher–public key encryption–RSA encryption–error correction: Correcting error– constructing error–correcting codes.					
UNIT III	STEGANOGRAPHY TECHNIQUES				9
Steganography techniques: Substitution systems, Spatial Domain, Transform domain techniques, Spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEncode, Hide 4 PGP, Hide and Seek, S Tools etc.) Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based.					

UNIT IV	MODELS OF WATERMARKING	9
Communications–Communication–Based Models of Watermarking–Geometric Models of Watermarking: Distributions and Regions in Media Space –Marking Spaces –Modeling Watermark Detection by Correlation: Linear Correlation –Normalized Correlation – Correlation Coefficient.		
UNIT V	WATERMARK SECURITY	9
Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication. Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.		
TOTAL : 45 PERIODS		
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Understand the fundamentals of information hiding CO2: Understand the current techniques of cryptographic algorithms CO3: Apply the different techniques to detect and extract hidden information CO4: Apply the various watermarking techniques and understand the concept. CO5: Understand various attacks and tools standards.		
TEXT BOOKS: 1. Peter Wayner, “Disappearing Cryptography–Information Hiding: Steganography & Watermarking”, 2nd Edition Morgan Kaufmann Publishers, New York, 2002. 2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, “Digital Watermarking and Steganography”, Morgan Kaufmann Publishers, 2nd Edition, New York, 2008. 3. Digital Watermarking and Steganography, Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Fridrich, and Ton Kalker. 2nd Edition, Morgan Kaufmann Publishers, 2008		
REFERENCES: 1. Neil F.Johnson, ZoranDuric, SushilJajodia, “Information Hiding: Steganography and Watermarking–Attacks and Countermeasures”, 3rd Edition, Springer, 2012. 2. Stefan Katzenbeisser, Fabien A. P. Petitcolas, “Information Hiding Techniques for Steganography and Digital Watermarking”, 1st EditionArtech House Print on Demand,1999. 3. M. Arnold, M. Schmucker, and S. D. Wolthusen, “Techniques and applications of digital Watermarking and content protection” , 2nd Edition Boston, MA: Artech House Publishers, 2003.		

VERTICAL II

21PCB07	BIOMETRICS AND SECURITY			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES: - To guide organizations in accurately accessing threats, - To introduce Bio-metric and traditional authentication methods. - To describe the background theory of image processing required in biometric security □ To classify algorithms related to various biometrics. - To evaluate the performance of various biometric systems. - To study the challenges and limitations associated with bio-metrics security.							
UNIT I	INTRODUCTION						9
Introduction and Definitions of bio-metrics, Traditional authenticated methods and technologies. Introduction to Image Processing, Image Enhancement Techniques: Spatial Domain Methods: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters.							
UNIT II	IMAGE ANALYSIS						9
Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, spatial filtering, inverse filtering, Minimum mean square Error filtering.							
UNIT III	IMAGE EXTRACTION						9
Introduction to image segmentation: Image edge detection: Introduction to edge detection, types of edge detectors. Introduction to image feature extraction.							
UNIT IV	TECHNOLOGIES IN BIO-METRIC						9
Bio-metric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.							
UNIT V	BIO-METRIC SYSTEMS						9
Multi bio-metrics Introduction –Sources of Multiple Evidence, Acquisition and Processing Architecture– Fusion levels-sensor-level, feature-level, score-level, rank-level, decision-level fusion; Security of biometric systems–introduction, Adversary attacks, attacks at the user interface, attacks on biometric processing, attacks on the template Database– Case study of 3D face recognition and DNA matching							
						TOTAL : 45 PERIODS	
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Understand the various modules constituting a bio-metric system. CO2: Familiarize with different bio-metric traits and to appreciate their relative significance. CO3: Apply the feature sets used to represent some of the popular bio-metric traits. CO4: Evaluate and design security systems incorporating bio-metrics. CO5: Understand the use of multi bio-metrics systems.							
TEXT BOOKS: 1. Gonzalez, R.C. and Woods, R.E., “Digital Image Processing” 2 nd edition India: Person Education, 2009 2. Anil Jain, Arun A. Ross, Karthik Nanda kumar, “Introduction to biometric”, 2 nd Edition, Springer, 2011. 3. Paul Reid, “Biometrics for network security”, 1 st Edition, Hand book of Pearson, 2004.							

REFERENCES:

1. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology, Design and Performance Evaluation, Springer, 2004.
2. A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999.
3. John Chirillo and Scott Blaul, "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005.

21PCB08	CYBERCRIME INVESTIGATIONS AND LAW ENFORCEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To learn the overview of cybercrime. - To learn the issues of cybercrime. - To learn various methods to investigate cybercrime. - To learn about digital forensics. - To understand the laws and act behind.					
UNIT I	INTRODUCTION	9			
Introduction and Overview of Cyber Crime – Nature and Scope of Cyber Crime – Types of Cyber Crime: Social Engineering – Categories of Cyber Crime – Property Cyber Crime.					
UNIT II	CYBER CRIME ISSUES	9			
Unauthorized Access to Computers – Computer Intrusions – White collar Crimes – Viruses and Malicious Code – Internet Hacking and Cracking – Virus Attacks – Software Piracy – Intellectual Property – Mail Bombs – Exploitation – Stalking and Obscenity in Internet – Digital laws and legislation – Law Enforcement Roles and Responses.					
UNIT III	INVESTIGATION	9			
Introduction to Cyber Crime Investigation – Investigation Tools – Discovery – Digital Evidence Collection – Evidence Preservation – E-Mail Investigation – Tracking – IP Tracking – E-Mail 116 Recovery – Hands on Case Studies – Encryption and Decryption Methods – Search and Seizure of Computers – Recovering Deleted Evidences – Password Cracking.					
UNIT IV	DIGITAL FORENSICS	9			
Introduction to Digital Forensics – Forensic Software and Hardware – Analysis and Advanced Tools – Forensic Technology and Practices – Forensic Ballistics and Photography – Face, Iris and Fingerprint Recognition – Audio Video Analysis – Windows System Forensics – Linux System Forensics – Network Forensics.					
UNIT V	LAWS AND ACTS	9			
Laws and Ethics – Digital Evidence Controls – Evidence Handling Procedures – Basics of Indian Evidence ACT IPC and CrPC – Electronic Communication Privacy ACT – Legal Policies.					
					TOTAL : 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Understand various ideas about cybercrime. CO2: Understand the various issues of cybercrime. CO3: Apply investigation and find the cybercrime. CO4: Identify the occurrence of cybercrime. CO5: Understand the clear idea of the various laws and acts.					

TEXT BOOKS:

1. Gonzalez, R.C. and Woods, R.E., "Digital Image Processing" 2nd ed. India: Person Education, 2009
2. Anil Jain, Arun A. Ross, Karthik Nanda kumar, "Introduction to biometric", 2nd Edition, Springer, 2011.
3. Paul Reid, "Biometrics for network security", 1st Edition, Hand book of Pearson, 2004.

REFERENCES:

1. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology, Design and Performance Evaluation, Springer, 2004.
2. A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999.
3. John Chirillo and Scott Blaul, "Implementing Biometric Security", 1st Edition, Wiley Eastern Publication, 2005.

21PCB09	SECURE CODING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To learn the overview of cybercrime. - To understand the most frequent programming errors leading to software vulnerabilities. - To identify and analyze security problems in software. - To understand and protect against security threats and software vulnerabilities. - To apply their knowledge to the construction of secure software systems. - To learn the outlines of the techniques for developing a secure application.					
UNIT I	SECURITY CONCEPTS				9
Security concepts–Security Policy –Security Flaws – Vulnerabilities–Exploitation and Mitigations. C and C++ – Problems with C, Legacy Code, Development platforms – OS, compilers.					
UNIT II	CYBER CRIME ISSUES				9
Strings–Common string manipulation errors–String vulnerabilities and exploits–Mitigation strategies for strings–String handling functions–Runtime protection strategies – Mitigation strategies for Strings.					
UNIT III	DYNAMIC MEMORY MANAGEMENT				9
Dynamic memory management –C memory management – Common C management errors – C++ dynamic memory management – Common C++ memory management errors–Memory managers– Mitigation Strategies– Null pointers, Randomization, Runtime Analysis Tools					
UNIT IV	INTEGER SECURITY				9
Integer Security– Introduction – Integer datatypes – Integer conversions – Integer operations – Integer vulnerabilities – Mitigation Strategies – Integer type selection , Range checking , overflow detection.					
UNIT V	FILE IO				9
File IO – Basics – File I/O interfaces –Access control – File identification – Race condition – Time of Check, Time of Use, Exclusive Access, Shared Directories, Mitigation Strategies – Closing the Race window, Eliminating the Race Object, Race detection tools.					
					TOTAL : 45 PERIODS
COURSE OUTCOMES:					

At the end of the course, learners will be able to CO1: Develop secure programs and various risk in the software. CO2: Describe various possible security attacks CO3: Classify various errors that lead to vulnerabilities CO4: Use Real time software and vulnerabilities. CO5: Understand and write code using file secure basics.
TEXT BOOKS: 1. Seacord, R. C., “Secure Coding in C and C++”, 2nd edition, Addison Wesley for Software Engineering Institute, 2013. 2. Chess, B., and West, J., “Secure Programming with static Analysis”, 2nd Edition, Addison Wesley Software Security Series, 2007. 3. Seacord, R. C., “The CERT C Secure Coding Standard”, 3rd Edition, Pearson Education, 2009.
REFERENCES: 1. Howard, M., LeBlanc, D., “Writing Secure Code”, 2nd Edition. Pearson Education, 2002. 2. Neil Daswani, Christoph Kern, and Anita Kesavan, “Foundations of Security”, 1st Edition, Apress, 2007. 3. Robert C. Seacord, “Secure Coding in C and C++”, 2nd Edition, Sei Series, 2013.

21PCB10	SECURITY ASSESSMENT & RISK ANALYSIS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To acquire theoretical and empirical knowledge about security policy, risk analysis and organizations in a changing world. - To enable the student to perform vulnerability analysis. - To acquire skills to analyze complex risk and security issues and developments, as well as the ability to plan and implement strategic processes in organizations and private companies. - To acquire competences to translate knowledge about the political field of risk and security into risk analysis and strategies - To identify socially, politically and economically sustainable solutions and opportunities for public organizations and private companies					
UNIT I	SECURITY BASICS	9			
Information Security (INFOSEC) Overview: critical information characteristics – availability information states processing security Countermeasures– education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security countermeasures–policy, procedures and practices, threats, Vulnerabilities.					
UNIT II	THREATS TO AND VULNERABILITIES OF SYSTEMS	9			
Definition of terms (e.g., threats, vulnerabilities, risk), major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS), malicious logic, hackers, environmental and technological hazards, disgruntled employees, careless employees, HUMINT, and monitoring), threat impact areas, Counter measures: assessments (e.g., surveys, inspections). Concepts of Risk Management: consequences (e.g., corrective action, risk assessment).					
UNIT III	SECURITY PLANNING	9			
Directives and procedures for policy mechanism, Risk Management: acceptance of risk (accreditation), corrective actions information identification, risk analysis and/or vulnerability assessment components, risk					

analysis results evaluation, roles and responsibilities of all the players in the risk analysis process, Contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event, development of procedures for offsite processing, emergency destruction procedures.		
UNIT IV	POLICIES AND PROCEDURES	9
Physical Security Measures: alarms, building construction, cabling, communications centre, environmental controls (humidity and air conditioning), filtered power, physical access control systems (key cards, locks and alarms) Personnel Security Practices and Procedures: access authorization/verification (need-to- know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel, Administrative Security Procedural Controls: attribution, copyright protection and licensing		
UNIT V	OPERATIONS SECURITY	9
OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography–encryption (e.g., point–to–point, network, link), cryptography–key management (to include electronic key), Cryptography– strength (e.g., complexity, secrecy, characteristics of the key). Case study of threat and vulnerability assessment.		
		TOTAL : 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Understand OPSEC surveys and OPSEC planning CO2: Explain cryptographic encryption and key management CO3: Understand the security counter measures CO4: Employ personnel security practices and procedures CO5: Understand about the Operations Security.		
TEXT BOOKS: 1. Whitman & Mattord, “Principles of Incident Response and Disaster Recovery”,2021 2. Jonathan Rosenoer, “Cyber Law: The law of the Internet”, Springer–Verla. 3. Dr. Farooq Ahmad, Cyber Law in India, Allahbad Law Agency– Faridabad.		
REFERENCES: 1. C. Kaufman, r. Perlman, & M. Speciner, “Network security: Private communication in a public world”, 2 nd Edition, Upper Saddle River, NJ:Prentice Hall, 2002 2. C. P. Pfleeger, S. L. Pfleeger, “Security in Computing”, 4 th Edition, Upper Saddle River, NJ:Prentice Hall, 2007 3. M. Merkow, & J. Breithaupt, “Information security: Principles and practices”., 2 nd Edition, Upper Saddle River, NJ:Prentice Hall, 2005		

21PCB11	PROACTIVE SECURITY TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: • To use and application of security tools and techniques on real life scenarios such as cyber security consultancy and forensics. • To improve their technical skill–sets and enhance their learning experiences through the use of various cyber tools. • Understand how important security principles must be adhered to when securing the infrastructures • Understand the importance of balancing security, operational effectiveness and cost • Analyze and to aptly secure the cyber perimeter of the infrastructures against cyber attacks					

UNIT I	UNDERSTANDING THE DARK SIDE: MALICIOUS INTENT	9
Analyzing the Malicious Individual, Analyzing the Unique Individual, Richard Reid: The Shoe Bomber, Ted Bundy: The Infamous Serial Murderer, The Individual Cyber Attacker, Modeling the Individual: Advantages and Disadvantages, Analyzing the Malicious Group, Understanding the Group Adversary, Analyzing the Coordinated Group Cyber Threat, Theme–Guided Smart Searches		
UNIT II	CURRENT NETWORK SECURITY	9
Hacking and National Network Security, Growing Damage and Threat, Assessing Current Technology, Moving Toward Fixing Current Ineffective Network Protection, Envisioning an Effective Future Network Protection Technology, Future Threats to Our National Security, Increasing Threat on a Global Basis, Need for New Proactive Methods, Automated Pattern Classification		
UNIT III	HONEYPOT AND NETWORKING BACKGROUND	9
TCP/IP Introduction, Honeypot Background, High interaction honeypots – Advantages and disadvantages, VMware, Usermode Linux, Argos, Safeguarding your honeypots, Low interaction honeypots – Tiny Honeypot, Honeyd–Basics.		
UNIT IV	LEARNING – MALICIOUS SOFTWARE	9
Collecting malware with Honeypots – Nepenthes – A Honeypot solution to collect Malware, Honeytrap, Hybrid systems, Client honeypots		
UNIT V	SECURITY METRICS	9
Security metrics: What is a security metric? Metric and measurement, Designing effective security metrics, Data sources for security metrics, Analysis of security metrics data, Designing the security measurement project, Measuring security cost and value, Different context for security process management.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Use and security tools and techniques on real life scenarios such as cyber security consultancy and forensics. CO2: Improve their technical skill–sets and enhance their learning experiences through the use of various cyber tools. CO3: Understand how important security principles must be adhered to when securing the infrastructures CO4: Understand the importance of balancing security, operational effectiveness and cost CO5: Analyze the cyber perimeter of the infrastructures against cyber attacks		
TEXT BOOKS: 1. Gary M. Jackson, Predicting Malicious Behavior, John Wiley & Sons, 2012. 2. Niels Provos, Thorsten Holz, Virtual Honeypots: From Botnet Tracking to Intrusion Detection, Addison Wesley, 2007. 3. Lance Spitzner, Know Your Enemy: Learning about Security Threats (2nd Edition), 2004.		
REFERENCES: 1. IT Security Metrics, Lance Hayden, Tata McGraw Hill. 2. Mike Huffman, “ Building Open Source Security Tools: Components and Techniques”, 2nd Edition, Wiley, 2002 3. The Honeypot Project, “Know your Enemy: Learning about security Threats”, 2nd Edition, Wesley, 2007		

21PCB12	INTRUSION DETECTION SYSTEM			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
- To provide an in–depth introduction to the science and art of intrusion detection. □ To study the methodology, Techniques, and tools for monitoring events in computer □ network. - To provide the study of preventing and detecting unwanted process activity and recovering from malicious behavior. - To compare alternative tools and approaches for Intrusion Detection through quantitative analysis. - To Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies							
UNIT I	INTRODUCTION						9
Network Attacks, Attack Taxonomies, Probes , IPSweep and PortSweep, NMap, MScan, SAINT, Satan, Privilege Escalation Attacks, Denial of Service (DoS) and Distributed Denial of Service (DDoS) Attacks, Worms Attacks , Routing Attacks							
UNIT II	DETECTION APPROACHES						9
Detection Approaches, Misuse Detection, Pattern Matching, Rule–based Techniques, State– based Techniques, Techniques based on Data Mining, Anomaly Detection, Advanced Statistical Models, Rule based Techniques, Biological Models, Learning Models, Specification–based Detection, Hybrid Detection							
UNIT III	DATA COLLECTION AND THEORETICAL FOUNDATION						9
Data Collection, Data Collection for Host–Based IDSs, Audit Logs, System Call Sequences and Data Collection for Network–Based IDSs, Theoretical Foundation of Detection, Taxonomy of Anomaly Detection Systems, Fuzzy Logic, Architecture and Implementation, Centralized, Distributed, Intelligent Agents, Mobile Agents and Cooperative Intrusion Detection							
UNIT IV	ALERT MANAGEMENT AND CORRELATION						9
Alert Management and Correlation, Data Fusion, Alert Correlation, Preprocess, Correlation Techniques, Postprocess, Alert Correlation Architectures, Validation of Alert Correlation System, Cooperative Intrusion Detection, Basic Principles of Information Sharing and Cooperation Based on Goal–tree Representation of Attack Strategies							
UNIT V	EVALUATION CRITERIA						9
Evaluation Criteria, Accuracy, False Positive and Negative, Confusion Matrix, Precision, Recall, and F– Measure, ROC Curves, The Base–Rate Fallacy, Performance, Completeness, Timely Response, Intrusion Tolerance and Attack Resistance, Redundant and Fault Tolerance Design and Test, Evaluation and Data Sets							
						TOTAL : 45 PERIODS	
COURSE OUTCOMES:							
At the end of the course, learners will be able to							
CO1: Understand the fundamentals and history of Intrusion Detection system.							
CO2: Apply knowledge of Intrusion Detection in order to avoid common pitfall in the creation and evaluation of new intrusion detection system.							
CO3: Understand the principles and techniques used in intrusion detection.							
CO4: Apply intrusion detection tools and techniques							
CO5: Understand the evaluation Criteria and accuracy in intrusion detection.							
TEXT BOOKS:							

1. Ali A. Ghorbani, "Network Intrusion Detection and prevention concepts and techniques", 2 nd Edition, Springer, 2010.
2. Peter Szor, "The Art of Computer Virus Research and Defense, 1 st Edition, Symantec Press, 2010.
3. Markus Jakobsson and Zulfikar Ramzan, Crimeware, "Understanding New Attacks and Defenses", 2 nd Edition, Symantec Press, 2008.
REFERENCES:
1. Roberto Di Pietro, Luigi V. Mancini, "Intrusion Detection System", 2 nd Edition, Springer, 2008.
2. Stephen Northcutt, Judy Novak, "Network Intrusion Detection", 3 rd Edition, New Riders Publishing, 2002.
3. Carl Endorf, Eugene Schultz and Jim Mellander, " Intrusion Detection & Prevention", 1 st Edition, Tata McGraw-Hill, 2004.

21PCB13	CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To study the basic concepts, requirements, principles, and techniques in emerging cyber physical systems. - To provide students hands-on experience in prototyping a cyber-physical system. - To address real-world problems through Cyber Physical Systems. - To analyse tools for physical, computational and communication modelling. - To identify domains where CPS is highly inevitable.					
UNIT-I	FOUNDATION OF CYBER PHYSICAL SYSTEMS				9
Cyber Physical Systems in Real world, Basic Principle of Cyber Physical Systems, Industry 4.0, IIoT, Cyber Physical Systems Design Recommendations, CPS system requirements, Cyber Physical System Application, Case study of Cyber Physical Systems					
UNIT-II	COMPONENTS OF CPS				9
Physical Space - Sensors and Actuators - Embedded Processors, Input and Output Interfaces-ADC and DAC. Control Systems - Feedback Control systems open and closed loop. Human in the loop predictive model based control systems - Concurrency and Synchronization of components in distributed CPS.					
UNIT-III	MODELS OF COMPUTATION IN PHYSICAL DOMAIN				9
Dataflow models, Process Networks, Synchronous Reactive Models, Finite State Machine, Discrete Event Models, Modal Models, Hybrid Models, Continuous time models, Modelling Timed Systems, Event Oriented Modelling. Actor Oriented Design. Composing MoC using Kepler/ Ptolemy tool					
UNIT-IV	INTELLIGENT CYBER PHYSICAL SYSTEMS				9
Industrial Big data Analytics and Cyber physical systems Industries 4.0 applications. Collaborative CPS. Real-time ML enabled Digital Twins.					
UNIT-V	SECURITY AND PRIVACY IN CYBER PHYSICAL SYSTEMS				9
Security and Privacy Issues in CPSs, Local Network Security for CPSs, Internet-Wide Secure Communication, Security and Privacy for Cloud-Interconnected CPSs, Case Study: Cybersecurity in Digital Manufacturing/Industry 4.0					
					TOTAL : 45 PERIODS
COURSE OUTCOMES:					
At the end of the course, the learners will be able to					
CO1: State the challenges and opportunities of CPS.					
CO2: Recall the physical components that constitute the physical space of CPS.					

CO3: Analyse the communication components of a CPS.
CO4: Evaluate Design of CPS systems enabling verification and validation.
CO5: Analyse common methods used to secure cyber-physical systems
TEXT BOOKS:
1. Principles of Cyber Physical Systems, Rajeev Alur, MIT Press, 2015
2. Edward A. Lee and Sanjit A. Seshia, “Introduction to Embedded Systems, A Cyber-Physical Systems Approach”, Second Edition, MIT Press, ISBN 978-0-262-53381-2, 2017
3. “System Design, Modelling, and Simulation” by The Ptolemy Project, University of California, Berkeley
REFERENCES:
1. Guido Dartmann, Houbing song, Anke schmeink, “Big data analytics for Cyber Physical System”, Elsevier, 2019
2. Houbing song, Danda B Rawat, Sabina Jeschke, Christian Brecher, “Cyber Physical Systems Foundations, Principles and Applications”, Elsevier, 2017
3. Chong Li, Meikang Qiu, “Reinforcement Learning for Cyber Physical Systems with Cyber Securities Case Studies”, CRC press, 2019
4. Houbing Song, Glenn A.Fink, Sabina Jesche, “Security and Privacy in Cyber-Physical Systems: Foundations, Principles and Solutions”, IEEE Press.

VERTICAL III

21PCB14	SOFTWARE TESTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To understand the basics of software testing • To learn how to do the testing and planning effectively • To build test cases and execute them • To focus on wide aspects of testing and understanding multiple facets of testing • To get an insight about test automation and the tools used for test automation					
UNIT-I	FOUNDATIONS OF SOFTWARE TESTING				9
Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, Vmodel of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing					
UNIT-II	TEST PLANNING				9
The Goal of Test Planning, High Level Expectations,Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics					
UNIT-III	TEST DESIGN AND EXECUTION				9
Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design					
Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.					

UNIT-IV	ADVANCED TESTING CONCEPTS	9
Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications		
UNIT-V	TEST AUTOMATION AND TOOLS	9
Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.		
TOTAL :45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, learners will be able to		
CO1: Understand the basic concepts of software testing and the need for software testing.		
CO2: Design Test planning and different activities involved in test planning		
CO3: Design effective test cases that can uncover critical defects in the application		
CO4: Carry out advanced types of testing		
CO5: Automate the software testing using Selenium and TestNG		
TEXT BOOKS:		
1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, 1st Edition, Pearson Education, 2017.		
2. Dr. D. Chitra, A. Kaliappan, “Software Testing”, 1st Edition, Technical Publications, 2019		
3. Arnon Axelrod, “Complete Guide to Test Automation: Techniques, Practices, and Patterns for Building and Maintaining Effective Software Projects”, 1st Edition, Apress Publisher, 2018		
REFERENCES:		
1. Paul C. Jorgensen, Byron DeVries, “Software Testing A Craftsman’s Approach”, 5th Edition, Auerbach Publications, 2021		
2. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.		
3. Aditya P. Mathur, “Foundations of Software Testing _ Fundamental Algorithms and Techniques”, 1st Edition, Pearson Education, 2008.		

21PIT11	UI AND UX DESIGN		L	T	P	C
			2	0	2	3
COURSE OBJECTIVES:						
- To outline the design of graphical user interfaces. - To illustrate the user interfaces design process. - To demonstrate the concepts and principles of UX. - To develop an UX plane for an application. - To build a simple application with UI and UX.						
UNIT I		INTRODUCTION TO THE USER INTERFACE				12
The importance of User Interface (UI) – The importance of Good Design – A Brief Historical Overview of Interface Design – Characteristics of Graphical and Web User Interface – Interaction Styles – The Graphical User Interface – Web User Interface – Principles of UI Design – The Merging of Graphical Business						

Systems and the Web.		
SUGGESTED ACTIVITIES:		
GUI Basics – Building an Interface.		
UNIT II	USER INTERFACE DESIGN PROCESS	12
Know Your User or Client - Understand the Business Function - Understand the Principles of Good Interface and Screen Design - Develop System Menus and Navigation Schemes - Select the Proper Kinds of Windows - Select the Proper Interaction Devices - Choose the Proper Screen-Based Controls - Create Meaningful Graphics, Icons, and Images - Choose the Proper Colors - Organize and Layout Windows and Pages.		
SUGGESTED ACTIVITIES:		
Graphics – The Canvas.		
UNIT III	INTRODUCTION TO THE USER EXPERIENCE	12
The Tao of UXD Basics- What Is User Experience Design? - The Broad Definition - The Project Ecosystem - Identify the Type of Site - Choose Your Hats - Understand the Company Culture - Proposals for Consultants and Freelancers - UX Design Guidelines.		
SUGGESTED ACTIVITIES:		
Widget Events – Binding Actions.		
UNIT IV	UX PLANE	12
The Strategy Plane - The Scope Plane - The Structure Plane - The Skeleton Plane - The Surface Plane - The Elements Applied - User Experience and the Web - Meet the Elements.		
SUGGESTED ACTIVITIES:		
Improving the User Experience.		
UNIT V	UI/ UX Design Tools	12
Invaders Revenge - An Interactive Multi-touch Game - Invaders Revenge – An animated multi-touch game- Atlas – An efficient management of images-Boom – simple sound effects - Ammo – simple animation- Invader – transitions for animations - Dock – automatic binding in the Kivy language - Fleet – infinite concatenation of animations - Scheduling events with the clock- Shooter – multi-touch control- Invasion – moving the shooter with the keyboard - Combining animations with '+' and '&'.		
SUGGESTED ACTIVITIES:		
Develop sound effect and shooter for a simple game.		
		TOTAL: 60 PERIODS
COURSE OUTCOMES:		
At the end of the course, learners will be able to		
CO1: Explain the design of graphical user interfaces.		
CO2: Summarize the User Interfaces to design a good product.		
CO3: Relate the concepts and principles of UX.		
CO4: Experiment with UX plane.		
CO5: Develop a simple application incorporating UI and UX.		
TEXT BOOKS:		
1. Wilbert O. Galitz, “The Essential Guide to User Interface Design An Introduction to GUI Design		

Principles and Techniques”, 3rd Edition, Wiley Publishing, Inc., 2017.

2. Russ Unger and Carolyn Chandler, “A Project Guide to UX Design: For user experience designers in the field or in the making”, 2nd Edition, New Riders Publishing, 2012.
3. Roberto Ulloa, “Kivy – Interactive Applications and Games in Python”, 2nd Edition, Packt Publishing, 2015.

REFERENCES:

1. Jesse James Garrett, “The Elements of User Experience: User-Centered Design for the Web and Beyond”, 2nd Edition, Pearson Education, 2011.
2. Rex Hartson and Pardha S. Pyla, “The UX Book Process and Guidelines for Ensuring a Quality User Experience”, Elsevier, 2012.
3. Pamala Deacon, “UX and UI Strategy: A step by step Guide on UX and UI design”, 1st Edition, Packt Publishing, 2020.

21PAD43	DIGITAL MARKETING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To understand the process of online market. • To acquire the knowledge on search engine optimization. • To Explore the role and importance of digital marketing in today’s rapidly changing business environment. • To learn about social media marketing. • To focuses on how digital transformation can be utilized by organizations and how its effectiveness can be measured.					
UNIT-I	INTRODUCTION TO ONLINE MARKET				9
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.					
UNIT-II	SEARCH ENGINE OPTIMISATION				9
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising - Display Advertisement.					
UNIT-III	E- MAIL MARKETING				9
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.					
UNIT-IV	SOCIAL MEDIA MARKETING				9
Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.					
UNIT-V	DIGITAL TRANSFORMATION				9
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.					

TOTAL: 45PERIODS	
COURSE OUTCOMES At end of the course, learners will be able to CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment. CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured. CO3: To know the key elements of a digital marketing strategy. CO4: To study how the effectiveness of a digital marketing campaign can be measured. CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.	
TEXT BOOKS: 1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", 1st edition, Pearson Education, 2017. 2. Vandana Ahuja, "Digital Marketing" Oxford University Press, 2015. 3. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach, 2E South-Western, Cengage Learning, 2017.	
REFERENCES: 1. Philip Kotler, "Marketing 4.0: Moving from Traditional to Digital" Wiley, 1st edition, 2017. 2. Ryan, D., "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited, 2014. 3. Pulizzi, J Beginner's Guide to Digital Marketing, Mcgraw Hill Education, 2019.	

21PIT17	TECHNIQUES OF ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To explain the fundamentals of Robotic Process Automation. - To model the basics of Robotic Process Automation tool. - To outline the automation techniques of Robotic Process Automation. - To experiment with bot using triggering concept. - To develop and maintain the bot.					
UNIT-I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION				9
History of Automation - What is RPA - RPA vs Automation - Benefits of RPA - Components of RPA - RPA platforms - About UiPath - UiPath Robot - Record and Play-UiPath stack - Learning UiPath Studio-Task recorder-Step-by-step examples using the recorder.					
UNIT-II	RPA TOOL				9
What is a Sequence? - Using activities with workflows – Flowchart - Control Flow, Sequencing the workflow - Control flow, various types of loops, and decision making - Step-by-step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow.					
UNIT-III	DATA MANIPULATION				9
Variables and scope–Collections –Arguments – Purpose and use - Data table usage with examples - Clipboard management - File operation with step-by-step example - CSV/Excel to data table and vice versa.					

UNIT-IV	TAKING CONTROL OF THE CONTROLS	9
Taking Control of the Controls - Implementing the Attach Window activity -Finding the control - Techniques for waiting for a control - Act on controls – mouse and keyboard activities -Working with UiExplorer - Handling events - Handling events - Screen Scraping-When to use OCR-Types of OCR available - Avoiding typical failure points-SAP automation-Java plugin-Citrix automation.		
UNIT-V	HANDLING USER EVENTS AND ASSISTANT BOTS	9
What are assistant bots? - Monitoring system event triggers - Monitoring image and element triggers -Launching an assistant bot on a keyboard event- Common exceptions and ways to handle them - Logging and taking screenshots - Debugging techniques - Collecting crash dumps - Error reporting -Nesting workflows -Reusability of workflows.		
		TOTAL :45 PERIODS
COURSE OUTCOMES:		
At the end of the course, learners will be able to:		
CO1: Explain the fundamentals of Robotic Process Automation.		
CO2: Identify the different Robotic Process Automation tools and its usage.		
CO3: Outline the automation techniques of Robotic Process Automation.		
CO4: Apply the various triggering concept for monitoring bots.		
CO5: Plan, develop and deploy bots.		
TEXT BOOKS:		
1. Alok Mani Tripathi, “Learning Robotic Process Automation”, 1 st Edition Packt Publishing, 2018.		
2. Nandan Mullakara, Arun Kumar and Asokan, “Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere”, 1 st Edition, Packt Publishing, 2020.		
3. Robert Fantina, Andriy Storozhuk and Kamal Goyal, “Introducing Robotic Process Automation to Your Organization”, 1 st Edition, Apress Publication, 2021.		
REFERENCES :		
1. Christian Czarnecki, Peter Fettke, “Robotic Process Automation: Management, Technology, Applications”, 1 st Edition, Walter de Gruyter Publishing, 2021.		
2. Tom Taulli “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, 1 st Edition, Apress Publication, 2020.		
3. Husan Mahey “Robotic Process Automation with Automation Anywhere”, 1 st Edition, Packt Publishing LTD, 2021.		

21PAD45	APP DEVELOPMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
The main objectives of this course are:					
- To understand the basics of web and mobile app development. - To learn development of native applications with basic GUI Components. - To develop cross-platform applications with event handling. - To implement applications with location and data storage capabilities. - To demonstrate web applications with database access.					
UNIT-I	FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT	9			

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.		
UNIT-II	NATIVE APP DEVELOPMENT USING JAVA	9
Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props.		
UNIT-III	HYBRID APP DEVELOPMENT	9
Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova.		
UNIT-IV	CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE	9
What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.		
UNIT-V	NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS	9
Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX and Reusability.		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At end of the course, learners will be able to CO1: Develop Native applications with GUI Components. CO2: Enhance hybrid applications with basic event handling. CO3: Implement cross-platform applications with location and data storage capabilities. CO4: Exhibit cross platform applications with basic GUI and event handling. CO5: Develop web applications with cloud database access.		
TEXT BOOKS: 1. Dawn Griffiths, Head First Android Development, , O'Reilly, 3rd edition, November 2021. 2. Raymond K. Camden, "Apache Cordova in Action", Manning. 2015. 3. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, "Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native", FullStack publishing, 2019.		
REFERENCES: 1. John Horton, "Android Programming for Beginners", Packt Publishing, 2nd Edition, 2018. 2. Shaun Lewis, Mike Dunn, "Native Mobile Development", 2019. 3. Pawan Lingras, Matt Triff, Rucha Lingras, "Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach" 2015.		

21PAD46	DEVOPS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To introduce DevOps terminology, definition & concepts. - To understand the different Version control tools like Git, Mercurial etc. - To understand the concepts of Continuous Integration, Continuous Testing and Continuous Deployment. - To understand Configuration management using Ansible. - Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems.					

UNIT-I	INTRODUCTION TO DEVOPS	9
Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.		
UNIT-II	COMPILE AND BUILD USING MAVEN , GRADLE & ANT	9
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artifacts, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.		
UNIT-III	CONTINUOUS INTEGRATION USING JENKINS	9
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.		
UNIT-IV	CONFIGURATION MANAGEMENT USING ANSIBLE	9
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.		
UNIT-V	BUILDING DEVOPS PIPELINES USING AZURE	9
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, and ELK.		
TOTAL:45 PERIODS		
COURSE OUTCOMES: At end of the course, learners will be able to CO1: Understand different actions performed through Version control tools like Git. CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle. CO3: Ability to Perform Automated Continuous Deployment. CO4: Ability to do configuration management using Ansible. CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps.		
TEXT BOOKS: 1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, 2nd Edition, Kindle Edition, 2016. 2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014. 3. Mitesh Soni, Hands-On Azure Devops: CI/CD Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CI/CD Implementation for DevOps and Microsoft Azure , Paperback ,2020 .		
REFERENCES: 1. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, 1st Edition, 2015. 2. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, 2nd Edition, 2016. 3. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, 2nd Edition, 2019. 4. https://www.jenkins.io/user-handbook.pdf 5. https://maven.apache.org/guides/getting-started/		

21PAD47	OPEN SOURCE TECHNOLOGIES				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES:								
- Understand the difference between open-source software and commercial software. - Understand the policies, licensing procedures and ethics of FOSS. - Understand open-source philosophy, methodology and ecosystem. - Awareness with Open-Source Technologies. - Knowledge to start, manage open-source projects.								
UNIT-I	INTRODUCTION							9
Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs OpenSource Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.								
UNIT-II	OPEN-SOURCE PRINCIPLES AND METHODOLOGY							9
Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization - Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.								
UNIT-III	OPEN SOURCE PROJECT							9
Starting and maintaining own Open-Source Project, Open-Source Hardware, Open-Source Design, Opensource Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice.								
UNIT-IV	UNDERSTANDING OPEN-SOURCE ECOSYSTEM							9
Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.								
UNIT-V	OPEN SOURCE ETHICS & CASE STUDIES							9
Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source Technology – Shared Software – Shared Source.Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies. Study: Understanding the developmental models, licensing, mode of funding, commercial/non-commercial use.								
TOTAL:45 PERIODS								
COURSE OUTCOMES								
At end of the course, learners will be able to								
CO1:Differentiate between Open Source and Proprietary software and Licensing.								
CO2:Understand the policies, licensing procedures and ethics of FOSS.								
CO3:Build and modify one or more Free and Open Source Software packages.								
CO4:Recognize the applications, benefits and features of Open-Source Technologies.								
CO5:Contribute software to and interact with Free and Open Source Software development projects.								
CO6:Gain knowledge to start, manage open-source projects.								

TEXT BOOKS:

1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt Ltd, 1st Edition, 2012.
2. P.Rizwan Ahmed, Open Source Software, Margham Publication, 2015.
3. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy", Cambridge Universities Press 2009.

REFERENCES:

1. Kailash Vadera & Bhavyesh, "Open-Source Technology", Gandhi, University Science Press, Laxmi Publications, 2009.
2. Sumitabha Das, "Unix Concepts and Applications" Tata McGraw Hill Education, 2006.
3. "Perspectives on Free and Open-Source Software", Clay Shirky and Michael Cusumano, MIT press, 2007.

VERTICAL IV

21PCB15	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• Study the concepts of Artificial Intelligence. • Learn the methods of solving problems using Artificial Intelligence. • Introduce the concepts of Expert Systems and machine learning.					
UNIT-I	INTRODUCTION TO AI AND PRODUCTION SYSTEMS				9
Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breadth first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.					
UNIT-II	REPRESENTATION OF KNOWLEDGE				9
Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logicStructured representation of knowledge.					
UNIT-III	KNOWLEDGE INFERENCE				9
Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.					
UNIT-IV	PLANNING AND MACHINE LEARNING				9
Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.					
UNIT-V	EXPERT SYSTEMS				9
Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.					
					TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify appropriate AI methods to solve a given problem.

CO3: Formalise a given problem in the language/framework of different AI methods.

CO4: Implement basic AI algorithms.

CO5: Design and carry out an empirical evaluation of different algorithms on a problem

CO6: Formalisation, and state the conclusions that the evaluation supports.

TEXT BOOKS:

1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.

2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.

REFERENCES :

1. Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.

2. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.

3. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.

21PIT15	CONCEPTS OF AUGMENTED REALITY AND VIRTUAL REALITY		L	T	P	C
			3	0	0	3
COURSE OBJECTIVES: • To demonstrate various augmented reality methods. • To explain the scientific, technical and engineering aspects of augmented reality. • To explain the scientific, technical and engineering aspects of virtual reality. • To develop applications based on AR and VR technologies. • To summarize the applications of AR and VR.						
UNIT-I		INTRODUCTION				9
Introduction to Augmented Reality, Other Enhancements, The Relationship between Augmented Reality and Other Technologies, Virtual and Mixed Reality, Cyber Space, Virtuality and the Virtuality Continuum,The Reality Continuum, The Metaverse and the Metaverse Roadmap, Introduction to VR – The three I's of VR, Early commercial VR technology, VR becomes an Industry, Five classic components of VR system						
UNIT-II		AUGMENTED REALITY HARDWARE				9
The Two-Step Process of Augmented Reality Applications, Hardware Components For AR - Sensors, Processors, Displays,Augmented Reality System.						
UNIT-III		VIRTUAL REALITY HARDWARE				9
Input Devices: Trackers, Navigation and Gesture Interfaces, Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays, Computing Architecture for VR, Modeling.						
UNIT-IV		AR AND VR SOFTWARE DEVELOPMENT				9
Software involved directly in the Augmented Reality application- Environmental acquisition, Sensor integration, Application engine, Rendering software,Augmented Reality libraries,Software used to create content for the Augmented Reality Application, VR Programming – Toolkits and Scene graphics, World toolkit, Java 3D, General Haptics Open Software Toolkit (GHOST).						
UNIT-V		APPLICATIONS				9

AR Applications – Magic books, Magic Mirrors, Magic Windows and Doors, Magic Lens, Navigation Assistance, Non referential augmentation, Objective view augmented reality, Traditional VR applications – Medical Applications of VR, Virtual anatomy, Triage and Diagnostic, Surgery, Rehabilitation, Education, arts and Entertainment, Military VR Applications.
TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: CO1: Explain the basic knowledge of AR and VR. CO2: Outline the scientific, technical and engineering aspects of AR. CO3: Outline the scientific, technical and engineering aspects of VR. CO4: Experiment with technologies related to AR and VR software development. CO5: Summarize the applications of AR and VR engineering.
TEXT BOOKS: 1. Burdea, G. C. and P. Coffet, “Virtual Reality Technology”, 2 nd Edition, Wiley. IEEE Press, 2006. 2. Alan B. Craig, “Understanding Augmented Reality, Concepts and Applications”, 1 st Edition, Morgan Kaufmann, 2013. 3. John Vince, “Virtual Reality Systems”, 1 st Edition, Pearson Education, 2002.
REFERENCES : 1. Alan Craig, William Sherman and Jeffrey Will, “Developing Virtual Reality Application, Foundations of Effective Design”, 1 st Edition, Morgan Kaufmann, 2009. 2. George Mather, “Foundations of Sensation and Perception”, 3 rd Edition, Psychology Press, 2009. 3. Chetankumar G Shetty, “Augmented Reality - Theory, Design and Development”, 1 st Edition, McGraw Hill 2020.

21PCB16	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: At the end of the course, learners will be able - To Explore the need of Data Science. - To Understand the life cycle of Data Analytics. - To gain the insights from the data through statistical analysis. - To visualize the data by applying visualization techniques. - To solve real world data analysis using R programming.					
UNIT-I	INTRODUCTION TO DATA SCIENCE				9
What is Data – Taxonomy of Data Analytics – History on Methodologies on Data Analytics – KDD Process – State of Practice in Analytics – Key Roles for The New Big Data Ecosystem.					
UNIT-II	DATA ANALYTICS LIFE CYCLE				9
Data Analytics Life Cycle Overview – Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize – Case Study on Global Innovation Network and Analysis (GINA).					
UNIT-III	INSIGHTS FROM DATA				9
Descriptive statistics – Descriptive Univariate Analysis – Univariate Frequencies – Data Visualization – Statistics - Descriptive Bivariate Analysis - Descriptive Multivariate Analysis.					

UNIT-IV	DATA VISUALIZATION	9
Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.		
UNIT-V	DATA ANALYTICS USING R	9
R – Programming - Key concepts – Basic features of R -Data Exploration and analysis with R –Excel - Statistical methods for evaluation - Presentation and analysis of Quantitative Data - Presentation and analysis of Qualitative Data- Inferential Statistical analysis of data. Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting. Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools. Time Series Data Analysis: Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Explain the concept of data science and role of data analytics. CO2: Understand the overview of life cycle of data analytics. CO3: Apply data analytics on data and use different analytics method related to data. CO4: Create informative visualization and summarize data sets. CO5: Analyze applications using data analysis various applications.		
TEXTBOOKS: 1. Moreira, J., Carvalho, A., Carvalho, A. C. P. d. L. F., Horvath, T. (2018). A General Introduction to Data Analytics. United Kingdom: Wiley. 2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. (2015). Germany: Wiley. 3. McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media, 2017.		
REFERENCES: 1. Thomas Mailund, “Beginning Data Science in R – Data Analysis, Visualization and Modelling for the Data Scientist”, Apress Publication, 2017. 2. O’Neil, C., & Schutt, R., Doing Data Science: Straight Talk from the Frontline O’Reilly Media, 2013.		

21PCS03	NEURAL NETWORKS AND DEEP LEARNING			L	T	P	C
				3	0	0	3
COURSE OBJECTIVES:							
- To summarize the theoretical foundations, algorithms and methodologies of neural network □ To experiment with different activation functions working in neural network. - To design building blocks of deep learning models. - To construct architectures and to train deep neural network. - To utilize the practical knowledge in handling and analyzing real world applications							
UNIT-I	INTRODUCTION TO NEURAL NETWORKS						9
Neural Networks: The Biological Neuron- The Perceptron - Multilayer Feed-Forward Networks. Training Neural Networks: Backpropagation Learning.							
UNIT-II	ACTIVATION FUNCTIONS AND PARAMETERS						9
Activation functions, Loss Functions: Notation - Loss function for Reconstruction - Parameters Vs Hyperparameters							
UNIT-III	INTRODUCTION TO DEEP NETWORKS						9
Defining Deep Learning - Common Architectural Principles of Deep Networks - Building Blocks of Deep Networks							
UNIT-IV	ARCHITECTURES OF DEEP NETWORKS						9
Introduction to Convolutional Neural Networks (CNNs) - Recurrent Neural Networks - Recursive Neural Networks.							
UNIT-V	APPLICATIONS						9
Large-Scale Deep Learning. Computer Vision- Speech Recognition- Natural Language Processing-Other Applications							
TOTAL:45 PERIODS							
COURSE OUTCOMES							
At end of the course, learners will be able to:							
CO1:Utilize different methodologies to create application using neural network							
CO2: Make use of activation function and parameters to train the neural network							
CO3: Experiment with working knowledge of deep learning models for solving problem CO4: Identify appropriate deep learning models for analyzing the data for a variety of problems.							
CO5: Build deep learning models for solving real world problems.							
TEXT BOOKS:							
Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach",1 st Edition ,O'Reilly Media, 2017							
Ian Goodfellow, YoshuaBengio, Aaron Courville," Deep Learning", 1 st Edition, The MIT press, 2017							
Bengio, Yoshua., "Learning deep architectures for AI. Foundations and trends in Machine Learning2.1", 1 st Edition, New Publishers, 2009							
REFERENCES:							
1. Nikhil Buduma and Nicholas Lacascio, "Fundamentals of Deep Learning", 1 st Edition, O.Reilly, 2017.							
2. PradeepPujari, Md. And RezaulKarim, MohitSewak, "Practical Convolutional Neural Networks", 1 st Edition, Packt Publishing, 2018.							
3. RagavVenkatesan and Baoxin Li, "Convolutional Neural Networks in Visual Computing (Data Enabled Engineering)", 1 st Edition, CRC Press, 2017.							

21PAD08	FOG COMPUTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: The main objectives of this course are: - To understand the basics of Edge and Fog Computing. - To conceptualize the communication standards. - To familiarize with integration of edge with data analytics. - To understand the importance of security infrastructures and management. - To explore the applications of edge Computing.					
UNIT-I	FOG AND ITS MODELS				9
Introduction to Fog Computing: Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles.					
UNIT-II	COMMUNICATION TECHNOLOGIES				9
Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.					
UNIT-III	EDGE, FOG & CLOUD				9
Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.					
UNIT-IV	IoT & SECURITY INFRASTRUCTURE				9
Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog-IoT Architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, Cloud Infrastructures: Methodology, Integrated C2F2T Literature by Modeling Technique by UseCase Scenarios, Integrated C2F2T Literature by Metrics.					
UNIT-V	APPLICATIONS				9
Exploiting Fog Computing in Health Monitoring: An Architecture of a Health Monitoring IoT Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction, DataDriven Intelligent Transportation Systems, Fog Computing for Smart Transportation, Applications Case Study: Intelligent Traffic Lights Management (ITLM) System.					
TOTAL:45 PERIODS					
COURSE OUTCOMES At end of the course, learners will be able to CO1: Explain the basic concepts in Edge computing. CO2: Understand the architecture, its components and working of components and its performance. CO3: Explore Fog on security, multimedia and smart data. CO4: Explore the integration of fog computing with IoT. CO5: Model the fog computing scenario.					

TEXT BOOKS:	
1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y., 2020	
2. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by Rajkumar Buyya and Satish Narayana Srirama, John Wiley & Sons, 2019	
3. Amir Vahid Dastjerdi and Rajkumar Buyya, —Fog Computing: Helping the Internet of Things Realize its Potential, University of Melbourne, IEEE Computer Soc, 2016	
REFERENCES:	
1. Amir M. Rahmani, Pasi Liljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edge, Springer International Publishing, 2018.	
2. Flavio Bonomi, Rodolfo Milioto, Jiang Zhu, Sateesh Addepalli, —Fog Computing and Its Role in the Internet of Things, MCC' 12, 2012.	

21PIT14	GAME DESIGN AND DEVELOPMENT	L	T	P	C
		2	0	2	3
COURSE OBJECTIVES: - To illustrate the basic concepts of game programming. - To experiment with 3D graphics concepts. - To apply the terminologies like sound, physics and cameras for developing simple games. - To choose user interfaces and scripting for developing games. - To make use of gaming concepts for game development.					
UNIT I	INTRODUCTION TO GAME PROGRAMMING				9
Game Programming Overview: Evolution of Video Game Programming - The Game Loop - Time and Games – Game Objects. 2D Graphics: 2D Rendering Foundations - Sprites – Scrolling - Tile Maps. Linear Algebra for Games..					
UNIT II	3D GRAPHICS				9
Basics - Coordinate Spaces - Lighting and Shading – Visibility - World Transform, Revisited - Input Devices - Event-Based Input Systems - Mobile Input.					
UNIT III	SOUND, PHYSICS AND CAMERAS				9
Basic Sound - 3D Sound - Digital Signal Processing - Planes, Rays, and Line Segments. - Collision Geometry - Collision Detection - Physics-Based Movement - Types of Cameras - Perspective Projections - Camera Implementations - Camera Support Algorithms.					
UNIT IV	USER INTERFACES AND SCRIPTING				9
Menu Systems - HUD Elements - Other UI Considerations - Scripting Languages - Implementing a Scripting Language - Data Formats					
UNIT V	GAME DEVELOPMENT				9
Side-Scroller for iOS - Tower Defense for PC/Mac - Tetris game.					
					TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to CO1: Explain the basic concepts of game programming. CO2: Experiment with 3D graphics concepts. CO3: Make use of the concepts of sound, physics and cameras to develop simple games. CO4: Apply the concepts of user interfaces and scripting to develop games. CO5:Utilize the gaming concepts to develop games in various platforms.					

TEXT BOOKS:	
1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison-Wesley Professional, 2 nd Edition, 2014.	
2. K. Patinson, "Game Development: Gaming Design and Programming", Code Academy Publishers, 1 st Edition, 2021.	
3. <u>James R Parker</u> and <u>J R Parker</u> , "Introduction to Game Development.", Mercury Learning & Information Publishers, 1 st Edition, 2015.	
REFERENCES:	
1. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress Publishers, 1 st Edition, 2007.	
2. Paul Vincent Craven, "Program Arcade games", Apress Publishers, 4 th Edition, 2016.	
3. Steve Rabin, "Introduction to Game Development", Charles River Media Publishers, 2 nd Edition, 2009.	

21PIT21	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To explain the foundation of traditional computing. • To interpret the knowledge on the modeling of quantum circuit. • To summarize the knowledge of basic quantum algorithms. • To outline the knowledge of advanced quantum algorithms. • To interpret the quantum computational complexity and error correction methods.					
UNIT I	INTRODUCTION AND BACKGROUND				9
Overview of traditional computing – Computers and the Strong Church–Turing Thesis - The Circuit Model of Computation - A Linear Algebra Formulation of the Circuit Model - Reversible Computation - A Preview of Quantum Physics - Quantum Physics and Computation					
UNIT II	DIRAC NOTATION AND QUANTUM MECHANICS				9
The Dirac Notation and Hilbert Spaces - Dual Vectors – Operators - The Spectral Theorem- Functions of Operators - Tensor Products - The Schmidt Decomposition Theorem - Some Comments on the Dirac Notation. The State of a Quantum System - Time-Evolution of a Closed System - Composite Systems - Measurement - Mixed States and General Quantum Operations - Mixed States, Partial Trace, General Quantum Operations.					
UNIT III	A QUANTUM MODEL OF COMPUTATION				9
The Quantum Circuit Model - Quantum Gates - 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates - Efficiency of Approximating Unitary Transformations - Implementing Measurements with Quantum Circuits.					
UNIT IV	INTRODUCTORY QUANTUM ALGORITHMS				9
Probabilistic Versus Quantum Algorithms - Phase Kick-Back - The Deutsch Algorithm - The Deutsch– Jozsa Algorithm - Simon’s Algorithm.					
UNIT V	QUANTUM ERROR CORRECTION				9
Classical Error Correction - The Error Model, Encoding, Error Recovery - The Classical Three-Bit Code - Fault Tolerance - Quantum Error Correction - Error Models for Quantum Computing, Encoding, Error Recovery.					
					TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the foundations of traditional computing

CO2: Interpret the knowledge on the modeling of quantum circuit CO3: Infer the knowledge of basic quantum computing.

CO4: Extend the knowledge of advanced quantum algorithms.

CO5: Summarize the quantum computational complexity and error correction methods.

TEXT BOOK:

1. Jack Hidary, “Quantum Computing: An Applied Approach” Springer, 2019.

2. Chris Bernhardt “Quantum Computing for Everyone” 1stEdition, The MIT Press, 2019.

3. Wolfgang Scherer, “Mathematics of Quantum Computing: An Introduction Hardcover” Springer, 2019.

REFERENCES:

1. Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, “Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations”, 1stEdition, Springer, 2018.

2. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, 10thEdition, Cambridge University Press, 2010.

3. P. Kaye, R. Laflamme, and M. Mosca, “An introduction to Quantum Computing”, 1stEdition, Oxford University Press, 2007.

VERTICAL V

21PME34	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• To predict the importance of knowledge in management • To demonstrate the process of planning in an organization. • To illustrate functions of an industry. • To use different motivational techniques and leadership skills in the organization. • To use the various controlling techniques and tools in the organization..					
UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS				9
Definition of Management – Science or Art – Manager Vs. Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.					
UNIT II	PLANNING				9
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and					
UNIT III	ORGANISING				9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV	DIRECTING	9
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Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V	CONTROLLING	9
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System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the foundational knowledge in management. CO2:

Relate the various planning.

CO3: Illustrate various functions of organization.

CO4: Interpret the functions of motivation.

CO5: Demonstrate the practices in budget and reporting.

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

2. Stephen P. Robbins & Mary Coulter, “Management”, 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.

3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 7th Edition, Pearson Education, 2011.

REFERENCES:

1. Robert Kreitner & Mamata Mohapatra, “Management”, 1st Edition, Biztrantra, 2008.

2. Harold Koontz & Heinz Weihrich, “Essentials of Management”, 1st Edition, Tata McGraw Hill, 1998.

3. Tripathy PC & Reddy PN, “Principles of Management”, 1st Edition, Tata McGraw Hill, 1999

21PME35	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					

- To apply the foundational knowledge in Total Quality Management. - To relate the various TQM Principles. - To illustrate various TQM Tools and Techniques I. - To interpret the functions of TQM Tools and Techniques II. - To demonstrate the practices in Quality Management System.		
UNIT I	INTRODUCTION	9
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer Satisfaction, Customer complaints, Customer retention.		
UNIT II	TQM PRINCIPLES	9
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier Partnership - Partnering, Supplier selection, Supplier Rating.		
UNIT III	TQM TOOLS AND TECHNIQUES I	9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.		
UNIT IV	TQM TOOLS AND TECHNIQUES II	9
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures		
UNIT V	QUALITY MANAGEMENT SYSTEM	9
Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration. ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001— Benefits of EMS.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, learners will be able to CO1: Explain the quality management philosophies and Framework. CO2: Demonstrate the need of customer expectations, employee involvement and Supplier Partnership. CO3: Illustrate TQM tools and Techniques to improve the product and process Quality CO4: Use the modern tools to improve quality of the product. CO5: Explain the Management Standards and certification process.		
TEXT BOOKS:		
- Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre, Hemant Urdhwaresh and Rashmi Urdhwaresh, "Total Quality Management", Revised 3rd Edition, Pearson Education Asia, Indian Reprint, 2013. - James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th		

Edition, Cengage Learning, 2012.

3. Oakland J S, "TQM - Text with Cases", 3rd Edition, Butterworth - Heinemann Ltd., Oxford, 2012.

REFERENCES:

1. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", 1st Edition, Prentice Hall (India) Pvt. Ltd., 2006.
2. Suganthi.L and Anand Samuel, "Total Quality Management", 2nd Edition, Prentice Hall (India) Pvt. Ltd., 2006.
3. Ramachandran S, "Total Quality Management", 3rd Edition, Air Walk Publications, 2014. ISO9001-2015 standards

21PCB17	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
• Understanding the concept of Engineering Economics. • Implement various micro economics concept in real life. • Gaining knowledge in the field of macro economics to enable the students to have better • Understanding of various components of macro economics. • Understanding the different procedures of pricing. • Learn the various cost related concepts in micro economics.					
UNIT-I	DEMAND & SUPPLY ANALYSIS	9			
Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function Supply elasticity.					
UNIT-II	PRODUCTION AND COST ANALYSIS	9			
Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.					
UNIT-III	PRICING	9			
Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.					
UNIT-IV	FINANCIAL ACCOUNTING (ELEMENTARY 9 TREATMENT)				
Balance sheet and related concepts - Profit & Loss Statement and related concepts - - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.					
UNIT-V	CAPITAL BUDGETING (ELEMENTARY TREATMENT)	9			
Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.					
TOTAL: 45 PERIODS					

COURSE OUTCOMES:			
Upon successful completion of this course, students will acquire			
- The skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions - Evaluate the economic theories, cost concepts and pricing policies - Understand the market structures and integration concepts - Understand the measures of national income, the functions of banks and concepts of globalization - Apply the concepts of financial management for project appraisal			
TEXT BOOKS:			
1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.			
2. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, 13 th Edition,, Sultan Chand, 2007.			
3. Chan S. Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.			
REFERENCES:			
1. Donald G. Newman, Jerome P. Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.			
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.			
3. Zahid A Khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012			
4. Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009			

21PCB18	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To provide knowledge about management issues related to staffing, - To provide knowledge about management issues related to training, - To provide knowledge about management issues related to performance - To provide knowledge about management issues related to compensation - To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.					
UNIT-I	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT	9			
The importance of human resources – Objective of Human Resource Management - Human resource policies - Role of human resource manager.					
UNIT-II	HUMAN RESOURCE PLANNING	9			
Importance of Human Resource Planning – Internal and External sources of Human Resources - Recruitment - Selection – Socialization.					
UNIT-III	TRAINING AND EXECUTIVE DEVELOPMENT	9			
Types of training and Executive development methods – purpose – benefits.					
UNIT-IV	EMPLOYEE COMPENSATION	9			
Compensation plan – Reward – Motivation – Career Development - Mentor – Protege relationships.					
UNIT-V	PERFORMANCE EVALUATION AND CONTROL	9			
Performance evaluation – Feedback - The control process – Importance – Methods – grievances – Causes – Redressal methods.					

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Students would have gained knowledge on the various aspects of HRM
- Students will gain knowledge needed for success as a human resources professional.
- Students will develop the skills needed for a successful HR manager.
- Students would be prepared to implement the concepts learned in the workplace.
- Students would be aware of the emerging concepts in the field of HRM

TEXT BOOKS:

1. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2. John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition, Tata McGraw Hill, 2013, New Delhi.
2. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2007.

REFERENCES:

1. Luis R., Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, "Managing Human Resources", 7th Edition, PHI, 2012.
2. Dessler, "Human Resource Management", Pearson Education Limited, 2007

21PCB19	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: The student should be made to: • Learn the Evolution of Knowledge management. • Be familiar with tools. • Be exposed to Applications. • Be familiar with some case studies.					
UNIT-I	INTRODUCTION	9			
Introduction: An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.					
UNIT-II	CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING	9			
Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.					
UNIT-III	KNOWLEDGE MANAGEMENT-THE TOOLS	9			
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.					
UNIT-IV	KNOWLEDGE MANAGEMENT APPLICATION	9			
Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).					

UNIT-V	FUTURE TRENDS AND CASE STUDIES	9
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES: • Understand the process of acquiring knowledge from experts • Understand the learning organization. • Use the knowledge management tools. • Develop knowledge management Applications. • Design and develop enterprise applications.		
TEXT BOOKS: 1. Srikantaiah, T.K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000.		
REFERENCES: 1. Nonaka, I., Takeuchi, H., "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995.		

21PCB20	INDUSTRIAL MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations. - To study the planning; organizing and staffing functions of management in professional organization. - To study the leading; controlling and decision making functions of management in professional organization. - To learn the organizational theory in professional organization. - To learn the principles of productivity and modern concepts in management in professional organization.					
UNIT-I	INTRODUCTION TO MANAGEMENT	9			
Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.					
UNIT-II	FUNCTIONS OF MANAGEMENT - I	9			
Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.					
UNIT-III	FUNCTIONS OF MANAGEMENT - II	9			
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.					

UNIT-IV	ORGANIZATION THEORY	9
Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.		
UNIT-V	PRODUCTIVITY AND MODERN TOPICS	9
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics(concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering(BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise ResourcePlanning (ERP); Management of Information Systems (MIS).		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course the students would be able to		
CO1:Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.		
CO2:Discuss the planning; organizing and staffing functions of management in professional organization.		
CO3:Apply the leading; controlling and decision making functions of management in professional organization.		
CO4:Discuss the organizational theory in professional organization.		
CO5:Apply principles of productivity and modern concepts in management in professional organization.		
TEXT BOOKS:		
1. M. Govindarajan and S. Natarajan, "Principles of Management", Prentice Hall of India, New Delhi, 2009.		
2. Koontz. H. and Weihrich. H., "Essentials of Management: An International Perspective", 8 th Edition, Tata McGrawhill, New Delhi, 2010.		
3. S.Trevis Certo, "Modern Management Concepts and Skills", Pearson Education, 2018.		
REFERENCES:		
1. Joseph J, Massie, "Essentials of Management", 4 th Edition, Pearson Education, 1987.		
2. Saxena, P. K., "Principles of Management: A Modern Approach", Global India Publications, 2009.		
3. S.Chandran, "Organizational Behaviours", Vikas Publishing House Pvt. Ltd., 1994.		
4. Richard L. Daft, "Organization Theory and Design", South Western College Publishing, 11 th Edition, 2012.		

21PME38	INTRODUCION TO INDUSTRY 4.0	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To interpret the basic concepts of Industry 4.0 - To relate the concepts of evolution of Industry 4.0 - To construct the concepts of IIOT - To discover the real time application of Industry 4.0 - To prepare the Business opportunities and challenges in Industry 4.0					
UNIT I	INTRODUCTION TO INDUSTRY 4.0	9			

The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - The Journey so far: Developments in USA, Europe, China and other countries - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.		
UNIT II	ROAD TO INDUSTRY 4.0	9
Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics		
UNIT III	IIOT	9
Fourth Revolution – Sustainability assessment of Manufacturing Industry – Lean Production system – Smart and connected business perspective – smart factories – cyber-physical systems – collaboration platform and PLM		
UNIT IV	APPLICATIONS	9
Inventory Management and Quality Control – Plant security and safety – Facility management – oil, chemical and Pharmaceutical Industry – Milk processing and packaging industries		
UNIT V	BUSINESS ISSUES IN INDUSTRY 4.0	9
Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era – Strategies for competing in an Industry 4.0 world		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
At the end of the course, learners will be able to CO1: Show the basics of Industrial Revolution CO2: Interpret the basic concepts of Industry 4.0 CO3: Relate the Concepts of Industrial IOT in various sectors CO4: Demonstrate the applications of Industrial IOT CO5: Solve the Business issues in Industry 4.0		
TEXT BOOKS:		
1. The Fourth Industrial Revolution! by Klaus Schwab, World Economic Forum 2nd Edition 2. Arsheep Bahga and Vijay Madiseti, “Internet of Things: A Hands-On Approach”, 8th Edition, University Press. 3. NOC: "Introduction to Industry 4.0 and Industrial Internet of Things" 3rd Edition		
REFERENCES:		
1. Jean-Claude André, “Industry 4.0”, 3rd Edition, Wiley- ISTE, 2019. 2. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, “Handbook of Industry 4.0 and SMART Systems”, 2nd Edition, Taylor and Francis, 2020. 3. Miller M, “The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world”, 3rd Edition, Pearson Education, 2015		

VERTICAL VI

21PCB26	PROGRAMMING IN C	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To understand the basics of C programming and develop simple programs. - To implement decision-making and looping constructs using C. - To utilize arrays, strings, and functions in C programming. - To work with structures and unions in C programs. - To manage files using C programming techniques.					
UNIT I	C PROGRAMMING BASICS	9			
Introduction to ‘C’ programming – fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations.					
UNIT II	DECISION MAKING AND LOOPING STATEMENTS	9			
Decision Making - if - if-else - nested if-else – else-if ladder statement – switch – goto – Looping Statements for-while – do-while – break – continue statements – Problem solving with decision making and looping statements.					
UNIT III	ARRAYS, STRINGS AND FUNCTIONS	9			
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions.					
UNIT IV	STRUCTURES AND UNIONS	9			
Introduction-Defining a Structure- Declaring Structure Variables – Accessing Structure Members Structure Initialization- Arrays of Structures- Arrays within Structures – Nested Structures – Self Referential Structures- Structures and Functions – Unions.					
UNIT V	FILE MANAGEMENT	9			
Introduction-Defining and Opening a File-Closing a File- Input / Output Operations on File- Error Handling during I/O operations-Random Access to Files-Command Line Arguments.					
					TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: - Understand the basics of C programming and develop simple programs. - Implement decision-making and looping constructs in C programs. - Utilize arrays, strings, and functions in C programming. - Make use of structures and unions in C programs. - Develop C program using file concepts.					
TEXTBOOKS: - Balagurusamy, E, “Programming in Ansi C”,6th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2012 - Anita Goel ,Ajay Mittal, ” Computer Fundamentals and Programming in C”,1st Edition, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011. - Behrouz A. Forouzan, Richard F.Gilberg, “A Structured Programming Approach using C”,3rd Edition, Thomson Course Technology, 2007.					
REFERENCES: - Yashavant P. Kanetkar, “ Let Us C”, BPB Publications,15th Edition 2017. - Kernighan.B.W ,Ritchie.D.M, “The C Programming language”, Pearson Education,2nd Edition, 2006. - Byron S Gottfried, ” Programming with C ”, Schaum’s Outlines, Tata McGraw-Hill,2nd Edition, 2006.					

21PCB27	FUNDAMENTALS OF DATA STRUCTURES				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: - To understand the concepts of ADTs in linear data structures - To learn the concepts of stacks and queues - To develop skills for applying non-linear data structures - To familiarize with some graph algorithm such as shortest path and minimum spanning tree - To discuss various hashing algorithms								
UNIT I	LINEAR DATA STRUCTURES – LIST							9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation -singly linked lists- doubly linked lists – applications of lists- Polynomial Manipulation.								
UNIT II	LINEAR DATA STRUCTURES-STACK & QUEUE							9
Stack ADT – Evaluating arithmetic expressions- other applications- Queue ADT – circular queue implementation – Double ended Queues – applications of queues.								
UNIT III	TREE STRUCTURES							9
Introduction-Terminologies-General Tree- Representations-Binary Tree- Representations-Traversal Operations on a Binary Tree-Conversion of General Tree to Binary Tree- Binary Search Trees-Operations on Binary Search Tree								
UNIT IV	HASH STRUCTURES							9
Hashing – Separate chaining – open addressing – Linear Probing-Quadratic Probing-Double Hashing-rehashing – extendible hashing- Applications.								
UNIT V	GRAPH STRUCTURES							9
Introduction-Terminologies-Representations-Traversals-Applications-Dijkstra’s Single Path Problem - Topological Sort-Minimum Spanning Trees-Prim’s and Kruskals								
							TOTAL: 45 PERIODS	
COURSE OUTCOMES: At the end of the course, learners will be able to: - Make use of different linear data structures in standard sample applications. - Develop code to implement the Stack and Queue abstract data types for linear data structures - Demonstrate the performance of various trees data structures. - Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval - Use the concept of Graph data structures for shortest path and minimum spanning tree								
TEXT BOOKS: - Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2009. - Krishnamoorthy,R, Indirani Kumaravel,G, “Data Structures using C”,1st Edition Tata McGraw-Hill Publishing Company Limited, 2008. - Reema Thareja, “Data Structures Using C”, 2nd Edition, Oxford University Press, 2011.								
REFERENCES: - ISRD Group, “Data Structures using C”, 2nd Edition, McGraw-Hill Education (India) Private Limited, 2013. - Gilberg. R. F, Forouzan. B. A, “Data Structures”, Thomson India Edition, 2nd Edition, 2005. - Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 2nd Edition, 2013.								

21PCB28	OBJECT ORIENTED PROGRAMMING USING JAVA	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To implement object-oriented designs using Java. - To extend Java classes through inheritance and dynamic binding. - To utilize the Java Collections API and Packages. - To handle exceptions using exception classes. - To make use of String Classes in Java					
UNIT I	JAVA FUNDAMENTALS				9
Introduction to Java - Java Architecture –keywords –Identifiers –Variables – Data types–Operators–Type conversion–Selection control Structure –Iteration Control Structure					
UNIT II	INTRODUCTION TO OBJECT ORIENTED PROGRAMMING				9
Introduction to Object Oriented Programming–Methods – Constructors – This keyword –Memory management–Encapsulation - Abstraction - Access Modifiers – Arrays					
UNIT III	INHERITANCE & POLYMORPHISM				9
Introduction to inheritance- Single Inheritance – Multilevel Inheritance –Polymorphism –Method overloading – Method Overriding –Constructor overloading –Super keyword –Final Keyword- Static modifier –Abstract class – Interfaces.					
UNIT IV	COLLECTIONS , PACKAGES AND EXCEPTION HANDLING				9
Collection Interface – Collection Class – Array List –Linked List –Introduction to Package –Import – Exception – Try – Throw– throws – Catch –Finally – User defined Exception					
UNIT V	STRING HANDLING				9
String Constructors – Character extraction – String Comparison – Searching strings – String Buffer-String Builder					
					TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: - Develop program using Java Fundamentals. - Understand the principles of Object-Oriented Programming. - Implement concepts of Inheritance & Polymorphism effectively. - Utilize Collections, Packages, and Exception Handling in Java programming. - Make use of string handling operations in Java.					
TEXT BOOKS: - Herbert Schildt, “Java-The Complete Reference”, 8th Edition, McGraw Hill Professional, 2011. - Cay S. Horstmann, Gary cornell,”Core Java Volume -I Fundamentals”, 9th Edition, Prentice Hall, 2013. - Steven Holzner,”Java 2 Black book”, 5th Edition Dreamtech press, 2011.					
REFERENCES: - Timothy Budd, “Understanding Object-oriented programming with Java”, 1st Edition, Pearson Education, 2000 - Paul Dietel and Harvey Deitel, “Java How to Program”, 8th Edition, Prentice Hall of India. - Mahesh P. Matha, “Core Java -A Comprehensive Study”, 1st Edition,Prentice Hall of India, 2011.					

21PCB29	INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To learn the fundamentals of data models and to represent a database system using ER diagrams. - To study the fundamentals of SQL Queries – DDL, DML & TCL. - To use various SQL functions to perform calculation on data, retrieve data from tables - To describe the features and syntax of PL/SQL - To discuss normalization techniques with simple examples					
UNIT I	INTRODUCTION				9
Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys, Entity-Relationship Diagram, Extended E-R features.					
UNIT II	SQL FUNDAMENTALS				9
SQL Fundamentals - Data types - Database Language commands: Data Definition Language (DDL): CREATE, ALTER, TRUNCATE, DROP - constraints: Entity Integrity Constraints -Referential Integrity Constraints - Data Manipulation Language (DML): INSERT, SELECT, UPDATE, DELETE - Transactional Control: Commit, Save point, Rollback - DCL Commands: Grant and Revoke					
UNIT III	IN BUILT FUNCTIONS AND JOINS				9
Operators Arithmetic, Comparison, Logical SQL functions- Single row function - SQL functions: Single row function- Numeric Functions (abs, power, mod, round, trunc, sqrt) - Conversion Functions (to-char, to-date, to-number) - Groupby, Having and Order by clause - Joins: Simple, Equi-join, Non-equi, Self-Joins, Outer-joins - Subqueries - Multiple, Correlated - Implementation of Queries using SQL Set operators: Union, union all, Intersect, Minus					
UNIT IV	PL/ SQL AND TRIGGERS				9
Basics of PL / SQL: Data types - Creating and Executing a PL/SQL Block - Control Structures: Conditional, Iterative, Sequential - Exceptions: Predefined Exceptions, User defined exceptions - Cursors: Static (Implicit & Explicit), Dynamic - Procedures & Functions - Database Triggers					
UNIT V	DATABASE DESIGN				9
Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form					
					TOTAL: 45 PERIODS
COURSE OUTCOMES:					
At the end of the course, learners will be able to:					
- Build a database by understanding ER Diagrams and mapping the ER model with relational model - Construct a database schema and manipulate the database using SQL queries. - Learn to use joins and build in functions. - Make use of PL/SQL and triggers for creating and maintaining the tables in RDBMS - Build a database for a given application					
TEXT BOOKS:					
- Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2008. - Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, 6th Edition, Tata Mc Graw Hill, 2011. - C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.					

REFERENCES:

1. Atul Kahate, "Introduction to Database Management Systems", 2nd Edition, Pearson Education, New Delhi, 2012.
2. Alexis Leon and Mathews Leon, "Database Management Systems", Edition Vikas Publishing House Private Limited, New Delhi, 2003.
3. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

21PCB30	FUNDAMENTALS OF OPERATING SYSTEMS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES: - To provide basic knowledge about the services rendered by operating systems - To explain the various issues related to process management - To provide a detailed discussion of the various memory management techniques - To discuss the various file-system design and implementation issues - To discuss how the protection domains, help to achieve security in a system.					
UNIT I	INTRODUCTION AND PROCESS CONCEPT				9
Basic OS Concepts - User's view of the OS - Architectural support - OS services - OS structures - System calls - Building and Booting OS - Process - Threads - Multithreading					
UNIT II	MULTITHREADED PROGRAMMING AND PROCESS SCHEDULING				9
Thread and process scheduling - Types of schedulers - Scheduling Policies – Inter-process synchronization - Critical Section problem - Hardware and Software solutions					
UNIT III	DEADLOCK AND INTERPROCESS COMMUNICATION				9
Semaphores - Monitors – Inter-process communication - Deadlocks: Characterization - Handling of deadlocks - Prevention - Avoidance - detection and recovery.					
UNIT IV	MEMORY MANAGEMENT SYSTEM				9
Memory Management - Contiguous allocation - Static and dynamic partitioned memory allocation - Non-contiguous allocation - Paging - Segmentation - Virtual Memory - Demand Paging.					
UNIT V	FILE SYSTEMS				9
Need for files - File abstraction - File naming - File system organization - File system optimization - Reliability - Security and protection - I/O management and disk scheduling - Recent trends and development. Case Study: Linux and Windows OS					
					TOTAL: 45 PERIODS
COURSE OUTCOMES: At the end of the course, learners will be able to: - Summarize the overview of Computer and Operating Systems. - Estimate CPU Scheduling for the given sample data. - Solve deadlock using prevention and avoidance algorithms. - Estimate memory management for given sample data. - Examine disks scheduling algorithms and file system structures using illustration.					
TEXT BOOKS: - Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012 - Gary Nutt, “Operating Systems”, 3rd Edition, Pearson Education, 2004. - Harvey M. Deitel, “Operating Systems”, 3rd Edition, Pearson Education, 2004.					
REFERENCES: - Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems -A Spiral Approach”, Tata McGraw Hill Edition, 2010. - Achyut S. Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016. - Andrew S. Tanenbaum, “Modern Operating Systems”, 2nd Edition, Pearson Education, 2004.					

21PCB31	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
- To introduce the basics of data communications in Computer Networks. - To examine and understand the physical and data link layer - To learn the functions of network layer and the various routing protocols - To familiarize the functions and protocols of the Transport layer - To understand the different protocols at Application layer					
UNIT I	DATA COMMUNICATION				9
Data Transmission - Multiplexing - Data Encoding Techniques - Introduction to computer networks - Network - Topologies - Reference Models: ISO/OSI Model and TCP/IP Model.					
UNIT II	PHYSICAL AND DATALINK LAYER				9
Transmission Media - Analog signals - Digital Signals - Data Link Layer - Error Detection and Correction - Parity - LRC - CRC - Hamming Code - Flow Control and Error Control - Stop and wait - ARQ - Sliding window - IEEE 802.3 Ethernet					
UNIT III	NETWORK LAYER				9
Packet Switching and Circuit Switching - IP addressing methods - Subnetting - Supernetting - Routing Protocols: IP - ARP - RARP - DHCP - Routing Algorithms: Distance Vector Routing - Link State Routing.					
UNIT IV	TRANSPORT LAYER				9
Transport Services - UDP - TCP - Congestion Control - Quality of Services (QOS).					
UNIT V	APPLICATION LAYER				9
Domain Name Space (DNS) - Electronic Mail - HTTP - WWW					
					TOTAL: 45 PERIODS
COURSE OUTCOMES:					
At the end of the course, learners will be able to:					
- Describe communication protocols and layered networked architecture - Familiarize with the transmission media, flow control and error detection mechanism - Understand fundamental concept in routing, addressing and working of Network Protocol - Gain familiarity with common transport protocols - Explain the different protocols used at application Layer					
TEXT BOOKS:					
- Behrouz A.Forouzan,“Data communication and Networking”,4th Edition, Tata McGraw Hill,2011. - Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers, 2011. - William Stallings,” Data and Computer Communications” 8th Edition , Pearson Education Ltd.2017					
REFERENCES:					
- James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, 5th Edition, Pearson Education, 2009. - Nader. F. Mir, “Computer and Communication Networks”, 3rd Edition, Pearson Prentice Hall Publishers, 2010. - Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, 2nd Edition, Tata Mc Graw Hill Publisher, 2011.					

21PCB32	INTERNET AND WEB TECHNOLOGIES		L	T	P	C
			3	0	0	3
COURSE OBJECTIVES:						
- To introduce the fundamentals of Internet, and the principles of web design. - To construct basic websites using HTML and Cascading Style Sheets. - To build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms - To practice server-side programming features PHP for developing Database Application.						
UNIT I	INTERNET BASICS					9
Evolution of the internet and World Wide Web-Web Basics-Client Side Scripting and Server Side Scripting-World Web Wide Consortium-Web2.0-Basic Internet Protocols-HTTP Request and Response Message-Web Client-Web server.						
UNIT II	HTML					9
Introduction to HTML5-HTML Elements - Headings - Lists - Links – Images-Tables-Frames-Forms-Page Structure Elements.						
UNIT III	CASCADING STYLE SHEET					9
Introduction to CSS – CSS Features-CSS Core Syntax- - Positioning Elements-backgrounds-Text Properties-Box Model-Normal flow Box Layout.						
UNIT IV	CLIENT SIDE SCRIPTING JAVA SCRIPT					9
Introduction- Syntax-Variables and Data Types –Statements- Operators – Functions- Objects-Arrays- Built in Objects.Document tree-DOM Event Handling.						
UNIT V	SERVER SIDE SCRIPTING PHP					9
Introduction-Data types-Operators-Arrays –Strings – String Processing using Regular expression-Forms Processing –Databases: Connection to Server-DDL and DML operations-Cookies.						
						TOTAL: 45 PERIODS
COURSE OUTCOMES:						
At the end of the course, learners will be able to:						
- Review the current topics in Web & Internet technologies. - Make use of HTML elements for designing static web pages. - Utilize CSS and its properties for designing styling web pages. - Develop client-side scripting with JavaScript for interactive web pages. - Implement server-side scripting using PHP for dynamic web content. system						
TEXT BOOKS:						
- Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet & World Wide Web How to Program”, Fifth Edition, Deitel Series, 2012. - Jason Gilmore, “Beginning PHP and MySQL from Novice to Professional”, Fourth Edition, Apress Publications, 2010 - Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.						
REFERENCES:						
- Robert W. Sebesta, “Programming with World Wide Web”, Fourth Edition, Pearson, 2008. - David William Barron, “The World of Scripting Languages”, Wiley Publications, 2000. - Breitman, Karin, Marco Antonio Casanova, Walt Truszkowski, “Semantic Web: Concepts, Technologies and Applications”, Springer Science & Business Media, 2007. - Khan, Badrul Huda et al., “Web-Based Instruction Educational Technology”, 1997.						

21PCB33	SOFTWARE ENGINEERING				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES: - To understand the phases in a software project - To understand fundamental concepts of requirements engineering and Analysis Modeling. - To demonstrate the various software design methodologies - To learn various testing and maintenance measures - To explain the quality management and different types of metrics used in software project management								
UNIT I	SOFTWARE PROCESS AND AGILE DEVELOPMENT							9
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.								
UNIT II	REQUIREMENTS ANALYSIS AND SPECIFICATION							9
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.								
UNIT III	SOFTWARE DESIGN							9
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.								
UNIT IV	TESTING AND MAINTENANCE							9
Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.								
UNIT V	PROJECT MANAGEMENT							9
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS								
							TOTAL: 45 PERIODS	
COURSE OUTCOMES: At the end of the course, learners will be able to: - Identify the key activities in managing a software project. - Concepts of requirements engineering and Analysis Modeling. - Apply systematic procedure for software design and deployment. - Compare and contrast the various testing and maintenance. - Manage project schedule, estimate project cost and effort required.								
TEXT BOOKS: 1.Roger S. Pressman, "Software Engineering -A Practitioner's Approach",7th Edition, Mc Graw-Hill International Edition, 2010. 2.Ian Sommerville,"Software Engineering", 9th Edition, Pearson Education Asia, 2011. 3. Stephen R.Schach,"Software Engineering",2nd Edition, Tata McGraw-Hill Publishing Company Limited, 2007.								
REFERENCE BOOKS 1.Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, PHI Learning Private Limited, 2009. 2.Pankaj Jalote,"Software Engineering-A Precise Approach", 3rd Edition ,Wiley India, 2010 3.Kelkar S.A., "Software Engineering", 3rd Edition, Prentice Hall of India Pvt. Ltd, 2007.								