

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

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

PERAMBALUR - 621212

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

B.E COMPUTER SCIENCE AND ENGINEERING

CURRICULUM & SYLLABI



**DEPARTMENT OF COMPUTER SCIENCE AND
ENGINEERING**

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

VISION MISSION OF THE INSTITUTION

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 COMPUTER SCIENCE AND ENGINEERING

About the Department

The Department of Computer Science and Engineering was established in the year 2001. It offers a 4 year B.E (Computer Science and Engineering) Programme and 2 year M.E. (Computer Science and Engineering) Programme. The department has been recognized as a centre for carrying out Ph.D (By Research) Programme under Anna University, Chennai. Our Department accredited by NBA. It has dedicated and specialized faculty members in different areas of Computer Science and Engineering with rich experience in academics, industry and research. The department has well equipped and spacious laboratories with modern computer equipments.

Vision:

To produce globally competent, socially responsible professionals in the field of Computer Science and Engineering

Mission:

- M1: Impart high quality experiential learning to get expertise in modern software tools.
- M2: Inculcate industry exposure and build inter disciplinary research skills.
- M3: Mould the students to become Software Professionals, Researchers and Entrepreneurs by providing advanced laboratories.
- M4: Acquire Innovative skills and promote lifelong learning with a sense of societal and ethical responsibilities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1 Graduates of the programme will develop proficiency in identifying, formulating, and resolving complex computing problems
- PEO 2 Graduates of the programme will achieve successful careers in the field of computer science and engineering, pursue advanced degrees, or demonstrate entrepreneurial success
- PEO 3 Graduates of the programme will cultivate effective communication skills, teamwork abilities, ethical values, and leadership qualities for professional engagement in industry and research organizations

PROGRAM OUTCOMES (POs)

PO Graduate Attribute

- Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- Modern tool usage:** Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 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.
- Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- Project management and finance:** 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.
- Life-long learning:** 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.

PROGRAMSPECIFICOUTCOMES(PSOs)

PSO 1 Analyze, develop and provide solutions to industrial problems in computer domain using programming, data processing and analytical skills.

PSO 2 Apply software application-oriented skills to innovate solution to meet the ever-changing demands of IT industry.

PEO's – PO's & PSO's MAPPING:

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

**DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS), PERAMBALUR – 621 212.**

B.E. COMPUTER SCIENCE AND ENGINEERING

**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	U23PHT13	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 and Python Programming Laboratory	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	2	0	0	2	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	4	4	2

SEMESTER III

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	U23CST41	Design and Analysis of Algorithms	PC	3	1	0	4	4
2	U23CST42	Machine Learning	PC	3	0	0	3	3
3	U23CST43	Operating Systems	PC	3	0	0	3	3
4	U23GET41	Environmental Sciences and Engineering	BS	2	0	0	2	2
5	U23CST44	Computer Networks	PC	3	0	0	3	3
PRACTICAL								
6	U23CSP41	Operating Systems Laboratory	PC	0	0	4	4	2
7	U23CSP42	Machine Learning Laboratory	PC	0	0	4	4	2
8	U23CSP43	Networks Laboratory	PC	0	0	4	4	2

SEMESTER V

SEMESTER V								
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CST51	Mobile Application Development	PC	3	0	0	3	3
2	U23CST52	Data Mining and Data Warehousing	PC	3	0	0	3	3
3	U23CST53	Software Engineering	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	U23CSP51	Data Mining and Data Warehousing Laboratory	PC	0	0	4	4	2
7	U23CSP52	Mobile Application Development Laboratory	PC	0	0	4	4	2

SEMESTER VI

SEMESTER VI								
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CST61	Big Data Analytics	PC	3	0	0	3	3
2	U23CST62	Internet of Things	PC	3	0	0	3	3
3	U23CST63	Blockchain Technologies	PC	3	0	0	3	3
4	U23CST64	Information Security	PC	3	0	0	3	3
5		Professional Elective-II	PE	3	0	0	3	3
6		Professional Elective - III	PE	3	0	0	3	3
PRACTICAL								
7	U23CSP61	Data Analytics Laboratory	PC	0	0	4	4	2
8	U23CSP62	Internet of Things 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	U23CST71	Cloud Computing	PC	3	0	0	3	3
2	U23CST72	Natural Language Processing	PC	3	0	0	3	3
3		Elective - Management	HS	3	0	0	3	3
4		Professional Elective - IV	PE	3	0	0	3	3
5		Open Elective-II	OE	3	0	0	3	3
PRACTICAL								
6	U23CSP71	Cloud Computing Laboratory	PC	0	0	4	4	2
7	U23CSP72	Mini Project	PC	0	0	2	1	1

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Professional Elective V	PE	3	0	0	3	3
2		Professional Elective VI	PE	3	0	0	3	3
PRACTICAL								
3	U23CSP81	Project Work	EE	0	0	20	20	10

**VERTICAL – I
(Data Science)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV11	Exploratory Data Analysis	PE	3	0	0	3	3
2	U23CSV12	Recommender Systems	PE	3	0	0	3	3
3	U23CSV13	Neural Networks and Deep Learning	PE	3	0	0	3	3
4	U23CSV14	Text and Speech Analysis	PE	3	0	0	3	3
5	U23CSV15	Business Analytics	PE	3	0	0	3	3
6	U23CSV16	Image and video analytics	PE	3	0	0	3	3
7	U23CSV17	Computer Vision	PE	3	0	0	3	3
8	U23CBT51	Theory of Computation	PE	3	0	0	3	3
9	U23CSV19	Artificial Intelligence	PE	3	0	0	3	3

**VERTICAL – II
(Full Stack Development)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23ITT43	Web Technologies	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	U23CSV26	Web Application Security	PE	3	0	0	3	3
7	U23ITV27	DevOps	PE	3	0	0	3	3
8	U23CSV28	Principles of Programming Languages	PE	3	0	0	3	3
9	U23CSV29	Bio-Inspired Optimization Techniques	PE	3	0	0	3	3

VERTICAL – III
(Cloud Computing and Data Centre Technologies)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV31	Cloud Computing Technologies	PE	3	0	0	3	3
2	U23CSV32	Virtualization	PE	3	0	0	3	3
3	U23CSV23	Cloud Services Management	PE	3	0	0	3	3
4	U23CSV33	Advanced 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	U23CSV36	Stream Processing	PE	3	0	0	3	3
8	U23CBT73	Security and Privacy in Cloud	PE	3	0	0	3	3
9	U23CSV26	Web Application Security	PE	3	0	0	3	3

VERTICAL – IV
(Cyber Security and Data Privacy)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CBT73	Security and Privacy in Cloud	PE	3	0	0	3	3
2	U23CBT63	Ethical Hacking	PE	3	0	0	3	3
3	U23ITV41	Digital and Mobile Forensics	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	U23CBT53	Engineering Secure Software Systems	PE	3	0	0	3	3
7	U23CSV46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	3
8	U23CSV47	Android Security	PE	3	0	0	3	3
9	U23CBT81	Malware Analysis	PE	3	0	0	3	3

VERTICAL – V
(Creative Media)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV24	UI and UX Design	PE	3	0	0	3	3
2	U23CSV51	Augmented Reality/Virtual Reality	PE	3	0	0	3	3
3	U23CSV52	Multimedia and Animation	PE	3	0	0	3	3
4	U23AIV52	Video Creation and Editing	PE	3	0	0	3	3
5	U23CSV54	Digital marketing	PE	3	0	0	3	3
6	U23CSV55	Visual Effects	PE	3	0	0	3	3
7	U23CSV56	Game Development	PE	3	0	0	3	3
8	U23CSV57	Multimedia Data Compression and Storage	PE	3	0	0	3	3
9	U23CSV58	Cognitive Science	PE	3	0	0	3	3

VERTICAL – VI
(Emerging Technologies)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23CSV61	Robotic Process Automation	PE	3	0	0	3	3
2	U23CSV13	Neural Networks and Deep Learning	PE	3	0	0	3	3
3	U23CSV63	Cyber security	PE	3	0	0	3	3
4	U23CSV64	Quantum Computing	PE	3	0	0	3	3
5	U23CSV66	3D Printing and Design	PE	3	0	0	3	3
6	U23CSV67	Knowledge Engineering	PE	3	0	0	3	3
7	U23CSV46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	3
8	U23CSV51	Augmented Reality/Virtual Reality	PE	3	0	0	3	3
9	U23CSV56	Game Development	PE	3	0	0	3	3

VERTICAL – VII
(Artificial Intelligence and Machine Learning)

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	U23CSV71	Soft Computing	PE	3	0	0	3	3
3	U23CSV62	Neural Networks and Deep Learning	PE	3	0	0	3	3
4	U23CSV14	Text and Speech Analysis	PE	3	0	0	3	3
5	U23CSV72	Optimization Techniques	PE	3	0	0	3	3
6	U23CSV73	Game Theory	PE	3	0	0	3	3
7	U23CSV58	Cognitive Science	PE	3	0	0	3	3
8	U23CSV74	Ethics And AI	PE	3	0	0	3	3
9	U23CSV19	Artificial Intelligence	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 Resource Management	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	U23CSTO01	Computer Vision	OE	3	0	0	3	3
2	U23CSTO02	App Development	OE	3	0	0	3	3
3	U23CSTO03	Cloud Computing	OE	3	0	0	3	3
4	U23CSTO04	Ethical Hacking	OE	3	0	0	3	3
5	U23CSTO05	Multimedia and Animation	OE	3	0	0	3	3
6	U23CSTO06	Machine Learning Technique	OE	3	0	0	3	3
7	U23CSTO07	Block Chain Technologies	OE	3	0	0	3	3
8	U23CSTO08	Deep Learning	OE	3	0	0	3	3
9	U23CSTO09	Internet of Things	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	-	10	6.10
2	Basic Sciences	12	7	4	2	-	-	-	-	25	15.24
3	Engineering Sciences	5	7	-	-	-	-	-	-	12	7.32
4	Professional Core	-	5	18	19	13	16	9	-	80	48.78
5	Professional Elective	-	-	-	-	3	6	3	6	18	10.98
6	Open Elective	-	-	-	-	3	-	3	-	6	3.66
7	Employability Enhancement Courses	1	2	-	-	-	-	-	10	13	7.93
	Total	22	24	22	21	19	22	18	16	164	100%

SEMESTER - I

U23HST11	COMMUNICATIVE ENGLISH (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 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:

- CO 1:** Remember appropriate words in a situational conversation.
- CO 2:** Gain understanding of basic grammatical structures and use them in right context.
- CO 3:** Read and infer the denotative and connotative meanings of technical texts.
- CO 4:** Write Dialogue, Letter and paragraphs on various topics.
- CO 5:** Make the students prepare effective notes for main sources available.
- CO 6:** 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.

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
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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
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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
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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
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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
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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

- CO 1:** Use the matrix algebra methods for solving practical problems.
- CO 2:** Use both the limit definition and rules of differentiation to differentiate functions.
- CO 3:** Apply differential calculus tools in solving various application problems.
- CO 4:** Able to use differential calculus ideas on several variable functions.
- CO 5:** Apply multiple integral ideas in solving areas, volumes and other practical problems.
- CO 6:** 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.

U23PHT13	PHYSICS FOR ENGINEERS AND TECHNOLOGISTS	L	T	P	C
	(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 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 Moduli 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 (CO₂), 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

- CO 1:** Differentiate the elastic and plastic nature of the materials.
- CO 2:** Know the experimental techniques in both production and applications of ultrasonic waves.
- CO 3:** Gain knowledge in the basics of quantum mechanics concepts.
- CO 4:** Develop new devices based on LASER source.
- CO 5:** Understand the advantages of optical fiber than metal wire.
- CO 6:** 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 Murugesan, 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.

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. CO₂ 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: H₂-O₂ 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

- CO 1:** Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
- CO 2:** Apply the basic knowledge of Corrosion and various electrodes.
- CO 3:** Know the economically and new methods of synthesis nano materials.
- CO 4:** Apply the knowledge of phase rule and composites for material selection requirement.
- CO 5:** Understand the concepts of suitable fuels for engineering processes and applications.
- CO 6:** 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.

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

- CO 1:** Develop algorithmic solutions to simple computational problems
- CO 2:** Develop and execute simple Python programs
- CO 3:** Develop simple Python programs using conditionals and loops for solving problems
- CO 4:** Explain the Concept of Lists and Tuples
- CO 5:** Develop simple Python programs for Read and write data from/to files in Python programs
- CO 6:** 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.

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.

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

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

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS:

1. 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)

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, ஓயிலாட்டம், 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 அச்ச வரலாறு.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS:

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

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 / Software	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

- CO 1:** Develop algorithmic solutions to simple computational problems.
- CO 2:** Develop and execute simple Python programs
- CO 3:** Develop real-time/technical applications using Sets, Dictionaries
- CO 4:** Build programs using Functions and Strings
- CO 5:** Construct Python program using Python Standard Libraries
- CO 6:** Develop real-time/technical applications using File handling and Exception handling

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 Supply, 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

- CO 1:** Understand the functioning of various physics laboratory equipment.
- CO 2:** Observe and tabulate experimental data.
- CO 3:** Solve problems individually and collaboratively.
- CO 4:** Analyze the quality of water samples with respect to their acidity, alkalinity
- CO 5:** Determine the amount of hardness in the water
- CO 6:** Analyze quantitatively the impurities in solution by electro analytical techniques

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

CO 1: Identify and comprehend complex academic texts.

CO 2: Interpret accurately and fluently in formal and informal communicative contexts.

CO 3: Demonstrate their opinions effectively in both oral and written medium of communication.

CO 4: Plan travelogue and construct paragraphs on various aspects.

CO 5: Develop journal reading skills and small talk.

CO 6: Utilizing technical terms and making power point presentations.

SEMESTER-II

U23HST21	PROFESSIONAL ENGLISH (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		2	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 6

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 LECTURE ENRICHMENT AND PASSAGE COMPOSE 6

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 6

Listening- Watching videos/documentaries and responding to questions based on them. **Speaking** – Speaking about one's 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 6

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 6

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: 30 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Compare and contrast products and ideas in technical texts.
- CO 2 :** Identify cause and effects in events, industrial processes through technical texts.
- CO 3 :** Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- CO 4 :** Motivate students to write reports and winning job applications.
- CO 5 :** Recall and comprehend different discourses and genres of texts.
- CO 6 :** 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.

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. To introduce the numerical techniques of interpolation in various intervals and
4. 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
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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
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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
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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
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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
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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:

- CO 1:** Apply the concept of testing of hypothesis for small and large samples in real life problems.
- CO 2:** Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- CO 3:** Solve the algebraic and transcendental equations.
- CO 4:** Understand the knowledge of numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- CO 5:** Solve the ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
- CO 6:** 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.

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 - Bravais'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 OPTO ELECTRONICS AND DEVICES**9**

Classification of optical materials-Light detectors and solar 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 DIELECTRIC 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

- CO 1:** Know basics of crystallography and its importance for varied materials properties.
- CO 2:** Acquire knowledge on basics of semiconductor physics and its applications in various devices.
- CO 3:** Illustrate the SMA and metallic glasses.
- CO 4:** Understand the optical properties of materials and working principles of various optical devices
- CO 5:** Explain types of polarization and its mathematical expression
- CO 6:** 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

- CO 1:** Compute the electric circuit parameters for simple problems
- CO 2:** Explain the working principle of electrical machines
- CO 3:** Explain the applications of electrical machines
- CO 4:** Analyze the characteristics of analog electronic devices
- CO 5:** Explain the basic concepts of digital electronics
- CO 6:** 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

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

- CO 1:** Simplify Boolean functions using K-Map
- CO 2:** Design and Analyze Combinational and Synchronous Sequential Circuits.
- CO 3:** Design and Analyze SR and JK flip flop.
- CO 4:** Write HDL code for combinational and Sequential Circuits
- CO 5:** Implement the different memory management.
- CO 6:** Implement designs using Programmable Logic Devices

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog”, 6th Edition, Pearson Education, 2017.
2. G.K. Kharate, Digital Electronics, Oxford University Press, 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, CENGAGE Learning, 2013
3. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, 2003.

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

- CO 1:** Demonstrate knowledge on C Programming constructs
- CO 2:** Design and implement applications using arrays and strings
- CO 3:** Develop and implement modular applications in C using functions and pointers
- CO 4:** Develop applications in C using structures and unions
- CO 5:** Design applications using sequential and random access file processing.
- CO 6:** 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.

GE3252

TAMILS AND TECHNOLOGY

L	T	P	C
1	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY

3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

3

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

UNIT III MANUFACTURING TECHNOLOGY

3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY

3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING

3

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

TOTAL: 15 PERIODS

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. பொருதை – 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.

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 குழுவித் 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)
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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.

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 / Software	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

- CO 1:** Demonstrate knowledge on C programming constructs.
CO 2: Develop programs in C using basic constructs
CO 3: Construct programs in C using arrays.
CO 4: Develop applications in C using strings, pointers, functions
CO 5: Build applications in C using structures.
CO 6: Develop applications in C using file processing

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: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment / Software	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:

- CO 1:** Distinguish their technical competency through language skill.
- CO 2:** Predict context effectively in-group discussions held in a formal / semi-formal discussions.
- CO 3:** Understanding candidates' key characteristics.
- CO 4:** Finding personality traits by sharing and comparing thoughts and ability.
- CO 5:** Understanding the value of ethics.(rules and regulations).
- CO 6:** Construct emails and effective job applications.

SEMESTER - III

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DISCRETE MATHEMATICS

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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 combinatorics and 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 will be able to

- CO 1: Summarize the concept of elementary mathematical logical arguments
- CO 2: Apply basic counting techniques to solve combinatorial problems .
- CO 3: Identify the applications of Graph theory models and data structures
- CO 4: Apply the concepts and properties of algebraic structures such as groups, rings and fields.
- CO 5: Extend the concepts of Boolean algebra in the area of lattices
- CO 6: 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.

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 and floating-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 – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multi-core processors.

UNITV 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 will be able to

- CO 1:** Understand the basic structures of a computer system.
- CO 2:** Explain the various arithmetic operations used in computers
- CO 3:** Apply pipelined control units and the different types of hazards in the instructions
- CO 4:** Interpret the concepts of parallel processing architecture
- CO 5:** Summarize the fundamentals of memory system
- CO 6:** 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

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 will be able to

- CO 1:** Explain linear data structures using array and linked list.
- CO 2:** Understand the concept of stacks & queues.
- CO 3:** Explain non-linear data structures of tree traversal.
- CO 4:** Understand Breadth-first traversal and Depth-first traversal.
- CO 5:** Apply Searching and sorting techniques in data structures.
- CO 6:** Apply hashing techniques in data structures

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
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.

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 will be able to

- CO 1:** Explain the fundamental concepts of relational database and SQL.
- CO 2:** Build the ER model for Relational model mapping to perform database design Effectively.
- CO 3:** Summarize the properties of transactions and concurrency control mechanisms.
- CO 4:** Compare and contrast various indexing strategies in different database systems.
- CO 5:** Extend Distributed Databases
- CO 6:** Explain the different advanced databases.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017

REFERENCE BOOK:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

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 JAVA FX

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 JAVA FX EVENT HANDLING, CONTROLS AND COMPONENTS**9**

JAVA FX 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 will be able to

- CO 1:** Develop Java programs using Object Oriented Programming principles
- CO 2:** Explain Java programs with inheritance and interface concepts
- CO 3:** Build Java applications using exceptions
- CO 4:** Build Java applications with I/O and generics classes
- CO 5:** Develop interactive Java programs using JAVAFX event handling
- CO 6:** 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 BOOK:

1. Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11TH Edition, Prentice Hall, 2018

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 / Software	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

- CO 1:** Utilize typical data definitions and manipulation commands
- CO 2:** Develop applications to test Nested and Join Queries
- CO 3:** Build simple applications using Views
- CO 4:** Build Procedures and Functions
- CO 5:** Develop and manipulate data using NOSQL database.
- CO 6:** Develop applications that require a Front-end Tool

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 / Software	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

- CO 1:** Develop and array implement of Stack and Queue ADTs
- CO 2:** Develop and array implement of List ADT
- CO 3:** Develop and implement List, Stack and Queue ADTs.
- CO 4:** Apply the concept of Binary Trees, Binary Search Trees, AVL Trees
- CO 5:** Develop and implement Heaps using Priority Queues
- CO 6:** Apply the concept of searching and sorting algorithms

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 / Software	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

- CO 1:** Develop and implement Java programs for simple applications that make use of classes and packages
- CO 2:** Develop and implement Java programs for simple applications that make use of interfaces
- CO 3:** Develop and implement Java programs with array list and exception handling
- CO 4:** Develop and implement Java programs with multithreading
- CO 5:** Design applications using file processing and generic programming
- CO 6:** Design applications using event handling

SEMESTER IV

U23CST41	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
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COURSE OBJECTIVES

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

1. To understand and apply the algorithm analysis techniques on searching and sorting algorithms
2. To critically analyze the efficiency of graph algorithms
3. To understand different algorithm design techniques
4. To solve programming problems using state space tree
5. To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

UNIT I INTRODUCTION 12

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – **searching:** linear search, binary search and Interpolation Search, **Pattern search:** The naïve string- matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. **Sorting:** Insertion sort – heap sort.

UNIT II GRAPH ALGORITHMS 12

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.

UNIT III ALGORITHM DESIGN TECHNIQUES 12

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort **Dynamic programming:** Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. **Greedy Technique:** Elements of the greedy strategy - Activity-selection problem — Optimal Merge pattern — Huffman Trees

UNIT IV STATE SPACE SEARCH ALGORITHMS 12

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem **Branch and Bound:** Solving 15-Puzzle problem - Assignment problem – Knapsack Problem - Travelling Salesman Problem

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 12

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3- CNF problem. **Approximation Algorithms:** TSP - **Randomized Algorithms:** concept and application - primality testing - randomized quick sort - Finding k^{th} smallest number.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Analyze the efficiency of algorithms using various frameworks
- CO 2:** Apply graph algorithms to solve problems and analyze their efficiency.
- CO 3:** Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.
- CO 4:** Make use of state space tree method for solving problems.
- CO 5:** Solve problems using approximation algorithms and randomized algorithms.
- CO 6:** Understand the concept of NP, NP- Complete and NP Hard Problems

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran — Computer Algorithms / C++|| Orient Black swan, 2nd Edition, 2019.

REFERENCE BOOKS:

1. Anany Levitin, -Introduction to the Design and Analysis of Algorithms||, 3rd Edition, Pearson Education, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.
3. S. Sridhar, -Design and Analysis of Algorithms, Oxford university press, 2014.

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
6. To understand Undecidability and NP class problems.

UNIT I PROBLEM SOLVING 9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – 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

Perception - Multilayer perception, 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 will be able to

- CO 1:** Make Use of appropriate search algorithms for problem solving
- CO 2:** Apply reasoning under uncertainty
- CO 3:** Build supervised learning models
- CO 4:** Build ensembling and unsupervised models
- CO 5:** Build deep learning neural network models
- CO 6:** Explain gradient descent optimization

TEXT BOOKS:

1. Tom Mitchell, –Machine Learning, McGraw Hill, 3rd Edition, 1997.
2. Christopher M. Bishop, –Pattern Recognition and Machine Learning, Springer, 2006.
3. Charu C. Aggarwal, –Data Classification Algorithms and Applications, CRC Press, 2014

REFERENCE BOOKS:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, –Foundations of Machine Learning, MIT Press, 2012.
2. Dan W. Patterson, –Introduction to Artificial Intelligence and Expert Systems, Pearson Education, 2007
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, –Deep Learning, MIT Press, 2016

COURSE OBJECTIVES

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

1. To understand the basics and functions of operating systems.
2. To understand processes and threads
3. To analyze scheduling algorithms and process synchronization.
4. To understand the concept of deadlocks.
5. To analyze various memory management schemes.
6. To be familiar with I/O management and file systems.
7. To be familiar with the basics of virtual machines and Mobile OS like Ios and Android.

UNIT I INTRODUCTION 9

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface – System Calls – System Programs – Design and Implementation – Structuring methods.

UNIT II PROCESS MANAGEMENT 9

Processes – Process Concept – Process Scheduling – Operations on Processes – Inter-process Communication; CPU Scheduling – Scheduling criteria – Scheduling algorithms; Threads – Multithread Models – Threading issues; Process Synchronization – The Critical-Section problem – Synchronization hardware – Semaphores – Mutex – Classical problems of synchronization – Monitors; Deadlock – Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III MEMORY MANAGEMENT 9

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory – Demand Paging – Copy on Write – Page Replacement – Allocation of Frames –Thrashing.

UNIT IV STORAGE MANAGEMENT 9

Mass Storage system – Disk Structure – Disk Scheduling and Management; File-System Interface – File concept – Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation – File System Structure – Directory implementation – Allocation Methods – Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS 9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS – iOS and Android.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Explain the overall view of the computer system and operating system.
- CO 2:** Analyze various scheduling algorithms and process synchronization
- CO 3:** Compare and contrast various memory management schemes
- CO 4:** Explain the functionality of file systems and I/O systems
- CO 5:** Compare iOS and Android Operating Systems.
- CO 6:** Explain the concept of Virtual Machines

TEXT BOOKS:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, — Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7 th Edition, Prentice Hall, 2018.

REFERENCE BOOK:

1. Achyut S.Godbole, Atul Kahate, –Operating Systems, McGraw Hill Education, 2016.

COURSE OBJECTIVES

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

1. To the study of nature and the facts about environment.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world envisions the surrounding environment, its functions and its value.
5. To study the integrated themes and biodiversity, natural resources, pollution control and waste Management.

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 will be able to

- CO 1:** Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.
- CO 2:** Discover knowledge in ecological perspective and value of environment
- CO 3:** Categorize different types of pollutions and their control measures.
- CO 4:** Understand the significance of various natural resources and its management.
- CO 5:** Analyze global environmental problems and come out with best possible solutions.
- CO 6:** Understand environmental laws and sustainable development.

TEXT 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.

REFERENCE BOOKS:

1. Dharmendra S. Sengar, _Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007
2. Rajagopalan, R, _Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
3. Erach Bharucha -Textbook of Environmental Studies for Undergraduate Courses Orient Blackswan Pvt.Ltd. 2013.

COURSE OBJECTIVES

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

1. To understand the concept of layering in networks.
2. To know the functions of protocols of each layer of TCP/IP protocol suite.
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
6. Recognize essential computer network protocols.

UNIT I INTRODUCTION AND APPLICATION LAYER**9**

Data Communication – Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets – Application Layer protocols: HTTP – FTP – Email protocols (SMTP – POP3 – IMAP – MIME) – DNS – SNMP

UNIT II TRANSPORT LAYER**9**

Introduction – Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control – Congestion Control – Congestion avoidance (DECbit, RED) – SCTP – Quality of Service

UNIT III NETWORK LAYER**9**

Switching : Packet Switching – Internet protocol – IPV4 – IP Addressing – Subnetting – IPV6, ARP, RARP, ICMP, DHCP

UNIT IV ROUTING**9**

Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing – OSPF – Path-vector routing – BGP – Multicast Routing: DVMRP – PIM

UNIT V DATA LINK AND PHYSICAL LAYERS**9**

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) – Physical Layer: Data and Signals – Performance – Transmission media- Switching – Circuit Switching.

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

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

- CO 1:** Apply Domain Name System and SNMP in the network
- CO 2:** Compare the different transport layer protocols and their applicability based on user requirements
- CO 3:** Understand the different services of network layer
- CO 4:** Explain the concept of Routing and protocols
- CO 5:** Explain how data flows from one node to another node with regard to data link layer
- CO 6:** Identify various layers of network and discuss the functions of physical layer

TEXT 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.

REFERENCE BOOKS:

1. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
2. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, –Computer Networks: An Open Source Approach, McGraw Hill, 2012.

COURSE OBJECTIVES

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

1. To install windows operating systems.
2. To understand the basics of Unix command and shell programming.
3. To implement various CPU scheduling algorithms.
4. To implement Deadlock Avoidance and Deadlock Detection Algorithms
5. To implement Page Replacement Algorithms
6. To implement various memory allocation methods.
7. To be familiar with File Organization and File Allocation Strategies.

LIST OF EXPERIMENTS

1. Installation of windows operating system
2. Illustrate UNIX commands and Shell Programming
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Illustrate the inter process communication strategy
6. Implement mutual exclusion by Semaphore
7. Write C programs to avoid Deadlock using Banker's Algorithm
8. Write a C program to Implement Deadlock Detection Algorithm
9. Write C program to implement Threading
10. Implement the paging Technique using C program
11. Write C programs to implement the following Memory Allocation Methods
 - a. First Fit
 - b. Worst Fit
 - c. Best Fit
12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs
 - a. Sequential
 - b. Indexed
 - c. Linked
15. Write C programs for the implementation of various disk scheduling algorithms.
16. Install any guest operating system like Linux using VMware.

TOTAL: 60 PERIODS**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

Sl No	Name of the Equipment / Software	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.	Linux Ubuntu 20 or higher	30

COURSE OUTCOMES:

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

- CO 1:** Define and implement UNIX Commands.
- CO 2:** Compare the performance of various CPU Scheduling Algorithms.
- CO 3:** Compare and contrast various Memory Allocation Methods
- CO 4:** Define File Organization and File Allocation Strategies
- CO 5:** Implement various Disk Scheduling Algorithms.
- CO 6:** Analyze the performance of the various page replacement algorithms

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.
6. Students will develop the ability to build and assess data-based models.

LIST OF EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment / Software	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.	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

- CO 1:** Understand the implementation procedures for the machine learning algorithms.
- CO 2:** Design Java/Python programs for various Learning algorithms
- CO 3:** Apply appropriate data sets to the Machine Learning algorithms
- CO 4:** Apply Machine Learning algorithms to solve real world problems
- CO 5:** Apply k-Nearest Neighbor algorithm to classify the iris data set.
- CO 6:** Apply non-parametric Locally Weighted Regression algorithm

COURSE OBJECTIVES

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

1. To learn and use network commands
2. To learn socket programming.
3. To implement and analyze various network protocols
4. To learn and use simulation tools.
5. To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
 - Echo client and echo server
 - Chat
 - File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool
8. Simulation of Distance Vector/ Link State Routing algorithm
9. Performance evaluation of Routing protocols using Simulation tool
10. Simulation of error correction code (like CRC).

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment / Software	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.	C / C++ / Java / Python / Equivalent Compiler	30
4.	Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalent	30

COURSE OUTCOMES:

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

- CO 1:** Apply various protocols using TCP and UDP
- CO 2:** Compare the performance of different transport layer protocols
- CO 3:** Make use of simulation tools to analyze the performance of various network protocols
- CO 4:** Analyze various routing algorithms
- CO 5:** Build error correction codes
- CO 6:** Explain Network simulator (NS) and Simulate Congestion Control Algorithms using NS

SEMESTER-V

U23CST51	MOBILE APPLICATION DEVELOPMENT	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 basics of Android devices and Platform
- 2 Acquire knowledge on basic building blocks of GUI Components in Android programming
- 3 Analyze Data storage mechanism in different Android App
- 4 Appraise android services for different applications
- 5 Design and apply the knowledge to publish Android applications

UNIT I INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT 9

Introduction, Android platform: Features and architecture, versions, ART (Android Runtime), ADB (Android Debug Bridge). Development environment/IDE: Android studio and its working environment, Application anatomy: Application framework basics: resources layout, values, asset XML representation and generated R.Javafile, Android manifest file. Creating a simple application

UNIT II GUI FOR ANDROID 9

Introduction to activities life-cycle, intent filters, adding categories, linking activities, user interface design components, Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar, basics of screen design; different layouts, App widgets. Lollipop Material design: new themes, new widgets, Card layouts. RecyclerView, Fragments: Introduction to Fragments, life-cycle.

UNIT III MEMORY MANAGEMENT 9

Introduction to Different Data persistence schemes, Shared preferences, File Handling, Managing data using SQLite database. Content providers: user content provider, Android in-built content providers, Integration of Social media apps

UNIT IV THREADS AND ANDROID SERVICES 9

Introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service, Multi-Threading: Handlers, Async Task, android network programming: HTTP URL Connection, Connecting to REST-based and SOAP based Web services, Broadcast receivers: Local Broadcast Manager, Dynamic broadcast receiver, System Broadcast. Pending Intent, Notifications, Telephony Manager: Sending SMS and making calls, Interaction with server side apps

UNIT V CASE STUDY:BUILDING ANDROID AND IOS APPLICATIONS 9

Introduction to Location based services; Google maps V2 services using Google API. Animations and Graphics: Property Animation, View Animations, Drawable Animations, Media and Camera API: Working with video and audio inputs, Camera API, Sensor programming: Motion sensors, Position sensors, Environmental sensors, Guide lines, policies and process of uploading Apps to Google play

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Exhibit the knowledge on Android devices and Platform
- CO2:** Demonstrate the usage of GUI Components for App development
- CO3:** Decide on suitable Data storage mechanism for Apps
- CO4:** Implement Android services using threads
- CO5:** Develop and publish Android applications
- CO6:** Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

TEXT BOOKS:

1. Dawn Griffiths, David Griffiths, “Head First: Android Development”, OReilly 2015
2. Greg Milette, Adam Stroud, “PROFESSIONAL Android™ Sensor Programming”, John Wiley and Sons, Inc 2012.

REFERENCE BOOK:

1. Paul Deitel, Harvey Deitel, Alexander Wald, “Android6 for Programmers, App Driven approach”, 2015, Prentice Hall, ISBN: 9780134289366.

U23CST52	DATA MINING AND DATA WAREHOUSING	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 data warehouse concepts, architecture, business analysis and tools.
- 2 To understand data pre-processing and data visualization techniques
- 3 To study algorithms for finding hidden and interesting patterns in data
- 4 To understand and apply various classification and clustering techniques using tools.

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP

UNIT II DATA MINING – INTRODUCTION 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

UNIT IV CLASSIFICATION AND CLUSTERING 9

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection- Techniques to improve Classification Accuracy.

Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT V WEKA TOOL 9

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Design a Data warehouse system and perform business analysis with OLAP tools.
- CO2:** Apply suitable pre-processing and visualization techniques for data analysis
- CO3:** Apply frequent pattern and association rule mining techniques for data analysis
- CO4:** Apply appropriate classification and clustering techniques for data analysis
- CO5:** Ability to build Data Warehouse and Explore WEKA
- CO6:** Ability to design data mining algorithms

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and TechniquesI, Third Edition, Elsevier, 2012.
2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2017.

REFERENCE BOOKS:

1. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAPI, Tata McGraw – Hill Edition, 35th Reprint 2016
2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practicell, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and TechniquesII, Elsevier, Second Edition.

COURSE OBJECTIVES

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

- 1 To understand the phases in a software project.
- 2 To understand fundamental concepts of requirements engineering and Analysis Modeling
- 3 To understand the various software design methodologies
- 4 To learn various testing and maintenance measures

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 9

Software is testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Identify the key activities in managing a software project..
- CO2:** Compare different process models.
- CO3:** Concepts of requirements engineering and Analysis Modeling.
- CO4:** Apply systematic procedure for software design and deployment.
- CO5:** Compare and contrast the various testing and maintenance.
- CO6:** Manage project schedule, estimate project cost and effort required.

TEXT BOOKS:

1. Roger S. Pressman, Bruce Maxim “Software Engineering – A Practitioner’s Approach”, 9th Edition, Mc Graw-Hill International Edition, 2023.
2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2017.

REFERENCE BOOKS:

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

COURSE OBJECTIVES

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

- 1 Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
- 2 Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
- 3 Understand the data sets and data preprocessing
- 4 Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
- 5 Exercise the data mining techniques with varied input values for different parameters.
- 6 To obtain Practical Experience Working with all real data sets.

LIST OF EXPERIMENTS

- 1 Build Data Warehouse and Explore WEKA
- 2 Create an Employee Table with the help of Data Mining Tool WEKA.
- 3 Create a Weather Table with the help of Data Mining Tool WEKA.
- 4 Apply Pre-Processing techniques to the training data set of Weather Table
- 5 Apply Pre-Processing techniques to the training data set of Employee Table
- 6 Normalize Weather Table data using Knowledge Flow.
- 7 Normalize Employee Table data using Knowledge Flow.
- 8 Finding Association Rules for Buying data.
Finding Association Rules for Banking data.
- 9 Perform data preprocessing tasks and Demonstrate performing association rule mining on data set
- 10 Demonstrate performing classification on data sets
- 11 Demonstrate performing clustering on data sets
- 12 Demonstrate performing Regression on data sets
- 13 Credit Risk Assessment. Sample Programs using German Credit Data
- 14 Sample Programs using Hospital Management System
- 15 Beyond the Syllabus -Simple Project on Data Preprocessing

TOTAL: 60 PERIODS

LIST OF EQUIPMENT / SOFTWARE FOR BATCH OF 30 STUDENTS

WEKA tool Standalone desktops -30 Nos. (or) Server supporting 30 terminals or more

COURSE OUTCOMES:

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

- CO1 :** Ability to understand the various kinds of tools
- CO2 :** Demonstrate the classification, clustering and etc. in large data sets.
- CO3:** Describe various preprocessing techniques and statistical techniques and apply those techniques on the given data set.
- CO4:** Ability to add mining algorithms as a component to the exiting tools.
- CO5:** Ability to apply mining techniques for realistic data.
- CO6:** Create an application using outlier analysis.

COURSE OBJECTIVES

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

1. To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. To understand how to work with various mobile application development frameworks.
3. To learn the basic and important design concepts and issues of development of mobile applications.
4. To understand the capabilities and limitations of mobile devices.

LIST OF EXPERIMENTS

- 1 Develop an application that uses GUI components, Font and Colours
- 2 Develop an application that uses Layout Managers and event listeners.
- 3 Write an application that draws basic graphical primitives on the screen.
- 4 Develop an application that makes use of databases.
- 5 Develop an application that makes use of Notification Manager
- 6 Implement an application that uses Multi-threading
- 7 Develop a native application that uses GPS location information
- 8 Implement an application that writes data to the SD card.
- 9 Implement an application that creates an alert upon receiving a message
- 10 Write a mobile application that makes use of RSS feed
- 11 Develop a mobile application to send an email.
- 12 Develop a Mobile application for simple needs (Mini Project).

TOTAL: 60 PERIODS

LIST OF EQUIPMENT / SOFTWARE FOR BATCH OF 30 STUDENTS

C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker, Android Studio or Equivalent

HARDWARE: Standalone desktops -30 Nos. (or) Server supporting 30 terminals or more

COURSE OUTCOMES:

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

- CO1 :** Develop mobile applications using GUI and Layouts.
- CO2 :** Develop mobile applications using Event Listener.
- CO3:** Develop mobile applications using Databases.
- CO4:** Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multithreading and GPS.
- CO5:** Analyze and discover own mobile app for simple needs
- CO6:** Develop mobile applications using Projects.

SEMESTER-VI

U23CST61

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 – cloud and big data – mobile business intelligence – Crowd sourcing analytics – 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 – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III MAP REDUCE APPLICATIONS

9

MapReduce workflows – unit tests with MRUnit – 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 – Java interface – data flow – Hadoop I/O – data integrity – 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 will 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.

COURSE OBJECTIVES

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

1. To Identify the various IoT elements appropriate to the applications
2. To Design a portable IoT using Arduino/Raspberry Pi incorporating cloud and analytics
3. To understand the Elements of IOT
4. To Learn about IoT Communication Models
5. To Implement IoT applications for real-time environment

UNIT I FUNDAMENTALS OF IOT**9**

Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols - Logical design - IoT communication models, IoT Communication APIs - Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view.

UNIT II ARDUINO PROGRAMMING**9**

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 III ELEMENTS OF IOT**9**

IoT and M2M- difference between IoT and M2M - Software Defined Networks - Network Function Virtualization - IoT systems management – Needs - NETCONF, YANG - IoT design methodology.

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 CHALLENGES IN IOT AND CASE STUDIES**9**

Security Concerns and Challenges - Real time applications of IoT – Home automation – Automatic lighting – Home intrusion detection – Cities – Smart parking – Environment – Weather monitoring system – Agriculture – Smart irrigation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Describe the characteristics, physical and logical designs, domains and architecture.
- CO2:** Explain about Arduino and its types
- CO3:** Differentiate M2M and IoT, SDN and NFV design methodologies
- CO4:** Compare the communication models in IOT
- CO5:** Describe various real time applications of IOT
- CO6:** Design IoT applications using Arduino/Raspberry Pi /open platform

TEXT BOOKS:

1. Arshdeep Bahga,VijayMadiseti, "Internet of Things-A hands-on approach", Universities Press, 2015
2. Olivier Hersent,DavidBoswarthick, Omar Elloumi,“The Internet of Things:Key applications and Protocols”,Wiley Publications 2nd Edition,2013

REFERENCE BOOKS:

1. Raj Kamal,“InternetofThings–Architecture and Design Principles”,McGraw Hill Education Pvt.Ltd.,2017
2. Internet of Things and Data Analytics, Hwaiyu Geng, P.E,Wiley Publications, 2017
3. Marco Schwartz,—Internet of Things with the Arduino Yunl,Packt Publishing,2014
4. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”,Wiley Publications, 2012.

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 Blockchain
3. To learn the Blockchain implementation frameworks
4. To experiment the Hyperledger Fabric, Ethereum networks
5. To understand the Blockchain Applications

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 BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand emerging abstract models for Blockchain Technology.
- CO2:** Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
- CO3:** Understand the functions of Blockchain methods
- CO4:** Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
- CO5:** Learn about the Hyperledger Architecture
- CO6:** Describe about the Blockchain Applications

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Second Edition.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCE BOOKS:

1. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
3. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

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.

COURSE OBJECTIVES

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

1. To understand different modes of Hadoop
2. To implement MapReduce programs for processing big data.
3. To learn about various file management tasks
4. To install Hive
5. To install Hbase and Thrift

LIST OF EXPERIMENTS

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, Installing thrift along with Practice examples
7. Practice importing and exporting data from various databases.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT / SOFTWARE FOR BATCH OF 30 STUDENTS

SlNo	Name of the Equipment/Software Requirements:	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.	Cassandra, Hadoop, Java, Pig, Hive and HBase	30

COURSE OUTCOMES:

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

- CO1:** Demonstrate the knowledge of big data analytics and implement different file management task in Hadoop.
- CO2:** Understand Map Reduce Paradigm and develop data applications using variety of systems.
- CO3:** Illustrate and apply different operations on relations and databases using Hive.
- CO4:** Analyze and perform installation of Hive.
- CO5:** Understand and implement file management tasks, such as Adding files and directories, retrieving files and Deleting files
- CO6:** Understand the Fundamental Concepts Of Big Data and Hadoop

COURSE OBJECTIVES

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

1. To Connect Arduino board with internet.
2. To Deploy an IoT application using Arduino/Raspberry Pi and appropriate sensor and actuator .
3. To Demonstrate the working of simple IoT task of LED control
4. To Design a simple Internet of Things (IoT) application using Arduino/Raspberry Pi, sensors and actuators
5. To Build an IoT system using mobile app as a mini project

LIST OF EXPERIMENTS

1. Introduction to Arduino platform and programming
2. Introduction to Raspberry PI platform and python programming
3. Turn ON and OFF the LEDs.
4. Identify the objects using IR and PIR sensor.
5. Measure the moisture level of soil using soil moisture sensor.
6. Measure the distance between the ultrasonic sensor and the obstacle.
7. Identify the leakage of gas/smoke in the environment.
8. Measure the humidity and moisture value of the environment.
9. Control a LED using relay switch.
10. Identify the rain in the environment using rain sensor
11. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)

MINI PROJECT

1. Line follower robot
2. Smart weather monitoring system
3. Smart lighting system
4. Smart waste management system
5. Smart parking system

TOTAL: 60 PERIODS**LIST OF EQUIPMENT / SOFTWARE FOR BATCH OF 30 STUDENTS**

Sl. No	Name of the Equipment/Software Requirements:	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, Raspberry pi ,ZigBee Interface, LORA Interface computer with relevant simulation software, access to IoT cloud service like Thing Speaks ,Sensors etc. and high speed internet.	30

COURSE OUTCOMES:

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

- CO1 :** Understand the concept of Internet of Things
- CO2 :** Implement interfacing of various sensors with Arduino/Raspberry Pi.
- CO3:** Demonstrate the ability to transmit data wirelessly between different devices.
- CO4:** Show an ability to upload/download sensor data on cloud and server.
- CO5:** Implement IoT based street light control system.
- CO6:** Implement IoT based weather monitoring system

SEMESTER - VII

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 Challenges

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”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

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 Distributional methods

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 Publication, 2014
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 Javal, O'Reilly Media, 2015.
3. Nitin Indurkha 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.

COURSE OBJECTIVES

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

1. To develop web applications in cloud
2. To learn the design and development process involved in creating a cloud based application
3. To learn to implement and use parallel programming using Hadoop

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT / SOFTWARE 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.	Virtualbox - C/C++- VMware – ubuntu- Google App Engine – Openstack - python/java – Eclipse - Hadoop	30

COURSE OUTCOMES:

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

- CO1 :** Build various virtualization tools such as Virtual Box, VMware workstation.
- CO2 :** Develop a web application in a PaaS environment link layer
- CO3:** Demonstrate how to simulate a cloud environment to implement new schedulers
- CO4:** Demonstrate generic cloud environment that can be used as a private cloud
- CO5:** Build large data sets in a parallel environment.
- CO6:** Apply Hadoop single node cluster and run simple applications

COURSE OBJECTIVES

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

1. For gaining domain knowledge, and technical skills to solve potential business / research
2. Gather requirements and Design suitable software solutions and evaluate alternatives
3. To work in small teams and understand the processes and practices in the 'industry.
4. Implement, Test and deploy solutions for target platforms
5. Preparing project reports and presentation

PROCESS

The students shall individually / or as group work on business/research domains and related problems approved by the Department / organization that offered the internship / project.

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 300 PERIODS

COURSE OUTCOMES:

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

- CO1 :** Identify technically and economically feasible problems of social relevance
- CO2 :** Plan and build the project team with assigned responsibilities
- CO3:** Identify and survey the relevant literature for getting exposed to related solutions
- CO4:** Analyze, design and develop adaptable and reusable solutions of minimal complexity by using modern tools
- CO5:** Apply and test solutions to trace against the user requirements
- CO6:** Classify and support the solutions for better manageability of the solutions and provide scope for improvability

**VERTICAL 1
(DATA SCIENCE)**

U23CSV11	EXPLORATORY DATA 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 outline an overview of exploratory data analysis.
2. To implement data visualization using Matplotlib
3. To perform univariate data exploration and analysis.
4. To apply bivariate data exploration and analysis.
5. To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Outline the fundamentals of exploratory data analysis.
- CO 2:** Infer the data visualization using Matplotlib.
- CO 3:** Explain univariate data exploration and analysis.
- CO 4:** Apply bivariate data exploration and analysis.
- CO 5:** Utilize the Data exploration for multivariate data.
- CO 6:** Utilize the Data visualization techniques for time series data.

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCE BOOKS:

1. Eric Pimpler, Data Visualization and Exploration with R, Geospatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilley publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

COURSE OBJECTIVES

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

1. To understand the foundations of the recommender system.
2. To learn the significance of machine learning and data mining algorithms for Recommender systems
3. To learn about collaborative filtering
4. To make students design and implement a recommender system.
5. To learn collaborative filtering.

UNIT I INTRODUCTION**9**

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS**9**

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING**9**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection)

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS**9**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS**9**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Outline the basic concepts of recommender systems.
- CO 2:** Explain machine-learning and data-mining algorithms in recommender systems data sets.
- CO 3:** Illustrate the Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
- CO 4:** Contrast and implement a simple recommender system.
- CO 5:** Summarize the advanced topics of recommender systems.
- CO 6:** Summarize the advanced topics of recommender systems applications

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

REFERENCE BOOKS:

1. Francesco Ricci, Lior Rokach, Bracha Shapira, Recommender Systems Handbook, 1st ed, Springer (2011),
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 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- Heteroassociative 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 – Neuroscientific 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 Autoencoder, 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.

COURSE OBJECTIVES

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

1. Outline natural language processing basics
2. Apply classification algorithms to text documents
3. Build question-answering and dialogue systems
4. Develop a speech recognition system
5. Develop a speech synthesizer

UNIT I NATURAL LANGUAGE BASICS**9**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION**9**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS**9**

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems – evaluating dialogue systems

UNIT IV TEXT-TO-SPEECH SYNTHESIS**9**

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT V AUTOMATIC SPEECH RECOGNITION**9**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Explain existing and emerging deep learning architectures for text and speech processing
- CO 2:** Apply deep learning techniques for NLP tasks, language modelling and machine translation
- CO 3:** Explain coreference and coherence for text processing
- CO 4:** Build question-answering systems, chatbots and dialogue systems
- CO 5:** Apply deep learning models for building speech recognition and text-to-speech systems
- CO 6:** Explain HMM and DNN systems

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCE BOOKS:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O'REILLY.

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.

COURSE OBJECTIVES

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

1. Show the basics of image processing techniques for computer vision.
2. Apply the techniques used for image pre-processing.
3. Explain the various object detection techniques.
4. Classify the various Object recognition mechanisms.
5. Summarize the video analytics techniques.

UNIT I INTRODUCTION**9**

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING**9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING**9**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once (YOLO)- Salient Features-Loss Functions-YOLO architectures

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION**9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-DeepFace solution by Facebook- FaceNet for Face Recognition- Implementation using FaceNet-Gesture Recognition.

UNIT V VIDEO ANALYTICS**9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- ResNet architecture-ResNet and skip connections-Inception Network- GoogleNet architecture- Improvement in Inception v2-Video analytics- ResNet and Inception v3.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the basics of image processing techniques for computer vision and video analysis.
- CO 2:** Explain the techniques used for image pre-processing.
- CO 3:** Develop various object detection techniques.
- CO 4:** Understand the various face recognition mechanisms.
- CO 5:** Elaborate on deep learning-based video analytics.
- CO 6:** Explain the techniques used for ResNet and Inception v3.

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhani, (2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021

REFERENCE BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited, 2011.
2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
4. E. R. Davies, (2012), “Computer & Machine Vision”, Fourth Edition, Academic Press.

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.

COURSE OBJECTIVES

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

1. Understand various Computing models like Finite State Machine, Pushdown Automata.
2. Understand various Computing models like Turing Machine.
3. Be aware of Decidability and Un-decidability of various problems.
4. Learn types of grammars.

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 will be able to:

- CO 1:** Construct automata theory using Finite Automata.
- CO 2:** Write regular expressions for any pattern.
- CO 3:** Design context free grammar and Pushdown Automata
- CO 4:** Design Turing machine for computational functions
- CO 5:** Differentiate between decidable and undecidable problems
- CO 6:** 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. Micheal Sipser, "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

COURSE OBJECTIVES

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

1. To study the idea of intelligent agents and search methods.
2. To study about representing knowledge.
3. To study the reasoning and decision making in uncertain world.
4. To construct plans and methods for generating knowledge.
5. To study the concepts of expert systems.

UNIT I INTRODUCTION TO AI**9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents
Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS**9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search
Algorithms and Optimization Problems - Searching with Partial Observations - Constraint
Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal
Decisions in Games –Alpha - Beta Pruning - Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION**9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward
Chaining– Resolution – Knowledge Representation - Ontological Engineering-Categories and
Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories -
Reasoning with Default Information

UNIT IV FUZZY SYSTEMS**9**

Fuzzy Information, Fuzzy Neural Networks, Fuzzy Approaches for Supervised Learning Networks,
Fuzzy Generalizations of Unsupervised Learning Methods, Reasoning with Uncertain Information,
Pre-Processing and Post-Processing Using Fuzzy Techniques, Applications in Biomedical
Engineering

UNIT V EXPERT SYSTEM**9**

Introduction: Hopfield Network, Learning in Neural Network, Application of Neural Networks,
Recurrent Networks, Distributed Representations, Connectionism AI and Symbolic AI

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Utilize the appropriate search algorithms for any AI problem
- CO 2:** Rephrase a problem using first order and predicate logic
- CO 3:** Explain the apt agent strategy to solve a given problem
- CO 4:** Design software agents to solve a problem
- CO 5:** Develop applications for NLP that uses Artificial Intelligence.
- CO 6:** Explain the use of Connectionism AI and Symbolic AI

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

**VERTICAL II
(FULL STACK DEVELOPMENT)**

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COURSE OBJECTIVES

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

1. To understand different Internet Technologies
2. To learn java-specific web services architecture
3. To Develop web applications using frameworks

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-Functions Objects-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 INTRODUCTION TO ANGULAR AND WEB APPLICATIONS FRAMEWORKS 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 will be able to:

- CO 1:** Create simple Website by understand the basics
- CO 2:** Apply HTML and CSS effectively to create interactive and dynamic websites
- CO 3:** Build dynamic web pages with validation using Java Script objects and apply different event handling mechanisms
- CO 4:** Demonstrate simple web pages using Typescript
- CO 5:** Develop interactive web applications.
- CO 6:** Develop web applications using NodeJS.

TEXT BOOKS:

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing.

REFERENCE BOOKS:

1. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
4. UttamK.Roy, “Web Technologies”, Oxford University Press, 2011.
5. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly.

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
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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
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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
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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
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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.

UNIT V	NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS	9
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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.

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.

UNIT V 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.

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.

UNIT V 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.

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.

UNIT V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events.

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.

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.

COURSE OBJECTIVES

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

1. To introduce DevOps terminology, definition & concepts.
2. To understand the different Version control tools like Git, Mercurial.
3. To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment).
4. To understand Configuration management using Ansible.
5. Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems.

UNIT I	INTRODUCTION TO DEVOPS	9
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Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II	COMPILE AND BUILD USING MAVEN & GRADLE	9
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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
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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
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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
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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 will be able to:

- CO 1:** Understand different actions performed through Version control tools like Git.
- CO 2:** Explain Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
- CO 3:** Explain Automated Continuous Deployment.
- CO 4:** Extend configuration management using Ansible.
- CO 5:** Understand to leverage Cloud-based DevOps tools using Azure DevOps.
- CO 6:** Build devOps pipelines using azure.

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: Cidc 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. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

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.

U23CSV29	BIO-INSPIRED OPTIMIZATION TECHNIQUE	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 characteristics of natural agents and building blocks involved in biological processes.
2. To provide an understanding on the application of bio inspired algorithms to solve complex problems.
3. To provide insights into the implementation of bio inspired algorithms.

UNIT I INTRODUCTION 9

Artificial Neural Networks – Pattern classification – Single and Multilayer perceptions – Backpropagation – Pattern Association – Hebbian learning – Hopfield networks – Bidirectional Associative Memory Networks – Competitive learning – Kohonen’s Self Organizing Maps.

UNIT II OPTIMIZATION TECHNIQUES 9

Introduction to Optimization Problems – Single and Multi-objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding -representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

UNIT III SWARM INTELLIGENCE 9

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization -Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) -S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search -Local search methods – Scope of ACO algorithms.

UNIT IV SWARM ROBOTICS 9

Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics - Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V CASE STUDIES 9

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Travelling Salesman problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand phenomena guiding biological processes through self-organization and adaptability.
- CO 2:** Explain the basics of several biologically inspired optimization techniques.
- CO 3:** Extend the basics of several biologically inspired computing paradigms.
- CO 4:** Choose an appropriate bio-inspired computing method and implement for any application and data set.
- CO 5:** Understand the differences between the major bio-inspired computing methods.
- CO 6:** Apply Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

TEXT BOOKS:

1. Leandro Nunes De Castro, Fernando Jose Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Publishing, 2005.
2. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2000.

REFERENCE BOOKS:

1. Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2008
2. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
3. C. Ebelhart et al., "Swarm Intelligence", Morgan Kaufmann, 2001.

VERTICAL –III
(CLOUD COMPUTING AND DATA CENTRE TECHNOLOGIES)

U23CSV31	CLOUD COMPUTING 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 gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
2. To understand the architecture, infrastructure and delivery models of cloud computing
3. To explore the roster of AWS services and illustrate the way to make applications in AWS.
4. To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure.
5. To develop the cloud application using various programming model of Hadoop and Aneka.

UNIT I VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE 9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization- Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation

UNIT II CLOUD PLATFORM ARCHITECTURE 9

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Architectural Design Challenges.

UNIT III AWS CLOUD PLATFORM - IAAS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager

UNIT IV PAAS CLOUD PLATFORM 9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blops

UNIT V PROGRAMMING MODEL 9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the concepts of virtualization in the cloud computing.
- CO 2:** Explain the architecture, infrastructure and delivery models of cloud computing.
- CO 3:** Develop the Cloud Application in AWS platform
- CO 4:** Apply the concepts of Windows Azure to design Cloud Application
- CO 5:** Develop services using various Cloud computing programming models.
- CO 6:** Explain the concept of Aneka.

TEXT BOOKS:

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly, 2010.

REFERENCE BOOKS:

1. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , McGraw Hill Education (India) Pvt. Ltd., 2013..
2. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner's Guidel, McGraw-Hill Osborne Media, 2009.

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

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

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization VLAN-WAN Architecture-WAN Virtualization Cloud Service Reference Model, Cloud Service Life Cycle, 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

UNIT V 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:** Apply Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
- CO 3:** Understand the Cloud services and technologies
- CO 4:** Analyze the virtualization concepts and hypervisor
- CO 5:** Solve the real world problems using Cloud services and technologies
- CO 6:** Analyze the Cloud service governance and value

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

COURSE OBJECTIVES

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

1. To know the details of data warehouse Architecture
2. To understand the OLAP Technology
3. To understand the partitioning strategy
4. To differentiate various schema
5. To understand the roles of process manager & system manager

UNIT I INTRODUCTION TO DATA WAREHOUSE 9

Data warehouse Introduction - Data warehouse 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

What is ETL – 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 will be able to:

- CO 1:** Design data warehouse architecture for various Problems
- CO 2:** Apply the OLAP Technology
- CO 3:** Analyze the partitioning strategy
- CO 4:** Analyze the differentiation of various schema for given problem
- CO 5:** Explain roles of system manager
- CO 6:** Understand the roles of Data warehousing process manager

TEXT BOOKS:

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Ralph Kimball, “The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling”, Third edition, 2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

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, 2006.

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

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, Many-to-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

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 will be able to:

- CO 1:** Understand the cloud concepts and fundamentals.
- CO 2:** Explain the security challenges in the cloud.
- CO 3:** Extend cloud policy and Identity and Access Management
- CO 4:** Understand various risks and audit and monitoring mechanisms in the cloud.
- CO 5:** Explain the various architectural and design considerations for security in the cloud
- CO 6:** 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

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
- CO 2:** Apply the process for secure development and deployment of web applications
- CO 3:** Build the skill to design and develop Secure Web Applications that use Secure APIs
- CO 4:** Construct 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:** Understand the hackers tools and use tools set

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 McGrawHill Company
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
(CYBER SECURITY AND DATA PRIVACY)**

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 and 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 will 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:ll, Wiley 2013
2. Dave shackleford, “Virtualization Securityll, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacyll, OREILLY 2011

REFERENCE BOOKS:

1. Mark C. Chu-Carroll “Code in the Cloudll,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi

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 FOOT PRINTING, 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 will 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. TheBasicsofHackingandPenetrationTesting-PatrickEngelbrecht,SYNGRESS,Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOK:

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

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:

1. To understand basic digital forensics and techniques.
2. To understand digital crime and investigation.
3. To understand how to be prepared for digital forensic readiness.
4. To understand and use forensics tools for iOS devices.
5. To understand and use forensics tools for Android devices

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 – Jail breaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – Mobil Edit – 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 – Mobil Edit – Android App Decompiling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Illustrate knowledge on digital forensics.
- CO2:** Discuss about digital crime and investigations.
- CO3:** Discover forensic ready.
- CO4:** Compare Investigate, identify and extract digital evidence from Ios devices.
- CO5:** Simplify extract digital evidence from Android devices.
- CO6:** Extend identify and extract Android App Decompiling

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.

REFERENCE BOOK:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

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 influences on 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 in Social networks, Definition of community, Evaluating communities-Methods for community detection and mining-Applications of community mining algorithms- Tools for detecting - communities social network infrastructures and communities- Big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment – What is Neo 4j- Nodes - Relationships, Properties.

UNIT V ACCESSCONTROL, PRIVACY AND IDENTITYMANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service, consumers, The role of Identity provisioning

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course 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.x Second Edition By Jérôme Baton, Rik VanBruggen, 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.

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 cryptographic 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 of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI)- Proof of Equivalence of SS and MI-Hard Core Predicate- Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem- Relation between Hardcore Predicates and Trap-door permutations

UNIT II FORMAL NOTIONS OF ATTACKS 9

Attacks under Message Indistinguishability- Chosen 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 and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali- Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo-random Functions (PRF)

UNIT IV BUILDING A PSEUDO RANDOM PERMUTATION 9

The Luby Rackoff Construction-Formal Definition- Application of the Luby Rackoff Construction to the construction of Block Ciphers-The DES in the light of Luby Rackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES 9

Leftor Right Security(LOR).Formal Definition of Weak and Strong MACs, Using a PR FsaMAC- 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:** Analyze the 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 Goldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23

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. To Know the importance and need for software security.
2. To Know about various attacks.
3. To Learn about secure software design.
4. To Understand risk management in secure software development.
5. To 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 Un trusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking-Secure Design Threat Modeling and Security Design Principles

UNIT III SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle–Risk Profiling –Risk Exposure Factors–Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle – Risk Based Security Testing –Prioritizing Security Testing With Threat Modeling – Penetration Testing –Planning and Scoping-Enumeration– Remote Exploitation– Web Application Exploitation- ExploitsandClientSideAttacks–PostExploitation–BypassingFirewallsandAvoidingDetection

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 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:** Explain selection of 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”

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 .

UNIT V 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:** Understand the 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:** Utilize the 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. Daniel Drescher, “ Block chain Basics”, First Edition, 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.

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 world 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:** Motive the 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)

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 INTRODUCTION AND 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 will 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-V
(CREATIVE MEDIA)**

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.

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 - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V 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:** Designing the Sketching principles.
- CO 5:** Create Wireframe and Prototype.
- CO 6:** Examine the 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 BOOK:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’Reilly 2020.

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.

COURSE OBJECTIVES

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

1. To grasp the fundamental knowledge of Multimedia elements and systems.
2. To get familiar with Multimedia file formats and standards.
3. To learn the process of Authoring multimedia presentations and animations.
4. To explore different popular applications of multimedia.
5. Understand the complexity of multimedia applications in the context of cloud, security, Big data streaming, social networking, CBIR etc.,.

UNIT I INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORIZING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1** Develop the bigger picture of the context of Multimedia and its applications.
- CO 2** Make use of the different types of media elements of different formats on content pages.
- CO 3** Apply 2D and 3D creative and interactive presentations for different target multimedia applications.
- CO 4** Build different standard animation techniques for 2D, 21/2 D, 3D applications.
- CO 5** Understand the complexity of multimedia applications in the context of cloud, security, data streaming, social networking, CBIR etc.,
- CO 6** Understand the applications of Multimedia.

TEXT BOOK:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III).

REFERENCE BOOKS:

1. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
2. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

COURSE OBJECTIVES

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

1. To introduce the broad perspective of linear and nonlinear editing concepts.
2. To understand the concept of Storytelling styles.
3. To be familiar with audio and video recording. To apply different media tools.
4. To learn and understand the concepts of AVID XPRESS DV 4.
5. To understand the concept of trim mode.

UNIT I FUNDAMENTALS**9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II STORYTELLING**9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO**9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO**9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4**9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage -Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Compare the strengths and limitations of Nonlinear editing.
- CO 2:** Identify the infrastructure and significance of storytelling.
- CO 3:** Apply suitable methods for recording to CDs and VCDs.
- CO 4:** Build the core issues of advanced editing and training techniques.
- CO 5:** Design and develop projects using AVID XPRESS DV 4.
- CO 6:** Explain the implementation of importing files.

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.

REFERENCE BOOKS:

1. Final Cut Pro 6 User Manual, 2004.
2. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
3. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003

COURSE OBJECTIVES

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

1. The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
2. It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
3. To learn the concept of E-mail Marketing.
4. To understand the concept of social media marketing.
5. To explore the digital trends.

UNIT I INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

UNIT IV SOCIAL MEDIA MARKETING 9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION 9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- CO 2:** Analyze how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- CO 3:** Explain the key elements of a digital marketing strategy.
- CO 4:** Design how the effectiveness of a digital marketing campaign can be measured.
- CO 5:** Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.
- CO 6:** Develop the effectiveness of digital transformation.

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education. First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ; Publisher: Oxford University Press (April 2015). ISBN10: 0199455449.

REFERENCE BOOKS:

1. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
2. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education.

COURSE OBJECTIVES

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

1. To get a basic idea on animation principles and techniques.
2. To get exposure to CGI, color and light elements of VFX.
3. To have a better understanding of basic special effects techniques.
4. To have a knowledge of state of the art vfx techniques.
5. To become familiar with popular compositing techniques.

UNIT I ANIMATION BASICS**9**

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II CGI, COLOR, LIGHT**9**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model.

UNIT III SPECIAL EFFECTS**9**

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire.

UNIT IV VISUAL EFFECTS TECHNIQUES**9**

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving.

UNIT V COMPOSITING**9**

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the animation in 2D / 3D following the principles and techniques.
- CO 2:** Make use of the CGI, color and light elements in VFX applications.
- CO 3:** Create special effects using any of the state of the art tools.
- CO 4:** Apply popular visual effects techniques using advanced tools.
- CO 5:** Build the compositing tools for creating VFX for a variety of applications.
- CO 6:** Build the compositing tools for creating VFX for a variety of applications.

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.

REFERENCE BOOKS:

1. Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023.
2. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, “ The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures”, Third Edition, 2020.and Games”, Routledge, 1st Edition, 2022.

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.

COURSE OBJECTIVES

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

1. To understand the basics of compression techniques.
2. To understand the categories of compression for text, image and video.
3. To explore the modalities of text, image and video compression algorithms.
4. To know about basics of consistency of data availability in storage devices.
5. To understand the concepts of data streaming services.

UNIT I BASICS OF DATA COMPRESSION**9**

Introduction —Lossless and Lossy Compression– Basics of Huffman coding- Arithmetic coding
Dictionary techniques- Context based compression – Applications.

UNIT II IMAGE COMPRESSION**9**

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages –
Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile
encoding.

UNIT III VIDEO COMPRESSION**9**

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2-
H.263.

UNIT IV DATA PLACEMENT ON DISKS**9**

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint
allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system
– Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage
system.

UNIT V DISK SCHEDULING METHODS**9**

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling
methods for request streams.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Explain the basics of text, Image and Video compression.
- CO 2:** Understand the various compression algorithms for multimedia content.
- CO 3:** Discuss the applications of various compression techniques.
- CO 4:** Illustrate the knowledge on multimedia storage on disks.
- CO 5:** Infer the scheduling methods for request streams.
- CO 6:** Identify the disk scheduling methods.

TEXT BOOKS:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008.

REFERENCE BOOKS:

1. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
2. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis, 2019.
3. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009.

COURSE OBJECTIVES

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

1. To know the theoretical background of cognition.
2. To understand the link between cognition and computational intelligence.
3. To explore probabilistic programming language.
4. To study the computational inference models of cognition.
5. To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 9

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration.

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the underlying theory behind cognition.
- CO 2:** Illustrate the cognition elements computationally.
- CO 3:** Evaluate mathematical functions through WebPPL.
- CO 4:** Develop applications using cognitive inference model.
- CO 5:** Design applications using cognitive learning model.
- CO 6:** Outline the learning models of continuous function.

TEXT BOOKS:

1. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016.
2. Jose Luis Bermudez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.

REFERENCE BOOKS:

1. Noah D. Goodman, Andreas Stuhlmüller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, <https://dippl.org/>.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, <https://probmods.org/>.

VERTICAL – VI
(Emerging Technologies)

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-Heteroassociative 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 – Neuroscientific 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 Autoencoder, 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:** Understand 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 deepneural networks for various tasks.
- CO 5:** Apply autoencoders and generative models for suitable applications.
- CO 6:** Develop and Evaluating Autoencoder Models.

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”, Spsringer 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, A press, 2020.
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic 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.

COURSE OBJECTIVES

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

1. To learn cybercrime and cyberlaw.
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; Cybercriminals – 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 – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

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 will be able to:

- CO 1:** Explain the basics of cyber security, cyber crime and cyber law
- CO 2:** Classify various types of attacks and learn the tools to launch the attacks
- CO 3:** Apply various tools to perform information gathering
- CO 4:** Apply intrusion techniques to detect intrusion
- CO 5:** Apply intrusion prevention techniques to prevent intrusion
- CO 6:** Develop and Evaluation of Intrusion Prevention Systems

TEXT BOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", NotionPress, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)

REFERENCE BOOKS:

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015 (Units 4 and 5)
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

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
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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
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Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction.

UNIT III	QUANTUM ALGORITHMS	9
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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
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Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels.

UNIT V	QUANTUM CRYPTOGRAPHY	9
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Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekert 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 University Press, 2007.

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, CreateSpace 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.

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 REASONING 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 Ontology Matching – 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.

U23CSV46	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
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COURSE OBJECTIVES

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

1. To understand the basics of Blockchain
2. To learn Different protocols and consensus algorithms in Blockchain
3. To learn the Blockchain implementation frameworks
4. To understand the Blockchain Applications
5. To experiment the Hyperledger Fabric, Ethereum networks

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopolyproblem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand emerging abstract models for Blockchain Technology.
- CO 2:** Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
- CO 3:** Understand the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
- CO 4:** Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
- CO 5:** Outline various new applications of block chain.
- CO 6:** Explain Blockchain Applications in Various Industries.

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCE BOOKS:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.
2. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing.
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

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 World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

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-Modelling and Annotation-Navigation-Wearable devices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Understand the basic concepts of AR and VR
- CO2:** Understand the tools and technologies related to AR/VR
- CO3:** Explain the working principle of AR/VR related Sensor devices
- CO4:** Design of various models using modeling techniques
- CO5:** Develop AR applications in different domains
- CO6:** Develop VR 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.

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

Concepts and Instances – Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

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:** Explain gaming engines.
- CO 4:** Survey gaming environments and frameworks.
- CO 5:** Build a simple game in Pygame.
- CO 6:** Apply Game Design and Development.

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.
3. Paul Craven, “Python Arcade games”, Apress Publishers,2016.
4. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press,2006.
5. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

VERTICAL – VII
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

U23CSV67	KNOWLEDGE ENGINEERING	L	T	P	C
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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 REASONING UNDER UNCERTAINTY 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 & 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 REASONING 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 Ontology Matching– 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 this course, the students will be able to:

- CO 1:** Understand the basics of Knowledge Engineering.
- CO 2:** Apply methodologies and modelling for Agent Design and Development.
- CO 3:** Design and develop ontologies
- CO 4:** Apply reasoning with ontologies and rules.
- CO 5:** Understand learning and rule learning.
- CO 6:** 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

COURSE OBJECTIVES:

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

1. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
2. To provide the mathematical background for carrying out the optimization associated with neural network learning
3. To learn various evolutionary Algorithms
4. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
5. To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing

UNIT I	INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC	9
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Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II	NEURAL NETWORKS	9
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Supervised Learning Neural Networks – Perceptions - Backpropagation -Multilayer Perceptions – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III	GENETIC ALGORITHMS	9
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Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV	NEURO FUZZY MODELING	9
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ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum Analysis of Adaptive Learning Capability.

UNIT V	APPLICATIONS	9
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Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the fundamentals of fuzzy logic operators and inference mechanisms
- CO 2:** Understand neural network architecture for AI applications such as classification and clustering.
- CO 3:** Explain the functionality of Genetic Algorithms in Optimization problems
- CO 4:** Extend hybrid techniques involving Neural networks and Fuzzy logic
- CO 5:** Apply soft computing techniques in real world applications.
- CO 6:** Design and develop the soft computing.

TEXT BOOKS:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall, 1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

REFERENCE BOOKS:

1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
3. Samir Roy, Udit Chakraborty, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996

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-Heteroassociative 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 – Neuroscientific 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 Autoencoder, 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:** Understand 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 deepneural networks for various tasks.
- CO 5:** Apply autoencoders and generative models for suitable applications.
- CO 6:** Develop and Evaluating Autoencoder Models.

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, A press, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island, 2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic 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.

U23CSV14	TEXT AND SPEECH ANALYSIS	L	T	P	C
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COURSE OBJECTIVES

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

1. Outline natural language processing basics
2. Apply classification algorithms to text documents
3. Build question-answering and dialogue systems
4. Develop a speech recognition system
5. Develop a speech synthesizer

UNIT I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems evaluating dialogue systems

UNIT IV TEXT-TO-SPEECH SYNTHESIS 9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT V AUTOMATIC SPEECH RECOGNITION 9

Speech recognition: Acoustic modeling – Feature Extraction - HMM, HMM-DNN systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Explain existing and emerging deep learning architectures for text and speech processing
- CO 2:** Apply deep learning techniques for NLP tasks, language modelling and machine translation
- CO 3:** Explain coreference and coherence for text processing
- CO 4:** Build question-answering systems, chatbots and dialogue systems
- CO 5:** Apply deep learning models for building speech recognition and text-to-speech systems
- CO 6:** Explain HMM and DNN systems

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCE BOOKS:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress, 2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

1. Formulate and solve linear programming problems (LPP)
2. Evaluate Integer Programming Problems, Transportation and Assignment Problems.
3. Obtain a solution to network problems using CPM and PERT techniques.
4. Able to optimize the function subject to the constraints.
5. Identify and solve problems under Markovian queuing 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 salesman 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 condition.

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 this course, the students will be able to:

- CO 1:** Explain linear programming problems (LPP)
- CO 2:** Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- CO 3:** Build a solution to network problems using CPM and PERT techniques.
- CO 4:** Choose to optimize the function subject to the constraints.
- CO 5:** Identify and solve problems under Markovian queuing models.
- CO 6:** Identify the multiple service channels.

TEXT BOOK:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCE BOOKS:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw 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. New Delhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

1. To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
2. To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modelling applications.
3. To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
4. To introduce contemporary topics in the intersection of game theory, computer science, and economics.
5. To apply game theory in searching, auctioning and trading.

UNIT I INTRODUCTION**9**

Introduction -Making rational choices: basics of Games - strategy - preferences - payoffs - Mathematical basics - Game theory - Rational Choice - Basic solution concepts-non- cooperative versus cooperative games - Basic computational issues - finding equilibria and learning in games- Typical application areas for game theory (e.g., Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION**9**

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies – Nash equilibria —mixed strategy equilibrium - zero-sum games

UNIT III GAMES WITH IMPERFECT INFORMATION**9**

Games with Imperfect Information - Bayesian Games - Motivational Examples – General Definitions - Information aspects - Illustrations - Extensive Games with Imperfect - Information-Strategies - Nash Equilibrium —Repeated Games - The Prisoner's Dilemma - Bargaining.

UNIT IV NON-COOPERATIVE GAME THEORY**9**

Non-cooperative Game Theory - Self-interested agents - Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal - Form Games Computing Nash equilibria of two-player, zero-sum games -Computing Nash equilibria of two- player, general-sum games - Identifying dominated strategies

UNIT V MECHANISM DESIGN**9**

Aggregating Preferences - Social Choice - Formal Model - Voting - Existence of social functions Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with - unrestricted preferences

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts
- CO 2:** Discuss the use of Nash Equilibrium for other problems
- CO 3:** Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real-world situation.
- CO 4:** Identify some applications that need aspects of Bayesian Games.
- CO 5:** Apply a typical Virtual Business scenario using Game theory.
- CO 6:** Identify the mechanism design using preferences.

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.
2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.
3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge University Press, 2007.
4. A. Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

REFERENCE BOOKS:

1. Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.
2. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
3. Y. Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.
4. William Spaniel, "Game Theory 101: The Complete Textbook", CreateSpace Independent Publishing, 2011

COURSE OBJECTIVES:

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

1. To understand the link between cognition and computational intelligence.
2. To explore probabilistic programming language.
3. To study the computational inference models of cognition.
4. To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences Of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing– Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 9

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions– Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration.

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand the underlying theory behind cognition.
- CO 2:** Construct the cognition elements computationally.
- CO 3:** Explain mathematical functions through WebPPL.
- CO 4:** Develop applications using cognitive inference model.
- CO 5:** Develop applications using cognitive learning model.
- CO 6:** Develop continuous functions using mixture model.

TEXT BOOKS:

1. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.

REFERENCE BOOKS:

1. Noah D. Goodman, Andreas Stuhlmüller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, <https://dippl.org/>.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Models of Cognition", Second Edition, 2016, <https://probmods.org/>.

COURSE OBJECTIVES:

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

1. Study the morality and ethics in AI
2. Learn about the Ethical initiatives in the field of artificial intelligence
3. Study about AI standards and Regulations
4. Study about social and ethical issues of Robot Ethics
5. Study about AI and Ethics- challenges and opportunities

UNIT I INTRODUCTION**9**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II ETHICAL INITIATIVES IN AI**9**

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT III AI STANDARDS AND REGULATION**9**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS**9**

Robot-Robotics- Ethics and Morality- Moral Theories-Ethics in Science and Technology – Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Robotics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES**9**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand morality and ethics in AI
- CO 2:** Construct the cognition elements computationally.
- CO 3:** Explain mathematical functions through Web PPL.
- CO 4:** Develop applications using cognitive inference model.
- CO 5:** Develop applications using cognitive learning model.
- CO 6:** Explain the international strategies on AI.

TEXT BOOK:

1. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh, "AI Ethics", The MIT Press Essential Knowledge series, April 2020

COURSE OBJECTIVES:

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

1. To study the idea of intelligent agents and search methods.
2. To study about representing knowledge.
3. To study the reasoning and decision making in uncertain world.
4. To construct plans and methods for generating knowledge.
5. To study the concepts of expert systems

UNIT I INTRODUCTION TO AI 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents
Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

UNIT II PROBLEM SOLVING 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search
Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction
Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games
– Alpha - Beta Pruning - Stochastic Games.

UNIT III GAME PLAYING AND CSP 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward
Chaining– Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects –
Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with
Default Information.

UNIT IV LOGICAL REASONING 9

Fuzzy Information, Fuzzy Neural Networks, Fuzzy Approaches for Supervised Learning Networks,
Fuzzy Generalizations of Unsupervised Learning Methods, Reasoning with Uncertain Information, Pre-
Processing and Post-Processing Using Fuzzy Techniques, Applications in Biomedical Engineering

UNIT V PROBABILISTIC REASONING 9

Introduction: Hopfield Network, Learning in Neural Network, Application of Neural Networks,
Recurrent Networks, Distributed Representations, Connectionism AI and Symbolic AI

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Utilize the appropriate search algorithms for any AI problem
- CO 2:** Rephrase a problem using first order and predicate logic
- CO 3:** Explain the apt agent strategy to solve a given problem
- CO 4:** Design software agents to solve a problem
- CO 5:** Develop applications for NLP that uses Artificial Intelligence.
- CO 6:** Explain the use of Connectionism AI and Symbolic AI

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011

REFERENCE BOOKS:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003

ELECTIVE - (Management Courses)

U23GET71

PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. Sketch the Evolution of Management.
2. Extract the functions and principles of management.
3. Learn the application of the principles in an organization.
4. Study the various HR related activities.
5. Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers- managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches – Types of Business organization –Sole proprietorship , partnership , company - public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques– Decision making steps and process.

UNIT III ORGANISING 9

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

UNIT IV DIRECTING 9

Foundations of individual and group behavior– Motivation – Motivation theories –Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication–Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the significance and interrelationships of each managerial function in an organizational context.
- CO2:** Explain the concept of Planning tools and techniques.
- CO3:** Summarize the organization structure and its types.
- CO4:** Illustrate the theories of leadership qualities and Effective communication in IT.
- CO5:** Explain the detail about Budgetary control techniques.
- CO6:** Discuss in detail about the concept of reporting methods.

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich “Essentials of management” Tata McGraw Hill

REFERENCE BOOKS:

1. Robert Kreitner and Mamata Mohapatra, “ Management”, Biztantra, 2008
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

COURSE OBJECTIVES

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

1. Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
2. Explain the TQM Principles for application.
3. Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA
4. Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
5. Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION**9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM

UNIT II TQM PRINCIPLES**9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT III TQM TOOLS & TECHNIQUES I**9**

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT IV TQM TOOLS & TECHNIQUES II**9**

Foundations of individual and group behavior– Motivation – Motivation theories –Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V QUALITY MANAGEMENT SYSTEM**9**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation Internal Audits-Registration-Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the concept of TQM framework and its benefits.
- CO2:** Summarize the method of Bench marking and TQM principles.
- CO3:** Extend the Quality Function Deployment (QFD) model
- CO4:** Explain how the TQM tools are used in communication in IT sector.
- CO5:** Compare QMS and EMS in any organization.
- CO6:** Explain the importance of the ISO 14000 series in promoting environmental sustainability.

TEXT BOOKS:

1. Dale H.Besterfield, Carol B.Michna,Glen H. Bester field,MaryB.Sacre, HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCE BOOKS:

1. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – 193 Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006 .

U23GET73	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. Understanding the concept of Engineering Economics.
2. Implement various micro economics concept in real life
3. Gaining knowledge in the field of macro economics to enable the students to have better
4. Understanding of various components of macro economics.
5. Understanding the different procedures of pricing.
6. Learn the various cost related concepts in micro economics.

UNIT I DEMAND & SUPPLY ANALYSIS 9

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.

UNIT II PRODUCTION AND COST ANALYSIS 9

Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.

UNIT III PRICING 9

Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT IV FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT) 9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.

UNIT V CAPITAL BUDGETING (ELEMENTARY TREATMENT) 9

Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Evaluate the cost-effectiveness of different design options
- CO2:** Determine the economic theories, cost concepts and pricing policies
- CO3:** Identify the characteristics of each market structure.
- CO4:** Explain the concepts of financial management for project appraisal
- CO5:** Explain the method of investment decision.
- CO6:** Summarize the concept of Budgeting.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
2. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2007.

REFERENCE BOOKS:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012
5. Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009

U23GET74	HUMAN RESOURCE 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 provide knowledge about management issues related to staffing,
2. To provide knowledge about management issues related to training,
3. To provide knowledge about management issues related to performance
4. To provide knowledge about management issues related to compensation
5. To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.
6. To provide knowledge about management issues related to performance evaluation.

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

The importance of human resources – Objective of Human Resource Management - Human resource policies - Role of human resource manager.

UNIT II HUMAN RESOURCE PLANNING 9

Importance of Human Resource Planning – Internal and External sources of Human Resources - Recruitment - Selection – Socialization

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT 9

Types of training and Executive development methods – purpose – benefits.

UNIT IV EMPLOYEE COMPENSATION 9

Compensation plan – Reward – Motivation – Career Development - Mentor – Protege relationships.

UNIT V PERFORMANCE EVALUATION AND CONTROL 9

Performance evaluation – Feedback - The control process – Importance – Methods – grievances – Causes – Redressal methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the objective of Human Resource Management.
- CO2:** Summarize the importance of human resource planning.
- CO3:** Illustrate types of training and Executive development methods.
- CO4:** Explain the planning for career Development.
- CO5:** Discuss in detail about performance evaluation.
- CO6:** Classify the method of grievances and Redressal cell.

TEXT BOOKS:

1. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007
2. John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition, Tata McGraw Hill, 2013, New Delhi.

REFERENCE BOOKS:

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

COURSE OBJECTIVES

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

1. Learn the Evolution of Knowledge management.
2. Be familiar with tools.
3. Be exposed to Applications.
4. Be familiar with some case studies.

UNIT I INTRODUCTION 9

Introduction: An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II HUMAN RESOURCE PLANNING 9

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT III KNOWLEDGE MANAGEMENT-THE TOOLS 9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT APPLICATION 9

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT V FUTURE TRENDS AND CASE STUDIES 9

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain the process of acquire knowledge from experts.
- CO2:** Summarize the concept of learning organization.
- CO3:** Illustrate the concept of knowledge management tools.
- CO4:** Develop the knowledge management Applications.
- CO5:** Design and develop enterprise applications.
- CO6:** Analyze the future trends in knowledge management.

TEXT BOOKS:

1. Srikantaiah, T.K., Koenig, M., “Knowledge Management for the Information Professional” Information Today, Inc., 2000.

REFERENCE BOOKS:

1. Nonaka, I., Takeuchi, H., “The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation”, Oxford University Press, 1995.Edition, PHI, 2012.

COURSE OBJECTIVES

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

1. To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. To study the planning; organizing and staffing functions of management in professional organization.
3. To study the leading; controlling and decision-making functions of management in professional organization.

UNIT I INTRODUCTION TO MANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT II FUNCTIONS OF MANAGEMENT - I 9

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT III FUNCTIONS OF MANAGEMENT - II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mouton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT IV ORGANIZATION THEORY 9

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict

UNIT V PRODUCTIVITY AND MODERN TOPICS 9

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Explain basic concepts of management.
- CO2:** Discuss the planning, organizing and staffing functions of management in professional organization.
- CO3:** Summarize the leading, controlling and decision making functions of management in professional organization.
- CO4:** Discuss the organizational theory in professional organization
- CO5:** Explain the principles of productivity and modern concepts in management in professional organization.
- CO6:** Illustrate the future trends in modern topics.

TEXT BOOKS:

1. M. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India, New Delhi, 2009.
2. Koontz. H. and Weihrich. H., “Essentials of Management: An International Perspective”, 8th Edition, Tata McGrawhill, New Delhi, 2010.

REFERENCE BOOKS:

1. Joseph J, Massie, “Essentials of Management”, 4th Edition, Pearson Education, 1987.
2. Saxena, P. K., “Principles of Management: A Modern Approach”, Global India Publications, 2009.
3. S.Chandran, “Organizational Behaviours”, Vikas Publishing House Pvt. Ltd., 1994
4. Richard L. Daft, “Organization Theory and Design”, South Western College Publishing, 11th Edition, 2012.
5. S. Trevis Certo, “Modern Management Concepts and Skills”, Pearson Education, 2018.

OPEN ELECTIVE

U23CSTO01	COMPUTER VISION	L	T	P	C
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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 neighbourhood 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-Geo metric intrinsic calibration-Triangulation - Two-frame structure from motion -Factorization- Bundle adjustment-Constrained structure and motion-Translationalalignment-Parametricmotion-Spline-basedmotion-Opticalflow-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 maps and albedosos

UNIT V IMAGE- BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumi graphs - 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 would be able to

- CO 1 :** Understand basic knowledge, theories and methods in image processing and computer vision.
- CO 2 :** Explain basic and some 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.** Analyze Recognition databases and test sets

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.

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

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks - Build Performance - App Performance - Debugging capabilities - Time to Market - Maintainability - Ease of Development - UI/UX - Reusability

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Develop Native applications with GUI Components
- CO 2 :** Develop hybrid applications with basic event handling.
- CO 3:** Apply cross-platform applications with location and data storage capabilities.
- CO 4:** Apply cross platform applications with basic GUI and event handling.
- CO 5:** Develop web applications with cloud database access.
- CO 6.** Develop 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 Dzirdeh, 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

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 Challenges

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

- CO 1 :** Understand the design challenges in the cloud.
- CO 2 :** Apply the concept of virtualization and its types.
- CO 3:** Explain 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”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

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. - Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS**9**

Foot printing Concepts – Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence – Foot printing through Social Engineering – Foot printing 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 – War driving-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 Honey pots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Explain the basics of computer-based vulnerabilities
- CO 2 :** Understanding on different foot printing, reconnaissance and scanning methods.
- CO 3:** Explain the enumeration and vulnerability analysis methods
- CO 4:** Explain hacking options available in Web and wireless applications.
- CO 5:** Extend the options for network protection.
- CO 6.** Build 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 Engebrets on, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOK:

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

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MULTIMEDIA AND ANIMATION

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COURSE OBJECTIVES

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

1. To grasp the fundamental knowledge of Multimedia elements and systems
2. To get familiar with Multimedia file formats and standards
3. To learn the process of Authoring multimedia presentations and animations
4. To explore different popular applications of multimedia
5. Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

UNIT I INTRODUCTION TO MULTIMEDIA

9

Definitions - Elements - Multimedia Hardware and Software - Distributed multimedia systems - challenges: security - sharing / distribution - storage - retrieval - processing - computing. Multimedia metadata - Multimedia databases - Hypermedia - Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS

9

File formats – Text - Image file formats - Graphic and animation file formats - Digital audio and Video file formats - Color in image and video - Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORIZING

9

Authoring metaphors - Tools Features and Types: Card and Page Based Tools - Icon and Object Based Tools - Time Based Tools - Cross Platform Authoring Tools - Editing Tools - Painting and Drawing Tools - 3D Modeling and Animation Tools - Image Editing Tools - audio Editing Tools - Digital Movie Tools - Creating interactive presentations - virtual learning - simulations.

UNIT IV ANIMATION

9

Principles of animation: staging - squash and stretch - timing - onion skinning - secondary action - 2D, 2 ½ D, and 3D animation - Animation techniques: Keyframe - Morphing - Inverse Kinematics - Hand Drawn - Character rigging - vector animation - stop motion - motion graphics - Fluid Simulation - skeletal animation - skinning Virtual Reality - Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS

9

Multimedia Big data computing - social networks - smart phones - surveillance - Analytics - Multimedia Cloud Computing - Multimedia streaming cloud - media on demand - security and forensics - Online social networking - multimedia ontology - Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Understand the bigger picture of the context of Multimedia and its applications
- CO 2 :** Explain the different types of media elements of different formats on content pages
- CO 3:** Build 2D and 3D creative and interactive presentations for different target multimedia applications
- CO 4:** Explain different standard animation techniques for 2D, 2 1/2 D, 3D applications
- CO 5:** Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,
- CO 6.** Understand the applications of Multimedia

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)
2. John M Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", CRC press, 3rd Edition, 2016.
3. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.

REFERENCE BOOKS:

1. Prabhat K. Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
2. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
3. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
4. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
5. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
6. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

COURSE OBJECTIVES

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

1. To understand the concepts of machine learning.
2. To appreciate supervised and unsupervised learning and their applications.
3. To understand the theoretical and practical aspects of Probabilistic Graphical Models.
4. To appreciate the concepts and algorithms of reinforcement learning.
5. To learn aspects of computational learning theory.

UNIT I INTRODUCTION**9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations– Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS**9**

Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms– Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING**9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING**9**

K- Nearest Neighbor Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning

UNIT V ADVANCED LEARNING**9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Understand and outline problems for each type of machine learning
- CO 2 :** Design a Decision tree and Random Forest for an application
- CO 3:** Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.
- CO 4:** Use a tool to implement typical Clustering algorithms for different types of applications.
- CO 5:** Design and implement an HMM for a Sequence Model type of application.
- CO 6:** Identify applications suitable for different types of Machine Learning with suitable justification

TEXT BOOKS:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 1st edition, 2017.
2. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press, 3rd Edition, 2004.

REFERENCE BOOK:

1. Hastie. T, Tibshirani. R, Friedman. J. H, “The Elements of Statistical Learning”, Springer, 2nd Edition, 2017.

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 Blockchain
3. To learn the Blockchain implementation frameworks
4. To experiment the Hyperledger Fabric, Ethereum networks
5. To understand the Blockchain Applications

UNIT I INTRODUCTION TO BLOCKCHAIN**9**

Blockchain- Public Ledgers - Blockchain as Public Ledgers - Block in a Blockchain - Transactions. The Chain and the Longest Chain - Permissioned Model of Blockchain - Cryptographic -Hash Function - Properties of a hash function-Hash pointer and Merkle tree .

UNIT II BITCOIN AND CRYPTOCURRENCY**9**

A basic crypto currency - Creation of coins - Payments and double spending - FORTH – the precursor for Bitcoin scripting - Bitcoin Scripts - Bitcoin P2P Network - Transaction in Bitcoin Network - Block Mining - Block propagation and block relay.

UNIT III BITCOIN CONSENSUS**9**

Bitcoin Consensus - Proof of Work (PoW)- HashcashPoW - Bitcoin PoW - Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner - Mining Difficulty - Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM**9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network - EVM - Transaction fee - Mist Browser - Ether, Gas, Solidity.

UNIT V BLOCKCHAIN APPLICATIONS**9**

Smart contracts - Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management - Logistics - Smart Cities - Finance and Banking - Insurance,etc- Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1:** Understand emerging abstract models for Blockchain Technology.
- CO 2:** Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
- CO 3:** Understand the functions of Blockchain methods
- CO 4:** Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
- CO 5:** Learn about the Hyperledger Architecture
- CO 6:** Describe about the Blockchain Applications

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Second Edition.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCE BOOKS:

1. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
3. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

COURSE OBJECTIVES

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

1. To understand the concepts of machine learning.
2. To appreciate supervised and unsupervised learning and their applications.
3. To understand the theoretical and practical aspects of Probabilistic Graphical Models.
4. To appreciate the concepts and algorithms of reinforcement learning.
5. To learn aspects of computational learning theory.

UNIT I DEEP LEARNING CONCEPTS**9**

Foundation of Cognitive Computing: cognitive computing as a new generation - the uses of cognitive systems - system cognitive - gaining insights from data - Artificial Intelligence as the foundation of cognitive computing - understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system - building the corpus - bringing data into cognitive system - machine learning - hypotheses generation and scoring - presentation, and visualization services.

UNIT II NEURAL NETWORKS**9**

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system - semantic web - Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge - Defining Taxonomies and Ontologies - knowledge representation - models for knowledge representation - implementation considerations.

UNIT III CONVOLUTIONAL NEURAL NETWORK**9**

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data - defining big data - architectural foundation - analytical data warehouses - Hadoop - data in motion and streaming data - integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing - Key capabilities in advanced analytics - using advanced analytics to create value - Impact of open source tools on advanced analytics.

UNIT IV NATURAL LANGUAGE PROCESSING USING RNN**9**

Preparing for change ,advantages of new disruptive models - knowledge meaning to business - difference with a cognitive systems approach - meshing data together differently - using business knowledge to plan for the future - answering business questions in new ways - building business specific solutions - making cognitive computing a reality - cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform - defining the objective - defining the domain - understanding the intended users and their attributes - questions and exploring insights - training and testing.

UNIT V DEEP REINFORCEMENT & UNSUPERVISED LEARNING**9**

Building a cognitive health care application: Foundations of cognitive computing for healthcare - constituents in healthcare ecosystem - learning from patterns in healthcare Data - Building on a foundation of big data analytics - cognitive applications across the health care eco system - starting with a cognitive application for healthcare - using cognitive applications to improve health and wellness - using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO 1 :** Explain basic Concept of Cognitive Computing .
- CO 2 :** Extend the concept of Natural Language Processing.
- CO 3:** Illustrate Big Data and Cognitive Computing
- CO 4:** Explain NLP using CNN.
- CO 5:** Extend Deep Reinforcement .
- CO 6:** Explain Unsupervised Learning

TEXT BOOKS:

1. Josh Patterson and Adam Gibson, “Deep Learning A Practitioner’s Approach”, O’Reilly Media, Inc, 1st Edition, 2017.
2. Jojo Moolayil, “Learn Keras for Deep Neural Networks”, Apress, 1st Edition, 2018.

REFERENCE BOOKS:

1. Vinita Silaparasetty, “Deep Learning Projects Using TensorFlow 2”, Apress, 1st Edition, 2020.
2. François Chollet, “Deep Learning with Python”, Manning Shelter Island, 1st Edition, 2017.
3. Santanu Pattanayak, “Pro Deep Learning with TensorFlow”, Apress, 1st Edition, 2018.

COURSE OBJECTIVES

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

1. To Identify the various IoT elements appropriate to the applications
2. To Design a portable IoT using Arduino/Raspberry Pi incorporating cloud and analytics
3. To understand the Elements of IOT
4. To Learn about IoT Communication Models
5. To Implement IoT applications for real-time environment

UNIT I FUNDAMENTALS OF IOT**9**

Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols – Logical design - IoT communication models - IoT Communication APIs - Enabling technologies - Wireless Sensor Networks - Cloud Computing - Big data analytics - Communication protocols - Embedded Systems - IoT Levels and Templates - Domain specific IoTs - IoT Architectural view.

UNIT II ARDUINO PROGRAMMING**9**

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 III ELEMENTS OF IOT**9**

IoT and M2M- difference between IoT and M2M - Software Defined Networks - Network Function Virtualization - IoT systems management – Needs - NETCONF - YANG - IoT design methodology.

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 CHALLENGES IN IOT AND CASE STUDIES**9**

Security Concerns and Challenges - Real time applications of IoT – Home automation – Automatic lighting – Home intrusion detection – Cities – Smart parking – Environment – Weather monitoring system – Agriculture – Smart irrigation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1:** Describe the characteristics, physical and logical designs, domains and architecture.
- CO2:** Explain about Arduino and its types
- CO3:** Differentiate M2M and IoT, SDN and NFV design methodologies
- CO4:** Compare the communication models in IOT
- CO5:** Describe various real time applications of IOT
- CO6:** Design IoT applications using Arduino/Raspberry Pi /open platform

TEXT BOOKS:

1. Arshdeep Bahga,Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015
2. Olivier Hersent,David Boswarthick, Omar Elloumi,“The Internet of Things:Key applications and Protocols”,Wiley Publications 2nd Edition,2013

REFERENCE BOOKS:

1. Raj Kamal,“InternetofThings–Architecture and Design Principles”,McGraw Hill Education Pvt.Ltd.,2017
2. Internet of Things and Data Analytics, Hwaiyu Geng, P.E,Wiley Publications, 2017
3. Marco Schwartz,—Internet of Things with the Arduino Yun®,Packt Publishing,2014
4. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”,Wiley Publications, 2012.