DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

PERAMBALUR - 621212

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

B.E.CSE (CYBER SECURITY)

CURRICULUM & SYLLABI

DEPARTMENT OF CYBER SECURITY

(Applicable to students admitted from the Academic year 2023 – 2024 and subsequently under Choice Based Credit System)

Discussed in BOS-2 meeting Dated: 22.08.2024 / Cyber Security Ratified & Approved in Academic Council

VISION MISSION OF THE INSTITUTUION

Vision:

An active and committed centre of advanced learning focused on research and training in the fields of Engineering, Technology and Management to serve the nation better.

Mission:

- To develop eminent scholar with a lifelong follow up of global standards by offering UG,PG and Doctoral Programmes.
- To pursue Professional and Career growth by collaborating mutually beneficial partnership with industries and higher institutes of research.
- To promote sustained research and training with emphasis on human values and leadership qualities.
- To contribute solutions for the need based issues of our society by proper ways and means as dutiful citizen.

DEPARTMENT OF CYBER SECURITY

About the Department

The Department of Cyber Security has extremely experienced faculty each with atleast a decade of teaching experience. The Faculty have a profound research background in the areas of Computer Network and Secuity. The Department offers UG in Cyber Security and in the emerging areas. Department Labs have been functioning on cutting edge technologies such as IoT, Cyber Security, Cloud and Software Engineering. The Cyber Security department is focuses on protecting computer systems, networks, and data from cyber threats. It combines elements of computer science, information security, cryptography, and ethical hacking to develop secure digital environments.

Vision

To promote highly ethical and innovative cyber security professionals through excellence in teaching, training, and research.

Mission

M1: To produce globally competent cyber security experts, motivated to learn emerging technologies and Innovate in solving real-world security challenges.

M2: To foster research activities among students and faculty that enhances societal security and resilience.

M3: To impart moral and ethical values in their profession, ensuring a strong commitment to cyber security ethics and responsible practices.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To mould students to exhibit top performance in the higher education and research and to become the State–of–the–art technocrat.
PEO 2	To impart the necessary background in Cyber Security by providing solid foundation in Mathematical Science and Engineering with security fundamentals.
PEO 3	To equip the students with the breadth of Cyber Security threats innovate novel security solutions for the benefit of common man.
PEO 4	To groom the students to be multifaceted entrepreneurs with professional ethical attitude in broader social perspective.
PEO 5	To groom the students to be multifaceted entrepreneurs with professional ethical attitude in broader social perspective.

PROGRAM OUTCOMES (POs)

PO	GraduateAttribute
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature, and analyse Complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PO4	**Conductinvestigationsofcomplexproblems**: Use research–based knowledge and research Methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the Limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, And cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	**Environmentandsustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and Need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	**Individualandteamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	**Projectmanagementandfinance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	**Life – longlearning**: Recognize the need for, and have the preparation and ability to engage in independent and life–long learning in the broadest context of technological change .

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1	Exhibit proficiency in planning, implementing and evaluating team oriented–software Programming solutions to specific cyber threat problems and society needs.
PSO 2	Demonstrate professional skills in applying programming skills, competency and decision making capability through secure tools with hands–on experiences.
PSO 3	Apply logical thinking in analyzing complex real world problems, and use professional and ethical behaviors to provide proper solutions to those cyber problems.
PSO 4	Demonstrate the ability to work effectively as part of a team in applying security technology to business and personal situations.

PEO's – PO's & PSO's MAPPING:

PEO	**PO**												**PSO**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
I.	**3**		**3**			**2**								**2**		
II.	**2**	**2**		**3**									**3**		**2**	
III.				**2**	**3**	**3**	**3**								**2**	
IV.							**2**	**1**	**2**		**3**				**2**	**2**
V.										**2**	**3**	**3**				**2**

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS), PERAMBALUR – 621 212.
B.E. CSE (CYBER SECURITY)

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	IP3151	Induction Programme	-	-	-	-	-	-
2	U23HST11	Communicative English	HS	3	0	0	3	3
3	U23MAT12	Matrices and Calculus	BS	3	1	0	4	4
4	U23BST13	Physics for Engineers and Technologists	BS	3	0	0	3	3
5	U23CYT14	Chemistry for Engineering & Technology	BS	3	0	0	3	3
6	U23GET15	Problem Solving and Python Programming	ES	3	0	0	3	3
7	GE3152	தமிழர் மரபு / Heritage of Tamils	HS	1	0	0	1	1
PRACTICAL								
8	U23GEP13	Problem Solving andPython ProgrammingLaboratory	ES	0	0	4	4	2
9	U23BSP11	Physics and Chemistry Laboratory	BS	0	0	4	4	2
10	U23HSP12	English Laboratory	EE	0	0	2	2	1

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23HST21	Professional English	HS	3	0	0	3	2
2	U23MAT22	Statistics and Numerical Methods	BS	3	1	0	4	4
3	U23PHT25	Physics for Information Science	BS	3	0	0	3	3
4	U23EET23	Basic Electrical and Electronics Engineering	ES	3	0	0	3	3
5	U23ECT23	Digital Principles and System Design	ES	3	1	0	4	4
6	U23CST21	Programming in C	PC	3	0	0	3	3
7		NCC Credit Course Level 1	-	-	-	-	-	2*
8	GE3252	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	1
PRACTICAL								
9	U23CSP21	Programming in C Laboratory	PC	0	0	4	4	2
10	U23HSP22	Communication Laboratory	EE	0	0	2	2	2

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MAT32	Discrete Mathematics	BS	3	1	0	4	4
2	U23CST31	Computer Architecture & Organization	PC	3	0	0	4	3
3	U23CST32	Data Structures	PC	3	0	0	4	3
4	U23CST33	Database Management Systems	PC	3	0	0	4	3
5	U23CST34	Object Oriented Programming	PC	3	0	0	4	3
PRACTICAL								
6	U23CSP31	Database Management Systems Laboratory	PC	0	0	4	4	2
7	U23CSP32	Data Structures Laboratory	PC	0	0	4	4	2
8	U23CSP33	Object Oriented Programming Laboratory	PC	0	0	4	4	2

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT41	Foundations Of Data Science	PC	3	1	0	3	3
2	U23AIT44	Fundamentals of Computer Networks and communication	PC	3	0	0	3	3
3	U23CBT43	Cryptography and Cyber Security	PC	3	0	0	3	3
4	U23CBT44	Operating Systems and Security	PC	3	0	0	3	3
5	U23CBT45	Introduction to Cyber Security	PC	3	0	0	3	3
6	U23GET41	Environmental Science and Engineering	BS	3	0	0	3	2
PRACTICAL								
7	U23CBP41	Foundations of Data Science Laboratory	PC	0	0	4	4	2
8	U23CBP42	Cryptography and Cyber Security Laboratory	PC	0	0	4	4	2

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23ITT62	Artificial Intelligence and Machine Learning	PC	3	0	0	3	3
2	U23CBT53	Engineering Secure Software Systems	PC	3	0	0	3	3
3	U23CST64	Information Security	PC	3	0	0	3	3
4		Professional Elective-I	PE	3	0	0	3	3
5		Open Elective-I	OE	3	0	0	3	3
PRACTICAL								
6	U23CBP51	Artificial Intelligence and Machine Learning Laboratory	PC	0	0	4	4	2
7	U23CBP52	Engineering Secure Software Systems Laboratory	PC	0	0	4	4	2

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT61	Embedded Systems and IOT	PC	3	0	0	3	3
2	U23CBT62	Network Security	PC	3	0	0	3	3
3	U23CBT63	Ethical Hacking	PC	3	0	0	3	3
4		Professional Elective - II	PE	3	0	0	3	3
5		Professional Elective - III	PE	3	0	0	3	3
6		Elective – Management	HS	3	0	0	3	3
PRACTICAL								
7	U23CBP61	Embedded Systems and IOT Laboratory	PC	0	0	4	4	2
8	U23CBP62	Network Security Laboratory	PC	0	0	4	4	2

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT71	Cyber Forensics	PC	3	0	0	3	3
2	U23GET61	Human Values and Ethics	HS	3	0	0	3	2
3	U23CBT73	Security and Privacy in Cloud	PC	3	0	0	3	3
4		Professional Elective – IV	PE	3	0	0	3	3
5		Professional Elective – V	PE	3	0	0	3	3
PRACTICAL								
6	U23CBP71	Cyber Forensics Laboratory	PC	0	0	4	4	2
7	U23CBP72	Mini Project	PC	0	0	4	4	2

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT81	Malware Analysis	PC	3	0	0	3	3
2		Professional Elective VI	PE	3	0	0	3	3
PRACTICAL								
3	U23CBP81	Project Work	EE	0	0	12	12	10

VERTICAL – I (Full Stack Development)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23ITT43	Web Technology	PE	3	0	0	3	3
2	U23CSV22	App Development	PE	3	0	0	3	3
3	U23CSV23	Cloud Services Management	PE	3	0	0	3	3
4	U23CSV24	UI and UX Design	PE	3	0	0	3	3
5	U23CSV25	Software Testing and Automation	PE	3	0	0	3	3
6	U23CSV28	Principles of Programming Languages	PE	3	0	0	3	3
7	U23ITV27	Devops	PE	3	0	0	3	3
8	U23CSV26	Web Application Security	PE	3	0	0	3	3
9	U23CBT51	Theory of Computation	PC	3	0	0	3	3

VERTICAL – II (Cloud Computing and Data Center Technologies)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CST71	Cloud Computing	PE	3	0	0	3	3
2	U23CSV32	Virtualization	PE	3	0	0	3	3
3	U23CBV23	Digital Watermarking and Steganography	PE	3	0	0	3	3
4	U23ITV31	Data Warehousing	PE	3	0	0	3	3
5	U23CSV34	Storage Technologies	PE	3	0	0	3	3
6	U23CSV35	Software Defined Networks	PE	3	0	0	3	3
7	U23AIV61	Distributed Computing	PE	3	0	0	3	3
8	U23CSV36	Stream Processing	PE	3	0	0	3	3

VERTICAL – III (Cyber Security and Data Privacy)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV47	Android Security	PE	3	0	0	3	3
2	U23CBV32	Web & Database Security	PE	3	0	0	3	3
3	U23CBV33	Mobile Application Security	PE	3	0	0	3	3
4	U23CSV43	Social Network Security	PE	3	0	0	3	3
5	U23CSV44	Modern Cryptography	PE	3	0	0	3	3
6	U23ITV41	Digital and Mobile Forensics	PE	3	0	0	3	3
7	U23CSV46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	3
8	U23CSV26	Web Application Security	PE	3	0	0	3	3

VERTICAL – IV (Emerging Technologies)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV51	Augmented Reality/Virtual Reality	PE	3	0	0	3	3
2	U23CSV61	Robotic Process Automation	PE	3	0	0	3	3
3	U23CSV13	Neural Networks and Deep Learning	PE	3	0	0	3	3
4	U23CBV44	Intrusion Detection and Prevention System	PE	3	0	0	3	3
5	U23CSV64	Quantum Computing	PE	3	0	0	3	3
6	U23CBV46	Ad-hoc & Sensor Networks	PE	3	0	0	3	3
7	U23CSV56	Game Development	PE	3	0	0	3	3
8	U23CSV66	3D Printing and Design	PE	3	0	0	3	3

VERTICAL – V (Data Science)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV15	Business Analytics	PE	3	0	0	3	3
2	U23CSV17	Computer Vision	PE	3	0	0	3	3
3	U23AIV65	Human Computer Interaction	PE	3	0	0	3	3
4	U23CBV54	Edge Analytics	PE	3	0	0	3	3
5	U23CST72	Natural Language processing	PE	3	0	0	3	3
6	U23CBV56	Multimedia Security and Forensics	PE	3	0	0	3	3
7	U23ITV65	Optimization Techniques	PE	3	0	0	3	3
8	U23CBV58	Big Data Analytics	PE	3	0	0	3	3

VERTICAL – VI (Social Engineering)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV67	Knowledge Engineering	PE	3	0	0	3	3
2	U23CBV62	Software Project Management	PE	3	0	0	3	3
3	U23ITV45	Cloud Security	PE	3	0	0	3	3
4	U23CBV64	5G Technologies	PE	3	0	0	3	3
5	U23CBV65	IoT Security	PE	3	0	0	3	3
6	U23CSV44	Modern Cryptography	PE	3	0	0	3	3
7	U23CBV67	Cyber Law and Ethics	PE	3	0	0	3	3
8	U23CBV68	Biometric Security	PE	3	0	0	3	3

ELECTIVE - (Management Courses)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23GET71	Principles of Management	EM	3	0	0	3	3
2	U23GET72	Total Quality Management	EM	3	0	0	3	3
3	U23GET73	Engineering Economics and Financial Accounting	EM	3	0	0	3	3
4	U23GET74	Human ResourceManagement	EM	3	0	0	3	3
5	U23GET75	Knowledge Management	EM	3	0	0	3	3
6	U23GET76	Industrial Management	EM	3	0	0	3	3

OPEN ELECTIVE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT45	Introduction to Cyber Security	OE	3	0	0	3	3
2	U23CBT53	Engineering Secure Software Systems	OE	3	0	0	3	3
3	U23CST64	Information Security	OE	3	0	0	3	3
4	U23CBT62	Network Security	OE	3	0	0	3	3
5	U23CBT61	Embedded Systems and IoT	OE	3	0	0	3	3
6	U23CBT71	Cyber Forensics	OE	3	0	0	3	3
7	U23CBT43	Cryptography and Cyber Security	OE	3	0	0	3	3
8	U23CBT63	Ethical Hacking	OE	3	0	0	3	3
9	U23CBT73	Security and Privacy in Cloud	OE	3	0	0	3	3

SUMMARY

Sl. No.	Subject Area	Credits per semester								Credits Total	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Sciences	4	3	-	-	-	3	2	-	12	7.31
2	Basic Sciences	12	7	4	2	-	-	-	-	25	15.24
3	EngineeringSciences	5	7	-	-	-	-	-	-	12	7.31
4	Professional Core	-	5	18	19	13	13	10	3	81	49.09
5	ProfessionalElective	-	-	-	-	3	6	6	3	18	10.97
6	Open Elective	-	-	-	-	3	-	-	-	3	1.82
7	Employability Enhancement Courses	1	2	-	-	-	-	-	10	13	7.92
	Total	**22**	**24**	**22**	**21**	**19**	**22**	**18**	**16**	**164**	**100%**

SEMESTER - I

		L	T	P	C
U23HST11	**COMMUNICATIVE ENGLISH (COMMON TO ALL B.E./ B.TECH. PROGRAMMES)**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To enhance students listening ability for academic and Professional purposes.
2. To learn to use basic grammatical structures in suitable contexts
3. To help students acquire the ability to speak effectively in English in real - life situations.
4. To help learners use language effectively in professional contexts.
5. To develop students' ability to read and write complex texts, summaries, articles, definitions, Paragraph user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 9

Define communication. Kinds of communication. Quintessential of communication in technical progression. Key characteristics of an effective communicator- listening, attitude modification, way of response with appropriate language, tone modulation.

Listening- Listening to TV news, Guest lectures. Speaking- Answering the Questions.

Reading - Reading brochures and technical magazines (technical context), telephone messages / social media messages relevant to technical contexts and emails, **Writing**-Reading comprehension, Parts of Speech.

UNIT II READING QUEST 9

Listening- listening and responding to video lectures/talks. **Speaking**- Day today conversations. **Reading** –Edison of India-GD Naidu "The Great Inventor". **Writing-** Emails / Informal Letters - Inviting, Congratulating & Thanking, Punctuations.

UNIT III LANGUAGE RESOURCE GROWS CRITICAL JUDGEMENT 9

Listening- listening to specific task-focused audio tracks. Speaking- summary of Robert Frost "Stopping by woods on a snowy evening". Reading – Reading advertisements, gadget reviews; user manuals. Writing – Essay Writing: Analytical essay: Narrative Essay, Developing Hints, Usage of tenses in sentence formation. Voices.

UNIT IV LANGUAGE IN LIFE SKILL 9

Listening- Listening to speech of Great Scholars. Speaking- mechanics of presentation. **Reading** – Newspaper articles, power point presentation. **Writing** – Checklist, Jumbled Sentences - Rearrange the sentences in correct order, WH-Questions-Form questions by using statements, Prefixes and Suffixes.

UNIT V IMPROVING SPEAKING &READING 9

Listening- listening to situational based dialogues; **Speaking-** Stating intention to do something- Expressing opinion-asking people to repeat themselves**. Reading** – Summary of O.Henry's "The last Leaf". **Writing** – Dialogue Writing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Remember appropriate words in a situational conversation.
CO2: Gain understanding of basic grammatical structures and use them in right context.
CO3: Read and infer the denotative and connotative meanings of technical texts.
CO4: Write Dialogue, Letter and paragraphs on various topics.
CO5: Make the students prepare effective notes for main sources available.
CO6: Enhance them to give operational talk.

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition).
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3. The Gift of the Magi by O.Henry, McClure, Philips and company.

REFERENCE BOOKS:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communication – Principles and Practices", Oxford Univ. Press, 2016, New Delhi.
2. Lakshminarayanan, "A Course Book on Technical English",SciTech Publications (India) Pvt. Ltd.
3. AyshaViswamohan, "English for Technical Communication (With CD)", Mcgraw Hill Education.
4. Kulbhusan Kumar, RS Salaria, "Effective Communication Skill", Khanna Publishing House.
5 Dr. V. Chellammal, "Learning to Communicate", Allied Publishing House, New Delhi,2003.

U23MAT12 **MATRICES AND CALCULUS**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students:

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize the student with functions of several variables
4. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
5. To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems

UNIT I MATRICES 12

Introduction – Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton theorem – Diagonalization of the matrices by Orthogonal Transformations – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of a function – Continuity – Derivatives – Differentiation rules – Implicit differentiation – Logarithmic differentiation – Maxima and Minima of functions of one variable.

UNIT III MULTIVARIABLE CALCULUS 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRAL AND THEIR APPLICATIONS 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.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients– Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients – Method of undetermined coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

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

CO2: Use both the limit definition and rules of differentiation to differentiate functions.

CO3: Apply differential calculus tools in solving various application problems.

CO4: Able to use differential calculus ideas on several variable functions.

CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

CO6: Solve the ordinary differential equations using different techniques for that model engineering problems.

TEXT BOOKS:

1. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

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

U23BST13	PHYSICS FOR ENGINEERS AND TECHNOLOGISTS (COMMON TO ALL B.E./ B.TECH. PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To make the students to gain the knowledge in elastics and plastic nature of the materials in the presence and absence of load.
2. To understand the students to know the application of the sound waves in different fields.
3. To motivate the students towards the applications of photo electric phenomena.
4. To know the physical principle of LASER, the working of LASER applications.
5. To understand the propagation of light in optical fibers and its applications.

UNIT I ELASTICITY 9

Introduction- Elasticity - plasticity– Hooke's law - relationship between three Modulii of elasticity (Qualitative) – stress & strain diagram and its uses -Poisson's ratio - factors affecting elasticity - twisting couple of wire - Torsion Pendulum: theory and experiment.

Beam: Internal bending moment – Cantilever: theory and experiment – Young's Modulus: uniform and non – uniform bending (Qualitative) – I-shaped girders- advantages and applications.

UNIT II ULTRASONICS 9

Introduction – classification of sound- properties of infrasonic, audible and ultrasonics - production: Magnetostriction and Piezoelectric methods – determination of velocity of sound in liquid (Acoustic Grating Method) – general applications – industrial application: Non - Destructive Testing: pulse echo system through transmission and reflection modes. ultrasonic scanning methods – medical application: sonogram.

UNIT III MODERN PHYSICS 9

Introduction –Black Body Radiation – Classical and Quantum Laws of Black Body Radiation - Photon and its Properties - Wave Particle Duality and Matter waves – De - Broglie Wavelength - Schrodinger's Time Independent and Time Dependent Wave Equations - Physical Significance of The Wave Function. Application: Particle in One Dimensional Box - Normalization Process – Photo Electric Effect – Laws Governing the Photoelectric Effect – Einstein's Formula - Derivation – Applications: Solar Cell – Solar Water Heater – Photo resistor (LDR).

UNIT IV LASERS 9

Lasers: Introduction - Properties of Laser-Spontaneous and Stimulated Emission Process - Einstein's Theory of Matter Radiation Interaction & A and B Coefficients; Amplification of Light By Population Inversion – Pumping Methods - Types of Lasers: Solid-State Laser (Homo And Hetero Junction Semiconductor Lasers), Gas Laser (CO_2), Applications: Laser Cutting and Welding, LIDAR and Barcode Scanner.

UNIT V FIBER OPTICS AND APPLICATIONS 9

Optical Fiber: Structure - advantages- Principle [TIR]–Propagation Phenomena in optical fiber - Expression For Acceptance Angle and Numerical Aperture – Relation between Refractive Index of Core, Numerical Aperture and Fractional Index Change – Fabrication: Double Crucible Method -

Types: Material, Mode, Refractive Index - Applications: Optical Fiber Communication System – fiber optic sensors (Displacement and pressure sensors) – Medical Endoscope.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Differentiate the elastic and plastic nature of the materials.
CO2: Know the experimental techniques in both production and applications of ultrasonic waves.
CO3: Gain knowledge in the basics of quantum mechanics concepts.
CO4: Develop new devices based on LASER source.
CO5: Understand the advantages of optical fiber than metal wire.
CO6: Demonstrate some useful experiments based on optical fibre

TEXT BOOKS:

1. Dr. P. Mani, "Engineering Physics", Dhanam Publications, 2013.
2. Dr. G. Senthilkumar, "Engineering Physics", VRB Publishers, 2017.
3. K. Thyagarajan, Ajoy Ghatak, "Lasers Fundamentals and Applications" IInd Edition, Springer, 2010.
4. D.K. Bhattacharya, Poonam Tandon," Engineering Physics", Oxford HED Publishers, 2017.

REFERENCE BOOKS:

1. Marikani, "Engineering Physics", PHI, New Delhi, 2013.
2. Bhattacharya &Bhaskaran, "Engineering Physics", Oxford Publications, 2012.
3. R Murugeshan, Kiruthiga, Sivaprasath S, "Modern Physics", Chand Publishing, 2021.
4. S. Rajivgandhi & A. Ravikumar, "Engineering Physics I", RK Publications, 2023
5. Sathyaprakash, "Quantum Mechanics", Pragati Prakashan, Meerut, 2016.

U23CYT14	CHEMISTRY FOR ENGINEERING & TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To inculcate sound understanding of water quality parameters and water treatment techniques.
2. Impart knowledge on the basic principles and preparatory methods of nanomaterial.
3. To introduce the basic concepts and applications of phase rule and composites.
4. To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5. To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I Water Treatment 9

Water: Sources, impurities, Parameters. Types of water Hardness of water -types – expression of hardness – units – Estimation of hardness of water by EDTA. Desalination - Reverse Osmosis. Boiler troubles: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II Electro and Nano chemistry 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf by Poggendorff's compensation principle. Single electrode potential – Nernst equation – reference electrodes -types–Calomel electrode - electrolysis of water.

Nanomaterials: Basics of Nano Chemistry: Distinction between molecules, nanomaterials and bulk materials. Preparation of nanomaterials- laser ablation method and Chemical Vapour Deposition (CVD). Application of Nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III Phase Rule and Composites 9

Phase rule terms with examples. water system; Reduced phase rule Two component system: lead-silver system – Composites, Need, Constitution: Matrix materials, Applications and Reinforcement and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV Fuels & Combustion 9

Fuels –Classification-Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, and 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. CO_2 emission and carbon foot print.

UNIT V Energy Sources and Storage devices 9

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; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.

CO2: Apply the basic knowledge of Corrosion and various electrodes.

CO3: Know the economically and new methods of synthesis nano materials.

CO4: Apply the knowledge of phase rule and composites for material selection requirements.

CO5: Understand the concepts of suitable fuels for engineering processes and applications.

CO6: Have the knowledge of 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", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
4. J. Manivel , "Engineering Chemistry" R.K.Publishers, 1st Edition 2022.

REFERENCE BOOKS:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

U23GET15	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of algorithmic problem solving.
2. To learn to solve problems using Python conditionals and loops.
3. To define Python functions and use function calls to solve problems.
4. To use Python data structures - lists, tuples, dictionaries to represent complex data.
5. To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, GCD, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs
CO3: Develop simple Python programs using conditionals and loops for solving problems
CO4: Explain the Concept of Lists and Tuples
CO5: Develop simple Python programs for Read and write data from/to files in Python programs
CO6. Explain the Concept of exceptions

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.

GE3152	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 - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

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

		L	T	P	C
GE3152	தமிழர்மரபு	1	0	0	1

அலகு I 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 ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: 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 III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS:

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

U23GEP13	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To understand the problem-solving approaches.
2. To learn the basic programming constructs in Python.
3. To practice various computing strategies for Python-based solutions to real world problems.
4. To use Python data structures - lists, tuples, dictionaries.
5. To do input/output with files in Python.
6. To understand the problem-solving approaches.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase
   AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. 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)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (Reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (Copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (Divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	PyCharm / IDLE / Spyder /	30

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs
CO3: Develop real-time/technical applications using Sets, Dictionaries
CO4: Build programs using Functions and Strings
CO5: Construct Python program using Python Standard Libraries
CO6: Develop real-time/technical applications using File handling and Exception handling

U23BSP11	PHYSICS AND CHEMISTRY LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the proper use of various kinds of physics laboratory equipment.
2. To learn how data can be collected, presented and interpreted in a clear and concise manner.
3. To learn problem solving skills related to physics principles and interpretation of experimental data.
4. To determine error in experimental measurements and techniques used to minimize such error.
5. To make the student as an active participant in each part of all lab exercises.
6. To inculcate experimental skills to test basic understanding of water quality parameters, as, acidity, alkalinity, chloride.
7. To Induce the students to analyze the hardness of water
8. To induce the students to familiarize with electro analytical techniques such as, pH meter, conductometry in the determination of impurities in aqueous solutions.

LIST OF EXPERIMENTS

1. Torsion pendulum - Determination of rigidity modulus of wire and moment of inertia of regular disc.
2. Non - Uniform bending–Determination of Young's modulus.
3. Laser – (i) Determination of the wavelength of the laser using grating.
   (ii) Determination of size of the particles using laser source.
4. Air wedge – Determination of thickness of a thin sheet/wire.
5. Determination of Band gap of a semiconductor using PN junction kit.
6. To study the V-I Characteristics of Light Dependent Resistor (LDR).
7. Determination of types and amount of alkalinity in water sample.
8. Determination of total, temporary & permanent hardness of water by EDTA method.
9. Determination of chloride content of water sample by Argentometric method.
10. Determination of strength of given hydrochloric acid using pH meter.
11. Determination of strength of acids in a mixture of acids using conductivity meter.
12. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity
1.	Torsion pendulum set up (Metal Disc, Symmetrical Mass(2x100g), Stop Clock, Screw Gauge)	**5**
2.	Non – Uniform bending set up (Travelling Microscope, Knife Edges, Weight Hanger with Mass(5x50g), Screw Gauge, Vernier Caliper, Meter Scale)	**5**
3.	Laser set up (Semiconductor Laser, Screen, Grating Stand, Wooden Stand with Meter Scale)	**5**
4.	Air wedge (Air Wedge Set Up, Travelling Microscope, Sodium Vapour Lamp, Transformer)	**5**
5.	Band gap of a semiconductor (PN Junction Kit, Thermometer, Heater, Beaker, Oil)	**5**
6.	Light Dependent Resistor (Power Suppy, Voltmeter, Ammeter, LDR, Bulb, Resistors)	**5**
7.	PH meter	**5**
8.	Conductivity meter	**10**
9.	Common Apparatus (Pipette, Burette, Conical Flask, Porcelain tile, Dropper)	**15**

COURSE OUTCOMES:

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

CO1: Understand the functioning of various physics laboratory equipment.
CO2: Observe and tabulate experimental data.
CO3: Solve problems individually and collaboratively.
CO4: Analyze the quality of water samples with respect to their acidity, alkalinity
CO5: Determine the amount of hardness in the water
CO6: Analyze quantitatively the impurities in solution by electro analytical techniques

U23HSP12	ENGLISH LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L 0	T 0	P 2	C 1

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To improve the communicative competence of learners.
2. To help learners use language effectively in academic /work contexts.
3. To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
4. To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
5. To use language efficiently in expressing their opinions via various media.

LIST OF EXPERIMENTS

1. Listening for general information-specific details.
2. Conversation: Introduction to classmates.
3. Speaking - making telephone calls-Self Introduction.
4. Talking about current and temporary situations & permanent and regular situations.
5. Listening to podcasts, anecdotes / stories / event narration.
6. Event narration; documentaries and interviews with celebrities.
7. Events-Talking about current and temporary situations & permanent and regular situations.
8. Engaging in small talk.
9. Describing requirements and abilities- Picture description.
10. Discussing and making plans.
11. Talking about tasks- progress- positions -directions of movement.
12. Talking about travel preparations and transportation.
13. Listening to debates/ discussions.
14. Making prediction talking about a given topic.
15. Describing processes.

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

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

CO1: Identify and comprehend complex academic texts.

CO2: Interpret accurately and fluently in formal and informal communicative contexts.

CO3: Demonstrate their opinions effectively in both oral and written medium of communication.

CO4: Plan travelogue and construct paragraphs on various aspects.

CO5: Develop journal reading skills and small talk.

CO6: Utilizing technical terms and making power point presentations.

SEMESTER-II

		L	T	P	C
U23HST21	**PROFESSIONAL ENGLISH (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)**	**3**	**0**	**0**	**2**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To engage learners in meaningful language activities to improve their reading and writing skills.
2. To learn various reading strategies and apply in comprehending documents in professional context.
3. To help learners understand the purpose, audience, contexts of different types of writing.
4. To enable students write letters and reports effectively in formal and business situations.
5. To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I PREPARATORY DOCUMENTATIONS 9

Listening- Listening to formal conversations and Participating**. Speaking-** speaking about one's family. **Reading –** Summary of W.W Jacobs "The monkey's paw". **Writing –** Subject verb Agreement, Numerical -Adjectives, Kinds of sentences**,** Writing reviews (book / film),writing Instructions, Writing Recommendation.

UNIT II LECTURA ENRICHMENT AND PASSAGE COMPOSE 9

Listening- listening to lectures on academic topics; **Speaking-** Asking for and giving directions. **Reading -** Reading longer technical texts; **Writing -** Compound words, Homophones and Homonyms, Cause and Effect expressions. Essay Writing, Writing Letter to the Editor (complaint, acceptance, Requesting, Thanking).

UNIT III ANALYTICAL SKILL 9

Listening- Watching videos/documentaries and responding to questions based on them. **Speaking –** Speaking about ones favourite place**. Reading –** Summary of the poem – John keats "Ode to a Nightingale". **Writing-** Purpose statement, Extended Definitions. Writing Job/ Internship application – Cover letter & Resume.

UNIT IV REPORT WRITING 9

Listening- Listening to class room lectures/talks on engineering/technology. **Speaking–** Introduction to technical presentations. **Reading –** Newspaper articles; **Writing –** Comparative Adjectives Direct and Indirect speech**.** Report Writing- Fire Accident Report, Road Accident, Feasibility Report).

UNIT V ENABLING LINGUA IDEALITY & INFORMATION 9

Listening- TED/Ink talks. **Speaking –** Making presentation on a given topic. **Reading –**Company profiles, Statement of Purpose, (SOP), **Writing –** Relative Clauses, If conditions, Cause and Effect. Chart Interpretations - Bar Chart, Pie Chart, Flow Chart & Tables.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Compare and contrast products and ideas in technical texts.

CO2 : Identify cause and effects in events, industrial processes through technical texts.

CO3 : Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4 : Motivate students to write reports and winning job applications.

CO5 : Recall and comprehend different discourses and genres of texts.

CO6 : Making the students to become virtuous presenters.

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

U23MAT22 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of a few statistical tools and give procedures for solving different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of classifications of design of experiments in the field of agriculture.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce 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.
5. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS **12**

Introduction – Sampling distributions – Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS **12**

Introduction – Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **12**

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen Value of a matrices by power method and jacobi's method for Symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **12**

Single step methods : Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge– Kutta method for solving first order differential equations – Multi step methods : Milne's and Adams Bashforth predictor corrector methods for solving first order differential equations.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1 :	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2 :	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3:	Solve the algebraic and transcendental equations.
CO4:	Understand the knowledge of numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO5:	Solve the ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
CO6:	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson , R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCE BOOKS :

1. Burden,R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi , 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis” Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi,12th Edition, 2020.
5. Spiegel.M.R.,Schiller.J. and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

U23PHT25	PHYSICS FOR INFORMATION SCIENCES (COMMON TO CSE, IT AND AIDS PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To make the students to understand the basics of crystallography and its importance in studying materials properties.
2. To in still knowledge on physics of semiconductors, determination of charge carriers and device applications.
3. To inculcate an idea of significance of new materials, nanostructures ensuing nano device applications.

UNIT I CONDENSED MATTER PHYSICS 9

Introduction - Lattice - Unit Cell - Seven Crystal Systems -Bravai's Lattices - Lattice Planes - Calculation of Number of Atoms per Unit Cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP Structures. Miller Indices – Derivation for Inter-Planar Spacing in terms of Miller Indices-Crystal Growth Techniques: Melt Growth Technique (Bridgman and Czochralski Techniques).

UNIT II PHYSICS OF SEMICONDUCTOR 9

Introduction – Properties – 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 – Carrier Transport in Semiconductors: Drift, Mobility And Diffusion– Hall Effect and Devices.

UNIT III MODERN ENGINEERING MATERIALS 9

Shape Memory Alloys – Structures – Properties – Applications. Metallic Glasses – Preparation and Applications. Ceramics – Types - Properties and Applications.

Nanomaterials – Types – Properties and Applications – Preparation Techniques: Electrodeposition – Pulsed Laser Deposition. CNT – Structure – Types – Properties - Applications

UNIT IV OPTOELECTRONICS AND DEVICES 9

Classification of optical materials-Light detectors and solor cells – Light emitting diode- Laser diode- optical process in organic semiconductor device-Excitonic state – Electro-optics and nonlinear optics; Modulator and Switching devices-plasmonics-Applications of opto electronics devices.

UNIT V DIELCTRIC MATERIALS 9

Fundamental definitions – polarization: types – polarizability calculation – frequency and temperature dependence of polarization – internal electric field and Clausius – Mosotti relation – dielectric breakdown: types, characteristics and remedies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Know basics of crystal log raphy and its importance for varied materials properties.

CO2 : Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO3: Illustrate the SMA and metallic glasses.

CO4: Understand the optical properties of materials and working principles of various optical devices

CO5: Explain types of polarization and its mathematical expression

CO6: Classify the various types of dielectric breakdown based on materials

TEXT BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. G.W.Hanson .Fundamentals of Nano electronics. Pearson Education (Indian Edition),2009.
3. Dr. P. Mani, "Physics for Electronics Engineering" Dhanam Publications, 2017.
4. Dr. G. Senthilkumar, "Engineering Physics II" VRB Publishers, 2013.
5. Theraja .B.L., Basic electronics solid state, S.Chand and Company Ltd (2002).

REFERENCE BOOKS:

1. R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. Robert F.Pierret, Semiconductor Device Fundamentals, Pearson, 2006.
3. Dr. G. Senthilkumar, A. Ravikumar& S. Rajivgandhi, " Engineering Physics II", VRB Publishers, 2023
4. Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017.
5. Kasap.S.O "Principlesof Electronic materials and Devices.; McGraw-Hill education, 2007.
6. S. O. Pillai, "Solid State Physics", New Age International, New Delhi, 1995.

U23EET23	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To introduce the basics of electric circuits and analysis
2. To impart knowledge in the basics of working principles and application of electrical machines
3. To introduce analog devices and their characteristics
4. To educate on the fundamental concepts of digital electronics
5. To introduce the functional elements and working of measuring instruments

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor

UNIT III 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, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 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 (Simple Problems only)

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types – Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers - CT and PT, DSO - Block diagram - Data acquisition.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the working principle of electrical machines
CO3: Explain the applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the basic concepts of digital electronics
CO6: Explain the operating principles of measuring instruments

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008.
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, PuneetSawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCE BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

U23ECT23	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To design digital circuits using simplified Boolean functions
2. To analyze and design combinational circuits
3. To analyze and design synchronous and asynchronous sequential circuits
4. To understand Programmable Logic Devices
5. To write HDL code for combinational and sequential circuits

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 12

Number Systems -Arithmetic Operations-Binary Codes-Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra- Boolean Functions-Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates –NAND and NOR Implementations.

UNIT II COMBINATIONAL LOGIC 12

Combinational Circuits – Analysis and Design Procedures – Binary Adder– Subtractor –Decimal Adder– Magnitude Comparator– Decoders –Encoders–Multiplexers – Demultiplexer.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 12

Sequential circuits: Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables – Triggering of FF – Registers and Counters – Design of Counters – Ripple Counter – Ring Counters – Shift registers – Universal Shift Register.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 12

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables– Race free State Assignment–Hazards – Essential Hazards– Design of Hazard free circuits.

UNIT V MEMORY AND PROGRAMMABLE LOGIC 12

RAM – Memory Decoding – Memory Expansion – ROM – PROM – EPROM – EEPROM – Programmable Logic Devices– Programmable Logic Array.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 : Simplify Boolean functions using K-Map
CO2 : Design and Analyze Combinational and Synchronous Sequential Circuits.
CO3: Design and Analyze SR and JK flip flop.
CO4: Write HDL code for combinational and Sequential Circuits
CO5: Implement the different memory management.
CO6: Implement designs using Programmable Logic Devices

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to theVerilogHDL,VHDL,andSystemVerilog",6th Edition, PearsonEducation,2017.
2. G.K.Kharate, Digital Electronics, Oxford UniversityPress,2010

REFERENCE BOOKS:

1. John F.Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education,2017.
2. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGELearning,2013
3. Donald D.Givone, Digital Principles and Design‖,TataMcGrawHill,2003.

U23CST21	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the constructs of C Language.
2. To develop C Programs using basic programming constructs
3. To develop C programs using arrays and strings
4. To develop modular applications in C using functions
5. To develop applications in C using pointers and structures

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - 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 – Preprocessor 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 9

Shape 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 – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Demonstrate knowledge on C Programming constructs
CO2 : Design and implement applications using arrays and strings
CO3: Develop and implement modular applications in C using functions and pointers
CO4: Develop applications in C using structures and unions
CO5: Design applications using sequential and random access file processing.
CO6: Explain the concept of Command line arguments

TEXT BOOKS:

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016 ..
2. Kernighan, B.W and Ritchie ,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018 .
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020
3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013
5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

		L	T	P	C
GE3252	**TAMILS AND TECHNOLOGY**	**1**	**0**	**0**	**1**

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

TEXT-CUM-REFERENCE BOOKS:

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

		L	T	P	C
GE3252	**தமிழரும் தொழில்நுட்பமும்**	**1**	**0**	**0**	**1**

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் 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-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 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 IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

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

U23CSP21	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To familiarize with C programming constructs.
2. To develop programs in C using basic constructs.
3. To develop programs in C using arrays.
4. To develop applications in C using strings, pointers, functions.
5. To develop applications in C using structures.
6. To develop applications in C using file processing.

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.
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTELbaseddesktopPCwithmin.8GBRAMand500 GB HDD,17” or higher TFT Monitor, Keyboard and mouse	30
2.	Windows10 or higher operating system/Linux Ubuntu 20 or higher	30
3.	DevC /Eclipse CDT/ Code Blocks /Code Lite /equivalent opensource IDE	30

COURSE OUTCOMES:

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

- **CO1 :** Demonstrate knowledge on C programming constructs.
- **CO2 :** Develop programs in C using basic constructs
- **CO3:** Construct programs in C using arrays.
- **CO4:** Develop applications in C using strings, pointers, functions
- **CO5:** Build applications in C using structures.
- **CO6:** Develop applications in C using file processing

U23HSP22	COMMUNICATION LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L 0	T 0	P 2	C 2

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students :

1. To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
2. To be able to communicate effectively through writing.
3. Encouraging plan designing and decision making.
4. Understanding and writing technical instruction.
5. To understand the value of letter writing with correct format.

LIST OF EXPERIMENTS:

1. Speaking-Role Play Exercises Based on Workplace Contexts.
2. Talking about competition.
3. Discussing progress toward goals-talking about experiences.
4. Discussing likes and dislikes.
5. Discussing feelings about experiences.
6. Discussing imaginary scenarios.
7. Writing short essays.
8. Speaking about the natural environment.
9. Describing communication system.
10. Describing position and movement- explaining rules.
11. Understanding technical instructions-Writing: writing instructions.
12. Speaking: describing things relatively-describing clothing.
13. Discussing safety issues (making recommendations) talking about electrical devices.
14. Describing controlling actions.
15. Writing a job application (Cover letter + Resume).

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

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

CO1 : Distinguish their technical competency through language skill.

CO2 : Predict context effectively in-group discussions held in a formal / semi-formal discussions.

CO3: Understanding candidates' key characteristics.

CO4: Finding personality traits by sharing and comparing thoughts and ability.

CO5: Understanding the value of ethics.(rules and regulations).

CO6: Construct emails and effective job applications**.**

U23MAT32	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To extend student's logical and mathematical maturity and ability to deal with abstraction.
2. To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
3. To understand the basic concepts of graph theory.
4. To familiarize the applications of algebraic structures.
5. To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering

UNIT I LOGIC AND PROOFS 12

Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 12

Mathematical induction – Strong induction and well ordering – The basics of counting– The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III GRAPHS 12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Summarize** the concept of elementary mathematical logical arguments

CO2: **Apply** basic counting techniques to solve combinatorial problems .

CO3: **Identify** the applications of Graph theory models and data structures

CO4: **Apply** the concepts and properties of algebraic structures such as groups, rings and fields.

CO5: **Extend** the concepts of Boolean algebra in the area of lattices

CO6: **Apply** the concepts and properties of algebraic structures such as groups, rings and fields

TEXT BOOKS:

1. Rosen. K.H., "Discrete Mathematics and its Applications" , 7th Edition , Tata McGraw Hill Pub.Co. Ltd., New Delhi , Special Indian Edition, 2017.

2. Tremblay. J.P .and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd , New Delhi ,30th Reprint , 2011.

REFERENCE BOOKS:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction",5th Edition , Pearson Education Asia , Delhi , 2013.
2. Koshy. T. " Discrete Mathematics with Applications", Elsevier Publications , 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition , 2010.

U23CST31	COMPUTER ARCHITECTURE & ORGANIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To make students understand the basic structure and operation of digital computer.
2. To understand the hardware-software interface.
3. To familiarize the students with arithmetic and logic unit and implementation of fixed point andfloating-point arithmetic operations.
4. To familiarize the students with hierarchical memory system including cache memories and Virtual memory.

UNIT I OVERVIEW & INSTRUCTIONS **9**

Eight ideas – Components of a computer system – Technology – Performance – Power wall –Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions– Logical operations – control operations – Addressing and addressing modes

UNIT II ARITHMETIC OPERATIONS **9**

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Sub word parallelism.

UNIT III PROCESSOR AND CONTROL UNIT **9**

Basic MIPS implementation – Building data path – Control Implementation scheme – Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV PARALLELISM **9**

Instruction-level-parallelism – Parallelprocessing challenges – Flynn's classification – Hardware multithreading – Multi-core processors.

UNIT V MEMORY AND I/O **9**

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Understand** the basic structures of a computer system.
CO2: **Explain** the various arithmetic operations used in computers
CO3: **Apply** pipelined control units and the different types of hazards in the instructions
CO4: **Interpret** the concepts of parallel processing architecture
CO5: **Summarize** the fundamentals of memory system
CO6: **Explain** the concepts of I/O Devices

TEXT BOOKS:

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman Elsevier, Fifth edition, 2014.
2. Carl Hamacher.V, Zvonko G. Vranesic and Safat G.Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2012
3. William Stallings "Computer Organization and Architecture", Seventh Edition , Pearson Education, 2006.

REFERENCE BOOKS:

1. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
2. Govinda rajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
3. Bali N.P.and Manish Goyal "Engineering Mathematics"(For Semester-I)Third Edition, University Science Press

U23CST32 **DATA STRUCTURES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the concepts of ADTs
2. To Learn linear data structures – lists, stacks, and queues.
3. To understand non-linear data structures – trees and graphs.
4. To understand sorting, searching and hashing algorithms.
5. To apply Tree and Graph structures.

UNIT I LISTS **9**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multi lists.

UNIT II STACKS AND QUEUES **9**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

UNIT III TREES **9**

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS **9**

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Explain** linear data structures using array and linked list.
CO2: **Understand** the concept of stacks & queues.
CO3: **Explain** non-linear data structures of tree traversal.
CO4: **Understand** Breadth-first traversal and Depth-first traversal.
CO5: **Apply** Searching and sorting techniques in data structures.
CO6: **Apply** hashing techniques in data structures

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021
2. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

REFERENCE BOOKS:

1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022
3. Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
4. Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

U23CST33 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the fundamentals of data models, relational algebra and SQL
2. To represent a database system using ER diagrams and to learn normalization techniques
3. To understand the fundamental concepts of transaction, concurrency and recovery processing
4. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
5. To have an introductory knowledge about the Distributed databases, NOSQL and database security
6. To implement important commands and SQL Queries and the usage of nested and joint queries

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL .

UNIT II DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – 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.

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multi version – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging.

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations.

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	**Explain** the fundamental concepts of relational database and SQL.
CO2:	**Build** the ER model for Relational model mapping to perform database design Effectively.
CO3:	**Summarize** the properties of transactions and concurrency control mechanisms.
CO4:	**Compare** and contrast various indexing strategies in different database systems.
CO5:	**Extend** Distributed Databases
CO6:	**Explain** the different advanced databases.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016.
3. William Stallings, Lawrie Brown, "Computer Security: Principles and Practice", Fourth Edition, Pearson, 2019.

REFERENCE BOOKS:

1. C.J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2014.
3. Narain Gehani and Melliyal Annamalai, "The Database Book: Principles and Practice Using the Oracle Database System", Universities Press, 2012.

U23CST34	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand Object Oriented Programming concepts and basics of Java programming language
2. To know the principles of packages, inheritance and interfaces
3. To develop a java application with threads and generics classes
4. To define exceptions and use I/O streams
5. To design and build Graphical User Interface Application using JAVAFX

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java‟s Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication-Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menu bars – Menu Item.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Develop** Java programs using Object Oriented Programming principles
CO2: **Explain** Java programs with inheritance and interface concepts
CO3: **Build** Java applications using exceptions
CO4: **Build** Java applications with I/O and generics classes
CO5: **Develop** interactive Java programs using JAVAFX event handling
CO6: **Understand** the Concept of Controls components

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi,2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCE BOOKS:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018

U23CSP31	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn and implement important commands in SQL.
2. To learn the usage of nested and joint queries.
3. To understand functions, procedures and procedural extensions of databases.
4. To understand design and implementation of typical database applications.
5. To be familiar with the use of a front end tool for GUI based application development.

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 a 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 a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features
13. Case Study using any of the real life database applications from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management c) Cop Friendly App – Eseva
    d) Property Management – eMall
    e) Star Small and Medium Banking and Finance
    - Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
    - Apply Normalization rules in designing the tables in scope.
    - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
    - Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
    - Ability to showcase ACID Properties with sample queries with appropriate settings

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Oracle Database 12 or higher, MySQL 5.7 or higher versions, SQL Server 2022(16.x)	30

COURSE OUTCOMES:

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

CO1: **Utilize** typical data definitions and manipulation commands
CO2: **Develop** applications to test Nested and Join Queries
CO3: **Build** simple applications using Views
CO4: **Build** Procedures and Functions
CO5: **Develop** and manipulate data using NOSQL database.
CO6: **Develop** applications that require a Front-end Tool

U23CSP32	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To demonstrate array implementation of linear data structure algorithms.
2. To implement the applications using Stack
3. To implement the applications using Linked list
4. To implement Binary search tree and AVL tree algorithms.
5. To implement the Heap algorithm.
6. To implement Dijkstra‟s algorithm.
7. To implement Prim‟s algorithm
8. To implement Sorting, Searching and Hashing algorithms

LIST OF EXPERIMENTS

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra‟s Algorithm
10. Implementation of Prim‟s Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort
14. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE	30

COURSE OUTCOMES:

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

CO1 : **Develop** and array implement of Stack and Queue ADTs
CO2 : **Develop** and array implement of List ADT
CO3: **Develop** and implement List, Stack and Queue ADTs.
CO4: **Apply** the concept of Binary Trees , Binary Search Trees, AVL Trees
CO5: **Develop** and implement Heaps using Priority Queues
CO6: **Apply** the concept of searching and sorting algorithms

U23CSP33	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To build software development skills using java programming for real-world applications.
2. To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
3. To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.
   If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   First 100 units - Rs. 1 per unit
   101-200 units - Rs. 2.50 per unit
   201 -500 units - Rs. 4 per unit
   > 501 units - Rs. 6 per unit
   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   First 100 units - Rs. 2 per unit
   101-200 units - Rs. 4.50 per unit
   201 -500 units - Rs. 6 per unit
   > 501 units - Rs. 7 per unit

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

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

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations

5. Write a program to perform string operations using Array List. Write functions for the following
   a. Append - add at end
   b. Insert – add at particular index
   c. Search
   d. List all string starts with given letter

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

7. Write a Java program to implement user defined exception handling.

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes

9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number

10. Write a java program to find the maximum value from the given type of elements using a generic function.

11. Design a calculator using event-driven programming paradigm of Java with the following options.
    a) Decimal manipulations
    b) Scientific manipulations

12. Develop a mini project for any application using Java concepts

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Java / equivalent open source IDE	30

COURSE OUTCOMES:

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

- **CO1 :** **Develop** and implement Java programs for simple applications that make use of classes and packages
- **CO2 :** **Develop** and implement Java programs for simple applications that make use of interfaces
- **CO3:** **Develop** and implement Java programs with array list and exception handling
- **CO4:** **Develop** and implement Java programs with multithreading
- **CO5:** **Design** applications using file processing and generic programming
- **CO6:** **Design** applications using event handling

U23CBT41 FOUNDATIONS OF DATA SCIENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the data science fundamentals and process
2. To learn to describe the data for the data science process.
3. To learn to describe the relationship between data.
4. To utilize the Python libraries for Data Wrangling.
5. To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION 9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II DESCRIBING DATA 9

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III DESCRIBING RELATIONSHIPS 9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V DATA VISUALIZATION 9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Analyze** the data science process

CO2: **Understand** different types of data description for data science process

CO3: **Explain** Gain knowledge on relationships between data

CO4: **Make Use of** the Python Libraries for Data Wrangling

CO5: **Apply** visualization Libraries in Python to interpret and explore data

CO6: **Analyze** the efficiency of Geographic Data with Basemap

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)

REFERENCE BOOKS:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

U23AIT44	FUNDAMENTALS OF COMPUTER NETWORKS AND COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the protocol layering and physical level communication.
2. To analyze the performance of a network.
3. To visualize the end-to-end flow of information.
4. To learn the functions of network layer and the various routing protocols.
5. To familiarize the functions and protocols of the Transport layer.

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

Networks–Network Types–Protocol Layering–TCP/IP Protocol suite–OSI Model – Physical Layer: Performance–Transmission media – Switching – Circuit–switched Networks – Packet Switching.

UNIT II DATA-LINK LAYER & MEDIA ACCESS 9

Introduction–Link-Layer Addressing–DLC Services–Data-Link Layer Protocols–HDLC – PPP-Media Access Control –Wired LANs: Ethernet-Wireless LANs–Introduction –IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER 9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol-ARP, RARP,DHCP

UNIT IV TRANSPORT LAYER 9

Introduction–Transport Layer Protocols–Services–Port Numbers–User Datagram Protocol–Transmission Control Protocol -Congestion Control – SCTP.

UNIT V APPLICATION LAYER 9

WWW and HTTP–FTP–Email–Telnet–SSH –DNS–SNMP.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: Understand the basic layers and its functions in computer networks.
CO2: Evaluate the performance of a network.
CO3: Understand the basics of how data flows from one node to another.
CO4: Analyze and design routing algorithms.
CO5: Design protocols for various functions in the network.
CO6: Understand the working of various application layer protocols

TEXT BOOKS:

1. Behrouz A.Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-DarLin, Ren-Hung Hwangand Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

U23CBT43 CRYPTOGRAPHY AND CYBER SECURITY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Learn to analyze the security of in-built cryptosystems.
2. Know the fundamental mathematical concepts related to security.
3. Develop cryptographic algorithms for information security.
4. Comprehend the various types of data integrity and authentication schemes
5. Understand cyber crimes 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

UNIT II SYMMETRIC CIPHERS 9

SYMMETRIC KEY CIPHERS: 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

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA , Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos

UNIT V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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
CO6:	**Explain** the Network Access Control

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCE BOOKS:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

U23CBT44	OPERATING SYSTEMS AND SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of Operating Systems.
2. To explore the process management concepts including scheduling, synchronization, threads and deadlock.
3. To understand the memory, file and I/O management activities of OS.
4. To be familiar with the basics of virtual machines and Mobile OS like Ios and Android
5. 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 –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, Mutex locks, Semaphores; Deadlock – Deadlock characterization, Deadlock prevention, Deadlock avoidance, Detection.

UNIT III MEMORY MANAGEMENT AND FILE SYSTEMS 9

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation – Virtual Memory – Demand Paging, Page Replacement, Allocation; Allocating Kernel Memory. 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 Secrecy Models – Denning's Lattice Model – Bell LaPadula Model

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	**Understand** the concepts of Operating Systems.
CO2:	**Make use of** acquire knowledge on process management concepts including scheduling, synchronization threads and deadlock.
CO3:	**Uunderstand** the memory, file and I/O management activities of OS.
CO4:	**Understand** security issues in operating systems and appreciate the need for security models
CO5:	**Understand** the exposure to the operating systems security models of WINDOWS and UNIX OS.
CO6:	**Analyze** the efficiency of Windows Security, Windows Authorization and Windows Vulnerabilities

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons, Inc., 10th Edition, 2021.
2. Trent Jaeger, Operating System Security, Morgan & Claypool Publishers series, 2008.

REFERENCE BOOKS:

1. Morrie Gasser, "Building A Secure Computer System", Van Nostrand Reinhold, New York, 1988.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.
3. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Pearson, 2017.
4. Michael Palmer, "Guide to Operating Systems Security", Course Technology – Cengage Learning, New Delhi, 2008.

U23GET41	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To introduce the basic concepts of environment
2. To impart knowledge on the causes
3. To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources
4. To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability
5. To inculcate and embrace sustainability practices and develop a broader understanding on green materials

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow–ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV ENVIRONMENTAL ISSUES 9

Social Issues and possible solutions – climate change, global warming, acid rain,ozone layer depletion, nuclear accidents and holocaust - Population growth, variation among nations population explosion – family welfare programme – human rights – value education – HIV / AIDS – women and child welfare

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	**Demonstrate** a comprehensive understanding of the world's biodiversity and the importance of its conservation.
CO2:	**Discover** knowledge in ecological perspective and value of environment
CO3:	**Categorize** different types of pollutions and their control measures.
CO4:	**Understand** the significance of various natural resources and its management.
CO5:	**Analyze** global environmental problems and come out with best possible solutions.
CO6:	**Understand** environmental laws and sustainable development.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.

REFERENCE BOOKS:

1. R. K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Text book of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013

U23CBT45	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To learn cybercrime and cyber law.
2. To understand the cyber-attacks and tools for mitigating them.
3. To understand information gathering.
4. To learn how to detect a cyber-attack.
5. To learn how to prevent a cyber-attack.

UNIT I INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cyber criminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Explain the basics of cyber security, cyber crime and cyber law
- **CO2:** Classify various types of attacks and learn the tools to launch the attacks
- **CO3:** Apply various tools to perform information gathering
- **CO4:** Apply intrusion techniques to detect intrusion
- **CO5:** Apply intrusion prevention techniques to prevent intrusion
- **CO6:** **Explain** the techniques used for RestNet and Inception v3.

TEXT BOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021. (Unit-1 &2)

2. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015. (Unit-4 & 5)

REFERENCE BOOKS:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011. (Unit-3)
2. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013.
3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.

U23CBP41	FOUNDATIONS OF DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the python libraries for data science
2. To understand the basic Statistical and Probability measures for data science.
3. To learn descriptive analytics on the benchmark data sets.
4. To apply correlation and regression analytics on standard data sets.
5. To present and interpret data using visualization packages in Python.

LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Stats models and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b. Bivariate analysis: Linear and logistic regression modeling
   c. Multiple Regression analysis
   d. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
   a. Normal curves
   b. Density and contour plots
   c. Correlation and scatter plots
   d. Histograms
   e. Three dimensional plotting
7. Visualizing Geographic Data with Basemap

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	30
2.	Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Example data sets like: UCI, Iris, Pima Indians Diabetes etc.	30

COURSE OUTCOMES:

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

- **CO1 :** **Make use of** the python libraries for data science
- **CO2 :** **Make use of** the basic Statistical and Probability measures for data science.
- **CO3:** **Define** and descriptive analytics on the benchmark data sets.
- **CO4:** **Implement** correlation and regression analytics on standard data sets
- **CO5:** **Implement** and interpret data using visualization packages in Python.
- **CO6:** **Analyze** the interpret data using visualization packages in Python.

U23CBP42	CRYPTOGRAPHY AND CYBER SECURITY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Learn different cipher techniques.
2. Implement the algorithms DES, AES, RSA and Diffie-Hellman.
3. Implement hashing techniques such as SHA-1, MD-5.
4. Develop a digital signature scheme. .
5. Implement the Visualizing Geographic Data with Basemap

LIST OF EXPERIMENTS

1. Write a program to implement the following cipher techniques to perform encryption and decryption
   i. Caesar Cipher
   ii. Playfair Cipher
   iii. Hill Cipher
2. Write a program to implement the following transposition techniques
   (i) Rail fence technique –Row major transformation
   (ii) 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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	C / C++ / Java or equivalent compiler	30
2.	Standalone desktops	30

COURSE OUTCOMES:

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

CO1 : **Develop** a code for classical encryption techniques**.**
CO2 : **Build** a symmetric and asymmetric algorithm**.**
CO3: **Construct** a code for various Authentication schemes**.**
CO4: **Apply** the principles of digital signature**.**
CO5: **Understand** the Visualizing Geographic Data with Basemap
CO6: **Develop** a digital signature scheme

U23ITT62	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

- To introduce problem-solving agents, search algorithms, and optimization in AI.
- To explore probabilistic reasoning, Bayesian networks, and inference techniques.
- To understand supervised learning, including linear regression and classification models.
- To study ensemble techniques, unsupervised learning, and instance-based learning methods.
- To explore neural networks, perceptrons, and deep learning techniques.

UNIT I PROBLEM SOLVING 9

Introduction to AI - AI Applications -Problem solving agents – search algorithms – uninformedsearchstrategies–Heuristicsearchstrategies–Localsearchandoptimizationproblems– adversarialsearch– constraint satisfaction problems(CSP).

UNIT II PROBABILISTIC REASONING 9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks –exact inference in BN –approximate inference in BN –causal networks.

UNIT III SUPERVISED LEARNING 9

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model –Naive Bayes, Maximum margin classifier– Support vector machine, Decision Tree, Random forests.

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT V NEURAL NETWORKS 9

Perceptron- Multilayer perceptron, activation functions, network training–gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Use appropriate search algorithms for problem solving.
CO2: Explain reasoning under uncertainty.
CO3: Understand supervised learning models.
CO4: Understand ensemble and unsupervised models.
CO5: Explain deep learning neural network models.
CO6: Explain the concept of batch normalization and regularization.

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

REFERENCE BOOKS:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, Mc Graw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4. Deepak Khemani, “Artificial Intelligence”, Tata Mc Graw Hill Education, 2013 (http://nptel.ac.in/).

NPTEL LINKS:

1. https://onlinecourses.nptel.ac.in/noc24_cs88/preview
2. https://onlinecourses.nptel.ac.in/noc24_ce107/preview

U23CBT53	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Know the importance and need for software security.
2. Know about various attacks.
3. Learn about secure software design.
4. Understand risk management in secure software development.
5. Know the working of tools related to software security.

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 - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection.

UNIT V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Identify** various vulnerabilities related to memory attacks.

CO2: **Apply** security principles in software development.

CO3: **Evaluate** the extent of risks.

CO4: **Explain** selection o testing techniques related to software security in the testing phase of software development.

CO5: **Apply** tools for securing software.

CO6: **Show** the secure project management with implementation

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", First 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

REFERENCE BOOKS:

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", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing,2012
6. Jason Grembi, "Developing Secure Software"

U23CST64 **INFORMATION SECURITY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of Information Security
2. To know the legal, ethical and professional issues in Information Security •
3. To know the aspects of risk management
4. To become aware of various standards in this area
5. To know the technological aspects of Information Security

UNIT I INTRODUCTION 9

History, What is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discuss the basics of information security
CO2: Illustrate the legal, ethical and professional issues in information security
CO3: Demonstrate the aspects of risk management.
CO4: Become aware of various standards in the Information Security System
CO5: Design and implementation of Security Techniques
CO6: Discuss the basics of information security

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, fourth edition
2. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First edition, Syngress Publishing, 2011

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRCPress LLC, 2004
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata Mc GrawHill, 2003
3. Matt Bishop, "ComputerSecurity Art and Science", Pearson/PHI, 2002.

U23CBP51	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Study about uninformed and Heuristic search techniques.
2. Learn techniques for reasoning under uncertainty
3. Introduce Machine Learning and supervised learning algorithms
4. Study about ensembling and unsupervised learning algorithms
5. Learn the basics of deep learning using neural networks

LIST OF EXPERIMENTS

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17‖ or higher TFT Monitor, Keyboard and mouse 30	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh	
4.	Python 3.9 or later, Anaconda Distribution, python editors, Jupyter / PyCharm/equivalent	

COURSE OUTCOMES:

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

- **CO1 :** **Make use of** appropriate search algorithms for problem solving
- **CO2 :** **Apply** reasoning under uncertainty
- **CO3:** **Build** supervised learning models
- **CO4:** **Build** ensembling and unsupervised models
- **CO5:** **Build** deep learning neural network models
- **CO6:** **Apply** Machine Learning algorithms to solve real world problems

U23CBP52	ENGINEERING SECURE SOFTWARE SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Know the importance and need for software security.
2. Know about various attacks.
3. Learn about secure software design.
4. Understand risk management in secure software development.
5. Know the working of tools related to software security

LIST OF EXPERIMENTS

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. 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.
5. Develop and test the secure test cases
6. Penetration test using kali Linux

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17‖ or higher TFT Monitor, Keyboard and mouse 30	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE	
4.	Oracle Database 12 or higher, MySQL 5.7 or higher versions, SQL Server 2022(16.x)	

COURSE OUTCOMES:

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

CO1 : **Identify** various vulnerabilities related to memory attacks.

CO2 : **Apply** security principles in software development.

CO3: **Evaluate** the extent of risks.

CO4: **Apply** and Involve selection of testing techniques related to software security in the testing phase of software development.

CO5: **Make use of** tools for securing software.

CO6: **Apply** Machine Learning algorithms to solve real world problems

U23CBT61 **EMBEDDED SYSTEMS AND IOT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the internal architecture and programming of an embedded processor.
2. To introduce interfacing I/O devices to the processor.
3. To introduce the evolution of the Internet of Things (IoT).
4. To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
5. To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR **9**

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING **9**

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING **9**

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS **9**

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT **9**

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** **Explain** the architecture of embedded processors.
- **CO2:** **Write** embedded C programs.
- **CO3:** **Design** simple embedded applications.
- **CO4:** **Compare** the communication models in IOT
- **CO5:** **Design** IoT applications using Arduino/Raspberry Pi /open platform.
- **CO6:** **Explain** about Arduino and its types

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

REFERENCE BOOKS:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

U23CBT62	NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of security
2. To understand the concept of authentication protocols and digital signatures.
3. To learn various methods and protocols to understand the cryptography.
4. To learn various network security attacks.
5. To understand the IP and Web security.

UNIT I FUNDAMENDALS OF NETWORKING SECURITY 9

Overview of networking security- Security Services -Confidentiality, Authentication, Integrity, Non-repudiation, access Control - Availability and Mechanisms- Security Attacks -Interruption, Interception ,Modification and Fabrication.

UNIT II AUTHENTICATION AND SECURITY 9

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 9

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 9

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 attacks - route table modification - UDP hijacking - man-in-the-middle attacks.

UNIT V IP SECURITY AND WEB SECURITY 9

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 Wireshark – 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 the course the students would 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:	**Analyze** and get better knowledge on fundamental concepts of cryptography, encryption and hashing techniques.
CO4:	**Identify** and assess different types of threats and attacks such as social engineering, rootkit, and botnets,etc.
CO5:	**Acquire** Demonstrate the ability to select among available network security technology and protocols such as IDS, firewalls, SSL , TLS, etc.
CO6:	**Demonstrate** the applications of social networks

TEXT BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

REFERENCE BOOKS:

1. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech
2. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
3. A look back at Security Problems in the TCP/IP Protocol Suite, S. Bellovin, ACSAC 2004.

U23CBT63	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of computer based vulnerabilities.
2. To explore different foot printing, reconnaissance and scanning methods.
3. To expose the enumeration and vulnerability analysis methods.
4. To understand hacking options available in Web and wireless applications.
5. To explore the options for network protection.
6. To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I INTRODUCTION 9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.

UNIT II FOOTPRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING 9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT V NETWORK PROTECTION SYSTEMS 9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** **Evaluate** knowledge on basics of computer-based vulnerabilities
- **CO2:** **Analyze** the different foot printing, reconnaissance and scanning methods.
- **CO3:** **Construct** the enumeration and vulnerability analysis methods
- **CO4:** **Discover** knowledge on hacking options available in Web and wireless applications.
- **CO5:** **Summarize** knowledge on the options for network protection.
- **CO6:** **Illustrate** tools to perform ethical hacking to expose the vulnerabilities.

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOKS:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

U23CBP61	EMBEDDED SYSTEMS AND IOT LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the internal architecture and programming of an embedded processor.
2. To introduce interfacing I/O devices to the processor.
3. To introduce the evolution of the Internet of Things (IoT).
4. To build a small low-cost embedded and IoT system using Arduino /Raspberry Pi/ open platform.
5. To apply the concept of Internet of Things in real world scenario.

LIST OF EXPERIMENTS

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write Basic and arithmetic Programs Using Embedded C.
5. Introduction to Arduino platform and programming
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
7. Introduction to Raspberry PI platform and python programming
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Setup a cloud platform to log the data
11. Log Data using Raspberry PI and upload to the cloud platform
12. Design an IOT based system

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL/ HP 280G3MT Processor-Intel(R) Core i7-7700 @3.00 GHz RAM – 8GB RAM, HDD-1TB, Keyboard, Mouse, Monitor OS: Windows 10 Pro and CentOS 6	30
2.	Arduino board and peripherals, Rasperry pi ,ZigBee Interface, LORA Interface ,computer with relevant simulation software, access to IoT cloud service like ThingSpeaks ,Sensors etc. and high speed internet.	

COURSE OUTCOMES:

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

CO1 : **Explain** the architecture of embedded processors.

CO2 : **Write** embedded C programs.

CO3: **Design** simple embedded applications.

CO4: **Compare** the communication models in IOT

CO5: **Design** IoT applications using Arduino/Raspberry Pi /open platform.

CO6: **Implement** IoT based weather monitoring system

		L	T	P	C
U23CBP62	**NETWORK SECURITY LABORATORY**	**0**	**0**	**4**	**2**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of security
2. To understand the concept of authentication protocols and digital signatures.
3. To learn various methods and protocols to understand the cryptography.
4. To learn various network security attacks.
5. To understand the IP and Web security.

LIST OF EXPERIMENTS

1. Using Wireshark explore the different layer protocol headers.
2. Demonstrate two different Certificates producing the same MD5 hash
3. Computing MACs, HASH and HMAC for messages
4. Implement and demonstrate Buffer overflow attack
5. Implement and demonstrate Denial of service attacks (DoS) and DDoS
6. Implement the ARP attack and MITM
7. Implement the Botnet attack detection using publically available dataset
8. Explore and install Snort intrusion detection tool
9. Implement Firewall rules using snort
10. Generate the network attack and Detect the attack using Snort

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL/ HP 280G3MT Processor-Intel(R) Core i7-7700 @3.00 GHz RAM – 8GB RAM, HDD-1TB, Keyboard, Mouse, Monitor OS: Windows 10 Pro and CentOS 6	30
2.	C / C++ / Java or equivalent compiler	

COURSE OUTCOMES:

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

CO1 : **Describe** computer and network security fundamental concepts and principles.

CO2 : **Demonstrate** the knowledge of various authentication protocols, key exchange mechanism, and digital certificates.

CO3: **Analyze** and to get better knowledge on fundamental concepts of cryptography, encryption and hashing techniques.

CO4: **Identify** and assess different types of threats and attacks such as social engineering, rootkit, and botnets,etc.

CO5: **Demonstrate** the ability to select among available network security technology and protocols such as IDS, firewalls, SSL , TLS, etc.

CO6: **Construct** a code for various Authentication schemes.

U23CBT71 **CYBER FORENSICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn cyber crime and forensics
2. To become familiar with forensics tools
3. To learn to analyze and validate forensics data
4. To understand cyber laws and the admissibility of evidence with case studies
5. To learn 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.

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 - Footprinting 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 the end of the course the students would be able to:

CO1: **Understand** the basics of cyber crime and computer forensics
CO2: **Apply** a number of different computer forensic tools to a given scenario
CO3: **Analyze** and validate forensics data
CO4: **Understand** Admissibility of evidence in India with Cyber laws and Case Studies
CO5: **Identify** the vulnerabilities in a given network infrastructure
CO6: **Implement** real-world hacking techniques to test system security

TEXT BOOKS:

1. Bill Nelson, Amelia Phillips, Christopher Steuart, ―Guide to Computer Forensics and Investigations‖, Cengage Learning, India Sixth Edition, 2019.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.
3. Dejey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018

REFERENCE BOOKS:

1. John R.Vacca, "Computer Forensics ", Cengage Learning, 2005
2. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik "Insider Computer Fraud‖ Auerbach Publications Taylor &Francis Group– 2008.

		L	T	P	C
U23GET61	**HUMAN VALUES AND ETHICS**	**3**	**0**	**0**	**2**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. Teach definition and classification of values.
2. Explain Purusartha.
3. Describe Sarvodaya idea.
4. Summarize sustenance of life.
5. Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES **9**

Extrinsic values- Universal and Situational values- Physical- Environmental- Sensuous- Economic Social-Aesthetic-Moral and Religious values.

UNIT II CONCEPTS RELATED TO VALUES **9**

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good.

UNIT III IDEOLOGY OF SARVODAYA **9**

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam.

UNIT IV SUSTENANCE OF LIFE **9**

The Problem of Sustenance of value in the process of Social, Political and Technological Changes.

UNIT V VIEWS ON HIERARCHY OF VALUES **9**

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Understand definition and classification of values.
CO2 : Understand purusartha.
CO3: Understand sarvodaya idea.
CO4: Understand sustenance of life.
CO5: Understand the hierarchy of values.
CO6: Compare hierarchial views of Pt. Madan Mohan Malviya and Mahatma Gandhi.

TEXT BOOKS:

1. Awadesh Pradhan : Mahamanake Vichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 2021)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

U23CBT73	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To Introduce Cloud Computing terminology, definition & concepts
2. To understand the security design and architectural considerations for Cloud
3. To understand the Identity, Access control in Cloud
4. To follow best practices for Cloud security using various design patterns
5. To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, 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 - 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 - 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Understand** the cloud concepts and fundamentals.
CO2: **Explain** the security challenges in the cloud.
CO3: **Extend** cloud policy and Identity and Access Management.
CO4: **Understand** various risks and audit and monitoring mechanisms in the cloud.
CO5: **Explain** the various architectural and design considerations for security in the cloud
CO6: **Discuss** the Information and Event Management

TEXT BOOKS:

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, "Cloud Computing:", Wiley 2013
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY 2011

REFERENCE BOOKS:

1. Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

U23CBP71	CYBER FORENSICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn cyber crime and forensics
2. To become familiar with forensics tools
3. To learn to analyze and validate forensics data
4. To understand cyber laws and the admissibility of evidence with case studies
5. To learn the vulnerabilities in network infrastructure with ethical hacking

LIST OF EXPERIMENTS

1. Study and explore the following forensic tools:
   (a) FTK Imager
   (b) Autopsy
   (c)EnCase Forensic Imager
   (d) LastActivityView
   (e) USBDeview
2. Recover deleted files using FTKImager
3. Acquire forensic image of hard disk using EnCase Forensics Imager and also perform integrity checking/validation
4. Restore the Evidence Image using EnCase Forensics Imager.
5. Study the following:
   (a) Collect Email Evidence in Victim PC.
   (b) Extract Browser Artifacts (ChromeHistory view for Google Chrome)
6. Use USBDeview to find the last connected USB to the system
7. Perform Live Forensics Case Investigation using Autopsy
8. Study Email Tracking and EmailTracing and write a report on them.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	INTEL/ HP 280G3MT Processor-Intel(R) Core i7-7700 @3.00 GHz RAM – 8GB RAM, HDD-1TB, Keyboard, Mouse, Monitor OS: Windows 10 Pro and CentOS 6	30
2.	C / C++ / Java or equivalent compiler	

COURSE OUTCOMES:

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

CO1 : **Understand** the basics of cyber crime and computer forensics

CO2 : **Apply** a number of different computer forensic tools to a given scenario

CO3: **Analyze** and validate forensics data

CO4: **Understand** Admissibility of evidence in India with Cyber laws and Case Studies

CO5: **Identify** the vulnerabilities in a given network infrastructure

CO6: **Implement** real-world hacking techniques to test system security

U23CBT81 **MALWARE ANALYSIS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To introduce the fundamentals of malware, types and its effects
2. To enable to identify and analyse various malware types by static analysis
3. To enable to identify and analyse various malware types by dynamic analysis
4. To deal with detection, analysis, understanding, controlling, and eradication of malware

UNIT I INTRODUCTIONAND BASIC ANALYSIS 9

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, 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.. Portable Executable File Format. The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques.

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, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging.

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, APK Tool, APK Inspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Analyze** various malicious file types
CO2: **Build** and utilize a sandbox environment for malware analysis
CO3: **Apply** various tools to Identify the vulnerabilities and to perform Malware analysis
CO4: **Apply** malware classification and functionality & anti-reverse engineering techniques
CO5: **Explain** about knowledge on the In-Depth Malware Analysis
CO6: **Illustrate** the detection of malware using evade analysis toolkit

TEXT BOOKS:

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012,ISBN: 9781593272906
2. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition,Jones & Bartlett Publishers, 2009.

REFERENCE BOOKS:

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel” by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O’Reilly, 2015.
4. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.

VERTICAL 1

U23ITT43	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To comprehend and analyze the basic concepts of web programming and internet protocols.
2. To describe how the client-server model of Internet programming works.
3. To demonstrate the uses of scripting languages
4. To practice server-side programming features – PHP, JSP.
5. To be familiar with database applications

UNIT I WEBSITE BASICS 9

Internet Overview - Fundamental computer network concepts - Web Protocols - URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website –Creating a Website - Client-side and server-side scripting.

UNIT II WEB DESIGNING 9

HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING 9

JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-FunctionsObjects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers.

UNIT IV TYPESCRIPT 9

Introduction of TypeScript, TypeScript Basics, Data types and variables, Destructuring and spread, Working with classes, working with interfaces, Generics, Modules and Name spaces, Ambients, Functions, Loops, Collections.

UNIT V SERVLETS AND DATABASE CONNECTIVITY 9

Introduction to AngularJS, MVC Architecture, Understanding attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django-UI & UX.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Create simple Website by understand the basics

CO2: Apply HTML and CSS effectively to create interactive and dynamic websites

CO3: Build dynamic web pages with validation using Java Script objects and apply different event handling mechanisms

CO4: Demonstrate simple web pages using Typescript

CO5: Illustrate Servlets in web applications

CO6: Create simple database applications.

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" 5th Edition, O'Reilly publishers, 2018.
2. Paul Deitel, Harvey Deitel, Abbey Deitel, “Internet & World Wide Web - How to Program”, 6th edition, Pearson Education, 2020.

REFERENCE BOOKS:

1. Jeffrey C. Jackson, "Web Technologies-A Computer Science Perspective", Pearson Education, 2007.
2. James F. Kurose, “Computer Networking: A Top-Down Approach”, 6th Edition, Pearson Education, 2012
3. Steven Holzemer, “PHP – The Complete Reference”, 1st Edition, Mc-Graw Hill, 2017
4. Fritz Schneider, Thomas Powell, “JavaScript - The Complete Reference”, 3rd Edition, McGraw Hill Publishers, 2017

U23CSV22	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn development of native applications with basic GUI Components.
2. To develop cross-platform applications with event handling.
3. To develop applications with location and data storage capabilities.
4. To develop 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.

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 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.

UNITV 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, Reusability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Develop Native applications with GUI Components.
- **CO 2:** Develop hybrid applications with basic event handling.
- **CO 3:** Implement cross-platform applications with location and data storage capabilities.
- **CO 4:** Implement cross platform applications with basic GUI and event handling.
- **CO 5:** Develop web applications with cloud database access.
- **CO 6:** Implement the non-functional characteristics of application frameworks.

TEXT BOOKS:

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition.
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015.
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing.

REFERENCE BOOKS:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition.
2. Native Mobile Development by Shaun Lewis, Mike Dunn.
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras.
4. Apache Cordova 4 Programming, John M Wargo, 2015.
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition.

U23CSV23	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Introduce Cloud Service Management terminology, definition & concepts.
2. Compare and contrast cloud service management with traditional IT service management.
3. Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services.
4. Select appropriate structures for designing, deploying and running cloud-based services in a business environment.
5. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems.

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

UNIT III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

UNIT IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

UNITV CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Explain cloud-design skills to build and automate business solutions using cloud technologies.
- **CO 2:** Extend Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.
- **CO 3:** Solve the real-world problems using Cloud services and technologies.
- **CO 4:** Discover Cloud service management operations.
- **CO 5:** Understand the pricing models for cloud services.
- **CO 6:** Evaluate the values of cloud services.

TEXT BOOKS:

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour.

REFERENCE BOOKS:

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing.
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi.

U23CSV24	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To provide a sound knowledge in UI & UX
2. To understand the need for UI and UX
3. To understand the various Research Methods used in Design
4. To explore the various Tools used in UI & UX
5. Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

UNIT III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests.

UNITV RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Build UI for user Applications.
- **CO 2:** Evaluate UX design of any product or application.
- **CO 3:** Demonstrate UX Skills in product development.
- **CO 4:** Implement Sketching principles.
- **CO 5:** Create Wireframe and Prototype.
- **CO 6:** Develop solutions for real world problems using information architecture.

TEXT BOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021.

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.

U23CSV25	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of software testing.
2. To learn how to do the testing and planning effectively.
3. To build test cases and execute them.
4. To focus on wide aspects of testing and understanding multiple facets of testing.
5. 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, V-model 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.

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.

UNITV 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understand the basic concepts of software testing and the need for software testing.
- **CO 2:** Design Test planning and different activities involved in test planning.
- **CO 3:** Design effective test cases that can uncover critical defects in the application.
- **CO 4:** Extend out advanced types of testing.
- **CO 5:** Explain the software testing using Selenium and TestNG.
- **CO 6:** Understand Web driver events using automation tools.

TEXT BOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012.
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018.

REFERENCE BOOKS:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing.
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.

U23CSV28	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand and describe syntax and semantics of programming languages.
2. To understand data, data types, and basic statements.
3. To understand call-return architecture and ways of implementing them.
4. To understand object-orientation, concurrency, and event handling in programming Languages.
5. To develop programs in non-procedural programming paradigms.

UNIT I SYNTAX AND SEMANTICS 9

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing.

UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS 9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements.

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS 9

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping.

UNIT IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 9

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling.

UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 9

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Demonstrate syntax and semantics of programming languages.
- **CO 2:** Explain data, data types, and basic statements of programming languages.
- **CO 3:** Design and implement subprogram constructs.
- **CO 4:** Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog.
- **CO 5:** Understand and adopt new programming languages.
- **CO 6:** Understand the fundamentals of functional programming languages.

TEXT BOOKS:

1. Robert W. Sebesta, "Concepts of Programming Languages", Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, "Programming Language Pragmatics", Fourth Edition, Elsevier, 2018.

REFERENCE BOOKS:

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, Prentice Hall, 2011.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Pearson, 1997.
3. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

U23ITV27	DEVOPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

- To learn DevOps, AWS, GCP, Azure, and Git.
- Master Maven and Gradle for builds and dependencies.
- Set up Jenkins for CI with Java, Git, and Maven.
- To learn Ansible basics and playbooks.
- Build DevOps pipelines with Azure.

UNIT I INTRODUCTION TO DEVOPS 9

DevOps Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 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 Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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.
CO6: Use Github Accounts and Azure pipelines.

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", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

REFERENCE BOOKS:

1. Hands-On Azure DevOps: Cicd Implementation for Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh soni.
2. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

NPTEL LINK:

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/cicd-devops-automation-and-devsecops-automation/?v=c86ee0d9d7ed

U23CSV26	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the fundamentals of web application security
2. To focus on wide aspects of secure development and deployment of web applications
3. To learn how to build secure APIs
4. To learn the basics of vulnerability assessment and penetration testing
5. 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understanding the basic concepts of web application security and the need for it.
- **CO 2:** Explain the process for secure development and deployment of web applications.
- **CO 3:** Apply the skill to design and develop Secure Web Applications that use Secure APIs.
- **CO 4:** Explain the importance of carrying out vulnerability assessment and penetration testing.
- **CO 5:** Apply the skill to think like a hacker and to use hackers tool sets.
- **CO 6:** Construct the solutions for hacking problems using tools.

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

U23CBT51 **THEORY OF COMPUTATION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand foundations of computation including automata theory
2. To construct models of regular expressions and languages.
3. To design context free grammar and push down automata
4. To understand Turing machines and their capability
5. To understand Undecidability and NP class problems

UNIT I AUTOMATA FUNDAMENTALS **9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions.

UNIT II REGULAR EXPRESSIONS AND LANGUAGES **9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata

UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES **9**

CFG – Parse Trees – Ambiguity in Grammars and Languages – Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES **9**

Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

UNIT V UNDECIDABILITY **9**

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Construct** automata theory using Finite Automata.
CO2: **Write** regular expressions for any pattern.
CO3: **Design** context free grammar and Pushdown Automata
CO4: **Design** Turing machine for computational functions
CO5: **Differentiate** between decidable and undecidable problems
CO6: **Develop** and implement the Class P and NP.

TEXT BOOKS:

1. Hopcroft, J.E. Motwani, R. and Ullman, J.D, "Introduction to Automata Theory, Languages and Computations", 2nd Edition, Pearson Education, 2013
2. Introduction to the Theory of Computation" by Michael Sipser

REFERENCE BOOKS:

1. MichealSipser, "Introduction of the Theory and Computation",Thomson Brokecole, 1997
2. Martin, J., "Introduction to Languages and the Theory of Computation", 3rd Edition, TMH, 2003.
3. Lewis, H. and Papadimitriou, C.H "Elements of the Theory of Computation", 2nd Edition, Pearson Education/PHI, 2003.
4. Greenlaw, "Fundamentals of Theory of Computation, Principles and Practice", Elsevier, 2008

VERTICAL 2

U23CST71	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To understand the principles of cloud architecture, models and infrastructure
2. To understand the concepts of virtualization and virtual machines
3. To gain knowledge about virtualization Infrastructure..
4. To explore and experiment with various Cloud deployment environments.
5. To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challe

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

- **CO1** Understand the design challenges in the cloud.
- **CO2** Apply the concept of virtualization and its types.
- **CO3:** Experiment with virtualization of hardware resources and Docker
- **CO4:** Develop and deploy services on the cloud and set up a cloud environment
- **CO5:** Explain security challenges in the cloud environment.
- **CO6:** Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G **Dongarra**, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCE BOOKS:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes",
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

U23CSV32 **VIRTUALIZATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To Learn the basics and types of Virtualization
2. To understand the Hypervisors and its types
3. To Explore the Virtualization Solutions
4. To Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION 9

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization – Para virtualization-Types of Hypervisors

UNIT II SERVER AND DESKTOP VIRTUALIZATION 9

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION 9

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization VLAN-WAN Architecture-WAN Virtualization

UNIT IV STORAGE VIRTUALIZATION 9

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT V VIRTUALIZATION TOOLS 9

VMW are-Amazon AWS-Microsoft Hyper V- Oracle VM Virtual Box - IBM Power VM - Google Virtualization- Case study**.**

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Analyze the virtualization concepts and Hypervisor
- **CO 2:** Apply the Virtualization for real-world applications
- **CO 3:** Construct and Configure the different VM platforms
- **CO 4:** Understand the concepts of storage virtualization
- **CO 5:** Understand the Virtualization tools
- **CO 6:** Examine with the VM with various software

TEXT BOOKS:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

REFERENCE BOOKS:

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006

U23CBV23	DIGITAL WATERMARKING AND STEGANOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn about the watermarking models and message coding.
2. To learn about watermark security and authentication.
3. To learn about steganography Perceptual models.
4. To learn about security and cryptography, Attacks
5. To learn about Steganography communication

UNIT I INTRODUCTION 9

Information Hiding, Steganography and Watermarking, History of watermarking, Importance of digital watermarking, Applications and Properties, Evaluating watermarking systems. Watermarking models & message coding, Notation, Error correction coding, Detecting multi-symbol watermarks.

UNIT II WATERMARKING WITH SIDE INFORMATION &ANALYZING ERRORS 9

Informed Embedding, Informed Coding –Structured dirty-paper codes, Message errors, False positive errors, False negative errors, ROC curves– Effect of whitening on error rates.

UNIT III PERCEPTUAL MODELS 9

Evaluating perceptual impact, General form of a perceptual model, Examples of perceptual models, Robust watermarking approaches, Redundant Embedding, Spread Spectrum Coding, Embedding in Perceptually significant coefficients.

UNIT IV WATERMARK SECURITY & AUTHENTICATION 9

Security requirements, Watermark security and cryptography, Attacks, Exact authentication, Selective authentication, Localization, Restoration.

UNIT V STEGANOGRAPHY 9

Steganography communication, Notation and terminology, Information, theoretic foundations of steganography, Practical steganographic methods, Minimizing the embedding impact, Steganalysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	Know the History and importance of watermarking and steganography.
CO2:	Analyze Applications and properties of watermarking and steganography.
CO3:	Demonstrate Models and algorithms of watermarking.
CO4:	Design and Possess the passion for acquiring knowledge and skill in preserving authentication of Information.
CO5:	Identify the theoretic foundations of steganography and steganalysis.
CO6:	**Understand** the Steganography communication.

TEXT BOOKS:

1. Digital Watermarking and Steganography, Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, Morgan Kaufmann Publishers, New York, 2008.

REFERENCE BOOKS:

1. Techniques and Applications of Digital Watermarking and Contest Protection, Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, Artech House, London, 2003.
2. Digital Watermarking for Digital Media, Juergen Seits, IDEA Group Publisher, New York, 2005.

   Disappearing Cryptography – Information Hiding: Steganography & Watermarking, PeterWayner, Morgan Kaufmann Publishers, New York, 2002.

U23ITV31	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

- To introduce the fundamental concepts of data warehouse architecture, design, and implementation.
- To equip students with knowledge of ETL processes (extraction, transformation, loading).
- To teach data modeling techniques like star and snowflake schemas.
- To differentiate schema types and explore data warehousing process architecture and parallelism.
- To understand the roles of Data Warehousing Process and System Configuration Managers.

UNIT I INTRODUCTION TO DATA WAREHOUSE 9

Introduction - components- operational database Vs data warehouse – Data warehouse Architecture – Three - tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

UNIT II ETL AND OLAP TECHNOLOGY 9

ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III META DATA, DATA MART AND PARTITION STRATEGY 9

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition.

UNIT IV DIMENSIONAL MODELING AND SCHEMA 9

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Data warehouse Tools.

UNIT V SYSTEM & PROCESS MANAGERS 9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Understand the fundamentals of data warehouse architecture for various Problems.
CO2: Explain the ETL and Online Analytical Processing Technologies and its operations.
CO3: Use the Categories of Metadata & Partitioning strategy technique.
CO4: Learn the differentiation of various schemas for given problem.
CO5: Frame roles of Data Warehousing Process Managers and System Configuration Managers.
CO6: Identify the skills and knowledge to effectively manage and optimize the various processes within a data warehouse.

TEXTBOOKS:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2010.
2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

REFERENCE BOOKS:

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2014.

NPTEL LINKS:

1. https://nptel.ac.in/courses/106105174
2. https://nptel.ac.in/courses/106106093/35

U23CSV34	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Characterize the functionalities of logical and physical components of storage
2. Describe various storage networking technologies
3. Identify different storage virtualization technologies
4. Discuss the different backup and recovery strategies
5. Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID 9

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and Scale - out storage Architecture

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, Connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION 9

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT V SECURING STORAGE INFRASTRUCTURE 9

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
- **CO 2:** Illustrate the usage of advanced intelligent storage systems and RAID
- **CO 3:** Illustrate various storage networking architectures - SAN, including storage subsystems and virtualization
- **CO 4:** Examine the different role in providing disaster recovery and remote replication technologies
- **CO 5:** Infer the security needs and security measures to be employed in information storage management
- **CO 6:** Understand the functions of storage management process

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein , Storage Networks Explained, Second Edition, Wiley, 2009

REFERENCE BOOK:

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein , Storage Networks Explained, Second Edition, Wiley, 2009

U23CSV35	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the need for SDN and its data plane operations
2. To understand the functions of control plane
3. To comprehend the migration of networking functions to SDN environment
4. To explore various techniques of network function virtualization
5. To comprehend the concepts behind network virtualization

UNIT I SDN: INTRODUCTION 9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 9

Data Plane functions and protocols – Open FLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, Open Daylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION 9

Network Virtualization - Virtual LANs – Open Flow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY 9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Explain the motivation behind SDN
- **CO 2:** Identify the functions of the data plane and control plane
- **CO 3:** Apply and develop network applications using SDN
- **CO 4:** Apply Orchestrate network services using NFV
- **CO 5:** Explain the Virtualized Network Functions of NFV
- **CO 6:** Explain various use cases of SDN and NFV

TEXT BOOK:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, 1st Edition, 2015.

REFERENCE BOOKS:

1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016
5. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017

U23AIV61	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To introduce the computation and communication models of distributed systems
2. To illustrate the issues of synchronization and collection of information in distributed systems
3. To describe distributed mutual exclusion and distributed deadlock detection techniques
4. To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
5. To explain the cloud computing models and the underlying concepts

UNIT I INTRODUCTION 9

Introduction: Definition-Relation to Computer System Components – Motivation – Message -Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System

UNIT II LOGICAL TIME AND GLOBAL STATE 9

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time - Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III DISTRIBUTED MUTEX AND DEADLOCK 9

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart Agrawala's Algorithm – Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT IV CONSENSUS AND RECOVERY 9

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure- Check pointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Check point-based Recovery – Coordinated Check pointing Algorithm - - Algorithm for Asynchronous Check pointing and Recovery

UNIT V CLOUD COMPUTING 9

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud - Cloud Services and Platforms: Compute Services – Storage Services – Application Services

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the foundations of distributed systems
CO2: Solve synchronization and state consistency problems
CO3: Use resource sharing techniques in distributed systems
CO4: Apply working model of consensus and reliability of distributed systems
CO5: Explain the fundamentals of cloud computing
CO6: Explain about cloud services.

TEXT BOOKS:

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc-Graw Hill Publishers, 1994

REFERENCE BOOKS:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
6. Arshdeep Bagga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", Universities Press, 2014.

U23CSV36 **STREAM PROCESSING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Introduce Data Processing terminology, definition & concepts
2. Define different types of Data Processing
3. Explain the concepts of Real-time Data processing
4. Select appropriate structures for designing and running real-time data services in a business environment
5. Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understand the applicability and utility of different streaming algorithms.
- **CO 2:** Apply current research trends in data-stream processing.
- **CO 3:** Analyze the suitability of stream mining algorithms for data stream systems.
- **CO 4:** Build stream processing systems, services and applications.
- **CO 5:** Understand the basic concepts of streaming and functions of streaming.
- **CO 6:** Solve problems in real-world applications that process data streams

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media

REFERENCE BOOK:

1. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

VERTICAL 3

U23CSV47	ANDROID SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn basic of the Android operating system and security aspects.
2. To practice the android malware analysis techniques.
3. To appraise the malwares analysis of real world applications.
4. To understand the android security Applications
5. To experiment Debugging Android process

UNIT I INTRODUCTION TO ANDROID OPERATING SYSTEMS 9

Introduction to Android, Android API, DVM, APK File Structure Basic Analysis of an APK, Dex structure, Dex Structure Parsing, APK install process, Android Root.

UNIT II APPLICATION SECURITY 9

Inspecting the AndroidManifest.xml file - Introduction to Android Debugging Tools and Their Usage, Interacting with the Activity Manager via ADB - Extracting Application Resources via ADB, Inspecting Application Certificates and Signatures - Verifying Application Signatures - Signing Android Applications. Mobile Security - IOS vs Android vs Windows

UNIT III PERMISSIONS AND ANDROID MALWARE VULNERABILITY 9

Nature of Permissions, Permission Management, Permission Assignment, Permission Enforcement Master Key Vulnerability - File Name Length Vulnerability Introduction to Obfuscation - DEX Code Obfuscation

UNIT IV ENTERPRISE LEVEL SECURITY FOR MOBILE DEVICES 9

Security enhancement for Android, Device administration, Customizable secure boot, Knox security, Knox container, TIMA Trust Zone-based Integrity Measurement Architecture.

UNIT V REVERSE ENGINEERING APPLICATIONS AND DEVICE ADMINISTRATION POLICIES 9

Introduction Decompiling DEX Files to Java Interpreting the Dalvik Bytecode Decompiling the applications native libraries, Debugging Android process, CFF explorer, dex2Jar, Hex Editor, JD-GUI- Introduction - Using Cryptography Libraries - Screen Security - Secure USB Debugging

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO1:** Identify various malwares and understand the behavior of malwares in real worl applications.
- **CO2:** Explain different malware analysis techniques.
- **CO3:** Understand the malware behavior in android.
- **CO4:** Understand the purpose of malware analysis.
- **CO5:** Identify the various tools for malware analysis.
- **CO6:** Motivethe student to use Secure USB Debugging

TEXT BOOKS:

1. Nikolay Elenkov, Android Security Internals - An InDepth Guide to Android Security Architecture , No Starch Press, 2015. (ISBN : 978-1-59-327581-5)
2. Keith Makan, Scott Alexander-Bown, Android Security Cookbook, Packt Publishers, 2013. (ISBN: 978 -1-78- 216716-7)

REFERENCE BOOK:

1. Erik Hellman, Android Programming Pushing the Limits, Wiley Publishers, 2014.(ISBN : 978-1-118-71737-0)

U23CBV32	WEB & DATABASE SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Give an Overview of information security
2. Give an overview of Access control of relational databases
3. To learn basic OLAP Systems
4. To understand Damage Quarantine and Recovery
5. To practice Mobile Environment

UNIT I WEB SECURITY 9

Web Security Problem, Risk Analysis and Best Practices Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification

UNIT II WEBS WAR ON YOUR PRIVACY 9

Privacy-Protecting Techniques, Backups and Anti-Theft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications

UNIT III DATABASE SECURITY 9

Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

UNIT IV SECURITY RE-ENGINEERING FOR DATABASES 9

Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities

UNIT V FUTURE TRENDS PRIVACY IN DATABASE PUBLISHING: 9

A Bayesian Perspective, Privacy-enhanced Location based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Understand the Web architecture and applications
- **CO2:** Understand client side and server-side programming
- **CO3:** Understand how common mistakes can be bypassed and exploit the application
- **CO4:** Identify common application vulnerabilities
- **CO5:** Understand Damage Quarantine and Recovery
- **CO6:** Analyse and explain the Mobile Environment

TEXT BOOKS:

1. Web Security, Privacy and Commerce Simson GArfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia

REFERENCE BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O'reill
2. Jonathan LeBlanc Tim Messerschmidt, Identity and Data Security for Web Development - Best Practices, O'reilly
3. McDonald Malcolm, Web Security For Developers, No Starch Press, US

U23CBV33	MOBILE APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. This course provides a thorough understanding of mobile platforms, including attack surfaces, risk landscape & more..
2. To learn basic of WAP and Mobile HTML Basics
3. To understand Bluetooth Security
4. To learn SMS Security
5. To understand Encryption and Full Disk Encryption

UNIT I INTRODUCTION TO ANDROID OPERATING SYSTEMS 9

Top Mobile Issues and Development Strategies: Top Issues Facing Mobile Devices, Physical Security, Secure Data Storage (on Disk), Strong Authentication with Poor Keyboards, Multiple-User Support with Security, Safe Browsing Environment, Secure Operating Systems, Application Isolation, Information Disclosure, Virus, Worms, Trojans, Spyware, and Malware, Difficult Patching/Update Process, Strict Use and Enforcement of SSL, Phishing, Cross-Site Request Forgery (CSRF), Location Privacy/Security, Insecure Device Drivers, Multi Factor Authentication, Tips for Secure Mobile Application Development .

UNIT II WAP AND MOBILE HTML SECURITY 9

WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, Cross-Site Scripting, SQL Injection, Cross-Site Request Forgery, HTTP Redirects, Phishing, Session Fixation, Non-SSL Login, WAP and Mobile Browser Weaknesses, Lack of HTTP Only Flag Support, Lack of SECURE Flag Support, Handling Browser Cache, WAP Limitations.

UNIT III BLUETOOTH SECURITY 9

Overview of the Technology, History and Standards, Common Uses, Alternatives, Future, Bluetooth Technical Architecture, Radio Operation and Frequency, Bluetooth Network Topology, Device Identification, Modes of Operation, Bluetooth Stack, Bluetooth Profiles, Bluetooth Security Features, Pairing, Traditional Security Services in Bluetooth, Security "Non-Features", Threats to Bluetooth Devices and Networks, Bluetooth Vulnerabilities, Bluetooth Versions Prior to v1.2, Bluetooth Versions Prior to v2.1. Security for 1g Wi-Fi Applications, Security for 2g Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications

UNIT IV SMS SECURITY 9

Overview of Short Message Service, Overview of Multimedia Messaging Service, Wireless Application Protocol (WAP), Protocol Attacks, Abusing Legitimate Functionality, Attacking Protocol Implementations, Application Attacks, iPhone Safari, Windows Mobile MMS, Motorola RAZR JPG Overflow, Walkthroughs, Sending PDUs, Converting XML to WBXML.

UNIT V ENTERPRISE SECURITY 9

Mobile OS Device Security Options, PIN, Remote, Secure Local Storage, Apple iPhone and Keychain, Security Policy Enforcement, Encryption, Full Disk Encryption, E-mail Encryption, File Encryption, Application Sandboxing, Signing, and Permissions, Application Sandboxing, Application Signing, Permissions, Buffer Overflow Protection, Windows Mobile, iPhone, Android, BlackBerry, Security Feature Summary.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Understand** common mobile application security vulnerabilities
CO2: **Define** the security controls of multiple mobile operating systems
CO3: **Understand** and analyze Bluetooth technology
CO4: **Understand** and analyze overview of SMS security and Enterprise security
CO5: **Illustrate** the Encryption and Full Disk Encryption
CO6: **Make use** of the Windows Mobile, iPhone, Android

TEXT BOOKS:

1. Mobile Application Security, Himanshu Dwivedi, Chris Clark, David Thiel, First edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Mobile and Wireless Network Security and Privacy, Kami S. Makki, et al, Springer.
2. Android Security Attacks Defenses, Abhishek Dubey, CRC Press.

U23CSV43	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To develop semantic web related simple applications
2. To explain Privacy and Security issues in Social Networking
3. To explain the data extraction and mining of social networks
4. To discuss the prediction of human behavior in social communities
5. 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 over view of privacy and security-Major paradigms-for understanding privacy and security.

UNIT II SECURITY ISSUES INSOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies- Contextual influenceson privacy attitudes and behaviors-Anonymity in a networked world

UNIT III EXTRACTION AND MININGINSOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities inSocial 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,

Privacyinonlinesocialnetworks,Trustinonline environment –Whatis Neo4j-Nodes - Relationships,Properties.

UNITV ACCESSCONTROL, PRIVACY AND IDENTITYMANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access ControlStrategies, Authentication and Authorization, Roles-based Access Control, Host, storage andnetwork access control options, Firewalls, Authentication, and Authorization in SocialNetwork, Identity & Access Management, Single Sign-on, Identity Federation, Identityproviders and service, consumers, The role of Identity provisioning

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO1:** Explain semantic web related simple applications
- **CO2:** Extend 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:** Demonstrate the applications of social networks
- **CO6:** Design the role of Identity provisioning

TEXT BOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Hand book of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j3.xSecond Edition ByJérôme Baton, RikVanBruggen, Packt publishing

REFERENCE BOOKS:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.

U23CSV44	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn about Modern Cryptography
2. To focus on how crypto graphic algorithms and protocols work and how to use them.
3. To build a Pseudo random permutation.
4. To construct Basic cryptanalytic techniques
5. 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 ofFunctions. Notions of Semantic Security (SS) and Message In distinguish ability (MI)- Proof ofEquivalence of SS and MI-Hard Core Predicate- Trap-door permutation, Gold was ser-MicaliEncryption. Gold reich-Levin Theorem- Relation between Hardcore Predicates and Trap-door permutations

UNIT II FORMALNOTIONS OF ATTACKS 9

Attacks under Message In distinguish ability- Chosen Plain text Attack (IND-CPA)-Chosen Cipher text Attacks (IND-CCA1 and IND-CCA2) - Attacks under Message Non-malleability- NM-CPA and NM- CCA2- Inter-relations among the attack model

UNIT III RANDOM ORACLES 9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak andStrong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-YaoConstruction,Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

UNIT IV BUILDIN GAP SEUDO RANDOM PERMUTATION 9

The Luby Rack off Construction-Formal Definition- Application of the Luby Rack off Construction to the construction of Block Ciphers-The DES in the light of Luby Rack off Construction.

UNITV MESSAGE AUTHENTICATION CODES 9

Leftor Right Security(LOR).Formal Definition of Weak and Strong MACs, Using aPR FasaMAC-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 One-way 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 the students will be able to:

- **CO1:** Interpret the basic principles of cryptography and general crypt analysis.
- **CO2:** Determine the concepts of symmetric encryption and authentication.
- **CO3:** Identify the use of public key encryption, digital signatures, and key establishment.
- **CO4:** Explain the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
- **CO5:** Extend the use of Message Authentication Codes.
- **CO6:** Analyzethe perform of Shamir's Secret Sharing Scheme

TEXT BOOKS:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications,Springer Verlag.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCE BOOKS:

1. Shaffi Gold wasser and Mihir Bellare, Lecture Notes on Cryptography,Available at http://citeseerx.ist.psu.edu/.
2. Oded Gold reich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23

U23ITV41	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students to:

- To introduce digital forensics and its process.
- To explore digital crime and evidence collection methods.
- To understand digital forensic readiness for law enforcement and enterprises.
- To study iOS device forensics, security, and tools.
- To examine Android device forensics, tools, and security.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT IV iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Understand the knowledge on digital forensics.
CO2: Know about digital crime and investigations.
CO3: Be forensic ready.
CO4: Identify digital evidence from iOS devices.
CO5: Identify the digital from Android devices.
CO6: Learn the Oxygen Forensics.

TEXT BOOKS:

1. Andre Arnes, “Digital Forensics”, Wiley, 2018. 2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.
2. Andre Arnes, “Digital Forensics”, Wiley, 2018.

REFERENCE BOOKS:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed,Charles River Media, 2005, ISBN: 1-58450-389.

NPTEL LINK:

1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

U23CSV46	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of Block chain
2. To learn Different protocols and consensus algorithms in Block chain
3. To learn the Block chain implementation frameworks
4. To understand the Block chain Applications
5. To experiment the Hyper ledger Fabric, Ethereum networks

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, TransactionsThe 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 BIT COINCONSENSUS 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 HYPER LEDGER FABRIC &ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNITV BLOCK CHAIN 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 the students will be able to:

- **CO1:** Understand emerging abstract models for Block chain Technology
- **CO2:** Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
- **CO3:** Understandthe function of Block chain as a method of securing distributed ledgers.
- **CO4:** Apply hyper ledger Fabric and Ethereum plat form to implement the Block chain Application.
- **CO5:** Discuss about knowledge on the options for network protection.
- **CO6:** Utilizethe Hyper ledger Fabric, Ethereum networks

TEXT BOOKS:

1. Bashir and Imran, Mastering Block chain: Deeper insights into decentralization, cryptography, Bit coin, and popular Block chain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

REFERENCE BOOKS:

1. DanielDrescher,"BlockchainBasics",FirstEdition,Apress,2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Gold feder. Bit coin and crypto currency technologies :a comprehensive introduction. Princeton University Press, 2016.

U23CSV26 **WEB APPLICATION SECURITY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the fundamentals of web application security
2. To focus on wide aspects of secure development and deployment of web applications
3. To learn how to build secure APIs
4. To learn the basics of vulnerability assessment and penetration testing
5. 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understanding the basic concepts of web application security and the need for it.
- **CO 2:** Explain the process for secure development and deployment of web applications.
- **CO 3:** Apply the skill to design and develop Secure Web Applications that use Secure APIs.
- **CO 4:** Explain the importance of carrying out vulnerability assessment and penetration testing.
- **CO 5:** Apply the skill to think like a hacker and to use hackers tool sets.
- **CO 6:** Construct the solutions for hacking problems using tools.

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

VERTICAL – IV

U23CSV51	AUGMENTED REALITY / VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To impart the fundamental aspects and principles of AR/VR technologies.
2. To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
3. To learn about the graphical processing units and their architectures.
4. To gain knowledge about AR/VR application development.
5. To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION 9

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II VR MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position Transformation Invariants –Object Hierarchies – Viewing the 3D

UNIT III VR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS 9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications– Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics– Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modeling and Annotation Navigation-Wearable devices

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understand the basic concepts of AR and VR.
- **CO 2:** Understand the tools and technologies related to AR/VR.
- **CO 3:** Explain the working principle of AR/VR related Sensor devices.
- **CO 4:** Design various models using modeling techniques.
- **CO 5:** Develop VR applications in different domains.
- **CO 6:** Develop AR applications in different domains.

TEXT BOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.

REFERENCE BOOKS:

1. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application ,Design", Morgan Kaufmann, 2003.

U23CSV61 ROBOTIC PROCESS AUTOMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of Robotic Process Automation.
2. To expose to the key RPA design and development strategies and methodologies.
3. To learn the fundamental RPA logic and structure.
4. To explore the Exception Handling, Debugging and Logging operations in RPA.
5. To learn to deploy and maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events.

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Explain the key distinctions between RPA and existing automation techniques and Platforms.

CO 2: Build control flows and work flows for the target process

CO 3: Apply recording, web scraping and process mining by automation

CO 4: Apply UiPath Studio to detect, and handle exceptions in automation processes

CO 5: Analyze and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

CO 6: Develop Comprehensive RPA Deployment Plans.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", A press publications, 2020.

REFERENCE BOOKS:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa a Complete Guide ", 2020.

U23CSV13 NEURAL NETWORKS AND DEEP LEARNING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics in deep neural networks
2. To understand the basics of associative memory and unsupervised learning networks
3. To apply CNN architectures of deep neural networks
4. To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
5. To apply autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION 9

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Auto Associative Memory Network- Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto Associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter Propagation Networks-Adaptive Resonance Theory Network

UNIT III THIRD-GENERATION NEURAL NETWORKS 9

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuro scientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV DEEP FEEDFORWARD NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

UNIT V RECURRENT NEURAL NETWORKS 9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Auto encoder, Stochastic Encoders and Decoders, Contractive Encoders.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Apply Convolution Neural Network for image processing.
CO 2: Explain the basics of associative memory and unsupervised learning networks.
CO 3: Apply CNN and its variants for suitable applications.
CO 4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
CO 5: Apply auto encoders and generative models for suitable applications.
CO 6: Apply auto Decoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCE BOOKS:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

U23CBV44	INTRUSION DETECTION AND PREVENTION SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To apply Intrusion Detection tools and techniques to improve the security of an enterprise
2. Apply knowledge in the creation and evaluation of new Intrusion Detection Systems
3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.

UNIT I INTRODUCTION 9

Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anamoly detection – specification based detection – hybrid detection.

UNIT II ARCHITECTURE AND IMPLEMENTATION 9

Centralized – Distributed – Cooperative Intrusion Detection – Tiered architecture.

UNIT III JUSTIFYING INTRUSION DETECTION 9

Intrusion detection in security – Threat Briefing – Quantifying risk – Return on Investment (ROI) .

UNIT IV APPLICATIONS AND TOOLS 9

Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS – Snorts Intrusion Detection – NFR security.

UNITV LEGAL ISSUES AND ORGANIZATIONS STANDARDS 9

Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	**Summarize** the Fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
CO2:	**Make use** of various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.
CO3:	**Summarize** knowledge on the options for network protection.
CO4:	**Understand** the Intrusion Detection
CO5:	**Illustrate** Law Enforcement
CO6:	**Develop** and Evaluating Organizations and Standardizations.

TEXT BOOKS:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003

REFERENCE BOOKS:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2. Carl Enrolf, Eugene Schultz, Jim Mellander, "Intrusion detection and Prevention", McGraw Hill, 2004
3. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.
4. Ankit Fadia and Mnu Zacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007.
5. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

U23CSV64 **QUANTUM COMPUTING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To know the background of classical computing and quantum computing.
2. To learn the fundamental concepts behind quantum computation.
3. To study the details of quantum mechanics and its relation to Computer Science.
4. To gain knowledge about the basic hardware and mathematical models of quantum computation.
5. To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Super positions.

UNIT II QUANTUM GATES AND CIRCUITS 9

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction.

UNIT III QUANTUM ALGORITHMS 9

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY 9

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantumnoiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY 9

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Understand the basics of quantum computing.

CO 2: Understand the background of Quantum Mechanics.

CO 3: Analyze the computation models.

CO 4: Build the circuits using quantum computation.Environments and frameworks.

CO 5: Understand the quantum operations such as noise and error–correction.

CO 6: Develop and Evaluation of Quantum Key Distribution Protocols.

TEXT BOOKS:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction",First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCE BOOKS:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge UniversityPress, 2007.

U23CBV46	AD HOC & SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the challenges of routing in ad-hoc and sensor networks
2. To understand various broadcast, mutlicast and geocasting protocols in ad hoc and sensor Networks
3. To understand basics of Wireless sensors, and Lower Layer Issues and Upper Layer Issues of WSN
4. To understand the sensor networks
5. Make use of Transport layer, High-level application layer

UNIT I INTRODUCTION TO AD HOC NETWORKS 9

Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

Routing in MANETs

Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-Proactive: DSDV, WRP; Reactive: DSR, AODV, TORA; Hybrid: ZRP; Position- based routing algorithms-Location Services-DREAM, Quorum-based, GLS;

UNIT II DATA TRANSMISSION 9

Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Areabased Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based:AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR.

UNIT III GEOCASTING 9

Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR.TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT IV BASICS OF WIRELESS SENSORS AND LOWER LAYER ISSUES 9

-Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT V UPPER LAYER ISSUES OF WSN 9

Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** **Understand** the concepts of sensor networks and applications
- **CO2:** **Understand** and compare the MAC and routing protocols for adhoc networks
- **CO3:** **Understand** the transport protocols of sensor networks
- **CO4:** **Design** and Understand MAC layer
- **CO5:** **Implement** the dynamic nature of WSNs.
- **CO6:** **Make use** of Transport layer, High-level application layer

TEXT BOOKS:

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

REFERENCE BOOKS:

1. 1. C. Siva Ram Murthy, B.S. Manoj Ad Hoc Wireless Networks: Architectures and Protocols.
2. TaiebZnati Kazem Sohraby, Daniel Minoli, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley.

U23CSV56	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To know the basics of 2D and 3D graphics for game development.
2. To know the stages of game development.
3. To understand the basics of a game engine.
4. To survey the gaming development environment and tool kits.
5. To learn and develop simple games using Pygame environment.

UNIT I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path finding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Explain the concepts of 2D and 3d Graphics.
- **CO 2:** Design game design documents .
- **CO 3:** Evaluate the gaming engines.
- **CO 4:** Construct the gaming environments and frameworks.
- **CO 5:** Develop a simple game in Pygame.
- **CO 6:** Demonstrate the overview of Isometric games.

TEXT BOOKS:

1. Paul Craven, "Python Arcade games", Apress Publishers, 2016.
2. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

REFERENCE BOOKS:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley, 2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress, 2007.

U23CSV66 **3D PRINTING AND DESIGN**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To discuss on basics of 3D printing
2. To explain the principles of 3D printing technique
3. To explain and illustrate inkjet technology
4. To explain and illustrate laser technology
5. To discuss the applications of 3D printing

UNIT I INTRODUCTION **9**

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.

UNIT II PRINCIPLE **9**

Processes – Extrusion, Wire, Granular, Lamination, Photo polymerization; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations.

UNIT III INKJET TECHNOLOGY **9**

Printer - Working Principle, Positioning System, print head, print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continuous jet, MultiJet; Powder based fabrication Colourjet.

UNIT IV LASER TECHNOLOGY **9**

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V INDUSTRIAL APPLICATIONS **9**

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Outline and examine the basic concepts of 3D printing technology

CO 2: Outline 3D printing workflow

CO 3: Explain and categories the concepts and working principles of 3D printing using inkjet technique

CO 4: Explain and categories the working principles of 3D printing using laser technique

CO 5: Explain various method for designing and modeling for industrial applications

CO 6: Explain Future Trends in Manufacturing.

TEXT BOOKS:

1. Christopher Barnett, 3D Printing: The Next Industrial Revolution, Create Space Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCE BOOKS:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010.
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007.
3. Joan Horvath, Mastering 3D Printing, A Press, 2014.

VERTICAL 5

U23CSV15	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Construct the Analytics Life Cycle.
2. Outline the process of acquiring Business Intelligence
3. Explain various types of analytics for Business Forecasting
4. Apply the supply chain management for Analytics.
5. Apply analytics for different functions of a business

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behavior in marketing and sales. Components of Power BI, Power BI architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO 1: Explain the real-world business problems and model with analytical solutions.
CO 2: Identify the business processes for extracting Business Intelligence
CO 3: Apply predictive analytics for business fore-casting
CO 4: Apply analytics for supply chain and logistics management
CO 5: Explain analytics for marketing and sales.
CO 6: Extend predictive analytics for sales.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016

REFERENCE BOOKS:

1. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
2. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
3. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

U23CSV17 **COMPUTER VISION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To understand the fundamental concepts related to Image formation and processing.
2. To learn feature detection, matching and detection
3. To become familiar with feature-based alignment and motion estimation
4. To develop skills on 3D reconstruction
5. To understand image-based rendering and recognition

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV 3D RECONSTRUCTION 9

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture map

UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO 1:** Understand basic knowledge, theories and methods in image processing and computer vision.
- **CO 2:** Explain about advanced image processing techniques in OpenCV.
- **CO 3:** Apply 2D a feature-based based image alignment, segmentation and motion estimations
- **CO 4:** Apply 3D image reconstruction techniques
- **CO 5:** Design and develop innovative image processing and computer vision applications
- **CO 6:** Design and develop innovative computer vision applications

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCE BOOKS:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

U23AIV65	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the foundations of Human Computer Interaction.
2. To become familiar with the design technologies for individuals and persons with disabilities.
3. To be aware of mobile HCI.
4. To learn the guidelines for user interface.

UNIT I FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT II DESIGN & SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules.

UNIT III MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT V WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: Design effective dialog for HCI

CO2: Design effective HCI for individuals and persons with disabilities.

CO3: Analyze the importance of user feedback.

CO4: Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.

CO5: Develop meaningful user interface.

CO6: Explain the importance of Contextual Tools.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)

REFERENCE BOOKS:

1. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (UNIT-V)

U23CBV54	EDGE ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. The aim of the course is to introduce the fundamentals of Edge Analytics
2. The course gives an overview of – Architectures, Components, Communication Protocols and tools used for Edge Analytics
3. Develop the Microsoft Azure IoT Hub
4. Design and explain Edge Analytics, Micropython
5. Implement the Visual Recognition

UNIT I INTRODUCTION TO EDGE ANALYTICS 9

What is edge analytics, Applying and comparing architectures, Key benefits of edge analytics, Edge analytics architectures, Using edge analytics in the real world.

UNIT II BASIC EDGE ANALYTICS 9

Basic edge analytics components, Connecting a sensor to the ESP-12F microcontroller, KOM-MICS smart factory platform, Communications protocols used in edge analytics, Wi-Fi communication for edge analytics, Bluetooth for edge analytics communication, Cellular technologies for edge analytics communication, Long-distance communication using LoRa and Signfox for edge analytics.

UNIT III MICROSOFT AZURE 9

Working with Microsoft Azure IoT Hub, Cloud Service providers, Microsoft Azure, Exploring the Azure portal, Azure ioT Hub, Using the Raspberry Pi with Azure IoT edge, Connecting our Raspberry Pi edge device, adding a simulated temperature sensor to our edge device.

UNIT IV MICROPYTHON 9

Using Micropython for Edge Analytics, Micropython, Exploring the hardware that runs MicroPython, Using MicroPython for an edge analytics application, Using edge intelligence with microcontrollers, Azure Machine Learning designer, Azure IoT edge custom vision.

UNIT V VISUAL RECOGNITION 9

Designing a Smart Doorbell with Visual Recognition setting up the environment, Writing the edge code, creating the Node-RED dashboard, Types of attacks against our edge analytics applications, Protecting our edge analytics applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Understand the concepts of Edge Analytics, both in theory and in practical application
- **CO2:** Demonstrate a comprehensive understanding of different tools used at edge analytics
- **CO3:** Design and implement the solutions for real world edge analytics
- **CO4:** Understand the concepts of Micropython
- **CO5:** Implement the Visual Recognition
- **CO6:** Creating and implementing the Node-RED dashboard

TEXT BOOKS:

1. Hands-On Edge Analytics with Azure IoT: Design and develop IoT applications with edge analytical solutions including Azure IoT Edge by Colin Dow

REFERENCE BOOKS:

1. Learn Edge Analytics - Fundamentals of Edge Analytics: Automated analytics at source using Microsoft Azure by Ashish Mahajan

U23CST72	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students :

1. To learn the fundamentals of natural language processing.
2. To learn the word level analysis methods.
3. To explore the syntactic analysis concepts.
4. To understand the semantics and pragmatics.
5. To learn to analyze discourses and Lexical Resources.

UNIT I INTRODUCTION 9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures

UNIT IV SEMANTICS AND PRAGMATICS 9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WorldNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Understand text with basic Language features.

CO2 : Apply rule based system to tackle morphology/syntax of a language

CO3: Explain the concept of Context Free Grammar

CO4: Explain Semantic analysis

CO5: Build tools to process natural language and design innovative NLP applications.

CO6: Evaluate lexical resources.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.

REFERENCE BOOKS:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java‖, O'Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

U23CBV56	MULTIMEDIA SECURITY & FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Knowledge of web application vulnerabilities and tools for cyber security
2. Secure both clean and corrupted systems
3. Understand key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft.
4. Determine computer technologies, digital evidence collection, and evidentiary reporting in forensic acquisition.

UNIT I DIGITAL RIGHTS MANAGEMENT (DRM) FRAMEWORK 9

Requirements of a DRM system, Architectures, Dimensions to content protection: Tracing (fingerprinting), authentication, Encryption, Key management and access control..

UNIT II DIGITAL WATERMARKING 9

Information Theory: Mutual Information and Channel Capacity - Watermarking with Side Information - Using Perceptual Models – Robust Watermarking -Affine-Resistant Watermarking. Image Watermarking, Video Watermarking, Audio Watermarking, Watermarking for CG-models, Watermarking for Binary Images, Watermarking for 3D Contents, Data Hiding through watermarking techniques.

UNIT III CONTENT AUTHENTICATION TECHNIQUES 9

Data authentication, One way hash functions, Message authentication codes (MACs); Multimedia authentication: Perceptual hashes; Parameterization; Watermarking based authentication: Notion of semi-fragility, Construction and design of semi-fragile watermarks, Privacy preserving protocols: Zero knowledge protocols, Anonymous fingerprinting, Public key watermarking, Non-perfect secret sharing constructions for anonymous fingerprinting with shared access control.

UNIT IV FORENSICS 9

Multimedia encryption - Digital Watermarking Security Attacks - Digital Forensics taxonomy - goals/ requirements - Forensic Data Acquisition - Forensics Analysis and Validation.

UNIT V CRYPTOGRAPHY AND MULTIMEDIA ENCRYPTION 9

Introduction to Cryptography, Multimedia Processing in the Encryption Domain, Privacy preserving Information Processing, Information Theory and Digital Forensics, Forgeries Detection, New ways for making Forgeries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Design and develop various applications of digital watermarking
- **CO2:** Analyze the main properties and classifications of digital watermarking systems
- **CO3:** Design of digital watermarking systems modelling
- **CO4:** **Design** Selected digital watermarking algorithms (e.g. LSB based approach and those in DCT domain)
- **CO5:** **Implement** Security of digital watermarking systems
- **CO6:** **Understand** the Multimedia Processing and Digital Forensics

TEXT BOOKS:

1. Michael Digital Watermarking and Steganography, 2nd Edition, by Cox, Miller, Bloom, Fridrich, and Kalker, 2008
2. W. Zeng, H. Yu and C. Lin, Multimedia Security Technologies for Digital Rights Management, Elsevier, UK, 2006.

REFERENCE BOOKS:

1. Multimedia Security Handbook, BorkoFurht, DarkoKirovski, CRC Press, 2004
2. Multimedia Security Technologies for Digital Rights Management, WenjunZeng, Heather Yu, Ching-Yung Lin, Elsevier, 2006
3. Advanced Techniques in Multimedia Watermarking: Image, Video and Audio Applications: Image,Video and Audio Applications, Al-Haj, Ali Mohammad

U23ITV65	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

- To understand linear programming, graphical methods, and the simplex method.
- To explore integer programming, branch and bound methods, and transportation problems.
- To study project scheduling, CPM, PERT, and cost considerations in project management.
- To learn classical optimization theory, unconstrained and constrained optimization problems.
- To analyze queuing theory, system characteristics, and single/multiple service channel models.

UNIT I LINEAR MODELS 9

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP-Simplex Method-Two-Phase method.

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 9

Integer programming: Branch and bound method- Transportation and Assignment problems – Traveling sales man problem.

UNIT III PROJECT SCHEDULING 9

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV CLASSICAL OPTIMIZATION THEORY 9

Unconstrained problems–necessary and sufficient conditions- Newton- Raphson method, Constrained problems–equality constraints–inequality constraints-Kuhn-Tucker conditions**.**

UNIT V QUEUING MODELS 9

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline,Single channel models, multiple service channels.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Understand the Formulate and solve linear programming problems (LPP).
CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.
CO3: Use the solution to network problems using CPM and PERT techniques.
CO4: Learn to optimize the functions object to the constraints.
CO5: Identify and solve problems under Markovian queuing models.
CO6: Explain Queuing system and multiple service channels.

TEXTBOOKS:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCE BOOKS:

1. ND Vohra, Quantitative Techniques in Management, Tata Mc Graw Hill, 4th Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt. Ltd. NewDelhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

NPTEL LINK:

1. https://onlinecourses.nptel.ac.in/noc25_ma59/preview
2. https://onlinecourses.nptel.ac.in/noc25_me60/preview

U23CBV58	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand big data.
2. To learn and use NoSQL big data management.
3. To learn mapreduce analytics using Hadoop and related tools.
4. To work with map reduce applications
5. To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I UNDERSTANDING BIG DATA 9

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – opensource technologies – inter and trans firewall analytics

UNIT II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III MAP REDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MR Unit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – Hive QL data definition – Hive QL data manipulation – HiveQL queries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Describe** big data and use cases from selected business domains.

CO2: **Explain** NoSQL big data management.

CO3: **Install,** configure, and run Hadoop and HDFS.

CO4: **Perform** map-reduce analytics using Hadoop.

CO5: **Usage** Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

CO6: **Describe** big data and use cases from selected business domains.

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012. 3. Sadalage, Pramod J. “NoSQL distilled”, 2013

REFERENCE BOOKS:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

VERTICAL 6

U23CSV67 **KNOWLEDGE ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of Knowledge Engineering.
2. To discuss methodologies and modeling for Agent Design and Development.
3. To design and develop ontologies.
4. To apply reasoning with ontologies and rules.
5. To understand learning and rule learning.

UNIT I INTRODUCTION 9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods- Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING 9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV REASONIING WITH ONTOLOGIES AND RULES 9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and OntologyMatching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING 9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of Knowledge Engineering.

CO2: Apply methodologies and modelling for Agent Design and Development.

CO3: Design and develop ontologies.

CO4: Apply reasoning with ontologies and rules.

CO5: Understand learning and rule learning.

CO6: Explain Hypothesis Learning.

TEXT BOOK:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCE BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

U23CBV62	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.
6. To deliver successful software projects that support organization's strategic goals.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	Understand Project Management principles while developing software.
CO2:	Gain extensive knowledge about the basic project management concepts, framework and the process models.
CO3:	Obtain adequate knowledge about software process models and software effort estimation techniques.
CO4:	Estimate the risks involved in various project activities.
CO5:	Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
CO6:	Learn staff selection process and the issues related to people management

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCE BOOKS:

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education

U23ITV45	CLOUD SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students to:

- To learn cloud computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To explore the Identity, Access control in Cloud
- To study security design patterns for cloud access control and interfaces.
- To learn monitoring, auditing, and management for cloud security.

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, 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.

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 the end of the course the students would be able to

CO1: Understand the cloud concepts and fundamentals.
CO2: Learn security design principles for cloud computing and virtualization
CO3: Use cloud security controls, including access management, incident response, and auditing techniques.
CO4: Understand various risks ,audit and monitoring mechanisms in the cloud.
CO5: Show monitoring and management strategies to detect, respond to, and mitigate security threats in cloud environments.
CO6: Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:

1. Winkler, Vic JR. Securing the Cloud: Cloud computer Security techniques and tactics. Netherlands, First edition, 2011.
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.

REFERENCE BOOKS:

1. Daniel Drescher, "Blockchain Basics", First Edition, A press, 2017.
2. Handbook of Research on Block chain Technology published by Elsevier Inc. ISBN: 9780128198162, 2020.

NPTEL LINK:

1. onlinecourses.nptel.ac.in › noc21_cs15 › preview

U23CBV64	5G TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Knowledge on the concepts of 5G and 5G technology and drivers,
2. Explain the 5G wireless Propagation Channels
3. Understand the concept of 5G network architecture,
4. Design and implementation of 5G network components.
5. Explain the 5G technology features and their benefits

UNIT I **9**

Overview of 5G Broadband Wireless Communications: Mobile communications generations: from 1G to 4G, Rationale of 5G - requirements, Standardization activities.

UNIT II **9**

The 5G wireless Propagation Channels: Channel model requirements, Propagation scenarios and challenges in the 5G modelling, Channel Models for MM Wave, MIMO Systems.

UNIT III **9**

The 5G radio-access technologies: Access design principles for multi-user communications – Orthogonal Frequency Division Multiplexing (OFDM), Filter Bank Multi-Carriers (FBMC) and Universal Filtered Multi-Carrier (UFMC), Multiple Access Techniques – Orthogonal Frequency Division Multiple Accesses (OFDMA), Non-Orthogonal Multiple Accesses (NOMA).

UNIT IV **9**

Device-to-Device (D2D) Communications– Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications.

UNIT V **9**

Millimetre-wave Communications – Spectrum and Regulations, Deployment scenarios, Beam-forming, physical layer techniques. Massive MIMO propagation channel models, Pilot design for Massive MIMO, Resource allocation and transceiver algorithms for massive MIMO, Fundamentals of baseband and RF implementations in massive MIMO.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Understand 5G and 5G Broadband Wireless Communications
- **CO2:** Understand 5G wireless Propagation Channels
- **CO3:** Understand the significance of radio access technologies for 5G
- **CO4:** Analyze Device-to-device (D2D) communications
- **CO5:** Learn Massive MIMO propagation channel models
- **CO6:** Explain the Massive MIMO propagation channel models

TEXT BOOKS:

1. Afif Osseiran, Jose.F. Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks, Cambridge University Press.

REFERENCE BOOKS:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
2. Amitabha Ghosh and RapeepatRatasuk "Essentials of LTE and LTE-A", Cambridge University Press
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, "New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press.
4. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.
5. Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.

U23CBV65	IOT SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Understand the various attacks and importance of Security aspects in IoT
2. Understand the techniques, protocols and security towards Gaming models
3. Understand security and privacy challenges of IoT
4. Understand the application of block chain technology for IoT Security
5. Understand the Authentication Techniques

UNIT I FUNDAMENTALS OF IOT **9**

Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity Modelling faults and adversaries Difference among IoT devices, computers, and embedded devices.

UNIT II IOT AND CYBER-PHYSICAL SYSTEMS **9**

IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT, IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions Consensus algorithms and their scalability problems Accelerometer, photoresistor, buttons

UNIT III SECURITY ENGINEERING FOR IOT **9**

Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator, IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal

UNIT IV DATA PRIVACY **9**

Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT Device/User Authentication in IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication

UNIT V INTRODUCTION TO AUTHENTICATION TECHNIQUES **9**

Introduction to Authentication Techniques, Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT, Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges, Data analytics in IoT - simple data analyzing methods

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: Incorporate the best practices learnt to identify the attacks and mitigate the same

CO2: Adopt the right security techniques and protocols during the design of IoT products

CO3: Assimilate and apply the skills learnt on ciphers and block chains when appropriate

CO4: Describe the essential components of IoT

CO5: Design and implementation of Authentication Techniques

CO6: Understand the Authentication Techniques

TEXT BOOKS:

1. B. Russell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
2. FeiHU, "Security and Privacy Internet of Things (IoTs): Models, Algorithms and Implementations", CRC Press, 2016
3. Narayanan et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction," Princeton University Press, 2016.

REFERENCE BOOKS:

1. A. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies," O'Reilly, 2014.
2. T. Alpcan and T. Basar, "Network Security: A Decision and Game-theoretic Approach," Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues" European Research Cluster.
5. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014.
6. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017

U23CSV44 MODERN CRYPTOGRAPHY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn about Modern Cryptography
2. To focus on how crypto graphic algorithms and protocols work and how to use them.
3. To build a Pseudo random permutation.
4. To construct Basic cryptanalytic techniques
5. 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 ofFunctions. Notions of Semantic Security (SS) and Message In distinguish ability (MI)- Proof ofEquivalence of SS and MI-Hard Core Predicate- Trap-door permutation, Gold was ser-MicaliEncryption. Gold reich-Levin Theorem- Relation between Hardcore Predicates and Trap-door permutations

UNIT II FORMALNOTIONS OF ATTACKS 9

Attacks under Message In distinguish ability- Chosen Plain text Attack (IND-CPA)-Chosen Cipher text Attacks (IND-CCA1 and IND-CCA2) - Attacks under Message Non-malleability- NM-CPA and NM- CCA2- Inter-relations among the attack model

UNIT III RANDOM ORACLES 9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak andStrong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-YaoConstruction,Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

UNIT IV BUILDIN GAP SEUDO RANDOM PERMUTATION 9

The Luby Rack off Construction-Formal Definition- Application of the Luby Rack off Construction to the construction of Block Ciphers-The DES in the light of Luby Rack off Construction.

UNITV MESSAGE AUTHENTICATION CODES 9

Leftor Right Security(LOR).Formal Definition of Weak and Strong MACs, Using aPR FasaMAC-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 One-way 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 the students will be able to:

- **CO1:** Interpret the basic principles of cryptography and general crypt analysis.
- **CO2:** Determine the concepts of symmetric encryption and authentication.
- **CO3:** Identify the use of public key encryption, digital signatures, and key establishment.
- **CO4:** Explain the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
- **CO5:** Extend the use of Message Authentication Codes.
- **CO6:** Analyzethe perform of Shamir's Secret Sharing Scheme

TEXT BOOKS:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications,Springer Verlag.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCE BOOKS:

1. Shaffi Gold wasser and Mihir Bellare, Lecture Notes on Cryptography,Available at http://citeseerx.ist.psu.edu/.
2. Oded Gold reich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23

U23CBV67	CYBER LAWS AND ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of cyber law.
2. To understand the problems and issues associated with it.
3. To understand the various act or regulations.
4. To understand the various approaches for incident analysis and response.
5. To understand the ethical laws of computer for different countries.

UNIT I INTRODUCTION TO CYBER LAW 9

Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement.

UNIT II INFORMATION TECHNOLOGY ACT 9

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences.

UNIT III CYBER LAW AND RELATED LEGISLATION 9

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code.

UNIT IV ELECTRONIC BUSINESS AND LEGAL ISSUES 9

Evolution and development in Ecommerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Application area: Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends

UNIT V CASE STUDY ON CYBER CRIMES 9

Harassment Via E-Mails, Email Spoofing (Online A Method of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS), Cyber-Stalking.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	Make learner conversant with the social and intellectual property issues emerging from cyberspace.
CO2:	Explore the legal and policy developments in various countries to regulate cyberspace
CO3:	Develop the understanding of relationship between commerce and cyberspace
CO4:	Give learners in depth knowledge of information technology act and legal frame work of right to privacy, data security and data protection.
CO5:	Make Study on Various Case Studies on Real Time Crimes.
CO6:	Understand the ethical laws of computer for different countries.

TEXT BOOKS:

1. K. Kumar," Cyber Laws: Intellectual property & E Commerce, Security",1 st Edition, Dominant Publisher,2011. (Units 1-2)
2. Rodney D. Ryder, "Guideto Cyber Laws", Second Edition, Wadhwa and Company, New Delhi, 2007.
3. Information Security policy &implementation Issues, NIIT, PHI. (Units 3-5)

REFERENCE BOOKS:

1. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI,2003.
2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi, 2003.
3. Sharma, S.R., "Dimensions of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
4. Augastine, Paul T.," Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007.

U23CBV68	BIOMETRIC SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Introduce Bio-metric and traditional authentication methods.
2. Describe the background theory of image processing required in biometric security
3. Understand the concept of Biometric Modalities
4. Design and implement of multimodal biometric systems
5. Implement the Biometric System Security

UNIT I Overview of Biometrics: 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 Processing 9

Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, spatial filtering, inverse filtering, Minimum mean square Error filtering. Introduction to image segmentation: Image edge detection: Introduction to edge detection, types of edge detectors. Introduction to image feature extraction

UNIT III Biometric Modalities 9

Algorithms Face recognition Voice Recognition Fingerprint Recognition Iris Recognition Other biometric modalities: Retina, signature, hand geometry, gait, keystroke Quantitative analysis on the biometrics, Performance evaluation in Biometrics – false acceptance rate; false rejection rate

UNIT IV Multimodal Biometric systems 9

Biometric system integration,: theory and applications, performance evaluation of multimodal biometric systems.

UNIT V Biometric System Security 9

Biometric attacks/tampering; solutions; biometric encryption.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: Understand the privacy challenges of Biometrics
CO2: Explain different biometrics parameters
CO3: Understand the various modules constituting a bio-metric system.
CO4: Understand the concept of Biometric Modalities
CO5: Design and implement of multimodal biometric systems
CO6: Implement the Biometric System Security

TEXT BOOKS:

1. Paul Reid, Biometrics for network security, Hand book of Pearson, 2004.
2. Gonzalez, R.C. and Woods, R.E., Digital Image Processing. 2nd ed. India: Person Education, 2009

REFERENCE BOOKS:

1. A.K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999.
2. J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology,
3. Design and Performance Evaluation, Springer, 2004.
4. Anil Jain, Arun A. Ross, Karthik Nanda kumar, Introduction to biometric, Springer, 2011
5. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio
6. D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition, Springer Verlag, 2003.

OPEN ELECTIVE

U23CBT45	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To learn cybercrime and cyber law.
2. To understand the cyber-attacks and tools for mitigating them.
3. To understand information gathering.
4. To learn how to detect a cyber-attack.
5. To learn how to prevent a cyber-attack.

UNIT I INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cyber criminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1:** Explain the basics of cyber security, cyber crime and cyber law
- **CO2:** Classify various types of attacks and learn the tools to launch the attacks
- **CO3:** Apply various tools to perform information gathering
- **CO4:** Apply intrusion techniques to detect intrusion
- **CO5:** Apply intrusion prevention techniques to prevent intrusion
- **CO6:** **Explain** the techniques used for RestNet and Inception v3.

TEXT BOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021. (Unit-1 &2)

2. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015. (Unit-4 & 5)

REFERENCE BOOKS:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011. (Unit-3)
2. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013.
3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.

U23CBT53	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Know the importance and need for software security.
2. Know about various attacks.
3. Learn about secure software design.
4. Understand risk management in secure software development.
5. Know the working of tools related to software security.

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 - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection.

UNIT V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1:	**Identify** various vulnerabilities related to memory attacks.
CO2:	**Apply** security principles in software development.
CO3:	**Evaluate** the extent of risks.
CO4:	**Explain** selection o testing techniques related to software security in the testing phase of software development.
CO5:	**Apply** tools for securing software.
CO6:	**Show** the secure project management with implementation

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", First 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

REFERENCE BOOKS:

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", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing,2012
6. Jason Grembi, "Developing Secure Software"

U23CST64 **INFORMATION SECURITY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of Information Security
2. To know the legal, ethical and professional issues in Information Security •
3. To know the aspects of risk management
4. To become aware of various standards in this area
5. To know the technological aspects of Information Security

UNIT I INTRODUCTION 9

History, What is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Discuss the basics of information security
CO2: Illustrate the legal, ethical and professional issues in information security
CO3: Demonstrate the aspects of risk management.
CO4: Become aware of various standards in the Information Security System
CO5: Design and implementation of Security Techniques
CO6: Discuss the basics of information security

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, fourth edition
2. Evan Wheeler, "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up", First edition, Syngress Publishing, 2011

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRCPress LLC, 2004
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata Mc GrawHill, 2003
3. Matt Bishop, "ComputerSecurity Art and Science", Pearson/PHI, 2002.

U23CBT62	NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basic concepts of security
2. To understand the concept of authentication protocols and digital signatures.
3. To learn various methods and protocols to understand the cryptography.
4. To learn various network security attacks.
5. To understand the IP and Web security.

UNIT I FUNDAMENDALS OF NETWORKING SECURITY 9

Overview of networking security- Security Services -Confidentiality, Authentication, Integrity, Non-repudiation, access Control - Availability and Mechanisms- Security Attacks -Interruption, Interception ,Modification and Fabrication.

UNIT II AUTHENTICATION AND SECURITY 9

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 9

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 9

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 attacks - route table modification - UDP hijacking - man-in-the-middle attacks.

UNIT V IP SECURITY AND WEB SECURITY 9

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 Wireshark – 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 the course the students would 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:	**Analyze** and get better knowledge on fundamental concepts of cryptography, encryption and hashing techniques.
CO4:	**Identify** and assess different types of threats and attacks such as social engineering, rootkit, and botnets,etc.
CO5:	**Acquire** Demonstrate the ability to select among available network security technology and protocols such as IDS, firewalls, SSL , TLS, etc.
CO6:	**Demonstrate** the applications of social networks

TEXT BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

REFERENCE BOOKS:

1. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech
2. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
3. A look back at Security Problems in the TCP/IP Protocol Suite, S. Bellovin, ACSAC 2004.

U23CBT61 EMBEDDED SYSTEMS AND IOT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn the internal architecture and programming of an embedded processor.
2. To introduce interfacing I/O devices to the processor.
3. To introduce the evolution of the Internet of Things (IoT).
4. To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
5. To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Explain** the architecture of embedded processors.
CO2: **Write** embedded C programs.
CO3: **Design** simple embedded applications.
CO4: **Compare** the communication models in IOT
CO5: **Design** IoT applications using Arduino/Raspberry Pi /open platform.
CO6: **Explain** about Arduino and its types

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

REFERENCE BOOKS:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

U23CBT71	CYBER FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To learn cyber crime and forensics
2. To become familiar with forensics tools
3. To learn to analyze and validate forensics data
4. To understand cyber laws and the admissibility of evidence with case studies
5. To learn 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.

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 - Footprinting 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 the end of the course the students would be able to:

CO1: **Understand** the basics of cyber crime and computer forensics
CO2: **Apply** a number of different computer forensic tools to a given scenario
CO3: **Analyze** and validate forensics data
CO4: **Understand** Admissibility of evidence in India with Cyber laws and Case Studies
CO5: **Identify** the vulnerabilities in a given network infrastructure
CO6: **Implement** real-world hacking techniques to test system security

TEXT BOOKS:

1. Bill Nelson, Amelia Phillips, Christopher Steuart, ―Guide to Computer Forensics and Investigations‖, Cengage Learning, India Sixth Edition, 2019.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.
3. Dejey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018

REFERENCE BOOKS:

1. John R.Vacca, "Computer Forensics ", Cengage Learning, 2005
2. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik "Insider Computer Fraud‖ Auerbach Publications Taylor &Francis Group– 2008.

U23CBT43 CRYPTOGRAPHY AND CYBER SECURITY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. Learn to analyze the security of in-built cryptosystems.
2. Know the fundamental mathematical concepts related to security.
3. Develop cryptographic algorithms for information security.
4. Comprehend the various types of data integrity and authentication schemes
5. Understand cyber crimes 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

UNIT II SYMMETRIC CIPHERS 9

SYMMETRIC KEY CIPHERS: 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

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA , Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos

UNIT V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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
CO6:	**Explain** the Network Access Control

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCE BOOKS:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

U23CBT63	ETHICAL HACKING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To understand the basics of computer based vulnerabilities.
2. To explore different foot printing, reconnaissance and scanning methods.
3. To expose the enumeration and vulnerability analysis methods.
4. To understand hacking options available in Web and wireless applications.
5. To explore the options for network protection.
6. To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I INTRODUCTION 9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.

UNIT II FOOTPRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING 9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT V NETWORK PROTECTION SYSTEMS 9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Evaluate** knowledge on basics of computer-based vulnerabilities
CO2: **Analyze** the different foot printing, reconnaissance and scanning methods.
CO3: **Construct** the enumeration and vulnerability analysis methods
CO4: **Discover** knowledge on hacking options available in Web and wireless applications.
CO5: **Summarize** knowledge on the options for network protection.
CO6: **Illustrate** tools to perform ethical hacking to expose the vulnerabilities.

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOKS:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

U23CBT73	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students:

1. To Introduce Cloud Computing terminology, definition & concepts
2. To understand the security design and architectural considerations for Cloud
3. To understand the Identity, Access control in Cloud
4. To follow best practices for Cloud security using various design patterns
5. To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, 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 - 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 - 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1: **Understand** the cloud concepts and fundamentals.
CO2: **Explain** the security challenges in the cloud.
CO3: **Extend** cloud policy and Identity and Access Management.
CO4: **Understand** various risks and audit and monitoring mechanisms in the cloud.
CO5: **Explain** the various architectural and design considerations for security in the cloud
CO6: **Discuss** the Information and Event Management

TEXT BOOKS:

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, “Cloud Computing:”, Wiley 2013
2. Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011

REFERENCE BOOKS:

1. Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi